ROUX

PRE-DESIGN INVESTIGATION WORK PLAN

350 Franklin Street
Olean, New York

October 26, 2021

Prepared for:

MJ Painting Contractor Corp
291 Homer Street
Olean, New York 14760

Prepared by:

Roux Environmental Engineering and Geology, D.P.C.
209 Shafter Street
Islandia, NY 11749

2317.0002M000.137.R-CV

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1.0 INTRODUCTION

Roux Associates, Inc. and Roux Environmental Engineering and Geology, D.P.C (collectively referred to as "Roux"), on behalf of MJ Painting Contractor Corp. (MJ Painting or the Volunteer), have prepared the following Pre-Design Investigation Work Plan (Work Plan) to characterize and evaluate the potential petroleum impacts in soil and groundwater, identify grossly contaminated media (GCM)/source material in areas where petroleum-related impacts have been observed and there is insufficient local monitoring well coverage to assess the mobility of the observed petroleum-related impacts via the presence or absence of LNAPL, and evaluate the presence of source material relative to NYSDEC Protection of Groundwater SCOs and groundwater concentrations at 350 Franklin Street (the Site). This Work Plan proposes further characterization and evaluation of the Site following the Remedial Investigation/ Alternative Assessment Report (RI/AAR) and in preparation for future remedial activities to be described in the forthcoming Remedial Action Work Plan (RAWP). This Work Plan has been prepared in general accordance with NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 3, 2010 (NYSDEC DER-10).

The remainder of this Work Plan is divided into the following sections:

- Section 2.0 provides a description of the Site and known conditions;
- Section 3.0 provides a description of the proposed investigation activities;
- Section 4.0 provides a discussion on the quality assurance/quality control (QA/QC) protocols to be implemented as part of the investigation activities;
- Section 5.0 provides a discussion on health and safety protocols to be followed during the investigation activities; and
- Section 6.0 provides a list of the principal personnel who will be conducting the work and their contact information, as well as an anticipated schedule for performing the work and a brief description of the email summary that will be prepared once the proposed investigation activities have been completed.

2.0 DESCRIPTION OF THE SITE AND KNOWN CONDITIONS

2.1 Site Description

The Site is located in the City of Olean, Cattaraugus County, New York, at 350 Franklin Street (Figure 1). According to the City of Olean Assessor's Office on-line property information database, 350 Franklin Street consists of a 9.34-acre parcel (S.B.L. #94.040-1-2.3). The property is currently owned by MJ Painting, a commercial and industrial painting contractor. Currently, 350 Franklin Street consists of an undeveloped grass field, with the exception of two billboards located along the northwestern property boundary, adjacent to Interstate 86 (I-86).

2.2 Historic Land Use

The section of Olean, NY which surrounds the area of the Site has historically been occupied with industrial operations including, but not limited to, petroleum storage and refining, leather tanneries, heavy and light manufacturing, chrome plating, fertilizer manufacturing, and railroad facilities. The Site and area immediately surrounding the Site were formally part of the Socony-Vacuum Oil Company, Inc. refinery, and used primarily as a petroleum refining facility between 1876 and 1954. From 1954 through 1964, Swan Finch Oil Company Olean Industries, Inc. stored grain and corn in approximately 60 tanks and buildings on the refinery property. From 1964 through 1981, Felmont Oil and Agway removed the old refinery tanks and buildings and constructed an anhydrous ammonia plant, jointly producing ammonia and other fertilizers on portions of the surrounding area.

Following ownership by Felmont Oil Corporation, the Cattaraugus County Industrial Development Agency owned the parcel from 1981 through 1989 when Blue Bird Industrial Park, Inc. took over ownership in 1989. The parcel was subsequently purchased from Blue Bird Industrial Park, Inc by MJ Painting in March 2018.

2.3 Regulatory History and Previous Site Investigations

According to NYSDEC Spill Database, three Spill Numbers (0501100, 0550226 and 1300859) have been assigned to areas surrounding and/or within the 350 Franklin Street parcel as far back as 2005. Several investigation and remedial activities were performed at 350 Franklin Street and are summarized in previous submittals to NYSDEC.

MJ Painting entered into the Brownfield Cleanup Agreement (BCA) with NYSDEC and was accepted into the BCP as a volunteer on January 14, 2019, and the Site is identified as BCP Site No. C905046. Roux, on behalf of MJ Painting, and in accordance with the NYSDEC approved December 19, 2018 Remedial Investigation Work Plan (RIWP) and the June 21, 2019 Emerging Contaminants Sampling and Analysis Plan, conducted remedial investigation activities at the Site between June 24, 2019, and December 16, 2020. The data collected during these activities are presented in the RIAAR.[1]

[1] For more information regarding Regulatory History and Previous Site Investigations, see the RIAAR submitted on April 30, 2021.

3.0 PROPOSED INVESTIGATION ACTIVITIES

As discussed, this Work Plan has been prepared to:

- aid waste characterization for disposal and/or support beneficial reuse of Site soils in preparation for future remedial activities at the Site;
- evaluate the extent of Site Cover System required based on collecting additional shallow soil data;
- aid in the identification of GCM/source material in areas where petroleum-related impacts have been observed and there is insufficient local monitoring well coverage to assess the mobility of the observed petroleum-related impacts via the presence or absence of LNAPL
- evaluate the presence of source material relative to NYSDEC Protection of Groundwater SCOs and groundwater concentrations.

The proposed investigation activities, which include the assessment of soil and groundwater are discussed in the Sections below. A Community Air Monitoring Plan (CAMP) has been prepared, outlined in Section 5.0 and included as **Appendix A**. Additionally, a Site-Specific Health and Safety Plan (HASP) has been included as **Appendix B**. Real time volatile organic compound (VOC) and particulate monitoring will be implemented during all ground intrusive activities throughout the implementation of this Work Plan in accordance with the CAMP.

All work will be conducted in general accordance with Roux procedures, EPA guidance and NYSDEC DER-10 guidance. A list of applicable Roux procedures is summarized in Section 4.0 and included as **Appendix C**.

3.1 Soil Characterization Activities

To meet the above investigation goals, Roux proposes to advance up to 48 soil borings (RX-21-01 – RX-21-48) (see **Figure 2** for locations) at the Site using direct-push drilling methods and sixty-three surficial samples using hand auger (RX-21-101 – RX-21-163) (see **Figure 3** for locations). At each location, soil generated from boring advancement will be visually inspected for the presence of petroleum impact, screened using a calibrated photoionization detector (PID), and characterized for visual and textural classifications based on the Unified Soil Classification System (USCS). In addition, any observations regarding staining, odor and/or sheen in/on the soil will be noted. Surficial borings will be advanced to depths of approximately 1 foot below grade (ft bg). Direct-push borings will be advanced to depths of approximately 12 ft bg, the anticipated vertical extent of excavation in the forthcoming RAWP.

Soil samples will be submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified commercial laboratory for analyses including:

- Target Analyte List (TAL)/Part 375 list VOCs by EPA Method 8260B including tentatively identified compounds (TICs);
- TAL/Part 375 list Semi-volatile organic compounds (SVOCs) by EPA Method 8270C including TICs;
- Part 375 list Herbicides 8151A and Pesticides 8081B;
- Emerging Contaminants (Part 375 PFAS list - 21 target compounds);
- TAL/Part 375 list Metals by EPA Methods 6010B/7470A[2];
- TCLP TAL Metals by EPA Methods 6010B/7470A; and
- pH, Reactivity, Ignitability, total solids, free liquids, and TPH.

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[2] TAL metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

Upon completion of soil sample collection, all soil removed during soil boring advancement will be returned to the subsurface in the general order that it was removed. The drilling contractor will be prepared with bentonite slurry/chips and/or neat grout to seal any confining layers identified within the borings. All locations will be recorded electronically using a Global Positioning System (GPS) device (and later surveyed). Prior to performing any subsurface investigation activities, DigSafely NewYork, Inc. and the City of Olean, New York water and sewer departments will be contacted by Roux to identify and mark, if applicable, known utilities at the Site.

3.1.1 Surficial Soil Sample Collection Methodology

Surficial soil columns (0 to 1 ft bg) will be collected using hang augers. Hand augers will be fully decontaminated in between each individual sample location.

Roux will collect one discrete and one composite soil sample from each soil boring location for laboratory analysis. The discrete soil samples will be collected from discrete intervals within each location based on visual classification, the presence of petroleum impacts, and/or evidence of VOCs in PID screening results. Composite soil samples will be collected from the entire length of each interval and homogenized. Sampling activities will be conducted in general accordance with Section 3.5 of the NYSDEC DER-10 and Roux procedures.

3.1.2 Subsurface Soil Sample Collection Methodology

Soil columns will be collected continuously during boring advancement using the direct-push drilling method. The direct-push drilling method involves the advancement of a two-inch diameter acetate-lined macrocore barrel into an undisturbed formation using downward pressure. The soil column (generally collected in 5-foot intervals) is extruded from the core barrel and collected in acetate macrocores. Upon soil column collection, the empty core barrel is decontaminated before being returned to the borehole and advanced to the next depth interval. Due to the nature and equipment used in this drilling, soil columns are collected in a continuous manner from the beginning of boring to the target depth. Upon retrieval, each soil column will be logged in accordance with the procedures discussed on the previous page.

Roux will collect up to four discrete and three composite soil samples from each soil boring location for laboratory analysis. Samples will be collected in designated intervals of approximately 1 - 4 ft bg, 4 – 7 ft bg, 7 – 10 ft bg, and 10 – 12 ft bg. The discrete soil samples will be collected from discrete intervals within each location based on visual classification, the presence of petroleum impacts, and/or evidence of VOCs in PID screening results. Composite soil samples will be collected from the entire length of each interval and homogenized. Each composite is prepared by collecting discrete samples from three to five random locations from the volume of soil to be tested. Sampling activities will be conducted in general accordance with Section 3.5 of the NYSDEC DER-10 and Roux procedures.

3.2 GCM/Source Material Investigation Activities

There exist areas on Site where petroleum-related impacts have been observed but GCM has not been identified. In areas where petroleum-related impacts have been observed and there is insufficient local monitoring well coverage to assess the mobility of the observed petroleum-related impacts via the presence or absence of LNAPL to identify GCM, Roux proposes to install, develop, and gauge monitoring wells for the presence of LNAPL. Proposed locations of the monitoring wells are shown on Figure 2.

The presence of GCM will be indicated by observations during monitoring well installation activities of GCM (i.e., material containing mobile LNAPL) in the form of tar-like material, petroleum saturated soil, and separate phase hydrocarbons correlated with the observation of recoverable LNAPL in monitoring wells within the vicinity of those impacts, which are the sources and indicators of mobile contamination (i.e., the characteristics of GCM) at the Site. The presence of source material may also be indicated by monitoring wells where soil contaminated with VOCs in excess of the Protection of Groundwater SCOs are collocated with groundwater contaminated by the same VOCs. This performance and SCO-based designation of GCM/source material at the Site was developed in cooperation with NYSDEC representatives.

Those areas where conditions indicative of the presence of GCM/source material are identified will be evaluated for further remedial measures in the forthcoming RAWP and/or as post-COC activities.

3.2.1 Monitoring Well Installation

Roux proposes to install eight monitoring wells (RXMW-106 through RXMW-113). Monitoring wells will be completed with a screened interval intercepting the extent of GCM identified by past investigations, from approximately 15 to 35 feet below grade. These monitoring wells will be installed to assist in identifying the presence of GCM with mobile SPH through visual observation of NAPL. The new wells will be developed by pumping or bailing in combination with surging subsequent to construction and then, at least one week later, a complete round of groundwater gauging and sampling will be performed including the newly installed wells and the 20 existing monitoring wells as outlined below.[3] All purged ground water generated during development or sampling activities will be containerized and disposed of offsite at an NYDEC approved facility.

Monitoring wells will be constructed with four-inch diameter, 0.10-inch slotted schedule 40 polyvinyl chloride (SCH 40 PVC) screen (well screen) with an appropriate length of solid SCH 40 PVC casing to extend the well to approximately surface grade. Well screens shall be approximately 20 feet in length and will extend from approximately 15 feet below grade to 35 feet below grade to intercept the water table at the depth at which GCM has been identified during previous investigations. To facilitate the installation of the monitoring wells, soil borings will be advanced using sonic rotary or similar alternative drilling methods. An effort will be made to avoid installing screened sections in layers of silt or clay. If a clay confining layer is observed, an effort will be made to avoid puncturing that layer; if that layer is inadvertently punctured, bentonite slurry/chips and/or neat grout will be used to 'seal' the confining layer. The bentonite slurry/chips and/or neat grout seal will be installed from the terminal depth of penetration to approximately 6-inches above the top of the identified confining layer.

The annulus around each well will be filled with silica sand from the bottom of the well to approximately one foot above the top of the well screen. A well seal consisting of approximately two feet of hydrated bentonite will be placed above the sand pack. The remainder of the annular space will be filled with bentonite, silica sand, and/or hydraulic cement. All monitoring wells will be fitted with a locking gripper plug and completed with a stickup protective steel casing.

Excess soil cuttings, including all soil not suitable for backfill, generated during boring advancement activities will be placed in Department of Transportation (DOT) approved 55-gallon steel drums and temporarily stored on-Site pending disposal characterization and profiling. Upon characterization and profiling, the drum(s) will be shipped to a NYSDEC-approved disposal/recycling facility.

Following monitoring well completion, a survey will be conducted by a licensed surveyor to measure the elevation of each monitoring well, as well as the ground surface elevation at each monitoring well and each soil boring location, relative to the North American Vertical Datum of 1988 (NAVD 88) and horizontal coordinates relative to the North American Datum of 1983 (NAD83).

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[3] Groundwater samples will be collected only from newly installed monitoring wells that do not exhibit the presence of LNAPL.

3.2.2 Soil Sample Collection Methodology

Up to 13 discrete soil samples (1 per monitoring well location) for the purpose of GCM identification by comparison to NYDEC Protection of Groundwater Soil Cleanup Objectives (SCOs) with co-located groundwater samples (described in Section 3.2.3) will be collected from the borings during monitoring well installation. The discrete soil samples will be collected from discrete intervals within each location based on visual classification, the presence of petroleum impacts, and/or evidence of VOCs in PID screening results. Sampling activities will be conducted in general accordance with Section 3.5 of the NYSDEC DER-10 and Roux procedures. Soil samples will be submitted to a NYSDOH ELAP certified commercial laboratory for analyses including:

- TAL/Part 375 List VOCs by EPA Method 8260B including TICs; and
- TAL/Part 375 List SVOCs by EPA Method 8270C including TICs;

3.2.3 Groundwater Sample Collection Methodology

Following monitoring well installation activities, the newly installed monitoring wells will be developed in accordance with Roux's procedure for developing monitoring wells in unconsolidated formations. Water levels (and LNAPL levels, if present) in each monitoring well will be measured using an electronic interface probe. Groundwater samples will be collected from all newly installed monitoring wells that do not exhibit the presence of LNAPL in general accordance with EPA low-flow sampling methodology.[4] Groundwater gauging and sampling activities will be conducted in accordance with Section 3.7 of the NYSDEC DER-10 and Roux procedures.

Groundwater samples collected will be submitted to a NYSDOH ELAP certified commercial laboratory for analyses including:

- TAL/Part 375 List VOCs by EPA Method 8260B including TICs; and
- TAL/Part 375 List SVOCs by EPA Method 8270C including TICs;

All liquid (e.g., purge water) generated during sample collection will be placed in DOT approved 55-gallon steel drums and temporarily stored at the Site pending disposal. Subsequent to groundwater sampling activities, the drum(s) will be shipped to a NYSDEC-approved disposal/recycling facility.

Following completion of groundwater gauging, monitoring wells with measurable LNAPL may be fitted with light non-aqueous phase liquid (LNAPL) absorbent socks. Periodic monitoring and replacement of the socks will be performed moving forward. The Roux procedures for these activities are provided in Appendix C.

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4 Low-flow sampling uses a peristaltic pump, bladder pump, or bailer to extract ground water while minimizing the stress to surrounding aquifer. Water quality parameters, including pH, dissolved oxygen content, oxidation reduction potential and temperature, are measured during ground water purging. Ground water samples are collected when water quality parameters stabilize, indicating that ground water is being drawn from the aquifer surrounding the well screen.

4.0 QA/QC PROTOCOLS

The following Quality Assurance Project Plan (QAPP) has been prepared for the soil, groundwater, and separate-phase product sampling activities.

4.1 Project Organization

This QAPP was prepared in accordance with Section 2 of the NYSDEC DER-10, Quality Assurance for Sampling and Laboratory Analysis and has been reviewed by the project Quality Assurance Officer (QAO). This project is managed by Brian Klaus of Roux under the direction of Mike John, Sr. of MJ Painting. Additional information regarding principal project personnel is provided in Section 6.0.

4.2 Sampling and Equipment Decontamination Procedures

Soil, groundwater, and separate-phase product sampling and equipment decontamination procedures will be conducted in general accordance with Roux procedures, EPA guidance and NYSDEC DER-10 guidance. Applicable Roux procedures are included as **Appendix C**.

4.3 Investigation Locations

As previously indicated, up to forty-five soil borings, sixty-three surficial soil borings, and thirteen monitoring wells are proposed to be advanced at the Site. Soil columns will be collected at continuous intervals from ground surface to the final depth of the boring. At least one soil sample collected from each of the soil borings is proposed to be submitted for laboratory analysis. A Site map showing the existing monitoring well locations and proposed soil boring locations is provided as Figure 2. Groundwater samples are also proposed to be collected from new monitoring wells, provided no LNAPL is present.

4.4 Analytical Methods/Quality Assurance Summary Table

The following Analytical Methods/Quality Assurance Summary Tables have been prepared for the environmental and quality control samples for the proposed soil and ground water sampling:

Sample Quantity	MS/ MSD	No. of Field Duplicates	Analytical Method	Sample Preservative	Container/ Volume	Holding Time
Up to 39 Waste Characterization soil samples (15 surficial, 24 subsurface)	0	0	TAL/Part 375 List VOCs EPA Method 8260B+TICs	MeOH	1 x 40-mL vial (glass)	14 days
				$NaHSO_4$	2 x 40-mL vial (glass)	14 days
			TCLP/Part 375 List TAL Metals EPA Methods 6010B and 7470A	Cool to 4°C	1 x 4-oz jar (glass)	180^{+} days
			TAL/Part 375 List SVOCs EPA Method 8270C+ TICs			14 days
			Part 375 List Pesticides EPA Method 8081B			
			Part 375 List Herbicides EPA Method 8151A			
			PCBs EPA Method 8082A			
			TPH			
			Ignitability			
			Reactivity			
			Total Solids			
			Free Liquids			
			pH EPA Method 9045C			immediate
Up to 21 Composite Surficial Reuse soil samples	2	2	Total Part 375 List TAL Metals EPA Methods 6010B and 7470A	Cool to 4°C	1 x 4-oz jar (glass)	180^{+} days
			TAL/Part 375 List SVOCs EPA Method 8270C+ TICs			14 days
			Part 375 List Pesticides EPA Method 8081B			
			Part 375 List Herbicides EPA Method 8151A			
			PCBs EPA Method 8082A			
			Emerging Contaminants (PFAS - 21 target compounds) EPA Method 1633			
Up to 48 Discrete Surficial Reuse soil samples	3	3	TAL/Part 375 List VOCs EPA Method 8260B+TICs	MeOH	1 x 40-mL vial (glass)	14 days
				$NaHSO_4$	2 x 40-mL vial (glass)	14 days

Sample Quantity	MS/ MSD	No. of Field Duplicates	Analytical Method	Sample Preservative	Container/ Volume	Holding Time
Up to 56 Composite Subsurface Reuse soil samples	3	3	Total TAL Metals EPA Methods 6010B and 7470A	Cool to 4°C	1 x 4-oz jar (glass)	180^{+} days
			TAL/Part 375 List SVOCs EPA Method 8270C+ TICs			14 days
			Part 375 List Pesticides EPA Method 8081B			
			Part 375 List Herbicides EPA Method 8151A			
			PCBs EPA Method 8082A			
			Emerging Contaminants (PFAS - 21 target compounds) EPA Method 1633			
Up to 116 Discrete Subsurface Reuse soil samples	6	6	TAL/Part 375 List VOCs EPA Method 8260B+TICs	MeOH	1 x 40-mL vial (glass)	14 days
				$NaHSO_4$	2 x 40-mL vial (glass)	14 days
Up to 8 Discrete GCM Identification soil samples	1	1	TAL/Part 375 List VOCs EPA Method 8260B+TICs	MeOH	1 x 40-mL vial (glass)	14 days
				$NaHSO_4$	2 x 40-mL vial (glass)	14 days
			TAL/Part 375 List SVOCs EPA Method 8270C+ TICs	Cool to 4°C	1 x 4-oz jar (glass)	14 days
1 groundwater sample per monitoring well location without LNAPL (up to 8 samples from newly installed monitoring wells)	1	1	TAL/Part 375 List VOCs EPA Method 8260B+TICs	HCl	3 x 40-mL vial (glass)	14 days
			TAL/Part 375 List SVOCs EPA Method 8270C+ TICs	Cool to 4°C	2 x 250-mL bottle (glass)	7 days

Notes:

If additional samples are collected, one field duplicate and one MS/MSD will be collected for every 20 samples.
MS/MSD = matrix spike/matrix spike duplicate
mL = milliliter
oz = ounce
HCl = hydrochloric acid
MeOH = methanol
$NaHSO_4$ = sodium bisulfate
VOC = volatile organic compound
SVOC = semi-volatile organic compound
TAL = target analyte list
+ = Mercury hold time is 28 days, all other metals are 180 days

All data deliverables submitted as part of this remedial investigation will be provided in NYSDEC Analytical Services Protocol (ASP) Category B deliverable format. The data used to characterize the soil at the Site for re-use or to identify GCM will be reviewed and a Data Usability Summary Report (DUSR) will be prepared in accordance with the requirement of Appendix 2B of NYSDEC DER-10. All analytical data generated as part of this remedial investigation will be submitted to the NYSDEC EQuIS system.[5]

4.5 Sampling Storage and Handling Requirements

All laboratory samples collected will be properly preserved according to laboratory requirements, placed in appropriate containers as specified in the above table, and transported on ice under chain of custody to a NYSDOH ELAP certified laboratory.

[5] More information on the NYSDEC EQuIS program is available at https://www.dec.ny.gov/chemical/62440.html

5.0 HEALTH AND SAFETY PROTOCOLS

Roux has prepared a Site-specific HASP that will be adhered to by all personnel involved in the Work Plan activities (see **Appendix B**). The Site-specific HASP was prepared in accordance with the Occupational Safety and Health Administration's (OSHA) Hazardous Waste Operations and Emergency Response Standards (29 CFR 1910.120 and 1926.65) and other OSHA requirements for job safety and health protection, as well as Roux procedures. The Site-specific HASP includes Safety Data Sheets (SDS) for chemicals and materials being used and personal protective equipment (PPE) requirements specific to the type of work that will be conducted. Various documents were consulted while preparing the HASP, including the National Institutes of Safety and Health (NIOSH's) Occupation Safety and Health Guidance Manual for Hazardous Waste Activities.

Site-specific information in the HASP includes:

- Personnel training requirements;
- Description of field activities;
- Decontamination procedures;
- Waste disposal protocols;
- Monitoring procedures for Site operations;
- A hazard assessment;
- The designation of a Site Health and Safety Officer (SHSO);
- A heavy equipment exclusion zone policy;
- CAMP; and
- COVID-19 guidance.

The HASP designates a SHSO who will report directly to the Project Manager and the Corporate Health and Safety Coordinator. The HASP will be subject to revision as necessary, based on new information that is identified during the field investigation. A copy of the Site-specific HASP will be on-Site at all times throughout the work activities.

Remedial construction specialty contractors (Contractors) working under the direction of Roux will be required to prepare and submit a Site-specific HASP prior to initiation of work activities that will cover their employees and their project-specific tasks. Contractors will monitor general Site conditions for safety hazards to verify that all OSHA requirements outlined in 29 CFR Part 1910 and 1926 are adhered to.

5.1 Community Air Monitoring

Real-time community air monitoring will be performed during work activities at the Site. The CAMP is included as **Appendix A**. The CAMP is consistent with the requirements for community air monitoring at remediation sites as established by the NYSDOH and NYSDEC. Accordingly, the CAMP follows procedures and practices outlined under NYSDEC DER-10, including NYSDOH's Generic Community Air Monitoring Plan, and Fugitive Dust and Particulate Monitoring.

Roux will monitor for airborne particulates and VOCs along the upwind and downwind perimeter of the work area. Air monitoring will occur during all ground intrusive activities throughout the duration of this Work Plan including, but not limited to: pre-clearing soil boring locations using hand tools as necessary; advancement of soil borings; completion of soil borings as monitoring wells; collection of subsurface soil, groundwater, and separate-phase product samples; and filling of drums for off-Site disposal. All monitoring data gathered in accordance with the CAMP will be recorded and available for NYSDEC and NYSDOH personnel to review upon request.

6.0 PRINCIPAL PERSONNEL, WORK SCHEDULE AND REPORTING

6.1 List of Principal Personnel/Contact Information

Provided below is a list of key personnel involved in the work, contact information and their responsibilities:

Mike John, Sr. – Property Owner
MJ Painting Contractor Corp.
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mikejohn@mjpaintingcontractor.com

Brian Robinson – Project Engineer/QAO
Senior Engineer
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brobinson@rouxinc.com

Brian Klaus – Senior Manager
Senior Geologist
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Noelle Clarke. P. E. – Principal Engineer
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Islandia, New York
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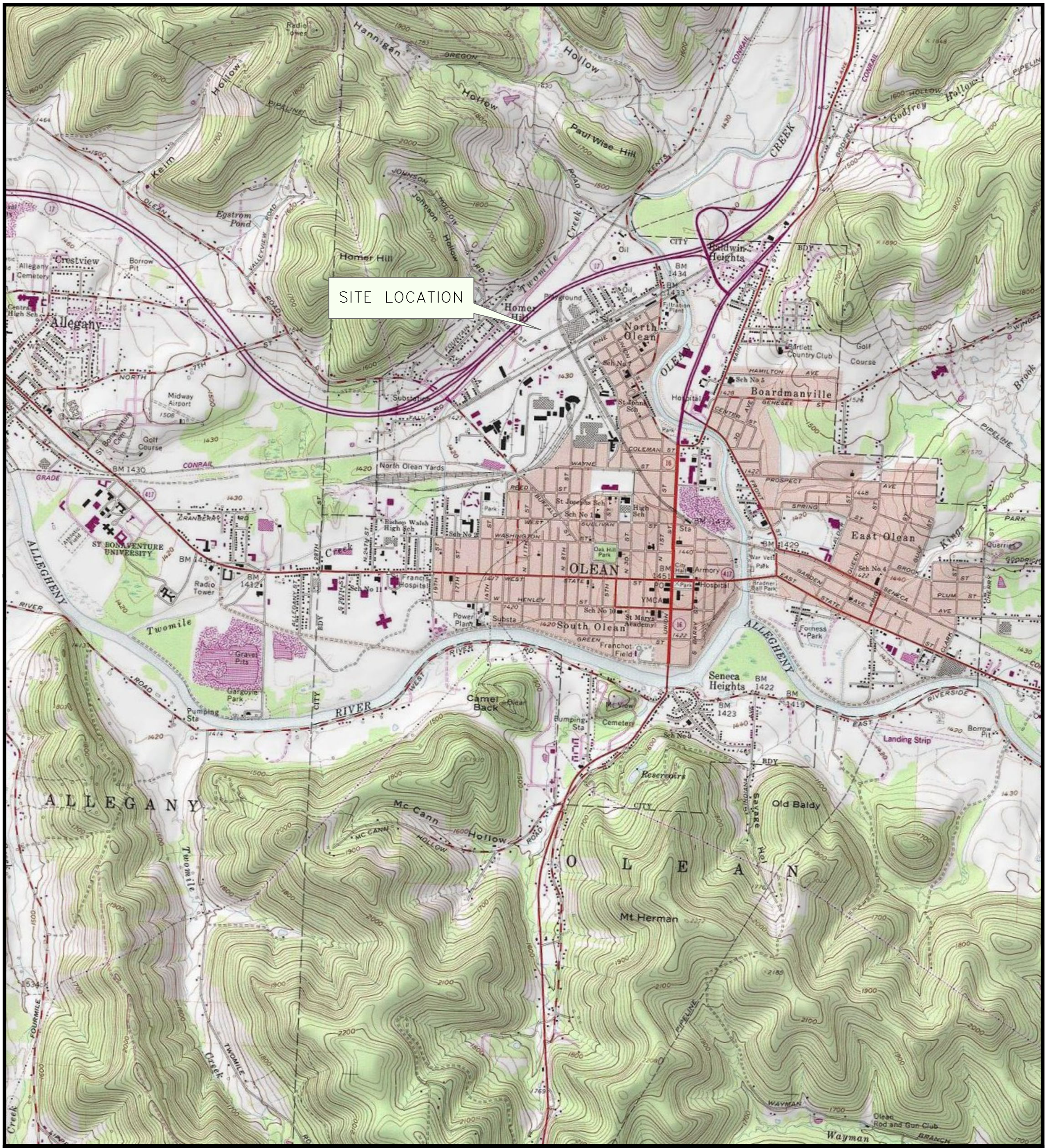
nclarke@rouxinc.com

6.2 Work Schedule and Reporting

The Investigation is anticipated to begin on Monday November 1, 2021 depending on NYSDEC approval of this Work Plan. Within 45 days following receipt of laboratory data, Roux will provide NYSDEC with and email summary of the results, including data tables and maps.

FIGURES



QUADRANGLE LOCATION

N

USGS, 1980, Olean, New York 7.5 Minute Topographic Quadrangle. Contour Interval 3 Meters

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

1,800 0 1,800 3,600 Feet

Title:

SITE LOCATION MAP

350 FRANKLIN STREET

Prepared For: MJ PAINTING CONTRACTOR CORP.

ROUX	Compiled by: SB	Date: 28JUN18	FIGURE
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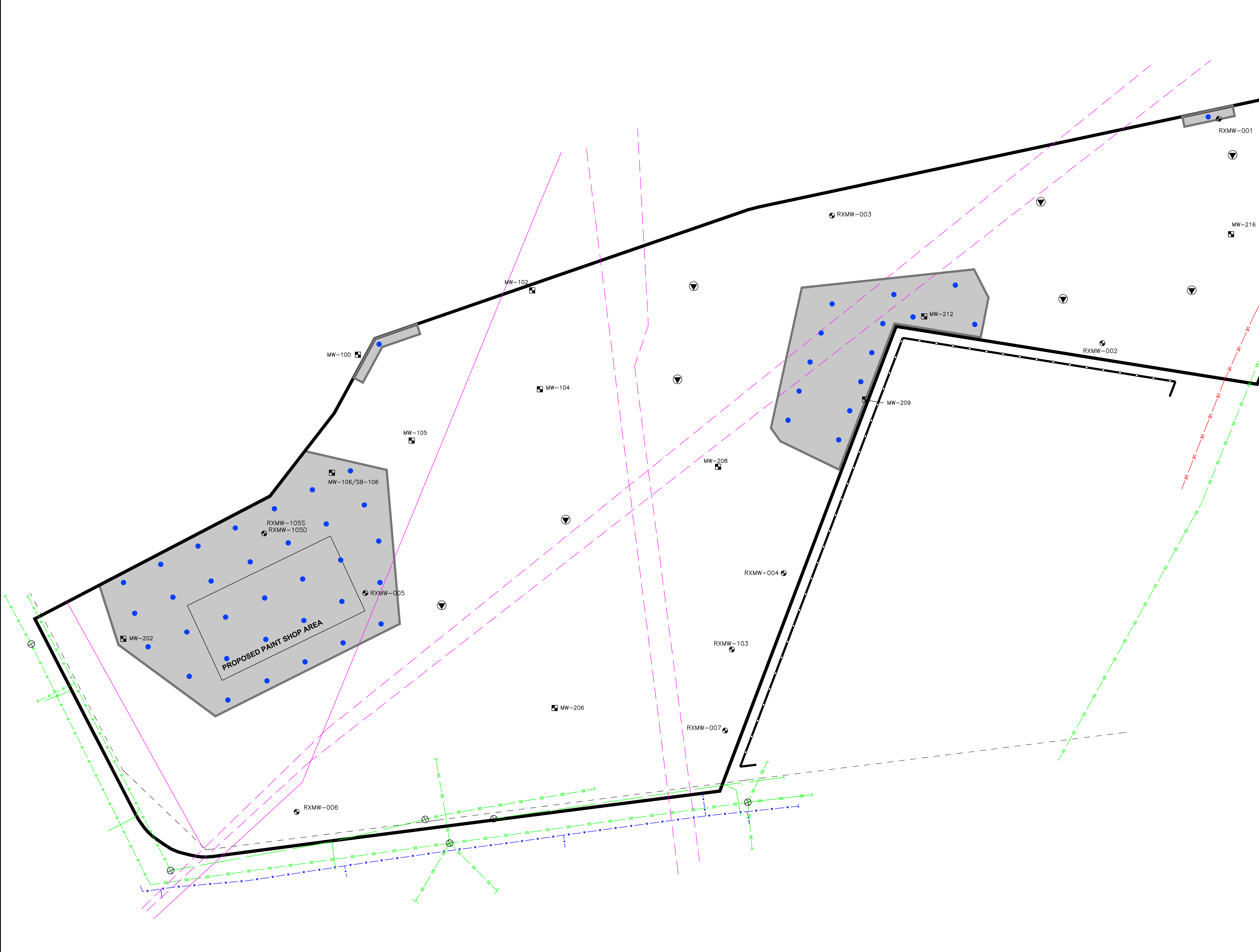

LEGEND

RX-008 REMEDIAL INVESTIGATION (2019–2020) MONITORING WELL LOCATION

MW-104 MONITORING WELL INSTALLED PRIOR TO REMEDIAL INVESTIGATION

PROPOSED MONITORING WELL INSTALLATION LOCATION

PROPOSED PDI SOIL BORING LOCATION

SITE BOUNDARY

NEIGHBORING FENCE LINE

REMEDY AREA

W UNDERGROUND WATER UTILITY

ST UNDERGROUND STORM SEWER UTILITY

SS UNDERGROUND SANITARY SEWER UTILITY

UE UNDERGROUND ELECTRIC UTILITY

OVERHEAD ELECTRIC UTILITY

UTILITY LINE IDENTIFIED ON FELMONT OIL CORP SURVEY MAPS, NOT FIELD VERIFIED, STATUS UNKNOWN

UTILITY CORRIDOR IDENTIFIED ON FELMONT OIL CORP SURVEY MAPS, NOT FIELD VERIFIED, STATUS UNKNOWN

NOTES:

ALL FEATURES ARE APPROXIMATE

THE ENTIRE BCP SITE WILL HAVE A BCP COMPLIANT SITE COVER SYSTEM

REMEDY AREAS WITH DASHED BOUNDARIES INDICATE THAT BOUNDARIES ARE UNDELINEATED

45' 0 45'

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PROJECT FOR:
MJ PAINTING CONTRACTOR CORP.

TITLE:
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ROUX
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12 GILL STREET SUITE 4700 WOBURN MASSACHUSETTS 01801
(781) 569-4000

PROJECT NAME:
MJ PAINTING 350 FRANKLIN STREET

PROJECT FOR:
MJ PAINTING CONTRACTOR CORP.

TITLE:
SURFACE SOIL CHARACTERIZATION PLAN

DRAWING NO.
3
DRAWING
3 OF 3

APPENDICES

APPENDIX A

Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN

350 Franklin Street,
Olean, New York 14760

October 18, 2021

Prepared for:

MJ PAINTING CONTRACTOR CORP.
Mr. Mike John
291 Homer Street, Olean, New York

Prepared by:

ROUX ASSOCIATES, INC.
12 Gill Street, Suite 4700
Woburn, Massachusetts 01801

2317.0002M000.103/RCV

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Appendix

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates), on behalf of MJ Painting Contractor Corp. (MJ Painting), has prepared the following Community Air Monitoring Plan (CAMP) to ensure the investigation and/or remediation activities at 350 Franklin Street Site (the Site), in Olean, New York 14760 do not adversely affect the downwind community, and to preclude or minimize airborne migration of Site contaminants to offsite areas. The proposed activities include advancement of soil borings for completion as monitoring wells and collection of soil (surface and subsurface) and groundwater samples.

Compliance with this CAMP is required during all subsurface investigation activities that have the potential to generate airborne particulate matter and volatile organic compounds (VOCs). Subsurface investigation activities include both ground intrusive activities requiring continuous monitoring (soil boring advancement, and installation of groundwater monitoring wells), as well as non-intrusive activities requiring periodic monitoring (collection of soil and groundwater samples). This CAMP has been prepared to ensure that subsurface investigation activities do not adversely affect passersby or workers in the area immediately surrounding the Site and to preclude or minimize airborne migration of airborne particulate matter and VOCs to off-Site areas.

This CAMP is consistent with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan, which is included as Appendix 1A of the New York State Department of Environmental Conservation (NYSDEC) “Draft DER-10 Technical Guidance for Site Investigation and Remediation (DER-10),” dated May 3, 2010.

2.0 AIR MONITORING PROCEDURES DURING SUBSURFACE INVESTIGATION ACTIVITIES

VOCs, semi-volatile organic compounds (SVOCs), and metals are all constituents of concern at the Site. The appropriate method to monitor air for these constituents during subsurface investigation activities is through real-time VOC and air particulate (dust) monitoring. As discussed, subsurface investigation activities include both ground intrusive activities requiring continuous monitoring for VOC and dust concentrations and non-intrusive activities requiring periodic monitoring for VOCs. Specific air monitoring procedures required during ground intrusive and non-intrusive activities are described below.

Ground Intrusive Activities

Continuous VOCs and particulate monitoring will be required for all ground intrusive activities conducted at the Site including soil boring advancement and groundwater monitoring well installation.

Non-Intrusive Activities

Periodic monitoring for VOCs will be required during non-intrusive activities including the collection of soil and groundwater samples.

2.1 Wind Direction

Wind direction will be evaluated at a minimum at the start of each workday, noon of each workday, and the end of each workday. These readings will be utilized to position the monitoring equipment in appropriate upwind and downwind locations. An appropriate Site figure will be included on the contractor's daily sheet to record the wind direction and monitoring equipment locations.

2.2 Volatile Organic Compound Monitoring

During all ground intrusive activities, VOCs will be monitored periodically at the upwind perimeter and continuously at the downwind perimeter of the designated work areas. A portable hand-held PID will be used to periodically monitor conditions at upwind locations. Monitoring equipment capable of measuring total VOC concentrations (PID) and capable of integrating (averaging) over periods of 15 minutes or less will be set up at the downwind location, at a height of approximately 4 to 5 feet above land surface (i.e., the breathing zone). The audible alarm on the PID will be set at 5 parts per million (ppm). Monitoring equipment will be MiniRAE 2000 portable VOC monitors or similar equipment.

VOC concentrations will be measured at monitoring stations located along the upwind and downwind perimeters of all ground intrusive work areas. Locations of both upwind and downwind monitoring stations will be determined based upon the meteorological data collected throughout the workday and are subject to change in response to changes in wind direction and speed.

A portable hand-held PID will be used to periodically monitor conditions at locations downwind of all non-intrusive work areas during, or immediately prior to, soil and groundwater sampling activities.

The following summarizes VOC action levels and the appropriate responses:

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area 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 are performed, work activities can resume, provided the total organic vapor level 200 feet downwind of the work area or half the distance to the nearest potential receptor or residential/commercial structure – whichever is less but in no case less than 20 feet – is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown, the source of vapors identified, and corrective measures taken to abate emissions, as described below in Section 2.2.1.

All readings will be recorded and made available for NYSDEC and NYSDOH personnel to review. If an exceedance of the Action Limits occurs, an Action Limit Report, as shown in Appendix A, will be completed.

2.2.1 Potential Corrective Measures and VOC Suppression Techniques

If the 15-minute integrated VOC level at the downwind location persists at a concentration that exceeds the upwind level by more than 5 ppm but less than 25 ppm during ground intrusive activities, then vapor suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive organic vapors:

- spraying water onto the equipment;
- covering soil stockpiles (if any) with 6-mil plastic sheeting;
- hauling waste materials in properly tarped containers;
- Odor masking; and/or
- Pausing operations until the wind conditions change such that VOCs and/or odors due to the work are not migrating toward downwind receptors.

All air monitoring readings will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review.

2.3 Particulate Monitoring

Air monitoring for particulates (i.e., dust) will be performed continuously during intrusive subsurface investigation activities using both air monitoring equipment and visual observation at upwind and downwind locations. Monitoring equipment capable of measuring particulate matter smaller than 10 microns (PM_{10}) and capable of integrating (averaging) over periods of 15 minutes or less will be set up at upwind (i.e., background) and downwind locations, at heights approximately four to five feet above land surface (i.e., the breathing zone). Monitoring equipment will be MIE Data Ram monitors, or equivalent. The audible alarm on the particulate monitoring device will be set at 90 micrograms per cubic meter ($\mu g/m^3$). This setting will allow proactive evaluation of worksite conditions prior to reaching the action level of 100 $\mu g/m^3$ above background. The monitors will be calibrated at least once per day prior to work activities and recalibrated as needed thereafter. In addition, fugitive dust migration will be visually assessed during all intrusive subsurface investigation activities.

The following summarizes particulate action levels and the appropriate responses:

- If the downwind PM_{10} particulate level is 100 µg/m^3 greater than background (upwind perimeter) for the 15-minute period, or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM_{10} particulate levels do not exceed 150 µg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM_{10} particulate levels are greater than 150 µg/m^3 above the upwind level, work must be stopped and an evaluation of activities initiated. Work can resume provided that dust suppression measures (as described in Section 2.3.1 below) and other controls are successful in reducing the downwind PM_{10} particulate concentration to within 150 µg/m^3 of the upwind level and in preventing visible dust migration.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. If an exceedance of the Action Limits occurs, an Action Limit Report, as shown in Appendix A, will be completed.

2.3.1 Potential Particulate Suppression Techniques

If the integrated particulate level at the downwind location exceeds the upwind level by more than 100 µg/m^3 at any time during intrusive subsurface investigation activities, then dust suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive dusts:

- spraying water onto the equipment;
- covering soil stockpiles (if any) with 6-mil plastic sheeting;
- hauling waste materials in properly tarped containers; and/or
- limiting vehicle speeds on Site.

Work may continue with dust suppression techniques provided that downwind PM_{10} levels are not more than 150 µg/m^3 greater than the upwind levels.

There may also be situations where the dust is generated by intrusive subsurface investigation activities and migrates to downwind locations, but is not detected by the monitoring equipment at or above the action level. Therefore, if dust is observed leaving the working area, dust suppression techniques such as those listed above will be employed.

If dust suppression techniques do not lower particulates to below 150 µg/m^3, or visible dust persists, work will be suspended until appropriate corrective measures are identified and implemented to remedy the situation.

All air monitoring readings will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review.

3.0 REFERENCES

NYSDOH, 2010. New York State Department of Health Generic Community Air Monitoring Protocol, May 3, 2010 (also included as Appendix 1A to the Draft Technical Guidance for Site Investigation and Remediation, NYSDEC, May 2010).

COMMUNITY AIR MONITORING PLAN

350 Franklin Street,
Olean, New York 14760

October 18, 2021

Prepared By:

Brian Robinson	10/18/2021	
Senior Engineer	Date	Signature

APPENDICES

A. Action Limit Report

APPENDIX A

Action Limit Report

ACTION LIMIT REPORT

Project Location: ______________________________

Date: ______________________ Time: ______________________

Name: ______________________________

Contaminant: PM-10: ______________ VOC: ______________

Wind Speed: ______________ Wind Direction: ______________

DOWNWIND DATA

Monitor ID #: ______________ Location:______________ Level Reported: ______________

Monitor ID#: ______________ Location:______________ Level Reported: ______________

UPWIND DATA

Monitor ID #: ______________ Location:______________ Level Reported: ______________

Monitor ID#: ______________ Location:______________ Level Reported: ______________

BACKGROUND CORRECTED LEVELS

Monitor ID #: ______________ Location:______________ Level Reported: ______________

Monitor ID#: ______________ Location:______________ Level Reported: ______________

ACTIONS TAKEN

APPENDIX B

Health and Safety Plan

ROUX

HEALTH & SAFETY PLAN

MJ Painting Contractor Corp.
350 Franklin Street
Olean, NY 14760

Date: July 17, 2018
Date of Reissue: December 13, 2018
Date of Reissue: October 29, 2020
Date of Reissue: October 15, 2021

2317.0002M000.102.HASP.REV3

Environmental Consulting
& Management
+1.800.322.ROUX
rouxinc.com

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SITE-SPECIFIC EMERGENCY INFORMATION

Emergency Phone Numbers

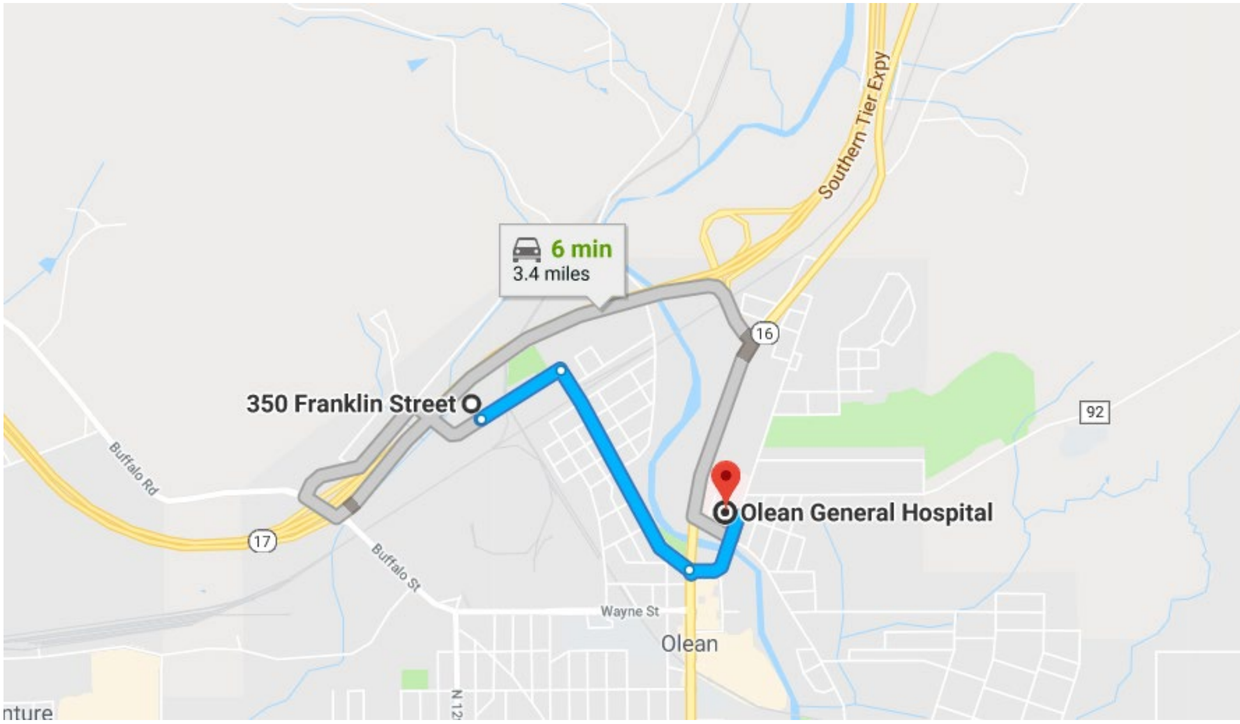
Most emergency services can be obtained by calling **911**. Where 911 service is not available, use the telephone numbers provided in the below table. The following is a master emergency phone list for use by the project management personnel. A more condensed version of the emergency numbers listed below will be posted throughout project work areas. Emergencies encountered on the site will be responded to by a combination of off-site emergency services and on-site personnel.

Emergency Contact Information		
Site Personnel		
Title	Contact	Telephone
Office Manager (OM)	Nancy Nevins, P.G., LSP	781-569-4053 617-549-5351 (Cell)
Project Principal (PP)	Ian Reed	781-569-4030 617-875-9384 (Cell)
Project Manager (PM)	Michael Vanderperre	781-569-4058 914-462-8704 (Cell)
Site Supervisor (SS)	Sophie Hibben	781-569-4032 617-733-3030 (Cell)
Site Health and Site Safety Officer (SHSO)	Sophie Hibben	781-569-4032 617-733-3030 (Cell)
Office Health and Safety Manager (OHSM)	Anthony Marsocci	781-569-4036 585-721-1196 (Cell)
Corporate Health and Safety Manager (CHSM)	Brian Hobbs, CIH, CSP	631-630-2419 631-807-0193 (Cell)
AllOne Health	Occupational Health Care Management Provider	800-350-4511
Client Emergency Contact	Mike John	844-977-9700 716-572-9700

Outside Assistance			
Agency	Contact	Telephone	Address/Location
Ambulance/emergency medical services (EMS)	Olean Fire Department	716-376-5609 911	542 North Union Street Olean, NY 14760
Police	Olean Police Department	716-376-5677 911	101 E State Street Olean, NY 14760
Fire	Olean Fire Department	716-376-5609 911	542 North Union Street Olean, NY 14760
Hospital	Olean General Hospital	716-373-2600	515 Main Street Olean, NY 14760
Occupational Health Clinic	Olean General Hospital Occupational Medicine	716-375-7495	901 Wayne Street Olean, NY 14760
Site Address	350 Franklin Street, Olean, New York		

Directions to Hospital

The nearest hospital to the Site is Olean General Hospital located approximately 1.4 miles from the Site at 515 Main Street, Olean, NY. The Hospital contact number for Olean General Hospital is (716) 373-2600. The map and directions from the Site to Olean General Hospital are as follows:



350 Franklin St
Olean, NY 14760

1. Head northeast on Franklin St

0.3 mi

2. Turn right onto N Union St
   Pass by 7-Eleven (on the right in 0.8 mi)

0.8 mi

3. At the traffic circle, take the 2nd exit onto Main St
   Pass by Pizza Hut (on the right)
   Destination will be on the left

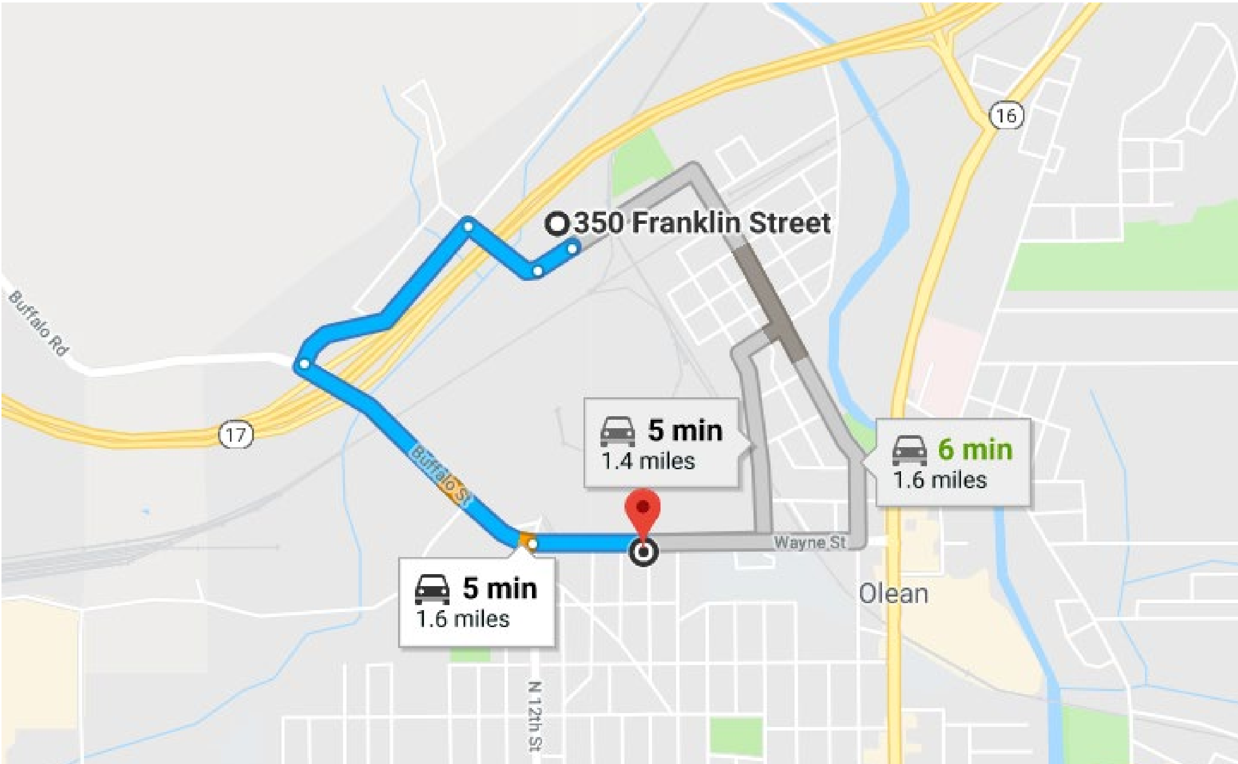
0.3 mi

Olean General Hospital
515 Main St, Olean, NY 14760

Directions to Occupational Health Clinic

An occupational health clinic (OHC) is to be used for non-emergency situations so that delays in treatment and unnecessary services and medications that typically occur as a result of emergency room visits can be avoided. A non-emergency situation is defined as a non-life-threatening occupational injury or illness where the proper use of first aid is the appropriate treatment as opposed to more extensive medical treatment unless it is subsequently determined that the more extensive medical treatment is necessary. Occupational health clinic professionals are more extensively trained in first aid protocols (as defined by OSHA at 29 CFR 1904). These protocols are designed to return of the injured or ill worker to his/her job as quickly as possible and avoid over treatment. Emergency room visits (i.e., 911 calls) are to be reserved for life-threatening situations and those requiring treatment beyond first aid including but not limited to: respiratory distress (i.e., not breathing), amputations, and severe bleeding.

The nearest occupational health clinic to the Site is Olean General Hospital Occupational Medicine, and is located approximately 1.3 miles from the Site at 901 Wayne Street, Olean, NY. The hours of the OHC are Monday - Friday 8 a.m. - 4 p.m. The telephone number for Olean General Hospital Occupational Medicine is (716) 375-7495. The map and directions from the Site are as follows:



350 Franklin St

Olean, NY 14760

↑	1. Head southwest on Franklin St toward Johnson St	472 ft
↑	2. Continue onto Johnson St	0.2 mi
↰	3. Turn left onto Homer St	0.5 mi
↰	4. Turn left onto Buffalo St	0.6 mi
↑	5. Continue onto Wayne St ⓘ Destination will be on the right	0.2 mi

901 Wayne St

Olean, NY 14760

1. INTRODUCTION

This Site-specific Health and Safety Plan (HASP) has been prepared by Roux Associates, Inc. (Roux) for use during the subsurface investigation activities at 350 Franklin Street in Olean, New York ("the Site"; see **Figure 1**). These activities fall within the scope of operations covered by the Occupational Safety and Health Administration (OSHA) standards promulgated at 29 CFR 1910.120 and 29 CFR 1926.65, both commonly referred to as the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard. In accordance with the HAZWOPER Standard, this Site-specific HASP was prepared to address the safety and health hazards associated with the subsurface investigation activities being performed at the Site by Roux and to provide requirements and procedures for the protection of Roux employees, subcontractor personnel, government oversight personnel, Site personnel, and the general public. It also addresses client- and Site-specific requirements for health and safety. Additionally, subcontractors may be required to submit their own HASP as it relates to their specific work activities and will be kept onsite during such work.

Implementation of this HASP is the joint responsibility of the Project Manager (PM), the Site Health and Safety Officer (SHSO), and all field staff, with assistance from the Project Principal (PP), Office Health and Safety Manager (OHSM), and Corporate Health and Safety Manager (CHSM). The PM for this project is Michael Vanderperre. The Site Supervisor (SS) and Site Health and Safety Officer (SHSO) is Sophie Hibben.

This HASP will be introduced to, reviewed, and signed off on by all Roux personnel through a formal training session prior to commencing work. A copy of the HASP will be kept at the Site at all times. The Roux SHSO or PM will be responsible for posting any changes, amendments, memos, etc. to the HASP. Any revisions to this HASP will be signed by appropriate personnel, which can include Roux's PP, CHSM, and SS. Any changes will be announced to all workers at the next safety meeting.

1.1 Roles and Responsibilities

Overall Roles and Responsibilities (R&Rs) of Roux personnel are provided in Roux's Policies and Procedures Manual. Only those R&Rs specific to HASP requirements are listed below.

Project Manager (PM)

The PM has responsibility and authority to direct all work operations. The PM coordinates safety and health functions with the Site Health and Safety Officer (SHSO), has the authority to oversee and monitor the performance of the SHSO, and bears ultimate responsibility for the proper implementation of this HASP. The specific duties of the PM are:

- Preparing and coordinating the Site work plan;
- Providing Site supervisor(s) with work assignments and overseeing their performance; Coordinating safety and health efforts with the SSHO;
- Ensuring effective emergency response through coordination with the Emergency Response Coordinator (ERC); and
- Serving as primary Site liaison with public agencies and officials and Site contractors.

Site Health and Safety Officer (SHSO)

The SHSO has the full responsibility and authority to develop and implement this HASP and to verify compliance. The SHSO reports to the Project Manager. The SHSO is on Site or readily accessible to the Site during all work operations and has the authority to halt Site work if unsafe conditions are detected. The specific responsibilities of the SHSO include:

- Managing the safety and health functions on this Site;
- Serving as the Site's point of contact for safety and health matters;
- Ensuring Site monitoring, worker training, and effective selection and use of PPE;
- Assessing Site conditions for unsafe acts and conditions and providing corrective action;
- Assisting the preparation and review of this HASP;
- Maintaining effective safety and health records as described in this HASP; and
- Coordinating with the Site Supervisor(s) and others as necessary for safety and health efforts.

Site Supervisor

The Site Supervisor is responsible for field operations and reports to the Project Manager (PM). The Site Supervisor ensures the implementation of the HASP requirements and procedures in the field. The specific responsibilities of the Site Supervisor include:

- Executing the work plan and schedule as detailed by the PM;
- Coordination with the SHSO on safety and health; and
- Ensuring Site work compliance with the requirements of this HASP.

Employees

All Roux employees are responsible for reading and following all provisions of the Corporate Health and Safety Manual, including this HASP. Employees report to the SS at the project Site. Each employee is also responsible for the following:

- Wearing all appropriate PPE as outlined within this HASP;
- Attending all safety meetings;
- Inspecting tools and equipment prior to use, and taking any defective tools or equipment out of service;
- Appropriately documenting field events as they occur within a logbook or equivalent;
- Properly operating machinery and/or equipment only if trained to do so;
- Stopping work operations if unsafe conditions exist;
- Identifying and mitigating hazards when observed;
- Reporting all incidents and near misses to the Roux SHSO and SS immediately (see **Appendix J**); and
- Knowing where emergency equipment is located (e.g. first aid kit, fire extinguisher).

Subcontractors and Visitors

Subcontractors and visitors are responsible for complying with the same health and safety requirements. It is the responsibility of all to make sure subcontractors and visitors comply and uphold the HASP. Subcontractors and visitors have the following additional responsibilities:

- Designating a qualified safety representative for the project that can make the necessary changes in work practices, as necessary;
- Attending all safety meetings while participating in Roux Site work activities;
- Reporting all incidents and near misses to Roux SHSO and SS immediately;
- Conducting initial and periodic equipment inspections in accordance with manufacturer and regulatory guidelines; and
- Providing copies of all Safety Data Sheets (SDS) to Roux SHSO for materials brought to the Site.

2. BACKGROUND

MJ Painting Contractor Corp. (MJ Painting) owns the property of concern at 350 Franklin Street, Olean, Cattaraugus County, New York depicted in **Figure 1**. The current use of the parcel is an undeveloped grass field with the exception of large energized billboards adjacent to Interstate 86 located along the northwestern property line. The parcel is comprised of approximately 9.34 acres of land currently zoned for Commercial/Industrial use. A Site Map is included as **Figure 2**.

MJ Painting plans to expand its current operations from the 291 Homer Street parcel onto the 350 Franklin Street parcel which will include redevelopment plans for future growth on an as-need basis. All future use following redevelopment activities on 350 Franklin Street will remain consistent with the current zoning laws/maps (Commercial/Industrial).

Relevant background information is provided below, including a general description of the Site; a brief review of the Site's history with respect to hazardous material use, handling, and/or storage; and a review of known and potential releases of hazardous substances at the Site.

2.1 Site Description

The Site is located in the City of Olean, Cattaraugus County, New York, at 350 Franklin Street (Figure 1). According to the City of Olean Assessor's Office on-line property information database, 350 Franklin Street consists of a 9.34-acre parcel (S.B.L. #94.040-1-2.3). As stated above, 350 Franklin Street consists of an undeveloped grass field, with the exception of the two billboards located along the northwestern property boundary, adjacent to Interstate 86 (I-86).

According to the U.S. Fish and Wildlife National Wetlands Inventory (FWS Wetland Mapper), Two Mile Creek is the only wetland located in the vicinity of the Site. Two Mile Creek is located directly northwest of the Site (see Figure 1). Two Mile Creek flows southwest through Olean, New York and discharges to the Allegheny River. According to the NYSDEC Protection of Waters Program, Two Mile Creek is considered a Class D Stream. Class D is the lowest ranking used by NYSDEC to classify waterways in New York and consists of all waterways and/or waterway segments which cannot be used as a drinking water source, are not suitable for swimming or contact activities and are not suitable for fisheries support or non-contact activities.

The Site and surrounding areas are located within the Allegheny-Ohio-Mississippi River drainage basin and according to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Olean, New York (Figure 3), the Site encompasses both "Zone B" and "Zone C" floodplain areas. Zone B areas are located between the limits of the base flood and the 500-year floodplain. Zone C areas are considered "areas of minimal flood hazard."

Properties in the vicinity (approximately a 0.5-mile radius) of the Site are primarily developed as mixed use and include residential, municipal, commercial, manufacturing and industrial properties. The Site is bordered to the north/northwest by I-86; to the east by "All Weather Self Storage" at 302 Franklin Street; to the southeast by "First Transit, Inc." at 351 Franklin Street and "Scotts Rotary Seals" at 301 Franklin Street; and to the southwest by "Napoleon Engineering Services" at 1601 Johnson Street.

2.2 Site History

The section of Olean, NY which surrounds the area of the Site, has historically been occupied with industrial operations including, but not limited to, petroleum storage and refining, leather tanneries, heavy and light manufacturing, chrome plating, fertilizer manufacturing, and railroad facilities. The Site and area immediately surrounding the Site were formally part of the Socony-Vacuum Oil Company, Inc. refinery, and used primarily as a petroleum refining facility between 1876 and 1954. From 1954 through 1964, Swan Finch Oil Company Olean Industries, Inc. stored grain and corn in approximately 60 tanks and buildings on the refinery property. From 1964 through 1981, Felmont Oil and Agway removed the old refinery tanks and buildings and constructed an anhydrous ammonia plant, jointly producing ammonia and other fertilizers on portions of the surrounding area. Following ownership by Felmont Oil Corporation, the Cattaraugus County Industrial Development Agency owned the parcel from 1981 through 1989 when Blue Bird Industrial Park, Inc. took over ownership in 1989. The parcel was subsequently purchased from Blue Bird Industrial Park, Inc by MJ Painting in March 2018.

2.3 Known and Potential Releases of Hazardous Substances at the Site

Several environmental investigations have been performed at the Site from 2005 through 2016. Previous environmental investigations at the Site include multiple subsurface investigations to evaluate the presence of petroleum impacted soil and/or groundwater associated with past uses of the land and various spills that have occurred on or near the property. Test pit investigations, coupled with geophysical surveys, and limited excavations were also conducted to assess and remove subsurface piping and petroleum-impacted soils.

Previous environmental investigations are summarized below by the applicable NYSDEC Spill Number:

Spill Number 0501100

According to the NYSDEC Spill Report Form for Spill Number 0501100, on April 27, 2005 at 5:06 am, a tractor-trailer owned and operated by Anthony Mast, Inc. was involved in a traffic accident on I-86 eastbound between exits 25 and 26 in Olean, New York. The accident involved the tractor-trailer overturning causing a release of approximately 30 gallons of diesel fuel from a saddle tank of the truck. The diesel fuel was released onto the unpaved, grassy medium. On April 29, 2005, NYSDEC received a report of a sheen on the surface of the water and banks of Two Mile Creek, which flows adjacent to 1-86. NYSDEC determined that the source of the sheen was a culvert that receives drainage from the bridge drains of I-86 in the area of the Anthony Mast, Inc. April 27, 2005 release.

On May 4, 2005, OP Tech excavated soil from the area around the storm water drainage culvert as part of release response actions associated with the Anthony Mast, Inc. diesel fuel release. While removing soils from ground surface to 6 inches (in) below ground surface (bgs), OP Tech personnel observed what they described to be a "sludge/oil material" directly below surficial soils. Under the direction of NYSDEC, OP Tech continued the excavation activities to an approximate depth of 4 to 5 feet (ft) bgs where they encountered groundwater with a "sludge/oil" material on the surface. NYSDEC determined that "a very old product was present just under the area that had been excavated for the spill" and assigned Spill Number 0550226. Spill Number 0501100 was subsequently closed by NYSDEC on February 23, 2006.

Spill Number 0550226

In a June 7, 2005 letter to ExxonMobil, NYSDEC identified ExxonMobil as a responsible party for Spill Number 0550226 and requested investigation and remedial work. Subsequently, several investigations including soil boring, well installation, soil sampling, and groundwater sampling were performed under Roux oversight, on behalf of ExxonMobil.

Spill Number 1300859

In a letter dated April 26, 2013 to ExxonMobil, NYSDEC issued Spill Number 1300859, indicating that *"This spill is associated with petroleum contained in, and potentially spilled from, abandoned dilapidated piping"*, potentially, *"…associated with the historic SOCONY Vacuum Refinery…"* located at 351 Franklin Street, Olean, New York (Parcel 94.040-1-29.1) and on the adjacent Southern Tier Railroad Authority (STRA) property (Parcels 94.048-1-3 and 94.040-1-26). Specifically, the *"petroleum contained within the piping"* was identified during remedial activities at the adjacent 301 Franklin Street property under the NYSDEC BCP (Scott Rotary Seals Site No. C905036). These remedial activities included *"the removal of abandoned refinery piping. Pipes extending off site were cut and capped at the property boundary"* and information pertaining to these pipes is provided in the *Final Engineering Report* prepared for the Scott Rotary Seals site. Further, in the April 26, 2013 letter, NYSDEC requested that ExxonMobil initiate cleanup and removal activities of the "spill" including submittal of a remedial investigation work plan.

Following the initial investigation/remedial efforts conducted under Spill Number 1300859, the Site was expanded to include the 350 Franklin Street parcel. Subsequently, several investigation and remedial activities including geophysical surveys, test pitting, and petroleum impacted soil removal activities were performed at the 350 Franklin Street parcel under Roux oversight, on behalf of ExxonMobil.

Investigation results and materials storage records indicate that benzene, toluene, ethylbenzene, xylenes (BTEX), total petroleum hydrocarbons (TPH), and other petroleum-related constituents are present at the Site including polyaromatic hydrocarbons (PAHs) and metals. The toxicological, physical, and chemical properties of these potential contaminants are presented in **Table 1**.

3. SCOPE OF WORK

Site activities planned at this time and covered by this HASP include activities associated with subsurface investigation activities. All subcontractors used for the completion of these activities will be vetted by Roux for compliance with respect to health and safety requirements and metrics as well as compliance with licensing and insurance requirements.

Proposed activities associated with the subsurface investigation and remediation activities include:

- Advancement of soil borings with direct-push soil boring rig and collection of soil samples.
- Advancement of soil borings for completion as monitoring wells.
- Advancement of shallow hand auger borings and collection of soil samples.
- Collection of groundwater samples.
- Performing air monitoring in the work area throughout the subsurface investigation and remediation activities as detailed in the Community Air Monitoring Plan in accordance with the New York State Department of Health (NYSDOH) (see **Appendix L**).

If there are any changes with the scope a revision of the HASP will be required to address any new hazards.

4. SITE CONTROL

This Site control program is designed to reduce the spread of hazardous substances from contaminated areas to clean areas, to identify and isolate contaminated areas of the Site, to facilitate emergency evacuation and medical care, to prevent unauthorized entry to the Site, and to deter vandalism and theft.

4.1 Site Map

A map of this Site, showing Site boundaries, designated work zones, and points of entry and exit is provided in **Figure 2**.

4.2 Site Access

During work, access to the Site will be restricted to reduce the potential for exposure to its safety and health hazards; work zones will be demarcated during heavy equipment operation and physical barriers (i.e., fencing) are planned to be installed for the heavy construction phase(s) at the Site.

Appendix A details Roux Associates' Traffic Control Management Program and shall be referenced when establishing Site access points.

4.3 Buddy System

Select field activities conducted in contaminated, hazardous, and remote areas of the Site may require the use of the buddy system. Prior to commencing with field tasks in a potentially hazardous area, the need for using the buddy system should be evaluated. The buddy system means that personnel work in pairs and stay in close visual contact to be able to observe one another and summon rapid assistance in case of an emergency. The responsibilities of workers using the buddy system include:

- Remaining in close visual contact with partner;
- Providing partner with assistance as needed or requested;
- Observing partner for signs of heat stress or other difficulties;
- Periodically checking the integrity of partner's PPE; and
- Notifying the Site manager or other Site personnel if emergency assistance is needed.

4.4 Site Communications

The following communication equipment is used to support on-site communication: Cell phones and visual hand signals.

Telephones are utilized for communication with emergency support services/facilities. Roux personnel will be equipped with a mobile telephone. The use of cell phones or other mobile communications devices (including but not limited to "smart" phones) while operating vehicles/ equipment/ tools or while working within defined work area exclusion zones is prohibited.

As applicable, hand signals will be used according to the following:

Hand Signals

SIGNAL	MEANING
Hand gripping throat	Out of air, can't breathe
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I'm all right, okay
Thumbs down	No, negative

A current list of emergency contact numbers is included in the Site-Specific Emergency Information at the beginning of this HASP.

4.5 Site Work Zones

This Site is divided into three (3) major zones, described below. These zones are characterized by the likely presence or absence of biological, chemical, or physical hazards and the activities performed within them. Zone boundaries are clearly marked at all times and the flow of personnel among the zones is controlled. The Site is monitored for changing conditions that may warrant adjustment of zone boundaries. Zone boundaries are adjusted as necessary to protect personnel and clean areas. Whenever boundaries are adjusted, zone markings are also changed and workers are immediately notified of the change.

Exclusion Zone

The area where contamination exists is the Exclusion Zone (EZ). All areas where excavation and handling of contaminated materials take place are considered part of the EZ. This zone will be clearly delineated by chain link fencing, caution tape, cones or other effective barriers, as necessary. Safety tape may be used as a secondary delineation within the EZ. The zone delineation markings may be opened in areas for varying lengths of time to accommodate equipment operation or specific construction activities. The SHSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy (co-worker);
- Required minimum level PPE;
- Medical authorization;
- Training certification; and
- Requirement to be in the zone.

Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) is established between the exclusion zone and the support zone. The CRZ contains the Contamination Reduction Corridor (CRC) and provides an area for decontamination of personnel and equipment. The CRZ will be used for general Site entry and egress in addition to access for heavy equipment and emergency support services. Personnel are not allowed in the CRZ without:

- A buddy (co-worker)
- Appropriate PPE
- Medical authorization
- Training certification
- Requirement to be in the zone

Support Zone

The Support Zone (SZ) is an uncontaminated area that will be the field support area for the Site operations. The SZ will contain the HASP, sampling equipment, air monitoring equipment and provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

5. JOB HAZARD EVALUATION

Roux's work at the Site is expected to entail a variety of physical, chemical, and biological hazards, all of which must be sufficiently managed to allow the work to be performed safely. Some of the hazards are Site-specific (i.e., they are associated with the nature, physical characteristics, and/or routine operation of the Site itself), while others are activity-specific (i.e., they are associated with [or arise from] the particular activity being performed). The various hazards can be grouped into the following categories:

- **Caught/Crushed** – the potential to become caught in, under, between, or by an object or parts of an object, such as equipment with parts that open and close or move up and down ("pinch points") or equipment that rotates, and the accompanying potential to have body parts cut, mangled, or crushed thereby.
- **Contact** – the potential to be struck by or against moving or stationary objects that can cause physical injury, such as heavy machinery, overhead piping, moving vehicles, falling objects, and equipment (including tools and hand-held equipment) or infrastructure with the ability to cut or impale.
- **Energy Sources** – the potential for bodily harm associated with energy sources, most notably electricity, but also including latent energy sources such as compressed air and equipment under tension (which when released could cause injurious contact or a fall).
- **Ergonomics** – the potential for musculoskeletal injury associated with lifting/carrying, pushing/pulling, bending, reaching, and other physical activity attributable to poor body position/mechanics, repetitive motion, and/or vibration (**Appendix C**).
- **Exposure** – the potential for injury/illness due to physical, chemical, or biological exposures in the work environment, including but not limited to temperature extremes, solar radiation, and noise (physical), chemical splashes and hazardous atmospheres (chemical), and animal/insect bites and poisonous plants (biological).
- **Falls** – the potential to slip or trip and thus fall or drop a load, resulting in bodily injury to oneself or others.

The foregoing is intended to provide Roux employees with a general awareness of the hazards involved with Site work. A more detailed review of the potential hazards associated with each specific activity planned for the Site (or on-going activity, as the case may be) is provided in the activity-specific Job Safety Analysis (JSA) forms in **Appendix F**. As can be seen in the JSA forms, the hazards are identified by category per the above, and specific measures designed to mitigate/manage those hazards are also identified. In preparing the JSA forms, all categories of hazards were considered, and all anticipated potential hazards were identified to the extent possible based on the experience of the personnel preparing and reviewing the JSA forms. However, there is always the possibility for an unanticipated hazard to arise, potentially as condition change over the course of the workday. Roux personnel must maintain a continual awareness of potential hazards in the work zone, regardless of whether the hazard is identified in the JSA form. Particular attention should be paid to hazards associated with exposure to hazardous substances (see **Table 1** for a listing of the hazardous substances most likely to be encountered in environmental media at the Site) and to Site personnel being located "in the line of fire" with respect to moving equipment, pinch points, and latent energy (e.g., being located or having body parts located within the swing radius of an excavator, between two sections of pipe being connected, below a piece of suspended equipment, or adjacent to a compressed air line).

5.1 Hazard Communication and Overall Site Information Program

The information in the JSAs and safety data sheets is made available to all employees and subcontractors who could be affected by it prior to the time they begin their work activities. Modifications to JSAs are communicated during routine pre-work briefings.

The information in the JSAs and Safety Data Sheets (SDSs) is made available to all employees and subcontractors who could be affected by an exposure to the hazards covered in them prior to the time they begin their work activities. Modifications to JSAs are communicated during routine pre-work briefings, and periodically updated as needed in the HASP. SDSs will be maintained by the SHSO/SS for new chemicals brought on-site as needed. Copies of SDSs can be found in **Appendix E**.

5.2 Noise

Noise is associated with the operation of heavy equipment, power tools, pumps, and generators. Noise is also a potential hazard when working near operating equipment such as excavators, drill rigs or pole drivers. High noise (i.e., < 85 dBA) operations may be evaluated by the SHSO utilizing a type 2 handheld sound level meter (SLM) operating on the "A"-weighted scale with slow response because this scale most closely resembles human response to noise and complies with OSHA 29 CFR 1910.95. Hearing protection is required in areas with noise exposure greater than 85 dBA. Double hearing protection (ear plugs and earmuffs) are required in areas where the noise exposure is more than 95 dBA. Noise exposure will be controlled by hearing protection as described above or by maintaining set-backs from high-noise equipment, as warranted. Personnel handling heavy equipment and using power tools that produce noise levels exceeding those described levels above are required by OSHA 29 CFR 1910.95 to wear the appropriate Noise Reduction Rating (NRR) level of hearing protection. Appropriate hearing protection will be evaluated by the SHSO as necessary in consultation with the OHSM and CHSM (see **Appendix D**).

5.3 Biological Hazards

Biological hazards that may potentially be present at a Site, include poisonous plants, insects (ticks, spiders, bees), animals (snakes, dogs), etc. Information on biological hazards can be found within Roux's Biological Hazard Awareness Management Program located within Roux's Corporate Health and Safety Manual. There is also potential for transmission and/or exposure to SARS-CoV-2, the virus that causes COVID-19. Prior to beginning work, on-Site protocols shall be established by the project team, including subcontractors, in accordance with federal, state, county, city, and/or other guidance, as applicable and consistent with **Appendix I**. Government guidance/orders generally consist of implementation of the following protocols/procedures (or some variation thereof):

- Self-monitoring for symptoms;
- Fitness check for work each day;
- Limiting businesses to "essential" operations;
- Social distancing (generally 6 feet);
- Cloth face masks/ coverings;
- Hand washing/ disinfectant use; and
- Care/ awareness of surroundings (public spaces, equipment, hotel rooms, rental cars).

Additional guidance on minimizing potential exposure to SARS-CoV-2, including a JSA, are included in **Appendix I**.

5.4 Chemical Hazards

Investigation results and materials storage records indicate that BTEX, TPH, PCBs, PAHs, metals and other petroleum-related constituents are present at the Site. The toxicological, physical, and chemical properties of these potential contaminants are presented in **Table 1**. This table includes Occupational Exposure Limits (OELs), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs®), National Institute of Occupational Safety & Health (NIOSH) Recommended Exposure Limits (RELs), and OSHA Permissible Exposure Limits (PELs) that will establish the level of protection. Permissible Exposure Limits (PELs) are located on each product's SDS. When evaluating exposure limits, OELs govern unless a lower TLV® or PEL has been established. For chemicals without an OEL, the most conservative value shall be considered. The potential for encountering these hazards exists during intrusive activities such as excavation/earth moving activities, or when exposed to untreated, recovered groundwater.

Due to the potential high frequency of heavy equipment use during site operations, the effect of carbon monoxide (CO) generation in breathing spaces can potentially be hazardous to Site personnel. As such, an assessment of health hazards associated with CO, routes of exposure, symptoms of exposure, effects on human physiology, air concentration Action Levels and corresponding measures to mitigate exposure, and CO have been included in the toxicological **Table 1**.

5.5 COVID-19

Due to ongoing community transmission of SARS-CoV-2, the virus that causes COVID-19. Prior to beginning work, on-Site protocols shall be established by the project team, including subcontractors, in accordance with federal, state, county, city, and/or other guidance, as applicable and consistent with Roux's Covid-19 Plan **Appendix I**. Government guidance/orders generally consist of implementation of the following protocols/procedures (or some variation thereof):

- Self-monitoring for symptoms;
- Fitness check for work each day;
- Limiting businesses to "essential" operations;
- Social distancing (generally 6 feet);
- Cloth face masks/coverings;
- Hand washing/disinfectant use; and
- Care/awareness of surroundings (public spaces, equipment, hotel rooms, rental cars).

Additional guidance on minimizing potential exposure to SARS-CoV-2, including a JLA, are included in **Appendix I**.

6. EMERGENCY RESPONSE PLAN

This emergency response plan details actions to be taken in the event of Site emergencies. The PM and SHSO is responsible for the implementation of emergency response procedures onsite. The SHSO/PM provides specific direction for emergency action based upon information available regarding the incident and response capabilities and initiates emergency procedures and notification of appropriate authorities. In the event of an emergency, Site personnel are evacuated and do not participate in emergency response activities, response is facilitated through external emergency services.

6.1 Emergency Response

The SHSO, after investigating the incident and relevant information, shall determine the level of response required for containment, rescue and medical care. Limited on-site emergency response activities could occur therefore the SHSO is responsible for notifying external emergency response agencies. The SHSO provides relevant information to the responding organizations, including but not limited to the hazards associated with the emergency incident, potential containment problems, and missing Site personnel.

6.2 Emergency Alerting and Evacuation

If evacuation notice is given, Site workers leave the worksite, if possible, by way of the nearest exit. Appropriate primary and alternate evacuation routes and assembly areas have been identified and are shown on the Site Plan with Emergency Muster Area (**Figure 2**). The routes and assembly area will be determined by conditions at the time of the evacuation based on wind direction, the location of the hazard source, and other factors as determined by SHSO/PM.

Personnel exiting the Site gather at a designated assembly point. To determine that everyone has successfully exited the Site, personnel will be accounted for at the assembly point. If any worker cannot be accounted for, notification is given to the SHSO, PM, and any arriving response authorities so that appropriate action can be initiated. Subcontractors on this Site have coordinated their emergency response plans to ensure that these plans are compatible and potential emergencies are recognized, alarm systems are clearly understood, and evacuation routes are accessible to all personnel relying upon them.

6.3 Emergency Medical Treatment and First Aid

In the event of a work-related injury or illness, employees are required to follow the procedures outlined below. All work-place injury and illness situations require Roux's Project and Corporate Management Team to be notified when an injury/illness incident occurs, and communication with the contracted Occupational Health Care Management Provider, AllOne Health (AOH), is initiated. The Injury/Illness Notification Flowchart is provided below and within Roux's Incident Investigation and Reporting program included within Roux's Corporate Health and Safety Manual.

If on-Site personnel require any medical treatment, the following steps will be taken:

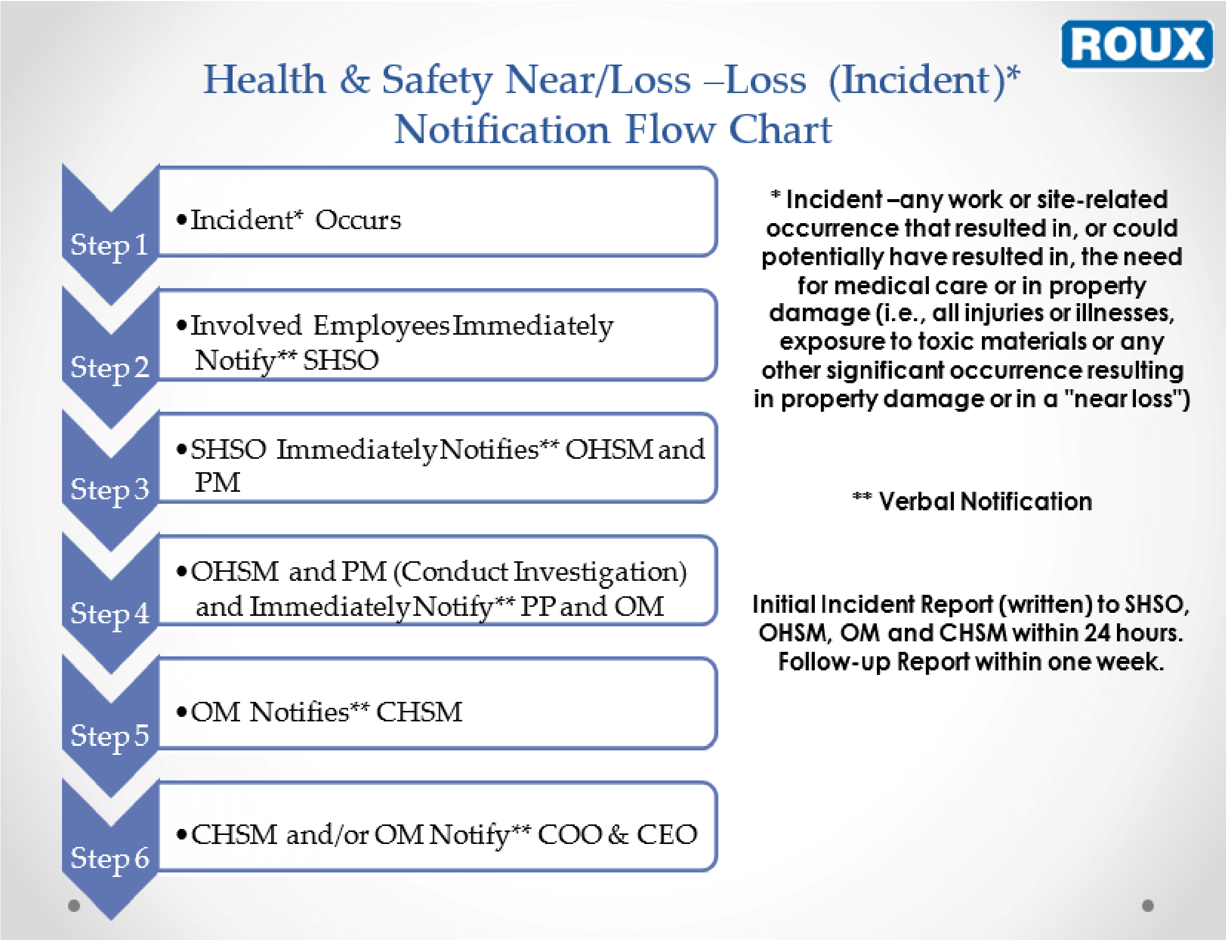
a. Notify Roux's Project and Corporate Management Team for any work-related injury and/or illness occurrence, and communicate with the contracted Occupational Health Care Management Provider, AOH, immediately following the notifications provided above.

b. Based on discussions with the Project Team, Corporate Management and the AOH evaluation, if medical attention beyond onsite First Aid is warranted, transport the injured / ill person (IP) to the Urgent Care Center, or notify the Fire Department or Ambulance Emergency service and request an ambulance or transport the victim to the hospital, and continue communications with Corporate Management Team. An Urgent Care/Hospital Route map with location to Olean General Hospital Occupational Medicine is provided at the beginning of this HASP.

c. Decontaminate to the extent possible prior to administration of first aid or movement to medical or emergency facilities.

d. First aid medical support will be provided by onsite personnel trained and certified in First Aid, Cardio Pulmonary Resuscitation (CPR), Automatic External Defibrillation (AED), and Blood-Borne Pathogens (BBP) Awareness, until relieved by emergency medical services (EMS).

e. The SHSO and Project Manager will perform a Loss Investigation (LI) and the Project Team will complete the final Loss Report. If a Roux employee is involved in a vehicular incident, the employee must also complete the Acord Automobile Loss Notice.



6.4 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO or project principal will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries;
- Potential for cold stress and cold-related injuries;
- Treacherous weather-related conditions;
- Limited visibility; and
- Electrical storm potential.

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lightning. Observe daily weather reports and evacuate if necessary in case of inclement weather conditions.

6.5 Electrical Storm Guidelines

In the event that lightning and/or thunder are observed while working onsite, all onsite activities shall stop and personnel shall seek proper shelter (e.g., substantial building, enclosed vehicle, etc.). Work shall not resume until the threat of lighting has subsided and no lightning or thunder has been observed for 30 minutes. If the possibility of lightning is forecast for the day, advise the onsite personnel on the risks and proper procedure at the pre-work safety briefing. Continuously monitor for changing weather conditions and allow enough time to properly stop work if lightning is forecast.

7. SAFETY PROCEDURES

This section of the HASP presents the specific safety procedures to be implemented during Roux's activities at the Site in order to protect the health and safety of various on-site personnel. Minimum OSHA-mandated procedures are presented first, followed by client- and Site-specific procedures. Lastly, activity-specific procedures are discussed. These Site and activity-specific procedures supplement the general safety procedures included in Roux's Corporate Health and Safety Manual, which also must be followed in their entirely.

7.1 Training

At a minimum, Site personnel who will perform work in areas where there exists the potential for toxic exposure will be health and safety-trained prior to performing work onsite per OSHA 29 CFR 1910.120(e) and 29 CFR 1926.65(e). More specifically, all Roux, subcontractor, and other personnel engaged in sampling and remedial activities at the Site and who are exposed or potentially exposed to hazardous substances, health hazards, or safety hazards must have received at a minimum the 40 hour initial HAZWOPER training consistent with the requirements of 29CFR 1910.120(e)(3)(i) training and a minimum of 3 days' actual field experience under the direct supervision of a trained experienced supervisor, plus 8 hours of refresher training on an annual basis. Depending on tasks performed, less training may be permitted. Evidence of such training must be maintained at the Site at all times. Furthermore, all on-Site management and supervisory personnel directly responsible for or who supervise the employees engaged in Site remedial operations, must have received an additional 8 hours of specialized training at the time of job assignment on topics including, but not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazard monitoring procedure and techniques, plus 8 hours of refresher training on an annual basis.

Roux personnel training records are maintained in a corporate database with records available upon request from either the OHSM/SHSO/CHSM or Human Resources Department.

7.2 Site-Specific Safety Briefings for Visitors

A site-specific briefing is provided to all site visitors who enter this site beyond the site entry point. For visitors, the site-specific briefing provides information about site hazards, the site lay-out including work zones and places of refuge, the emergency alarm system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

7.3 HASP Information and Site-Specific Briefings for Workers

Site personnel review this HASP and are provided a Site-specific tailgate briefing prior to the commencement of work to ensure employees are familiar with this HASP and the information and requirements it contains, as well as the relevant JSAs included in **Appendix F**. Additional briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during on-going Site characterization and analysis of changing conditions. Conditions for which we schedule additional briefings include, but are not limited to: changes in site conditions, changes in the work schedule/plan, newly discovered hazards, and incidents occurring during Site work.

7.4 Medical Surveillance

The medical surveillance section of the Health and Safety Plan describes how worker health status is monitored at this site. Medical surveillance is used when there is the potential for worker exposure to hazardous substance at levels above OSHA permissible exposure limits or other published limits. The purpose of a medical surveillance program is to medically monitor worker health to ensure that personnel are not adversely affected by site hazards. The provisions for medical surveillance at this site are based on the site characterization and job hazard analysis found in Section 4 of this HASP and are consistent with OSHA requirements in 29 CFR 1910.120(f) and the following substance-specific requirements found in **Table 1**.

- Benzene
- Toluene
- Ethylbenzene
- Xylenes
- Naphthalene
- Isopropylbenzene
- Pyrene
- Phenanthrene
- Arsenic
- Barium
- Chromium

7.4.1 Site Medical Surveillance Program

Medical surveillance requirements are based on a worker's potential for exposure as determined by the site characterization and job hazard analysis documented in Section 4 and JSAs within **Appendix F** of this HASP and in compliance with the requirements of 29 CFR 1910.120(f)(2). Based on site information and use of direct reading instruments, limited use of respirators (less than 30 days per year), and the absence of an employee-staffed HAZMAT team, a limited medical surveillance program is required and implemented at this site. The medical surveillance program provides that:

1. Workers assigned to tasks requiring the use of respirators receive medical examinations in accordance with 29 CFR 1910.134(e) to ensure they are physically capable to perform the work and use the equipment, and
2. If a worker is injured, becomes ill, or develops signs or symptoms of possible over-exposure to hazardous substance or health hazards, medical examinations are provided to that worker as soon as possible after the occurrence and as required by the attending physician.
3. These medical examinations and procedures are performed by or under the supervision of a licensed physician and are provided to workers free of cost, without loss of pay, and at a reasonable time and place. In addition, the need to implement a more comprehensive medical surveillance program will be re-evaluated after any apparent over-exposure.

7.4.2 Medical Recordkeeping Procedures

Medical recordkeeping procedures are consistent with the requirements of 29 CFR 1910.1020 and are described in the company's overall safety and health program. A copy of that program is available at our Islandia, New York office.

The following items are maintained in worker medical records:

- Respirator fit test and selection;
- Physician's medical opinion of fitness for duty (pre-placement, periodic, termination);
- Physician's medical opinion of fitness for respirator protection (pre-placement, periodic); and
- Exposure monitoring results.

7.4.3 Program Review

The medical program is reviewed to ensure its effectiveness. The Corporate Health and Safety Manager in coordination with the Human Resources Director is responsible for this review. At minimum, this review consists of:

- Review of accident and injury records and medical records to determine whether the causes of accidents and illness were promptly investigated and whether corrective measures were taken wherever possible;
- Evaluation of the appropriateness of required medical tests based on site exposures; and
- Review of emergency treatment procedures and emergency contacts list to ensure they were site-specific, effective, and current.

7.5 Personnel Protection

Site safety and health hazards are eliminated or reduced to the greatest extent possible through engineering controls and work practices. Where hazards are still present, a combination of engineering controls, work practices and PPE are used to protect employees. Appropriate personal protective equipment (PPE) shall be worn by Site personnel when there is a potential exposure to chemical hazards or physical hazards (e.g., falling objects, flying particles, sharp edges, electricity, and noise), as determined by the SHSO. The level of personal protection, type and kind of equipment selected will depend on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors will be made before work can be safely executed.

Roux maintains a comprehensive written PPE program that addresses proper PPE selection, use, maintenance, storage, fit and inspection. Roux's PPE program can be found within **Appendix K**. PPE to be used at the Site will meet the appropriate American National Standards Institute (ANSI) standards and the following OSHA (General/Construction Industry) standards for minimum PPE requirements.

The minimum level of PPE for entry onto the Site is Level D. The following equipment shall be worn:

- Work uniform (long pants, sleeved shirt);
- Hard hat;
- Steel or composite toe work boots;

- Safety Glasses (must comply with one of the following ANSI/ISEA Z87.1-2010, ANSI Z87.1-2003, ANSI Z87.1-2003);
- Boot Covers (as needed);
- Hearing protection (as needed);
- High visibility clothing (shirt/vest); and
- Hand protection (e.g., minimum cut resistance meeting ANSI 105-2000 Level 2).

Note that jewelry shall be removed or appropriately secured to prevent it from becoming caught in rotating equipment or unexpectedly snagged on a fixed object (e.g., wrist watches, bracelets, rings, chains and necklaces, open earrings). Do not wear loose clothing and all shoulder-length hair should be tied back.

Site specific PPE ensembles and materials are identified within task specific JSAs located within **Appendix F**, and any upgrades or downgrades of the level of protection (i.e., not specified in the JSA) must be approved by the PP and immediately communicated to all Roux personnel and subcontractors as applicable. PPE is used in accordance with manufacturer's recommendations.

7.5.1 Hearing Conservation

Hearing protection is made available when noise exposures equal or exceed an 8-hour time-weighted average sound level of 85 dBA. Hearing protection is required when the 8-hour time weighted average sound level $\geq$ 90 dBA. Where noise exposure meets or exceeds this level, noise is listed as a physical hazard in the JSA for the tasks/operation, and hearing protection is included as one of the control measures (PPE).

7.6 Monitoring

An air monitoring program is important to the safety of on- and off-Site personnel, and the surrounding area. A preliminary survey, to establish background conditions in the immediate sampling area, may be made prior to the initiation of Site work including, but not limited to, monitoring wind direction (e.g., wind socks) and approximate temperature during all invasive Site activities. This survey will be conducted with the appropriate pre-calibrated air monitoring instrument(s), as warranted by the field activity. Once this survey has been complete, any changes in the type of PPE will be determined and relayed to those working on-Site.

Work zone air monitoring will be performed to verify that the proper level of PPE is used, and to determine if increased protection or work stoppage is required. The following equipment shall be used to monitor conditions:

- A Photoionization Detector (PID) with a lamp energy of 10.6 eV will be used to provide direct readings of organic vapor concentrations during intrusive activities to determine that personnel protection is adequate. Concentrations shall be recorded during intrusive activities with the potential to encounter contaminant vapors.
- A pre-calibrated multi-gas meter with combustible Lower Explosive Limit (LEL), oxygen (O_2), carbon monoxide (CO), and hydrogen sulfide (H_2S) sensors shall be used to monitor the potential for oxygen-deficient atmospheres, explosive concentrations of organic vapors, and toxic gases during intrusive operations. Monitoring will be performed according to the action levels for oxygen and combustible gases provided in this section. The calibration for this device will be performed using a known gas composition calibration mixture.

Personal exposure monitoring utilizing activated charcoal tubes may be considered based on whether or not the area sample results are at or above half of the PEL. The decision to perform the monitoring will be made by, and under the control of, the CHSM.

Below are monitoring action levels for Site-specific chemicals of concern. In the event PID readings above the thresholds identified below are sustained for 5 minutes in the breathing zone, worker protection will require upgrading following notification to the OHSM and applicable parties (e.g., client, board of health, regulators, etc.).

7.6.1 Action Levels for Air Monitoring

PPE can remain at Level D if breathing zone VOC concentrations are less than 5 ppm and benzene is non-detect. Personnel are required to evacuate the Site when breathing zone VOC readings exceed 25 ppm.

The following tables include summaries of the air monitoring, work practices, and action levels for the expected contaminants. The action levels to initiate testing with colorimetric tubes for airborne volatiles is 1 ppm (PID reading) and is based on the Permissible Exposure Limit (PEL) for benzene (1 ppm). The colorimetric tubes are used to confirm the presence or absence of specific constituents, and they do not provide a measured concentration.

Air Monitoring Summary and Action Levels Organic Vapors	
PID Reading in Breathing Zone (ppm)[1]	**Action**
0-1 ppm above background[2]	Continue monitoring
1-5 ppm sustained 60 seconds	Continue monitoring, if applicable initiate additional collection of benzene using colorimetric tubes.
<5 ppm and no presence of benzene	Continue Monitoring, ventilate space
≥ 5 ppm - ≤ 25 ppm and no presence of benzene	Ventilate space until PID reads < 5 ppm. If < 5 ppm cannot be achieved, upgrade to Level C[3].
≥ 25 ppm	Ventilate space and evacuate area.

1 Based on relative response/sensitivity of PID to benzene.
2 Background concentrations should be established at the beginning of each work day. It may be necessary to re-establish background concentrations and ambient conditions vary through the day.
3 Measured air concentrations of known organic vapors will be reduced by the respirator to one half of the PEL or lower, and the individual and combined compound concentrations shall be within the service limit of the respirator cartridge.

Air Monitoring Summary and Action Levels Oxygen	
O_2 Reading in Breathing Zone (%)[1]	**Action**
20.9% O_2	Oxygen level normal
< 19.5% O_2	Oxygen deficient Interrupt task/Evacuate area
>23.5% O_2	Oxygen enriched Interrupt task/Evacuate area

1. Action levels based on USEPA Standard Operating Safety Guides; Table 5-1, Atmospheric Hazard Action Guidelines may be further restricted based on the CHSM's professional judgment and experience.

Air Monitoring Summary and Action Levels Carbon Monoxide	
CO Reading in Breathing Zone (ppm)[1]	**Action**
<25 ppm	Inspect exhaust system for leaks or other sources of CO. Monitor initially and every 15 minutes during use of CO-generating equipment.
25-50 ppm	Ventilate area. Monitor continuously and record measurements. Contact PM.
>50 ppm	Cease Field Operations. Ventilate area.

1. Based upon the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) of 25 ppm as an 8 hour time weighted average (TWA) and OSHA's Permissible Exposure Limit (PEL) of 50 ppm as an 8-hour TWA concentration.

Air Monitoring Summary and Action Levels Combustible Gases	
Lower Explosive Limit (LEL) Reading	**Action**
< 4% LEL (<2,000 ppm)	Site activities will continue with normal monitoring
4% – 20% LEL (2,000 – 10,000 ppm)	Stop work until levels dissipate to <4% LEL
> 20% LEL (>10,000 ppm)	Potential explosion hazard. Halt all site activities, research source of release, aerate work area, suppress source.

Air Monitoring Summary and Action Levels Hydrogen Sulfide	
Hydrogen Sulfide (H_2S) Reading	**Action**
<10 ppm	Site activities will continue with normal monitoring
>10 ppm	Stop work until levels dissipate to <10 ppm; use mechanical ventilation if possible
Cannot use air purifying respirators for H_2S because of olfactory fatigue	

7.6.2 Air Monitoring Equipment and Calibration

A PID calibrated to an appropriate calibration mixture will be used to detect organic vapors in and around the work areas. Monitoring will be conducted in and around all work areas and at the workers breathing zone before activities commence to establish a background level, then at 15-minute intervals throughout the day. All equipment will be calibrated according to the manufacturer's recommendation. A calibration log will be maintained and will include the name of the person who performed the calibration, the date and time calibrated, and the instrument reading at the time of calibration. A manual bellows pump or equivalent with colorimetric tubes for formaldehyde will be utilized to determine the course of action related to upgrading or downgrading the level of respiratory protection, as applicable.

If air monitoring data indicate safe levels of potentially harmful constituents at consistent intervals (5-minute intervals), then monitoring can be conducted less frequently (every 30 minutes). This determination will be made by the onsite SHSO. Monitoring data, including background readings and calibration records, will be documented. Work to be performed on-Site will conform to Roux's Standard Operating Procedures (SOPs). Conformance with these guidelines as well as the guidelines described in this HASP will aid in mitigating the physical and chemical hazards mentioned throughout this HASP.

7.7 Tailgate Safety Meetings

A designated Site worker will provide daily safety briefings (e.g., tailgate meetings) including, but not limited to, the following scenarios:

- When new operations are to be conducted;
- Whenever changes in work practices must be implemented; and
- When new conditions are identified and/or information becomes available.

Daily safety briefings shall be recorded on the Roux Daily Tailgate Health and Safety Meeting Log/Daily Site Safety Checklist, and all completed forms will become a part of the project file.

7.8 Spill Containment

Spill containment equipment and procedures should, at a minimum, meet the requirements of the facility's Spill Prevention, Control and Countermeasure Plan, if applicable. Otherwise, spill containment equipment and procedures must be considered depending on the task including, but no limited to, chemical/product transfer points and handling.

7.8.1 Initial Spill Notification and Response

Any worker who discovers a hazardous substance spill will immediately notify Ian Reed, the Principal Hydrogeologist. The worker will, to his/her best ability, report the hazardous substance involved, the location of the spill, the estimated quantity of material spilled, the direction/flow of the spill material, related fire/explosion incidents, and any associated injuries without compromising their own safety.

7.8.2 Spill Evaluation and Response

Ian Reed, Principal Hydrogeologist, is responsible for evaluating spills and determining the appropriate response. When this evaluation is being made, the spill area will be isolated and demarcated to the extent possible. If necessary to protect nearby community members, notification of the appropriate authorities is made by the PM as appropriate. On-Site response is limited to small spills (e.g., <10 gallons); large spills require external emergency responders who will be contacted by the SHSO.

7.9 Decontamination

The decontamination section of the HASP describes how personnel and equipment are decontaminated when they leave the Exclusion Zone. This section also describes how residual waste from decontamination processes is disposed. The site decontamination procedures are designed to achieve an orderly, controlled removal or neutralization of contaminants that may accumulate on personnel or equipment. These procedures minimize worker contact with contaminants and protect against the transfer of contaminants to clean areas of the site and off-site. They also extend the useful life of PPE by reducing the amount of time that contaminants contact and can permeate PPE surfaces. Decontamination is facilitated within the CRZ at this site, if applicable.

7.9.1 Decontamination Procedures for Personnel and PPE

The following are general decontamination procedures established and implemented at this site.

1. Decontamination is required for all workers exiting a contaminated area. Personnel may re-enter the SZ only after undergoing the decontamination procedures described below in the next section.
2. Protective clothing is decontaminated, cleaned, laundered, maintained and/or replaced as needed to ensure its effectiveness.
3. PPE used at this site that requires maintenance or parts replacement is decontaminated prior to repairs, or
4. PPE used at this site is decontaminated or prepared for disposal on the premises. Personnel who handle contaminated equipment have been trained in the proper means to do so to avoid hazardous exposure.
5. This site uses an off-site laundry for decontamination of PPE. The site has informed that facility of the hazards associated with contaminated PPE from this site.
6. The site requires and trains workers that if their permeable clothing is splashed or becomes wetted with a hazardous substance, they will immediately exit the work zone, perform applicable decontamination procedures, shower, and change into uncontaminated clothing.
7. Procedures for disposal of decontamination waste meet applicable local, State, and Federal regulations.

7.9.2 Decontamination Procedures for Equipment

All tools, equipment, and machinery from the EZ or CRZ are decontaminated in the CRZ prior to removal to the SZ. Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure and to avoid cross-contamination and chemical incompatibilities.

General Equipment Decontamination Procedures:

1. Decontamination is required for all equipment exiting a contaminated area. Equipment may re-enter the SZ only after undergoing the equipment decontamination procedures.
2. Vehicles that travel regularly between the contaminated and clean areas of the site are carefully decontaminated each time they exit the EZ and the effectiveness of that decontamination is monitored to reduce the likelihood that contamination will be spread to other parts of the site.
3. Particular attention is given to decontaminating tires, scoops, and other parts of heavy equipment that are directly exposed to contaminants and contaminated soil.

The following items may be used to decontaminate equipment:

- Fresh water rinse;
- Non-phosphorus detergent wash;
- Distilled water rinse;
- Acetone rinse;
- Distilled water rinse; and
- A steam cleaner or pressure washer (heavy equipment only).

7.9.3 Monitoring the Effectiveness of Decontamination Procedures

Visual examination and sampling are used to evaluate the effectiveness of decontamination procedures. Visual examination is used to ensure that procedures are implemented as described and that they appear to control the spread of contaminants under changing site conditions. Visual examination is also used to inspect for signs of residual contamination or for contaminant permeation of PPE.

Personnel who work in contaminated areas of the site, either the Contamination Reduction Zone (CRZ) or the Exclusion Zone, are trained in the principles and practices of decontamination described in this section of the HASP and in related SOPs. If site procedures are changed as a result of inspection and monitoring, all affected employees are notified of these changes.

7.10 Confined Space Entry

Confined space entry will not be performed. However, should the need arise the following section outlines safety requirements for confined space entry at the Site.

- **ROUX PERSONNEL ARE NOT AUTHORIZED TO ENTER AN OSHA PERMIT REQUIRED CONFINED SPACE;**
- Currently the scope of work **DOES NOT** require personnel to enter permitted confined space for this project; and
- Any changes to the field activities that may necessitate confined space entry will be reported to the Project Principal and OHSM.

Confined space is defined as any space, depression, or enclosure that:

- Has limited opening for entry and egress;
- Is large enough for and employee to enter and perform assigned work; and
- Is not intended for continuous occupancy.

A permit required confined space is one that meets the definition of a confined space and has one or more of the following characteristics:

- May contain or produce life-threatening atmospheres due to oxygen deficiency the presence of toxic, flammable, or corrosive contaminants;
- Contains a material that has the potential for engulfment;
- Has an internal configuration that may cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section; and
- Contains any other serious safety or health hazards.

Although Roux personnel will not perform confined space entry, it is expected that subcontractors performing cleaning and mitigation and/or remedial measures activities may be required to enter structures that are considered to be a permit required confined space. Permitting of the confined space as well as hazard mitigation for entry will be completed by the subcontractor in accordance with 1910.146.

7.11 Client and Site-Specific

In addition to the OSHA-specific procedures discussed above, there may be client and site-specific safety procedures that must be adhered to during the performance of remedial activities at the Site.

7.12 Unusual or Significant Risks

Field activities that appear to have unusual or significant risks that cannot be adequately managed with existing risk tools such as LPS, HASPs, traffic safety plans, work permits, design and O&M practices, equipment HAZOPS or other safety tools must be referred to the CHSM to help with the assessment and management of the associated potential safety risks. Examples include the use of explosives for demolition, use of firearms to control wildlife, rappelling, demolition over water, diving, etc.

7.13 Activity-Specific Hazards

In addition to the general hazards discussed above, there are activity-specific hazards associated with each work activity planned for the Site. For instance, **Appendix H** references a subsurface utility clearance management program that Roux has instituted to ensure, to the greatest extent possible, that utilities have been identified and other subsurface structures will be avoided during any drilling activities. An activity-specific JSA has been completed for each of the activities planned for the Site. Similarly, **Appendix G** details procedures to follow to mitigate worker exposure to biological hazards such as ticks. JSAs are provided in **Appendix F**. In the event that new work activities or tasks are planned, JSAs will be developed and implemented prior to performing the new activities. In the absence of a JSA, the personnel performing work must prepare a field JSA and receive clearance from a designated competent safety official prior to performing any task with significant risk. In emergency situations where time is critical SPSAs will be utilized to identify the task, associated hazards and mitigative actions to take. For lower risk activities (as deemed by the discretion of a Competent Person) where a JSA is determined to not be needed, the individual(s) conducting the activities must perform SPSAs prior to and during the work.

7.13.1 Electrical and Other Utility Assessment and Accommodations

Roux shall perform a site walk to identify any potential overhead electrical or utility lines. All applicable guidelines will be followed in the vicinity of overhead power and utility lines (see Section 7.13.3 below).

Roux has also reviewed all available Site maps showing buried utility lines to identify potential hazards, which revealed that one 4" gas line intersects a planned subsurface exploration area. Drilling activities around the identified utility will be performed with soft digging techniques as specified in Roux's Corporate Subsurface Utility Clearance Management program found within **Appendix H**.

7.13.2 Subsurface Work

Subsurface work activities will require adherence to Roux's Corporate Subsurface Utility Clearance Management program found within **Appendix H**.

7.13.3 Heavy Equipment

Use of heavy equipment at the Site will require adherence to Roux's Corporate Heavy Equipment Exclusion Zone Management Program found within **Appendix B**. Additionally, operation of the drill rig/other heavy equipment will maintain clearances from overhead power lines in accordance with OSHA 29 CFR1926.1408 Table A Minimum Clearance Distances provided below.

Minimum Required Clearances for Energized Overhead Power Lines

Nominal System Voltage of Power Line (K V)	Minimum Required Clearance (feet)
0-50	10
51-100	12
101-200	15
201-300	20
301-500	25
501-750	35
751-1000	45

1 kilovolt (KV) = 1,000 volts

7.14 Heat Stress

The National Oceanic and Atmospheric Administration records average minimum/maximum temperatures of 28 to 85 degrees Fahrenheit during the year in Western New York.

7.14.1 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment in hot weather environments. Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat stress are as follows:

- Severe muscle cramps, usually in the legs and abdomen;
- Exhaustion, often to the point of collapse; and
- Dizziness or periods of faintness.

First aid treatment includes, but is not limited to, shade, rest, and fluid replacement. Typically, the individual should recover within one-half hour while being monitored constantly. If the individual has not improved substantially within 30 minutes and the body temperature has not decreased, the individual should be transported to a hospital for medical attention.

7.14.2 Heat Exhaustion

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual fails as blood collects near the skin to rid the body of excess heat through transference. The signs and symptoms of heat exhaustion are as follows:

- Rapid and shallow breathing;
- Weak pulse;
- Cold and clammy skin with heavy perspiration;
- Skin appears pale;
- Fatigue and weakness;
- Dizziness; and
- Elevated body temperature.

First aid treatment includes, but is not limited to, cooling the victim, elevating the feet, and replacing fluids.

If the individual is not substantially improved within 30 minutes and the body temperature has not decreased, the individual should be transported to the hospital for medical attention.

7.14.3 Heat Stroke

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a MEDICAL EMERGENCY requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- Dry, hot red skin;
- Body temperature approaching or above 105 degrees F;
- Confusion, altered mental state, slurred speech;
- Seizures;
- Large (dilated) pupils; and
- Loss of consciousness – the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility. Heat stress is a significant hazard if any type of protective equipment (semi-permeable or impermeable) that prevents evaporative cooling when worn in hot weather environments.

7.15 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 60°F. A work/rest regimen will be initiated when ambient temperatures and protective clothing cause a stressful situation. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. The signs and symptoms of cold stress include the following:

- Severe shivering;
- Abnormal behavior;
- Slowing;
- Weakness;
- Stumbling or repeated falling;
- Inability to walk;
- Collapse; and/or
- Unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks and encourage activity such as walking, wrapped in a blanket.

8. FIELD TEAM REVIEW

Each person performing work at or visiting this site shall sign this section after site-specific training is completed and before being permitted to access the CRZ or Exclusion Zone.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provision contained therein.

Site/Project: MJ Painting Contractor Corp., 350 Franklin Street, Olean, New York

Name & Company	Signature	Date

9. APPROVALS

By their signature, the undersigned certify that this HASP is approved and will be utilized at MJ Painting Contractor Corp. Site located at 350 Franklin Street, Olean, NY 14760.

October 15, 2021

Sophie Hibben – Site Health and Safety Officer | Date

October 15, 2021

Anthony Marsocci - Office Health and Safety Manager | Date

October 15, 2021

Michael Vanderperre – Project Manager | Date

October 15, 2021

Ian Reed – Project Principal | Date

TABLE

Toxicological Properties of Hazardous Substances Present at the Site

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Arsenic (As)	7440-38-2	0.01	(ND)	0.5 mg/m³ organic 0.10 mg/m³ - inorganic	Dermal; inhalation; ingestion	Sensory irritant Lung & Skin Cancer Aplastic anemia Numbness	skin eyes lungs blood peripheral nervous system	Silver gray - tin white BP: sublimes
Asphalt (fume)	8052-42-4	0.5 (fumes)	(ND)	None	Dermal; inhalation ingestion	Severe burns Dermatitis Photosensitization Pyloric obstruction	skin eyes stomach	Black or dark brown mass BP = <470° F1.Pt = 464°F LEL = 0.7% UEL = 6.0%
Barium (soluble)	7440-39-3	0.5 mg/m³	250 mg/m³	0.5 mg/m³	Inhalation; ingestion	Sensory irritant Increase muscle contractility Slows heart rate	skin eyes smooth muscle heart	Silver white BP: 1640°
Barium (insoluble) (as barium sulfate)	7727-43-7	10 mg/m³	(ND)	10 mg/m³ 5 mg/m³ resp.	Inhalation; ingestion	Baritosis	lungs	White or yellow odorless
Benzene	71-43-2	1.6 mg/m³ 0.5 ppm	Ca (ND)	1 ppm	Dermal; inhalation ingestion	CNS depression Hematopoietic depression Dermatitis	CNS blood skin eyes resp system bone marrow	Liquid (solid below 42°F BP: 80.093°C flammable LEL: 1.4% UEL: 8.0%
Butane	106-97-8	1,000 mg/m³ 800 ppm	(ND)	1,900 mg/m³ 800 ppm	Dermal; inhalation	Frostbite Narcotic	eyes, skin CNS	Colorless gas; petroleum odor BP = 0.5° FP = 138° LEL = 1.9% UEL = 8.5% F1.Pt = -76°F

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Cadmium (dust)	7440-43-9	0.01 mg/m^3	9 mg/m^3	0.005 mg/m^3	Inhalation; ingestion	Sensory irritant Lung injury Kidney disease Cancer	skin eyes kidneys bone	Silver-white/blue tinged BP: 1409°F Noncombustible
Chromium	7440-47-3	0.5	250 mg/m3	OSHA: 1	Inhalation; Skin; eye contact; ingestion	Irritation to eyes, skin; lung fibrosis.	Eyes, Skin, Respiratory system.	Blue-White to steel-gray, lustrous, brittle, hard, odorless solid
Chromium (III)	7440-47-3	0.5 mg/m^3	25	0.5 mg/m^3	Dermal; inhalation ingestion	Decreased pulmonary function Sensory irritant	lung skin eyes	Steel gray metal
Chromium (VI)	7440-47-3	0.05 mg/m^3	(ND)	None	Dermal; inhalation; ingestion	Nasal and lung tumors Sensory irritant	lungs eyes skin	Red, rhombic crystals
Chromic Acid and Chromates	133-82-0	0.1 as CrO3	Ca [15 mg/m3] as Cr(VI)	0.1	Inhalation; Skin and/or eye contact; ingestion	Respiratory system irritant, nasal septum perforation, liver, kidney damage, leukocytosis, leukopenia, monocytosis, eosinophillia, skin ulcers [Potential Carcinogen].	Eyes, Skin, Respiratory system, Blood, Liver, Kidneys [Lung Cancer].	CRo3: Dark-red, odorless flakes or powder. [Note: often used in aqueous solutions (H2CrO4)]
Coal Tar (Petroleum Naptha)	8030-30-6	0.2 mg/m^3	Ca 80 ppm	0.2 mg/m^3	Dermal; inhalation	Acne, folliculitis Lung cancer	resp system bladder kidney skin	Black, dark brown amorphous residue
Copper (dusts and mists as Cu)	7440-50-8	1 mg/m^3	100 mg/m^3	1 mg/m^3	Dermal; inhalation; ingestion	Sensory irritant GI irritation CNS depressant	skin eyes GI tract CNS	Reddish metal BP: 4730°F Powdered form may ignite

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
1,1-Dichloroethane	75-34-3	405 mg/m³ 100 ppm	3,000 ppm	400 mg/m³ 100 ppm	Dermal; ingestion; inhalation	CNS depression Liver damage Sensory irritant	CNS liver eyes	Liquid; Chloroform odor BP: 57.3°C flammable LEL: 5.6% UEL: 11.4%
1,2-Dichloroethane (Ethylene dichloride)	107-06-2	40 mg/m³ 10 ppm	Ca (ND)	4.0 mg/m³ 1 ppm	Dermal; ingestion; inhalation	CNS depressant Liver neurosis Kidney damage Dermatitis	CNS liver kidneys skin	Colorless liquid BP: 83.5° LEL: 6.2% UEL: 15.9%
1,2-Dichloroethene	540-59-0	793 200 ppm	1,000 ppm	790 200 ppm	Dermal; ingestion; inhalation	CNS depressant Epigastric cramps Sensory irritant Dermatitis	CNS stomach skin	Colorless liquid BP: 59° LEL: 9.7% UEL: 12.8%
Diesel Fuel	68334-30-5	10 ppm	NA	NA	Dermal; inhalation	Resp irritation Dizziness, nausea Skin disorders Liver disorders	lungs CNS skin liver	Light amber liquid F1.Pt = >100°F LEL = 0.6% UEL = 7.0%
Ethylbenzene	100-41-4	434 mg/m³ 20 ppm	800 ppm (10% LEL)	435 mg/m³ 100 ppm	Dermal; inhalation; ingestion	Sensory irritant CNS depressant Narcosis Hematological disorders	eyes skin CNS respiratory system blood	Liquid aromatic odor BP: 277°F Fl.P: 59°F LEL: 1.2% UEL: 7.0%
No. 2 Fuel Oil	8008-20-6	200 ppm	None	NL	Dermal; inhalation	Sensory Irritant Pulmonary Edema	Skin, eyes, respiratory tract	Liquid Aromatic odor BP = 347-617°F Fl Pt. = 100-162°F UEL = 5.0% LEL = 0.7%
Fuel Oil	68476-33-5	200 ppm	(ND)	NA	Dermal; inhalation ingestion	Skin cancer Liver damage Blood disorders	skin liver bone marrow	Dark liquid LEL = 1.0% UEL = 3.0% F1.Pt = >140°F

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Jet A Fuel	8008-20-6	200 ppm	None	NL	Dermal; inhalation	Sensory Irritant Pulmonary Edema	Skin, eyes, respiratory tract	Liquid Aromatic odor BP = 347-617°F Fl Pt. = 100-162°F UEL = 5.0% LEL = 0.7%
Jet Fuel JP-4	8008-20-6	200 ppm	None	NL	Dermal; inhalation	Sensory Irritant Pulmonary Edema	Skin, eyes, respiratory tract	Liquid Aromatic odor BP = 347-617°F Fl Pt. = 100-162°F UEL = 5.0% LEL = 0.7%
Jet Fuel JP-5	8008-20-6	200 ppm	None	NL	Dermal; inhalation	Sensory Irritant Pulmonary Edema	Skin, eyes, respiratory tract	Liquid Aromatic odor BP = 347-617°F Fl Pt. = 100-162°F UEL = 5.0% LEL = 0.7%
Jet Fuel JP-8 (Kerosene)	8008-20-6	200 ppm	None	NL	Dermal; inhalation	Sensory Irritant Pulmonary Edema	Skin, eyes, respiratory tract	Liquid Aromatic odor BP = 347-617°F Fl Pt. = 100-162°F UEL = 5.0% LEL = 0.7%
Jet Oil II	8008-20-6	200 ppm	None	NL	Dermal; inhalation	Sensory Irritant Pulmonary Edema	Skin, eyes, respiratory tract	Liquid Aromatic odor BP = 347-617°F Fl Pt. = 100-162°F UEL = 5.0% LEL = 0.7%
Jet Oil 291	8008-20-6	200 ppm	None	NL	Dermal; inhalation	Sensory Irritant Pulmonary Edema	Skin, eyes, respiratory tract	Liquid Aromatic odor BP = 347-617°F Fl Pt. = 100-162°F UEL = 5.0% LEL = 0.7%

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Jet Oil 254	8008-20-6	200 ppm	None	NL	Dermal; inhalation	Sensory Irritant Pulmonary Edema	Skin, eyes, respiratory tract	Liquid Aromatic odor BP = 347-617°F Fl Pt. = 100-162°F UEL = 5.0% LEL = 0.7%
Lube Oil	NL	NL	None	NL	Dermal; inhalation	Sensory Irritant Pulmonary Edema	Skin, eyes, respiratory tract	Liquid BP = °F Fl Pt. = °F UEL = % LEL = %
Furfural	98-01-1	7.9 mg/m³ 2 ppm	100 ppm	20 mg/m³ 5 ppm	Dermal; inhalation; ingestion	Eye, skin irritation Resp. irritation Dizziness, nausea	eyes respiratory system skin CNS	Brown liquid F1.Pt = 142°F LEL = 2.1% UEL = 16.3%
Gasoline	8006-61-9	896 mg/m³ 300 ppm	Ca (ND)	None	Dermal; inhalation; ingestion	CNS depression Sensory irritant Dermatitis Pelmonary Edema	CNS eyes skin resp system	Liquid, aromatic F1.Pt = -50°F
Hydrogen Sulfide	7783-06-4	TWA 5 ppm STEL 10 ppm (adopted by EM, Sep. 2010)	100 ppm	20 ppm	Dermal; inhalation; ingestion	CNS depression Resp distress Conjunctivitis	resp system eyes CNS	Colorless gas, rotten egg odor BP - -76°F UEL = 46% LEL = 4.3%
Kerosene	8008-20-6	200 ppm	NA	NA	Dermal; inhalation	Eye/skin irritation Resp. irritation Dizziness, nausea	eyes skin resp. system CNS	yellow to white oily liquid F1.Pt = >115°F LEL = 0.7% UEL = 5.0%
Lead (as Pb)	7439-92-1	0.05 mg/m³	100 mg/m³	<0.1 mg/m³	Dermal; inhalation ingestion	Abdominal pain CNS depressant Anemia Nephropathy Reproductive effects	GI tract CNS blood kidneys	Metal - soft gray BP: 3164°F

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Naphtha	8032-32-4	1,590 mg/m³ 400 ppm	1000 ppm	400 mg/m³ 100 ppm	Inhalation; ingestion	Resp irritant Eye irritation	eye resp tract	Clear, flammable
Nickel	7440-02-0	1.5 mg/m³	Ca 10 mg/m³	0.015 mg/m³	Dermal; inhalation; ingestion	Pulmonary fibrosis Lung cancer Sinus cancer Sensory irritant GI irritation	lungs skin eyes GI tract	Silver-white metal BP: 2730°
Petroleum hydrocarbons (Petroleum distillates) (Red Dye Liquid)	8002-05-9	1,600 400 ppm	10,000	1,600 400 ppm	Dermal; inhalation; ingestion	CNS depressant Respiratory irritant Dried/cracked skin	CNS respiratory tract skin	Colorless liquid BP = 86-460□F UEL = 5.9% LEL = 1.1% Flammable
Selenium (Se)	7782-49-2	0.2 mg/m³	1 mg/m³	0.2 mg/m³	Dermal; inhalation; ingestion	Sensory irritant Bronchial irritation GI distress	respiratory system skin eyes liver kidneys blood	Steel grey, non-metallic BP: 690°F
Silver (Ag)	7440-22-4	0.1 mg/m³	10 mg/m³	0.01 mg/m³	Dermal; inhalation; ingestion	Sensory irritant Bronchitis	skin eyes lungs	Lustrous white metal BP: 2212°
Tetrachloroethene (perchloroethylene PCE)	127-18-4	170 mg/m³ 25 ppm	Ca 150 ppm	100 ppm	Dermal; inhalation; ingestion	CNS depression Liver damage Sensory irritant	CNS liver skin eyes kidneys	Liquid ether-like odor BP: 121.20°C
Toluene	108-88-3	188 mg/m³ 200 ppm	500 ppm	200 ppm	Dermal; inhalation; ingestion	CNS depression Liver damage Kidney damage Defatting of skin	CNS liver kidney skin	Liquid benzene odor BP: 110.4°C flammable LEL: 1.2% UEL: 7.1%

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Trichloroethene (TCE)	79-01-6	269 mg/m^3 10 ppm	Ca 1000 ppm	50 ppm	Dermal; inhalation; ingestion	CNS depression Sensory irritant Kidney damage Liver damage Heart damage	CNS skin eyes kidney liver CVS	Liquid BP: 86.7°flammable LEL: 12.5% UEL: 90%
1,1,1-Trichloroethane (methyl chloroform)	71-55-6	1,910 mg/m^3 350 ppm	700 ppm	1,900 mg/m^3 350 ppm	Dermal; ingestion; inhalation	Sensory irritant CNS depression Cardiac arrhythmia	skin CNS CVS eyes	Liquid; BP: 74.1° Fl.P: = 32.5°
Vinyl chloride (chloroethylene)	75-01-4	2.6 mg/m^3 1 ppm	Ca (ND)	1 ppm	Inhalation; ingestion	Liver tumors Blood tumors Sensory irritant CNS depressant	liver blood eyes skin CNS	Colorless gas Highly flammable BP: 13° FP: -159.7° LEL: 4% UEL: 22%
Xylene(s)	1330-20-7	434 mg/m^3 100 ppm	900 ppm	435 mg/m^3 100 ppm	Dermal; inhalation; ingestion	Sensory irritant Blood dyscrasia Bronchitis CNS depression	CNS eyes skin GI tract blood liver kidneys	Liquid Aromatic odor BP: 138.5° flammable LEL: 1.1% UEL: 7.0%
Zinc Oxide (dust)	7440-66-6	2 mg/m^3	None	10 5 resp.	Dermal; inhalation; ingestion	Skin irritant Cough	skin lungs	Bluish-white metallic element BP: 908°

Notes:
Ca – Carcinogen
TLV – Threshold Limit Value (ACGIH)
IDLH – Immediately Dangerous to Life and Health (OSHA)
PEL – Permissive Exposure Level (OSHA)
PPM – Parts per million
mg/m^3 – milligrams per cubic meter
Fl. Pt. – Flash point
LEL – Lower Explosive Level
UEL – Upper Explosive Level
BP – Boiling Point
NA – Not Available
ND – Not Determined

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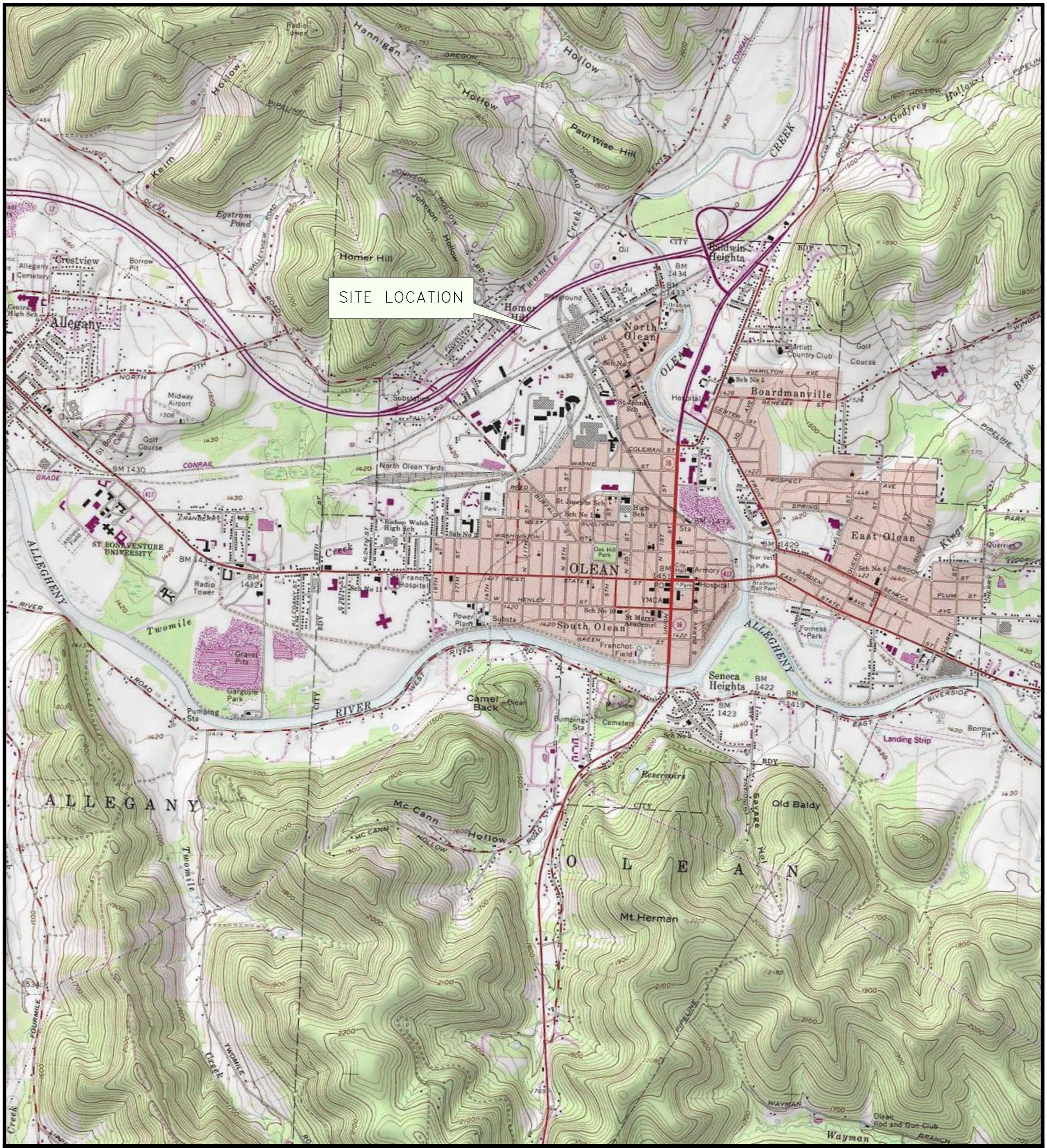
FIGURES



QUADRANGLE LOCATION

N

USGS, 1980, Olean, New York 7.5 Minute Topographic Quadrangle. Contour Interval 3 Meters

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1,800 0 1,800 3,600 Feet

Title:

SITE LOCATION MAP

350 FRANKLIN STREET

Prepared For: MJ PAINTING CONTRACTOR CORP.

ROUX

		FIGURE
Compiled by: SB	Date: 28JUN18	1
Prepared by: SB	Scale: AS SHOWN	
Project Mgr: AH	Project: 2317.0002M02000	
File: 2317.0002M000.100.1.mxd		

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LEGEND

MW-212	MONITORING WELL LOCATION
⊗	STORM/SANITARY SEWER DRAINAGE STRUCTURE LOCATION
	SITE BOUNDARY
	NEIGHBORING FENCE LINE
	SURVEY BOUNDARY
	UNDERGROUND WATER UTILITY
	UNDERGROUND STORM SEWER UTILITY
	UNDERGROUND SANITARY SEWER UTILITY
UE	UNDERGROUND ELECTRIC UTILITY
	OVERHEAD ELECTRIC UTILITY
	WOODED/BRUSH AREA

SOURCE:

WENDEL WD ARCHITECTURE, ENGINEERING, SURVEYING AND LANDSCAPE ARCHITECTURE, P.C., TOPOGRAPHIC SURVEY, DWG. NO. V100, DATED DECEMBER 17, 2020

AERIAL IMAGE OBTAINED FROM GOOGLE EARTH

NOTES:

ALL FEATURES ARE APPROXIMATE

THE ENTIRE BCP SITE WILL HAVE A BCP COMPLIANT SITE COVER SYSTEM

50' 0 50'

Title:

SITE PLAN ACCESS AND MUSTER LOCATIONS

350 FRANKLIN STREET
OLEAN, NEW YORK

Prepared for:

MJ PAINTING CONTRACTOR CORP.

ROUX

Compiled by: MV	Date: 2/23/2021	FIGURE
Prepared by: CC	Scale: AS SHOWN	2
Project Mgr: BR	Project: 2317.0002M000	
File: 2317.0002M000.102.02.DWG		

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APPENDICES

A. Traffic Control Program
B. Heavy Equipment Exclusion Zone Policy
C. Field and Office Ergonomics Program
D. Hearing Conservation Program
E. SDSs for Chemicals Used
F. Job Safety Analysis (JSA) Forms
G. Biological Hazard Awareness Management Program
H. Subsurface Utility Clearance Management Program
I. COVID-19 Interim Health and Safety Guidance
J. Incident Management Program
K. Personal Protective Equipment (PPE) Management Program
L. Community Air Monitoring Program

APPENDIX A

Traffic Control Program

TRAFFIC CONTROL GUIDANCE
MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**01/19**
REVISION NUMBER	**:**	**1**

TABLE OF CONTENTS

1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has established this Traffic Control Guidance Management Program to assure its employees and contractors work safely in situations where they are exposed to traffic hazards. This document provides guidance for assessing traffic hazards, mitigating traffic hazards and developing a traffic control plan for Roux projects to maintain a safe and secure work environment, provide a safe and efficient means of travel through a work area, and ensuring egress points are not obstructed in case of an emergency. (Note: Use of the word traffic is to be inclusive of vehicles and pedestrians.)

2. SCOPE AND APPLICABILITY

This guidance document shall be used when conducting work on Roux projects with actual or potential traffic hazards from external or internal traffic including:

- Active sites or facilities (e.g. parking lots, terminals, third party sites)
- Inactive and vacant sites
- Roadways, rights-of-ways

Nothing specified in this guidance document should be construed to suggest conducting work or traffic control in a manner contrary to strict compliance with national, regional and local regulations and/or more stringent contractor or site requirements. This document provides guidance for traffic control and may not contain all the information necessary to develop and implement a traffic control plan for public roadways. If necessary, a traffic control professional and/or licensed traffic control company should be contacted.

3. REQUIREMENTS AND MINIMUM SAFETY EXPECTATIONS

A Traffic Control Plan is used for the safe movement of vehicle and pedestrian traffic through a work zone/site and must be developed for each site with actual or potential traffic hazards.

The plan must include:

- Site map* that shows the location of work, flaggers, appropriate buffer areas, traffic flow, parking areas, existing structures and any required traffic control devices; and
- Established maximum speed limits for the site.

* For sites where work zones and/or traffic plans are changing frequently, consider using laminated site maps to allow for updates.

Safety Expectations

- Vehicles and heavy equipment must have an audible reverse signal or a horn will be used to signal backing.
- If backing a work vehicle is required, use a spotter and sound the horn twice before backing. If a spotter is not available, sound the horn twice before backing.
- Individuals who are not familiar with the work site are not permitted to drive on site without an escort.
- Identify a safe entrance and exit path for personnel, vehicles, trucks and heavy equipment that is clear of obstructions, requires no or minimal backing and allows maximum visibility for drivers and

others in the area. If visibility is obstructed when entering or exiting the site, mirrors must be installed to enhance visibility or a spotter must be used.

- Establish check-in / check-out procedures for heavy equipment onsite.
- Traffic control must be in place before any work that exposes individuals to a traffic hazard is conducted. All work should be completed before traffic control devices are removed.
- Traffic control devices must be secured to prevent movement in windy conditions.
- The Site Health and Safety Officer (SHSO) is responsible for communicating the traffic control plan including traffic communication methods to all site personnel prior to the start of any activities and periodically assessing site conditions and revising the traffic control plan as needed.

3.1 Buffer Areas

- Buffer area is a lateral and longitudinal area that separates traffic from the work. The minimum buffer area must be established between traffic and personnel, vehicles, and equipment.
- Buffer areas must be sized to provide separation between workers and internal and external traffic including vehicular, heavy equipment and pedestrian.
- The size of buffer zone depends on speed of traffic, volume, type of work, duration of work, visibility of work zone (curves, corners, rises and dips), access and egress and proximity to public facilities.
- If an unauthorized vehicle or pedestrian enters the work zone or buffer area, work must stop immediately and the traffic control plan reevaluated for effectiveness.

3.2 Levels of Traffic Control

Site factors and work factors are used to help determine the level of traffic control needed for safe operations. All work areas should keep in mind pedestrian and small motorized traffic as well as vehicle and heavy equipment traffic. Levels of traffic control are defined as follows:

Factor	Level 1	Level 2	Level 3
Speed in or next to Work Area	Low / <30km/h or 20 mph	High / >30 km/h 20 mph	NA
Use of Heavy Equipment	No	Yes	NA
Work in Public Roadway / Sidewalk/ Footpath	No	Yes	Yes
Lane Closure	No	No	Yes

The highest traffic control level based on the single highest ranking factor in the above table should be implemented. Site-specific factors or hazards not presented in the above table may justify selection of a higher traffic control level and/or additional control devices.

3.2.1 Level 1 Traffic Control

- Use delineators (cones with flags, stacker cones, looper tubes, grabber tubes, etc.) to surround work zone.
  - 1.1 meter (42-inches) in total height.

- 1.2 meter (4 feet) distance between delineators.

- Use caution tape or barricade boards between delineators.
- Use work vehicle parked between workers and on-coming traffic to provide visual warning to and physical protection from traffic.
- If working close to site entrance, use a second line of delineators to create an additional buffer or utilize a spotter.
- Use the buddy system or a watchperson when traffic conditions warrant.

Examples of Level 1 Traffic Control

Figures A1.2.2(a)(b)(c) - Examples of Level 2 Traffic Control

3.2.2 Level 2 Traffic Control

- Plastic security fencing and/or barricades:
  - meter (42-inches) in total height (1.8 meters/6 feet high in areas where drivers have poor visibility or other higher risk factors present).
  - meter (4 feet) distance between delineators.
- Use cautionary signs (e.g., “Men Working”, “Work Zone”) in all directions from which vehicles can approach (recommended 0.8 meter or 32 inches high) and any additional signage/protection required by local, regional or national regulations.
- Use work vehicle parked between workers and on-coming traffic to provide visual warning to and physical protection from traffic.
- If working close to site entrance, use second line of delineators to create an additional buffer or utilize a spotter.

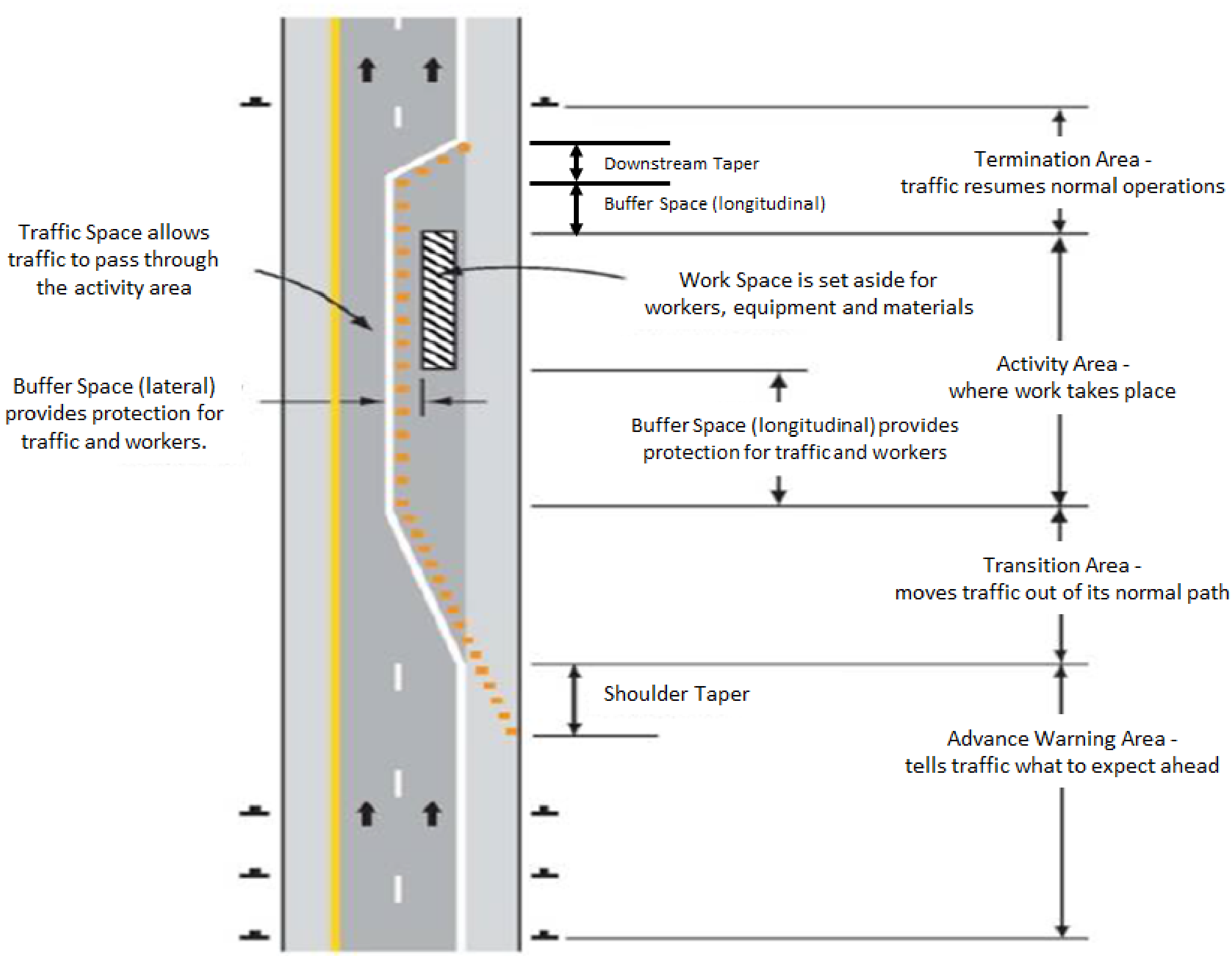
- Use the buddy system or a watchperson when traffic conditions warrant.
- Provide oversight by persons dedicated to traffic control.
- Coordinate work with appropriate authorities which may require a police detail.

Examples of Level 2 Traffic Control

3.2.3 Level 3 Normal Traffic Flow Interruption (Temporary Traffic Control Zone)

A temporary traffic control zone consists of four areas and may be needed when normal traffic flow is interrupted. A temporary control zone is the entire section of roadway between the first warning sign through the last traffic control device, where traffic returns to its normal path. Most temporary traffic control zones are divided into four areas:

1. Advance warning area – drivers are informed what to expect
2. Transition area – redirection of the driver's normal path
3. Activity area – area where the work is taking place
4. Termination area – traffic returns to normal path



Example of a temporary traffic control zone layout

3.3 Flagging

- Flagging is used when all other methods of traffic control are inadequate to direct or control traffic.
- Flagger locations must be documented on the Traffic Control Plan.
- Minimum standard flagging paddle size allowed is 18 inches (.45 m). It is recommended that a 24-inch (.6 m) paddle be used to improve visibility or for high speed operations.

3.4 Parking

Any vehicle not active in site operations should be parked either in a designated parking area or out of the way and/or used as a barrier to oncoming traffic to protect personnel in the work zone.

All parked vehicles (except light-duty pick-up trucks), trailers and heavy equipment; including those needing to idle while in use, must be secured as follows:

- Emergency brake set
- Manual transmission in gear (if not idling) or automatic transmission in “Park”, AND

- One of the following methods:
  - Lowered hydraulic rams
  - Connection of trailer to vehicle that is secured
  - Two properly sized chocks set on either side of a wheel

Please refer to the Wheel Chocking Management Program 2.16 for additional information.

4. TRAFFIC CONTROL PLANNING

4.1 Components of a Traffic Control Plan

A traffic control plan will be part of the site Health and Safety Plan (HASP) and in addition to the items listed in the Minimum Safety Expectations section, should include, but is not limited to the following:

- Traffic control design.
- Traffic control devices.
- Traffic control operations.
- Method for communicating any Traffic Control Plan changes.

4.2 Assessing Traffic Hazards

Before developing the plan, conduct a site/project assessment to identify internal and external traffic hazards including:

- Traffic flow patterns around and within the work zone.
- Vehicle/heavy equipment operations within work zone.
- Entry and exit routes for project-related and third-party vehicles/heavy equipment (e.g., congested roadways, limited visibility).
- High traffic areas (e.g., active roadways, parking lots and garages).
- Terrain conditions (e.g., hills, loose gravel, steep slopes).
- Survey of adjacent sites activities that may change traffic patterns (e.g., school drop-off, pick-up times).
- Weather and lighting conditions.
- Visibility of work area in relation to traffic flow.
- Areas of previous traffic accidents.
- Traffic hazards that may be encountered when traveling to and from site (including heavy equipment impacts on local streets, turning radius restrictions, etc.).

Movements of motor vehicles, bicycles, and pedestrians around the work zone should be considered, as well as the movements of personnel, vehicles and heavy equipment within the work zone. A work zone is an unexpected obstacle for those not involved in the work and may cause them to respond in unpredictable ways.

Any work in public roadways, right-of-ways, lanes, alleys, or sidewalks may require approval of appropriate jurisdiction, such as a municipality, county, state, or highway authority. This may require an application for a permit and a permit fee. Work schedules should take into account the time needed to obtain required permits.

In addition, when transporting oversized equipment to a site over public roadways or right-of-ways coordinate with local jurisd ictions for needed traffic control and permits.

4.3 Buddy System or Watchperson

If there are any questions regarding number of personnel required to safely perform project tasks on a site, a two-person crew should be dispatched for the first site visit for potential use of one person as a traffic watch. Subsequent review will determine if site activity remains a two-person job.

A two-person crew should also be scheduled if:

- Location requires traffic to be redirected into another lane or detoured.
- Traffic lane will be temporarily closed.
- Work is conducted alongside heavily-traveled roadway.
- Pedestrian or cyclists require direction or assistance for temporary crossing/diversion.
- Areas where hybrid or electric vehicles are prevalent since they may not be heard at slow speeds.

4.4 Project Specific Hazards

When working at active sites:

- Determine safest travel routes into and out of work areas for project-related vehicles and heavy equipment.
- If possible, minimize work-related impacts on existing site operations.
- Discuss TCP with site operator/manager and others who may be impacted.

When work involves excavation, consider the following:

- Space for support of the sidewalls (sloping, benching, shoring, and/or trench boxing)
- Space for the safe movement of workers and heavy equipment around the excavation.
- Should controls, such as physical barriers or visual indicators, be applied to limit access to utilities?
- When working near aboveground or underground utilities, consider the following:
  - Can equipment be operated in a way to maintain safe distances from overhead utilities?
  - Could equipment displace or crush underground utilities?

When laying out work zones, consider the following in allowing space for work activities:

- Can equipment and materials be delivered, stored, and handled readily?
- Can workers perform their tasks safely and efficiently?
- Is there space to walk so as to minimize slip, trip, and fall hazards?
- Are two-way roads three-times as wide as the widest piece of equipment using the road or does traffic need to be controlled?

On-Site Workers should take the following actions:

- Check surroundings often for potential changing traffic hazards.
- Listen for and respond to warnings such as horns, whistles, and sirens.
- Position yourself facing traffic. Where this is not practical, a “second set of eyes” should be considered such as a buddy or watchperson.
- If walking on/near a road or access way, walk in single file (not in a group) towards/facing oncoming traffic.
- Remove hearing protection when not needed.
- Look out for the safety of other workers in area.
- Turn off cell phones and do not use while operating or being in the vicinity of operating vehicles / heavy equipment.

4.5 Deploying/Removing Traffic Control Devices

- Begin placing devices in upstream (traffic advance warning area) locations.
- Flag person used to warn incoming traffic should be placed far enough in front of work zone to allow vehicles to maneuver.
- Delineate transition zone with cones and barricades.
- Establish work zone.
- Delineate downstream taper.
- Place signs for end of work zone.
- Remove devices in reverse order of deployment (remove devices at beginning of set-up last).

4.6 Traffic Control Devices

The work zone should be highly visible so that drivers can see and avoid the area. Geometry, color and reflectivity of devices affect how people see them. Location of devices relative to terrain and other objects also affects visibility. Visibility may be enhanced by increasing the height and number of traffic control devices.

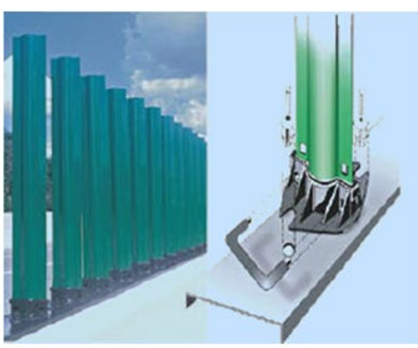
Traffic Control devices provide visibility and can include the following:

- Traffic cones with flags, looper tubes, grabber tubes and stacker cones (recommended height 1.1 meter/ 42 inches)
- High visibility security / temporary fencing (may require addition of reflective tape or lights)
- Warning tape
- Reflective tape
- Automated Flagger Assistance Device
- Warning and speed limit signs (e.g., "Caution Work Area")
- Traffic flow arrows (e.g., posted or painted on ground)
- Molded plastic barricades (sawhorses)

- Type I and II barricades
- Plastic channelizers (orange barrels)
- Concrete barriers (Jersey barriers or K-rails)
- Water-filled barricades
- Vehicles used as barricade (with hazard lights activated if possible)
- Light bars and reflective lights on vehicles
- Portable gates
- Glare screens
- Buddy system / Watchperson
- Temporary speed bumps or rumble strips

Commonly used traffic control devices

Extender bars used in place of tape



Glare screens can make a highly visible barrier

Barrier constructed of PVC pipe and orange fencing

Traffic control devices should be routinely inspected to ensure continued integrity and visibility.

Many traffic control devices only provide visual clues to drivers. Physical barriers, such as parked vehicles, concrete barriers, or water filled barriers can provide more protection if a driver has lost control or is not paying attention.

4.7 Night/Low Visibility

As much as practical, work should be conducted during daylight. Night operations may result in poor visibility for drivers and workers.

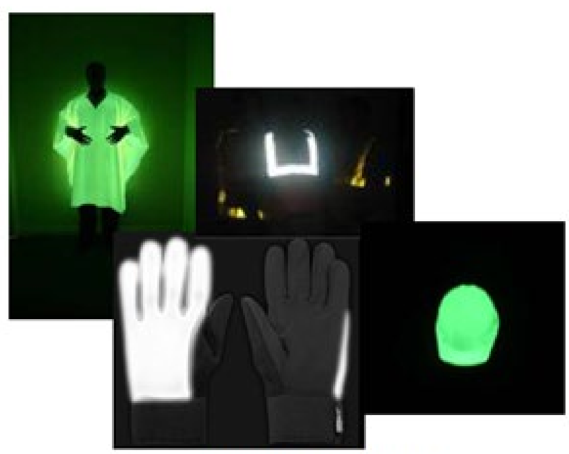
If work must be done at night, additional lighting/traffic control measures should be provided to warn vehicles and pedestrians. Glare from lighting should be controlled so as not to interfere with the vision of workers or drivers.

Nighttime visibility can be increased by:

- Lighted delineators
- Flood lights/Work area lights
- Higher class of high-visibility apparel
- Flashing lights on clothing/vehicles/hard hat
- Glow sticks attached to traffic vests
- Reflective tape on equipment

Glow stick

Lighted traffic control devices



Highly reflective safety gear

Rev 1.0	Traffic Control Minimum Safety Expectations	May 2016

Revision History	Comment	Date
Rev 0	Initial Issue	April 2010
Rev 1.0	Combined Traffic Control Plan, On-Site Traffic Safety Plan and Traffic Control Guidelines into one document.	May 2016

1 Contents

1. SCOPE AND OBJECTIVES

This document provides minimum safety expectations and guidelines for assessing traffic hazards, controlling traffic hazards and developing a traffic control plan for EMES project teams to maintain a safe and secure work environment, provide a safe and efficient means of travel through a work area, and ensuring egress points are not obstructed in case of an emergency. (Note: Use of the word traffic is to be inclusive of vehicles and pedestrians.)

This document will be used when conducting work at EMES sites with actual or potential traffic hazards from external or internal traffic including:

- active sites or facilities (service stations, parking lots, terminals, refineries, third party sites)
- inactive and vacant sites
- roadways, rights-of-ways

Nothing specified in this guidance document should be construed to suggest conducting work or traffic control in a manner contrary to strict compliance with national, regional and local regulations and/or more stringent contractor or site requirements. This document provides guidance for traffic control and may not contain all the information necessary to develop and implement a traffic control plan for public roadways. If necessary, a traffic control professional and/or licensed traffic control company should be contacted.

Refer to **the Heavy Equipment Exclusion Zone** for the minimum requirements in establishing heavy equipment exclusion zones during demolition and construction activities

Refer to **Excavation Guidelines** for establishing exclusions zones for excavation activities.

Refer to **Drilling Guidelines** for minimum requirements when establishing exclusion zones during drilling activities.

The primary consultant/contractor (CC) is responsible for ensuring that these safety expectations are implemented for all project work involving heavy equipment on construction and demolition sites. Any deviations from the requirements should be documented using OIMS Procedure 7.1.1 Management of Change (MOC) – Non-Personnel.

1.1 Statement of Corporate Separateness

EMES is a global functional organization established as a part of the Global Real Estate and Facilities (GREF) functional organization to provide functional guidance regarding soil and groundwater remediation activities, as well as non-operating surplus site stewardship activities, for Exxon Mobil Corporation and its affiliates.

EMES has developed considerable expertise in the stewardship of soil and groundwater remediation activities and non-operated surplus sites. Exxon Mobil Corporation and its affiliates have concluded that a greater centralization of remediation services will increase efficiency and effectiveness by promoting a greater sharing of best practices and expertise and standardizing of processes and procedures across ExxonMobil affiliates worldwide.

EMES performs these activities as a service to Exxon Mobil Corporation and its affiliates pursuant to the provisions of a Master Services Agreement and/or other interaffiliate agreements. In the United States, EMES operates through ExxonMobil Environmental Services Company, a Delaware corporation established on January 1, 2008 as a wholly owned subsidiary of ExxonMobil Global Services Company. Outside the United States, those ExxonMobil affiliate employees who are part of the EMES functional organization perform these activities.

EMES has concluded that the implementation of consistent processes and procedures will facilitate the protection of human health and the environment and mitigate potential liability of Exxon Mobil Corporation and its affiliates.

It is expected that these processes and procedures will be considered for adoption by each EM affiliate conducting activities stewarded by the EMES functional organization, and that following affiliate approval and adoption, these processes and procedures will be implemented by members of the EMES functional organization insofar as possible. Decisions not to adopt these process and procedures in whole or in part and any deviations should be referred to EMES management for endorsement as appropriate, consistent with corporate separateness considerations. Nothing in this Guide or the associated materials is intended to override the corporate separateness of local entities.

Compliance with all applicable laws and regulations and ExxonMobil policies and the timing of such compliance are independent of the requirements expressed here. Notwithstanding anything to the contrary expressed or implied in these materials, applicable legal and policy requirements must be met. This includes, among other things, GREF MPI Guidelines, Data Privacy laws, and applicable local record retention guidelines.

2 REQUIREMENTS AND MINIMUM SAFETY EXPECTATIONS

A Traffic Control Plan is used for the safe movement of vehicle and pedestrian traffic through a work zone/site and must be developed for each site with actual or potential traffic hazards.

The plan must include:

- a site map* that shows the location of work, flaggers, appropriate buffer areas, traffic flow, parking areas, existing structures and any required traffic control devices
- established maximum speed limits for the site

*For sites where work zones and/or traffic plans are changing frequently, consider using laminated site maps to allow for updates.

Vehicles and heavy equipment must have an audible reverse signal or a horn will be used to signal backing.

If backing a work vehicle is required, use a spotter and sound the horn twice before backing. If a spotter is not available, sound the horn twice before backing.

Individuals who are not familiar with the work site are not permitted to drive on site without an escort.

Identify a safe entrance and exit path for personnel, vehicles, trucks and heavy equipment that is clear of obstructions, requires no or minimal backing and allows maximum visibility for drivers and others in the area. If visibility is obstructed when entering or exiting the site, mirrors must be installed to enhance visibility or a spotter must be used.

Establish check-in / check-out procedures for heavy equipment onsite.

Traffic control must be in place before any work that exposes individuals to a traffic hazard is conducted. All work should be completed before traffic control devices are removed.

Traffic control devices must be secured to prevent movement in windy conditions.

The EMES CC is responsible for communicating the traffic control plan including traffic communication methods to all site personnel prior to the start of any activities and periodically assessing site conditions and revising the traffic control plan as needed.

2.1 Buffer Areas

Buffer area is a lateral and longitudinal area that separates traffic from the work. The minimum buffer area must be established between traffic and personnel, vehicles, and equipment.

Buffer areas must be sized to provide separation between workers and internal and external traffic including vehicular, heavy equipment and pedestrian.

The size of buffer zone depends on speed of traffic, volume, type of work, duration of work, visibility of work zone (curves, corners, rises and dips), access and egress and proximity to public facilities.

If an unauthorized vehicle or pedestrian enters the work zone or buffer area, work must stop immediately and the traffic control plan reevaluated for effectiveness.

2.2 Levels of Traffic Control

Site factors and work factors are used to help determine the level of traffic control needed for safe operations. All work areas should keep in mind pedestrian and small motorized traffic as well as vehicle and heavy equipment traffic. Levels of traffic control are defined as follows:

Factor	Level 1	Level 2	Level 3
Speed in or next to Work Area	Low / <30km/h or 20 mph	High / >30 km/h 20 mph	NA
Use of Heavy Equipment	No	Yes	NA
Work in Public Roadway / Sidewalk/Footpath	No	Yes	Yes
Lane Closure	No	No	Yes

The highest traffic control level based on the single highest ranking factor in the above table should be implemented. Site-specific factors or hazards not presented in the above table may justify selection of a higher traffic control level and/or additional control devices.

2.2.1 Level 1 Traffic Control

- Use delineators (cones with flags, stacker cones, looper tubes, grabber tubes, etc.) to surround work zone
  - 1.1 meter (42-inches) in total height
  - 1.2 meter (4 feet) distance between delineators
- Use caution tape or barricade boards between delineators
- Use work vehicle parked between workers and on-coming traffic to provide visual warning to and physical protection from traffic
- If working close to site entrance, use a second line of delineators to create an additional buffer or utilize a spotter
- Use the buddy system or a watchperson when traffic conditions warrant.

Example of Level 1 Traffic Control

2.2.2 Level 2 Traffic Control

- Plastic security fencing and/or barricades
  - 1.1 meter (42-inches) in total height (1.8 meters/6 feet high in areas where drivers have poor visibility or other higher risk factors present)
  - 1.2 meter (4 feet) distance between delineators
- Use cautionary signs (e.g., “Men Working”, “Work Zone”) in all directions from which vehicles can approach (recommended 0.8 meter or 32 inches high) and any additional signage/protection required by local, regional or national regulations.
- Use work vehicle parked between workers and on-coming traffic to provide visual warning to and physical protection from traffic.
- If working close to site entrance, use second line of delineators to create an additional buffer or utilize a spotter
- Use the buddy system or a watchperson when traffic conditions warrant.
- Provide oversight by persons dedicated to traffic control
- Coordinate work with appropriate authorities which may require a police detail

Example of Level 2 Traffic Control

2.2.3 Level 3 Normal Traffic Flow Interruption (Temporary Traffic Control Zone)

A temporary traffic control zone consists of four areas and may be needed when normal traffic flow is interrupted. A temporary control zone is the entire section of roadway between the first warning sign through the last traffic control device, where traffic returns to its normal path. Most temporary traffic control zones are divided into four areas:

1. Advance warning area – drivers are informed what to expect
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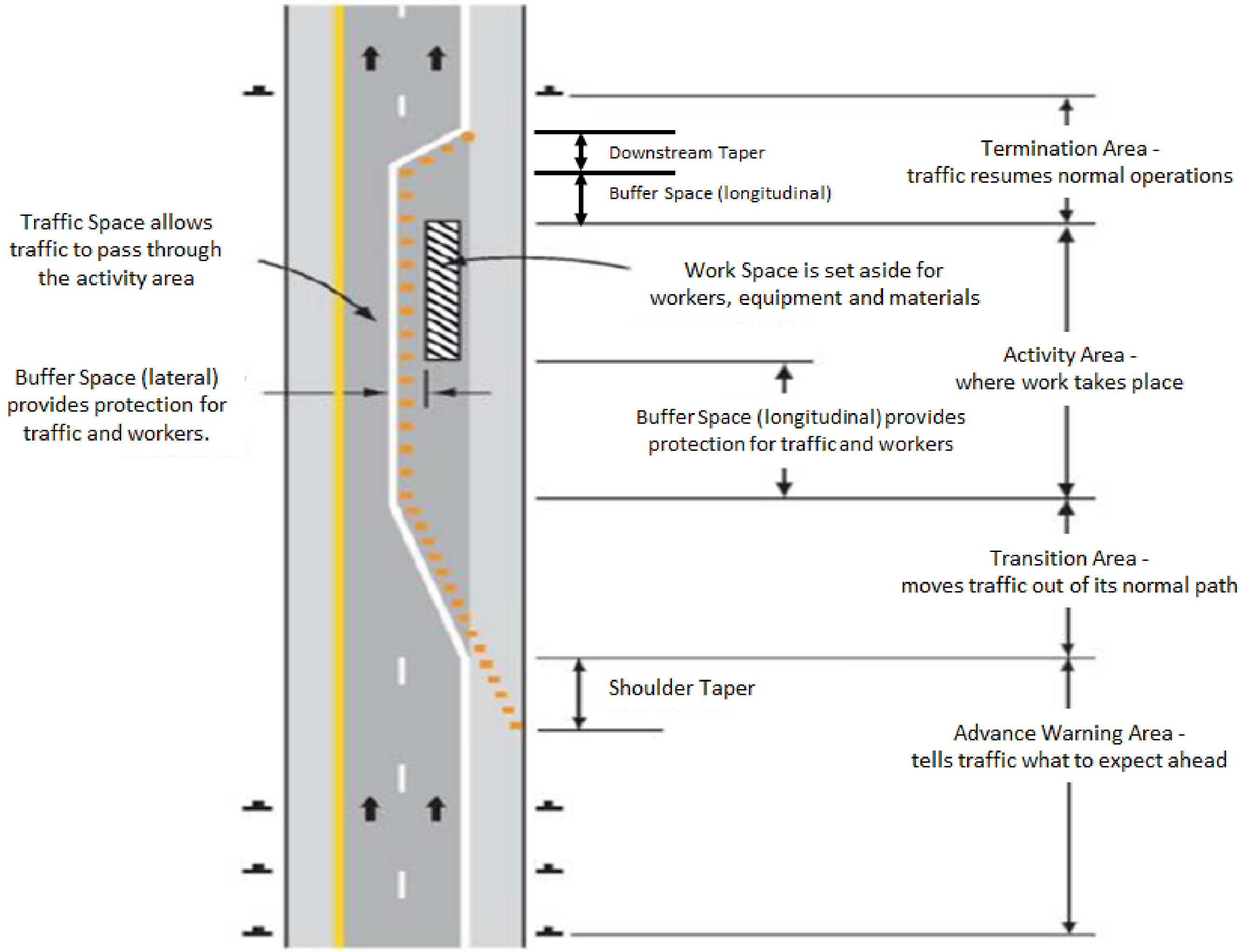

Example of a temporary traffic control zone layout

2.3 Flagging

Flagging is used when all other methods of traffic control are inadequate to direct or control traffic.

Flagger locations must be documented on the Traffic Control Plan.

Minimum standard flagging paddle size allowed is 18 inches (.45 m). It is recommended that a 24-inch (.6 m) paddle be used to improve visibility or for high speed operations.

2.4 Parking

Any vehicle not active in site operations should be parked either in a designated parking area or out of the way and/or used as a barrier to oncoming traffic to protect personnel in the work zone.

All parked vehicles (except light-duty pick-up trucks), trailers and heavy equipment; including those needing to idle while in use, must be secured as follows:

- emergency brake set
- manual transmission in gear (if not idling) or automatic transmission in "Park", AND
- one of the following methods:
  - lowered hydraulic rams
  - connection of trailer to vehicle that is secured
  - two properly sized chocks set on either side of a wheel

3 APPENDIX A

This appendix includes reference material that may be used to provide additional guidance during Traffic Control Planning.

3.1 Components of a Traffic Control Plan

A traffic control plan will be part of the site Health and Safety Plan (HASP) and in addition to the items listed in the Minimum Safety Expectations section, should include, but is not limited to the following:

- Traffic control design
- Traffic control devices
- Traffic control operations
- Method for communicating any Traffic Control Plan changes

3.2 Assessing Traffic Hazards

Before developing the plan, conduct a site/project assessment to identify internal and external traffic hazards including:

• Traffic flow patterns around and within the work zone

• Vehicle/heavy equipment operations within work zone

• Entry and exit routes for project-related and third-party vehicles/heavy equipment (e.g., congested roadways, limited visibility)

• High traffic areas (e.g., active roadways, parking lots and garages)

• Terrain conditions (e.g., hills, loose gravel, steep slopes)

• Survey of adjacent sites activities that may change traffic patterns (e.g., school drop-off, pick-up times)

• Weather and lighting conditions

• Visibility of work area in relation to traffic flow

• Areas of previous traffic accidents

• Traffic hazards that may be encountered when traveling to and from site (including heavy equipment impacts on local streets, turning radius restrictions, etc.)

Movements of motor vehicles, bicycles, and pedestrians around the work zone should be considered, as well as the movements of personnel, vehicles and heavy equipment within the work zone. A work zone is an unexpected obstacle for those not involved in the work and may cause them to respond in unpredictable ways.

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In addition, when transporting oversized equipment to a site over public roadways or right-of-ways coordinate with local jurisd ictions for needed traffic control and permits.

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A two-person crew should also be scheduled if:

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- Pedestrian or cyclists require direction or assistance for temporary crossing/diversion
- Areas where hybrid or electric vehicles are prevalent since they may not be heard at slow speeds

3.4 Project Specific Hazards

When working at active sites:

- Determine safest travel routes into and out of work areas for project-related vehicles and heavy equipment
- If possible, minimize work-related impacts on existing site operations
- Discuss TCP with site operator/manager and others who may be impacted

When work involves excavation, consider the following:

- Space for support of the sidewalls (sloping, benching, shoring, and/or trench boxing)
- Space for the safe movement of workers and heavy equipment around the excavation.
- Should controls, such as physical barriers or visual indicators, be applied to limit access to utilities?
- When working near aboveground or underground utilities, consider the following:
    - Can equipment be operated in a way to maintain safe distances from overhead utilities?
    - Could equipment displace or crush underground utilities?

When laying out work zones, consider the following in allowing space for work activities:

- Can equipment and materials be delivered, stored, and handled readily?
- Can workers perform their tasks safely and efficiently?
- Is there space to walk so as to minimize slip, trip, and fall hazards?
- Are two-way roads three-times as wide as the widest piece of equipment using the road or does traffic need to be controlled?

On-Site Workers should take the following actions:

- Check surroundings often for potential changing traffic hazards
- Listen for and respond to warnings such as horns, whistles, and sirens
- Position yourself facing traffic. Where this is not practical, a “second set of eyes” should be considered such as a buddy or watchperson

- If walking on/near a road or access way, walk in single file (not in a group) towards/facing oncoming traffic
- Remove hearing protection when not needed
- Look out for the safety of other workers in area
- Turn off cell phones and do not use while operating or being in the vicinity of operating vehicles / heavy equipment

3.5 Deploying/Removing Traffic Control Devices

- Begin placing devices in upstream (traffic advance warning area) locations.
- Flag person used to warn incoming traffic should be placed far enough in front of work zone to allow vehicles to maneuver
- Delineate transition zone with cones and barricades
- Establish work zone
- Delineate downstream taper
- Place signs for end of work zone
- Remove devices in reverse order of deployment (remove devices at beginning of set-up last)

3.6 Traffic Control Devices

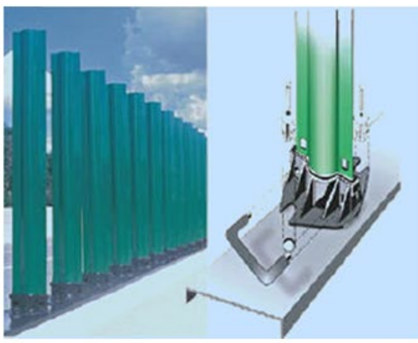
The work zone should be highly visible so that drivers can see and avoid the area. Geometry, color and reflectivity of devices affect how people see them. Location of devices relative to terrain and other objects also affects visibility. Visibility may be enhanced by increasing the height and number of traffic control devices.

Traffic Control devices provide visibility and include the following:

- Traffic cones with flags, looper tubes, grabber tubes and stacker cones (recommended height 1.1 meter/42 inches)
- High visibility security / temporary fencing (may require addition of reflective tape or lights)
- Warning tape
- Reflective tape
- Automated Flagger Assistance Device
- Warning and speed limit signs (e.g., "Caution Work Area")
- Traffic flow arrows (e.g., posted or painted on ground)
- Molded plastic barricades (sawhorses)
- Type I and II barricades
- Plastic channelizers (orange barrels)
- Concrete barriers (Jersey barriers or K-rails)
- Water-filled barricades
- Vehicles used as barricade (with hazard lights activated if possible)
- Light bars and reflective lights on vehicles
- Portable gates
- Glare screens
- Buddy system / Watchperson
- Temporary speed bumps or rumble strips

Commonly used traffic control devices

Extender bars used in place of tape



Glare screens can make a highly visible barrier

Barrier constructed of PVC pipe and orange fencing

Traffic control devices should be routinely inspected to ensure continued integrity and visibility.

Many traffic control devices only provide visual clues to drivers. Physical barriers, such as parked vehicles, concrete barriers, or water filled barriers can provide more protection if a driver has lost control or is not paying attention.

3.7 Night/Low Visibility

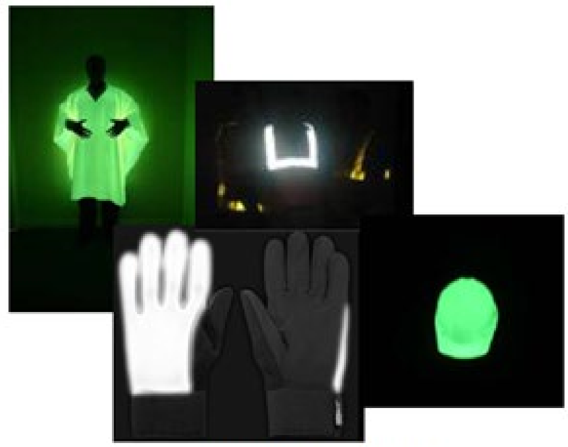
As much as practical, work should be conducted during daylight. Night operations may result in poor visibility for drivers and workers.

If work must be done at night, additional lighting/traffic control measures should be provided to warn vehicles and pedestrians. Glare from lighting should be controlled so as not to interfere with the vision of workers or drivers. Nighttime visibility can be increased by:

- Lighted delineators
- Flood lights/Work area lights
- Higher class of high-visibility apparel
- Flashing lights on clothing/vehicles/hard hat
- Glow sticks attached to traffic vests
- Reflective tape on equipment

Glow stick

Lighted traffic control devices



Highly reflective safety gear

STANDARD OPERATING PROCEDURE 1.11

MOTORIZED VEHICLES AND MOBILE EQUIPMENT WHEEL CHOCKING POLICY

CORPORATE HEALTH AND SAFETY MANAGER	:	Joseph W. Gentile
EFFECTIVE DATE	:	October 2007
REVISION NUMBER	:	0

Motorized Vehicles and Mobile Equipment Wheel Chocking Policy

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Motorized Vehicles and Mobile Equipment Wheel Chocking Policy

1.0 INTRODUCTION

Construction accident studies continue to reveal "rollaway" vehicle accidents as a common occurrence. These most often occur when the driver leaves the vehicle believing the vehicle transmission is in either Neutral or Park position and that the brakes have been set. The vehicle then rolls away and, in most instances, stops only after encountering some obstacle. Vehicular and other property damage are the result with the potential to include serious personal injuries and death.

Motorized Vehicles and Mobile Equipment Wheel Chocking Policy

2.0 SCOPE

This policy applies to the following:

A. All company owned, operated, leased, or contracted motorized vehicles and mobile equipment.

B. All projects managed or supervised by Roux.

C. All Roux company and subsidiary company employees and personnel operating motorized vehicles and mobile equipment.

D. All contractor and sub-contractor personnel performing work for and/or on behalf of Roux.

E. Leased equipment and lessor's operating personnel.

F. Personally owned vehicles.

Motorized Vehicles and Mobile Equipment Wheel Chocking Policy

3.0 PURPOSE

The purpose of this policy is to establish a uniform approach to address hazards associated with the unintended movement of cars, trucks, construction vehicles, and/or vehicle trailers while stopped, during loading, unloading, or other related activities. This policy is intended to provide protection to vehicle/mobile equipment operators, their passengers, pedestrians, forklift operators, and dockworkers through good parking practices and the effective use of wheel chocks.

4.0 PROCEDURAL GUIDELINES

This policy is applicable to Subcontractors as well as Roux employees.

A. Cars, SUVs, Pickups and Light Trucks

Park on level ground. Before exiting the vehicle, make sure the automatic transmission is in PARK with the emergency brake set. Check the brake twice.

B. All Other Motor Vehicles and Loading Dock Applications

Park on level ground. Before exiting the vehicle, make sure the automatic transmission is in PARK with the emergency brake set. Check the brake twice.

Do not leave a vehicle running without an operator seated in the driver's seat.

When stopped or parked on slopes/inclines, chock your wheels. When chocking, use specially designed wheel chocks of the appropriate size and material to securely hold the vehicle. Don't use lumber, cinder blocks, rocks, or other makeshift items to chock. Where applicable, lower hydraulic rams and check the security of the connection between the trailer and the vehicle.

Ensure chocks are easy to find. Store chocks inside trucks, other mobile equipment, and trailers.

Place "Chock Your Wheels" stickers above the wheels as reminders.

Keep chocks available at loading docks. Chain the chocks to the dock to prevent them from being misplaced.

To properly chock a freestanding vehicle, place chocks on the left and right rear axle wheels. It is safest to chock both the front and back wheels on both sides of a vehicle. Some vehicle wheels may also need to be chocked at the front and back of each tire.

Where trailers are loaded or unloaded at docks, ensure that trailers are firmly placed against the loading dock edges and prevent rollaways by using chocks. Positioning of chocks is important. Place chocks on the left and right wheels that are closest to the loading dock. This placement allows a forklift to push down on the trailer wheels and seat them more firmly against the chock. If only the front axle is chocked, a forklift could push the trailer forward and loosen the chock or cause the wheel to jump the chock. The driver, dock workers, and forklift drivers share the responsibility to ensure that the truck and trailer wheels are properly chocked.

Use extra caution when driving a forklift into a trailer from the dock edge. If the trailer rolls away from the dock edge, the forklift could fall into the gap, resulting in the potential for severe injuries or death. Never drive a forklift into a trailer until you make sure that the wheels are properly chocked. Ensure that the trailer floor is in good condition and that it can support the weight of the forklift and its load.

Include wheel chocking in hazards assessments and other procedures. Project and job site hazards assessments shall consider energy releases from motorized vehicles and mobile equipment on all Roux projects and work sites. Site-specific health and safety plans (HASP's) and standard operating procedures shall address wheel chocking requirements. Lockout/Tagout programs and procedures shall include applications for wheel chocking.

5.0 TYPICAL WHEEL CHOCKING APPLICATIONS

1. When performing maintenance on passenger cars, pickups, and light duty trucks, including the changing of flat tires.

2. While performing maintenance on wheeled earth-moving equipment, such as dump trucks, front end loaders, backhoes and other excavating equipment.

3. Parked auxiliary wheeled equipment whether performing maintenance or in stationary position, to include:

   a. Portable air compressors that have been disconnected from the vehicle.

   b. Portable water pumps.

   c. Portable air-moving equipment.

   d. Soil screening equipment.

   e. Wheeled drilling equipment including Geoprobes.

   f. Truck-mounted welding and cutting equipment.

   g. Truck-mounted masts and cranes.

4. Chock truck/trailer while loading/unloading pipe onto a pipe trailer or to a truck-attached bed.

5. Chock truck/trailer while loading/unloading wheeled heavy equipment (i.e., backhoe, track hoe, dozer, and forklift) from a lowboy truck trailer onto ground or when loading onto trailer.

6. Chock and secure wheel and truck mobile equipment while such equipment is being transported by trailer.

7. Chock trailer when being disconnected from truck.

8. NON-VEHICULAR APPLICATIONS: Ensure pipe is properly chocked on pipe rack; ensure 55-gallon drums on horizontal drum racks are chocked; ensure loads are blocked to prevent shifting and falling.

6.0 SPECIAL NOTE ABOUT HYBRID VEHICLES

What is critical to be aware of with hybrid vehicles is that with the engine shut off, there is no sound coming from the engine compartment or the electric motor, just silence. With a hybrid vehicle, a silent car is no guarantee of a safe car. Consider that it is in a sort of "sleep mode." Make sure you are aware of this before the vehicle "wakes up" and catches you by surprise!

Chocking the wheels is critical for safety around a hybrid vehicle. Fortunately, Toyota and Honda engineers have designed an indicator light to show the status of the vehicle and its potential to drive away. Under certain conditions, when the Honda Insight stops, such as in traffic or as a result of a vehicle crash, it goes into the Auto Idle-Stop mode. A small green Auto Stop LED light at the base of the tachometer in the instrument panel illuminates. This indicates that the engine is not moving at all, and reminds the driver and others, such as emergency responders, that the car is still in the "on" mode.

APPENDIX B

Heavy Equipment Exclusion Zone Policy

HEAVY EQUIPMENT EXCLUSION ZONE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
REVISION NUMBER	:	**1**

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1. PURPOSE

The purpose of the Exclusion Zone Management Program is to establish the minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). The intent is to have no personnel or equipment entering the Exclusion Zone while the equipment is in operation or moving to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment.

2. SCOPE AND APPLICABILITY

This Management Program applies to all Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") employees and their subcontractors who are performing field work and are potentially exposed to heavy equipment. For the purpose of this program, heavy equipment includes, but is not necessarily limited to: excavation equipment, drill rigs, vacuum trucks, forklifts, lull telehandlers, man lifts, bobcats, delivery trucks, etc.

3. PROCEDURES

As specified in the following sections of this Program, an Exclusion Zones must be established and maintained during activities involving the movement/operation of heavy equipment. The Exclusion Zone requirements apply to all personnel on the site but are primarily focused on those personnel who are required to be working in the vicinity of the equipment. The exclusion zone is in effect when heavy equipment is moving or engaged (ex. movement of an arm or bucket of an excavator, rotation of an auger, lifting of a load with a forklift, raising/lowering of a man lift, etc.).

1. The Exclusion Zone must meet the following minimum requirements:
   - A minimum distance of 10 feet from all heavy equipment and loads being moved by the equipment;
   - Greater than the swing/reach radius of any moving part on the heavy equipment (i.e., for large equipment this may mean an exclusion zone distance larger than 20 feet);
   - Greater than the tip-over distance of the heavy equipment; and
   - Greater than the radius of blind spots.

   > The size of the Exclusion Zone will need to be determined on a task-specific basis considering the size of the heavy equipment in use and the task being performed. Prior to all heavy equipment operations, the Exclusion Zone(s) distance must be specifically identified in the Job Safety Analysis (JSA).

2. The spotter (or another individual) should be assigned responsibility for enforcing the Exclusion Zone. The spotter should be positioned immediately outside of the Exclusion Zone within a clear line of sight of the equipment operator. The spotter must signal the operator to stop work if anyone or anything has the potential to enter or compromise the Exclusion Zone. The operator should stop work if the spotter is not within his/her line of sight. If multiple pieces of equipment are being used, each piece of equipment must have its own Exclusion Zone and spotter. For large excavation and demolition projects the spotter should be in constant radio contact (not cell phone) with the machine driver.
3. If an individual must enter the Exclusion Zone, the designated Spotter must signal the Equipment Operator to stop the equipment. Once the equipment is no longer moving (ex. movement of an arm of an excavator is STOPPED, lifting of a load with a forklift STOPPED, raising/lowering of a man lift is

STOPPED, etc.), the operator must DISENGAGE THE CONTROLS and STOP and SIGNAL BY "SHOWING HIS HANDS". This signal will indicate that it is safe for the personnel to enter the limits of the Exclusion Zone to perform the required activity. The equipment must remain completely stopped/disengaged until all personnel have exited the limits of the Exclusion Zone and the designated Spotter has signaled by "SHOWING HIS HANDS" to the Equipment Operator that it is safe to resume operations.

4. When entering the limits of the Exclusion Zone, personnel must at a minimum:
   - Establish eye contact with the operator and approach the heavy equipment in a manner that is in direct line of sight to the Equipment Operator;
   - Never walk under any suspended loads or raised booms/arms of the heavy equipment; and
   - Identify a travel path that is free of Slip/Trip/Fall hazards.
5. The Exclusion Zone should be delineated using cones with orange snow fence or solid poles between the cones, barrels, tape or other measures. For work in rights-of-way rigid barriers, such as Jersey barriers or temporary chain link fence should be used. For certain types of wide-spread or moving/mobile equipment operations, such delineation may not be practicable around pieces of equipment or individual work areas. In such instances, it is expected that the entire operation will be within a larger secure work area or that additional means will be utilized to ensure security of the work zone.

All subcontractors who provide heavy equipment operations to field projects must implement a program that meets or exceeds the expectations described above as well as any additional requirements that may be required on a client or site-specific basis.

3.1 Exceptions

It is recognized that certain heavy equipment activities may require personnel to work within the limits of the Exclusion Zone as specified in this program. Such activities may include certain excavation clearance tasks, drill crew activities or construction tasks. However, any such activity must be pre-planned with emphasis on limiting the amount and potential exposure of any activity required within the zone. The critical safety steps to mitigate the hazards associated with working within the Exclusion Zone must be defined in the JSA and potentially other project-specific plans (i.e., critical lift plans, etc.), and approved by the Roux Project Principal and client representative, if required, prior to implementation.

4. TRAINING

Many Roux projects have different requirements that are client-specific or site-specific in nature. It is the responsibility of the Project Principal (or Project Manager if delegated this responsibility by the Project Principal) to ensure that the workers assigned to his/her projects are provided orientation and training with respect to these client and/or site-specific requirements.

APPENDIX C

Field and Office Ergonomics Program

ERGONOMICS MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**01/19**
REVISION NUMBER	**:**	**0**

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APPENDIX

1. PURPOSE AND BACKGROUND

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following program to aide in preventing back injuries and other work-related musculoskeletal disorders (WMSDs) or cumulative trauma injuries to personnel. Ergonomic issues involving WMSDs can arise not only in the office but also in the field and when driving. WMSDs are disorders of the muscles, nerves, tendons, ligaments, joints, cartilage, blood vessels, or spinal discs. WMSDs may include muscle strains and tears, ligament sprains, joint and tendon inflammation, pinched nerves, and spinal disc degeneration.

2. SCOPE AND APPLICABILITY

This program applies to all tasks where Roux personnel and contractors perform manual lifting and have the potential for material handling and ergonomic stresses. It is the responsibility of the Corporate Health and Safety Manager (CHSM) to aide in developing and training Office Health and Safety Managers (OHSM) and Site Health and Safety Officers (SHSO) to implement this program.

3. PROCEDURES

3.1 Safe Lifting Practices Management

A. Evaluate all assignments to assess if they can be completed without risk of back injury e.g., moving boxes, computers, equipment, etc.).

B. Require that heavier items are stored on lower shelving units; ideally between knee and shoulder height.

C. Recognize lifting-intensive tasks (poor lift design, high frequency, and/or excessive weight) and provide the means by which personnel can perform lifting duties without risk of injury e.g., carts, dollies, trucks with lift gates).

D. Secure outside assistance if personnel cannot safely accomplish the job e.g., additional staff, contract movers).

E. Contact the OHSM or SHSO when assistance is necessary to evaluate a lifting task that may pose a back-injury/WMSD risk to assigned personnel.

F. Ensure that personnel receive the required training outlined below.

3.2 Training Management

A. Personnel who may have lifting or other ergonomic issues receive training that includes the following topics:

B.

1. Recognizing potential hazards and how to correct and prevent them.
2. Proper workstation set up and maintenance.
3. How to avoid unnecessary physical stress and strain.
4. How to comfortably handle lifting jobs without undue strain.
5. Proper use of equipment.
6. Stretching and strengthening exercises to minimize risk of injury.

3.3 Office Moves and Relocations

A. Utilize professional movers for moving office furniture for both offsite moves and interoffice moves.

1. Desks, file cabinets, bookcases, etc.
2. Intensive moving of file boxes
3. Any other heavy equipment or materials.

B. Ensure that the moving contractor is appropriately evaluated and insured.

C. Assure as applicable that all unstable items (e.g., bookcases) are secured to prevent tip over in transit, and when placed.

3.4 Workplace Evaluations

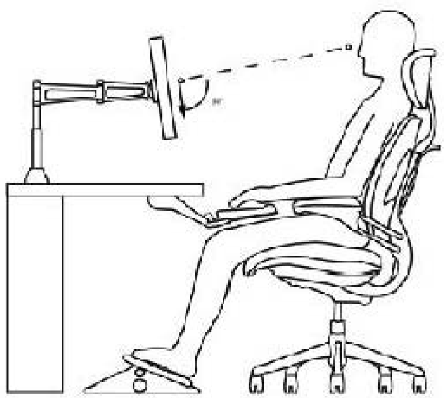
At the request of personnel, workstation evaluations of office workstations are available through the OHSM. As it relates to site-specific activities, guidelines will be specified within site-specific Job Safety Analyses (JSA) that are covered prior to any work activity. JSAs include information on the procedural steps, hazards and how to control specific hazards as it relates to specific tasks. Ergonomic hazards are identified and controls are recommended depending upon the specific activity.

4. OFFICE ERGONOMICS

There is no single “correct” posture that will fit everyone. An ergonomic injury or illness can be easily avoided however through ergonomic education and following basic design goals of an office desk.

Repetitive motions are one of the key causes for ergonomic injuries/illnesses and working at an office desk for a prolonged time significantly increases the potential for an ergonomic injury or illness. Highly repetitive tasks that involve long periods of static posture may require several short rest breaks called “micro breaks”. During these breaks, employees are encouraged to stand, stretch, and move around. This provides rest and allows muscles time to recover. Alternately the employee can try to vary their work tasks throughout the day to breakup highly repetitive tasks.

4.1 Office Ergonomic Set-up Recommendations



- Top of the monitor should be at, or just below eye level to avoid awkward neck posture, and positioned directly in front of you.
- Head and neck should be balanced and in-line with torso.
- Elbows should be close to the body and supported by arm rests.
- Hips and knees should be approximately at a 90-degree angle. The back of the knee should be slightly higher than the seat pan to allow blood to circulate freely.
- The lumbar curve of the back should be supported.
- Keep your wrist and hands in-line with forearms.
- Avoid crossing legs. Feet should be firmly on the ground or on a footrest.
- Keep monitor and keyboard as close as possible, this will keep you in a sound posture.
- The mouse should be located on the same level as the keyboard.
- Take advantage of how your chair can be adjusted to your body.
- Vary work task to cut down on repetitive motion.
- Take short breaks to stretch muscles and to rest the eyes.
- Keep items most frequently used close to you.

5. DRIVING ERGONOMIC GUIDANCE

5.1 Typical Problems from Frequent Driving

- Neck, Back and shoulder pain;
- Cramps, pressure points and poor circulation in the legs and buttocks;
- Immediately after driving, there is an increased chance of low back injury from lifting; and
- Long-term potential for degeneration of spinal discs and disc herniation.

5.2 Chronic Back and Neck Injuries from Driving are Caused by Two Main Risk Factors

- Sitting for long periods of time; and
- Whole-body vibration.

5.3 Long Term Sitting

When you sit, your pelvis rolls backward and the small of your back flattens out. This increases the pressure in the discs of the spine. (In this position, the discs are less prepared to handle the vibrations from your car.)

Ligaments in your back help to hold the spine together as you move. These ligaments will stretch and slacken if you sit down for a long time. After standing up, they remain slack for a while and cannot support the spine as they normally do.

If your seat is not correctly adjusted, you could develop pressure points in the buttocks and back of the legs and muscle strain in the low back.

Continuous upper back and neck muscle work is often required to hold the head in position, especially if vibration is present. Continuous muscle activity can lead to muscle strain.

Holding a foot pedal down over a long period may cause stiffness and spasm in the legs and low back.

5.4 Whole-body Vibration

Whole-body vibration stimulates bursts of back muscle activity. This causes neck and back muscles to tire more quickly and decreases the support these muscles can give to the spine. Even if the muscles are working very lightly, activity for an extended time without rest will lead to fatigue and increase the risk of back injury.

Long-term exposure to whole-body vibration is a common way to develop a herniated disc in your back. The increased disc pressure from sitting speeds up this process.

5.5 Ergonomic Driving Tips

1) Before you even get into your car, remove everything from your pocket - anything that can add pressure points to your body while you drive.
2) Move your car seat all the way to the back, get in and begin adjusting until you feel comfortable. Have the seat adjusted to approximately a 100° angle which decreases pressure on your lower back.

3) If your seatbelt is too tight or uncomfortable, pick up some soft, thick fabric and wrap it around your seatbelt.
4) If the back of the seat is uncomfortable, a lumbar support pillow can be used.
5) Adjust all mirrors to fit your body and line of sight. You shouldn't have to crane your neck to see what's going on around you. For blind spots, small mirrors can be purchased and placed on the side-view mirrors or dashboard to help you see.
6) Keep items you may need while driving in the front seat, such as tissue paper and sunglasses. Twisting and reaching in the car are awkward postures, not to mention the danger it leads to while operating a vehicle.
7) If you are on a long driving trip, take frequent breaks; get out of the car and stretch. Take a quick walk if possible. It's also a good idea to rest your eyes for a bit.
8) The best posture for gripping the steering wheel is keeping two hands on the wheel except when shifting gears. Change your hand postures frequently to improve circulation and reduce fatigue.

    a. **<u>Common Postures to be avoided:</u>**

        i. **Death Grip** – Your grip should be light. If your knuckles are white, you are gripping too hard.

        ii. **The one arm cool dude** – One wrist at the 12 o'clock position on the wheel with the fingers over the top. This causes compression of the soft tissues of the wrist, as well as reducing circulation of the neck and shoulder (and also will result in bone-to-bone contact with your face in the event the air bag were to deploy).

        iii. **Arms straight out** – You should be able to drive with your shoulders relaxed and your arms close to the sides of your body.

        iv. **One arm propped on your window** – This posture decreases circulation at the neck and shoulder and may compress soft tissue on the arm/wrist.

Appendix A- Symptom Solver

Symptom Solver

Discomfort Associated with Hands or Wrists

Possible Cause of Symptoms	Suggested Solutions
• Resting heavily on the hand, forearm or elbow that hurts. • Heavy use of a calculator. • High force when using the space bar. • Mouse size is too big or too small. • Heavy use of the mouse with one hand. • Heavy use of the number pad on the keyboard. • “Planting” your palms or wrists in a fixed position when typing or using the mouse. • Dropping your wrists to the work surface when typing • Resting wrists when typing. • Working surface or keyboard is too high or too low. • The wrist rest is too high or the edges are square and hard. • Typing or mousing on hard work surfaces with blunt edges. • The keyboard is sloping towards you.	• Do not rest heavily on either hand. • Use a wrist rest for your calculator. • Avoid high force when using the space bar. • Change mouse to one that fits you correctly. • Alternate hands using the mouse and switch to keyboard shortcuts (page 5). • Use proper keyboard and mouse techniques (page 5). • Use auto-text entries to minimize typing (page 5). • Use the wrist rest correctly (page 6). • Adjust the keyboard, keyboard platform or desk surface to just below your elbow height with the upper arm in line and comfortable against the body. • Adjust the keyboard so the keyboard lies flat.

Discomfort Associated with Headaches or Blurry Vision

Possible Cause of Symptoms	Suggested Solutions
• Image on the screen is not clear. • Staring or concentrating on your monitor for long periods of time. • Dry eyes.	• Position your monitor to reduce reflection. • Adjust the brightness and contrast settings to fit you. • Rest your eyes occasionally by switching tasks or looking away from the monitor. • The distance between your eyes and your monitor should be one arm’s length away from you. • Blink frequently to keep your eyes lubricated when doing computer work.

Discomfort Associated with Head or Neck

Possible Cause of Symptoms	**Suggested Solutions**
• Holding your head at an awkward angle. • Monitor is too high and/or is not centered with your keyboard. • Looking up and down between the keyboard and screen as you type. • Leaning forward to view the monitor. • Tilting your head back to accommodate your eye glasses. • Cradling the telephone between your head and shoulder. • Twisting your neck to look at a copy on your desk.	• Adjust the monitor correctly. (Pg. 6) • Take a touch-typing course. • Enlarge the font size. • Center the monitor with your keyboard. • Do not cradle the telephone. Hold the phone, use a headset or use your speaker phone. • Use a copy holder to avoid twisting your neck as you type.

Discomfort Associated with the Forearms or Elbows

Possible Cause of Symptoms	**Suggested Solutions**
• The position of your mouse or keyboard is causing you to extend your reach. • Leaning on your work surface while typing or using the mouse. • Resting your forearms heavily on the arms of your chair. • Extended reach of the mouse.	• Position the mouse close to and on the same level as your keyboard. • Sit up straight and allow your hands to “float” above the keyboard without resting your wrists. • Adjust the arm rests of the chair so your forearms are just barely touching them. • Do not lean heavily on arm rests.

Discomfort Associated with the Shoulders

Possible Cause of Symptoms	**Suggested Solutions**
• The position of your mouse is causing you to extend your reach. • Leaning to one side while you are using the keyboard or mouse. • Cradling the telephone between your head and shoulder. • Extended reaching ether side or behind you for the telephone.	• Position the mouse to and on the same level as the keyboard. • Sit up straight with your back against the back of your chair with your feet on the ground. • Center the keyboard with your monitor. • Hold the telephone, use a headset or use speaker phone. • Reposition frequently used items closer to you.

Discomfort Associated with Upper and Lower Back

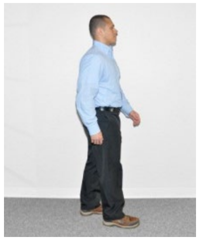
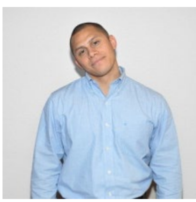
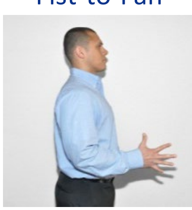
Possible Causes of Symptoms	Suggested Solutions
• Leaning forward to type or write. • Improperly supported back. • Cradling the phone between your head and shoulder.	• Adjust the monitor correctly. • Adjust the chair so that your lumber back is supported by the chair. • Position your keyboard and mouse close to the body. • Do not cradle the telephone. Hold the phone, use a headset, or use speaker phone. • Sit with your shoulders and hips directly in front of the keyboard and monitor. • Sit up straight with your back against the back of your chair with your feet on the ground or on a footrest.

Discomfort Associated with Legs/Feet

Possible Causes of Symptoms	Suggested Solutions
• Awkward posture of your feet or legs. • Tucking your feet under your legs or chair. • Feet not touching the floor or your legs are extended out in front of you.	• Sit up straight and do not lean to one side or the other. • Adjust the chair seat pan so there is space between your knees and the seat. • Place feet flat on the floor. • Use a footrest if your feet do not reach. • Clear the area below your desk so there is room for your legs and feet.

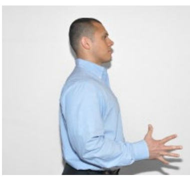
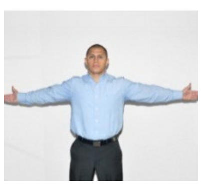
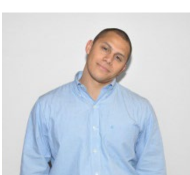
ExxonMobil Stretching Guide ▪ Environmental Services

Warm-up Description

Warm-up	Description	Repetition or Length	Comments
Walking on the Spot 	▪ Walking in place for a better part of the 5 minutes warm-up period	▪ 3 minutes total, including the time required to walk to the site	▪ Walking on the spot should be performed in conjunction with the "Fist-to-Fan" warm-up exercise ▪ Walking to the jobsite should be included in total walking time
Neck Circles 	▪ Rotate the head about the neck 5 times in each direction. Repeat the circling once for a total of 10 rotations in each direction	▪ 5 rotations in one direction followed by 5 rotations in the opposite direction ▪ Repeat once	▪ This exercise is not designed to require maximal effort and the neck range of motion should not be taken to extremes
Arm Circles 	▪ With arms raised out to the side, rotate them about the shoulder 10 times in each direction	▪ 5 rotations in one direction followed by 5 rotations in the opposite direction ▪ Repeat once	▪ The diameter of the circling should be approximately 2 feet and can be varied if preferred by the individual
Fist-to-Fan 	▪ Make a fist with each hand with nearly maximal force ▪ After 2 seconds, open (i.e. fan) each hand maximally for 2 seconds then shake out each hand.	▪ Perform a total of 10 hand fist-to-fan movements, 2 seconds for opening, 2 seconds for closing	▪ The employee should perform the fist-to-fan sequence with both hands simultaneously and repeat 5 times

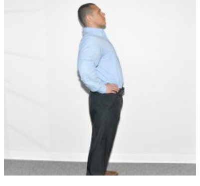
Stretching Guide ▪ Environmental Services

Stretching Description

Stretch Type	Description	Repetition or Length	Comments
Wrist Flexor/Extensors 	▪ With the palm facing upwards (flexors) or downwards (extensors), use the opposite hand to pull down or up on the fingers	▪ Hold for 20 seconds ▪ Perform once per arm	▪ Employees who input data into a computer using a keyboard should not perform the wrist flexor stretch
Palm 	▪ With arms at one's side, bend the elbows so that the forearms are parallel with the ground. Fan the fingers away from each other as far as manually possible	▪ Hold for 10 seconds ▪ Perform once per hand simultaneously	▪ The palm of the hand can be facing any direction during this stretch
Posterior Shoulder 	▪ Raise both arms out to the side and with palms facing forward bring both arms backward so that a stretch is felt across the front of the chest	▪ Hold for 20 seconds. ▪ Perform once	▪ Perform this stretch without assistance of a wall If a stretch is not felt, bending the elbows will allow for the arms to be positioned further backwards
Chest Stretch 	▪ Raise both arms out to the side and with palms facing forward bring both arms backward so that a stretch is felt across the front of the chest	▪ Hold for 20 seconds. ▪ Perform once	▪ Perform this stretch without assistance of a wall . If a stretch is not felt, bending the elbows will allow for the arms to be positioned further backwards
Side Neck Flexors 	▪ Starting with the head and neck positioned normally, slowly bend the neck to the side ▪ A mild stretch should be felt along the side of the neck in the opposite direction of the stretch	▪ Hold for 20 seconds ▪ Perform once.	▪ Ensure that the neck and head are the only body segments moving and that the shoulders stay stationary

Stretching Guide ▪ Environmental Services

Stretching Description

Stretch Type	Description	Repetition or Length	Comments
Neck Flexors 	▪ Starting with the head and neck positioned normally, extend the head backwards so that the chin moves upward	▪ Hold for 20 seconds ▪ Perform once	▪ This stretch should be performed in sequence with the Side Neck Flexor Stretch ▪ If no stretch is felt, protrude the chin outward
Neck Rotators 	▪ Start with the head and neck positioned normally, gently pull the head towards the opposite armpit. ▪ A stretch should be felt along the back of one side of the neck	▪ Hold for 20 seconds ▪ Perform once per side	▪ If no stretch is felt, position the arm that is not pulling the head behind the back
Lumbar Extension 	▪ Place the hands over the buttocks next to the hips and push the hips forward until a mild pressure is felt in the lower back	▪ Hold for 20 seconds ▪ Perform twice	▪ This posture should be started standing upright and tall
Standing Lunge 	▪ Take a step forward with hands on hips. Bend the front knee and keep the back foot flat on the ground. A stretch should be felt behind the back lower leg and front of hip	▪ Hold for 20 seconds ▪ Perform once	▪ If a stretch is not felt, straighten the back knee; ensure that that the low back stays neutral as the motion should be accomplished by the hips and legs

Ergonomics Guide

What is Ergonomics?

Ergonomics is a continuous improvement process to set up the work environment for what people do well and against what people don't do well.

What is the Impact?

If job task demands and work environment are designed to meet human performance capabilities, the results are:

- Reductions in musculoskeletal disorders (MSDs)
- Fewer injury costs
- Increased productivity
- Enhanced process stability and product quality

What are MSDs?

Musculoskeletal disorders affect the muscles, nerves, tendons, ligaments, or spinal discs that are the result of months and years of exposure to ergonomic risk factors. MSDs are not instantaneous injuries like slips and falls; they are injuries that occur over time.

How do MSDs Occur?

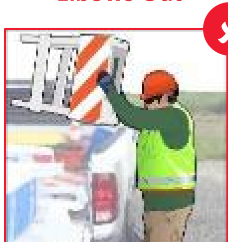
MSDs occur when there is more incoming trauma on the body than the natural healing process can absorb.

The Primary Ergonomic Risk Factors

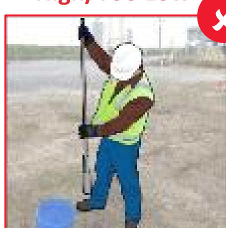
- Awkward postures
- High forces
- Extreme frequencies

Hit List – The Hit List is a simple observational tool used to quickly identify ergonomic issues.

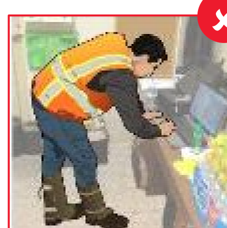
Elbows Out



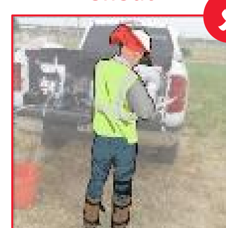
Shoulders Too High/Too Low



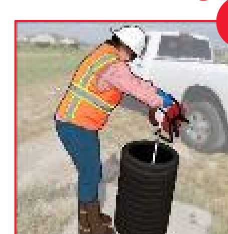
Butts Up



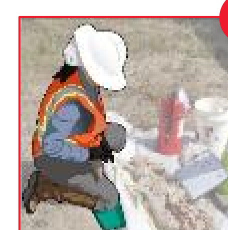
Twist and Shout



Overreaching



Awkward Legs



AVOID

Ergonomics Guide

Lifting Techniques – Follow these basic guidelines when lifting.

Lifting Best Practices – Behavior or work practices that positively impact ergonomic risk, efficiency, and/or productivity.

- Use a two-person lift whenever objects weigh > 45lb
- Grab handles to improve coupling, when available
- Avoid back twisting, especially while bending
- Remove anything that does not belong in the lifting area or that is not needed
- Do not push objects away from nearby storage locations unless necessary
- Always handle equipment with two hands
- Label shelves and product boxes, always placing items where they belong
- Keep origin of heavy and frequently used items within the comfort zone, 38" to 49" above the standing surface
- Keep the item close to the body during the entire lift to prevent overreaching
- Test the weight before lifting it

Ergonomics Guide

Push/Pull Techniques

Preferred

Center the load on the cart

Preferred

Push, don't pull the cart

Unacceptable

Unacceptable

Push/Pull Best Practices

- When possible, push carts with the swiveled casters at the end that is pushed
- Make multiple trips with lighter loads when possible
- Load heavier products on larger casters whenever possible or evenly distribute heavier products
- Perform scheduled caster maintenance on carts
- Casters should be pneumatic or rubber, 8" in diameter, and at least 2.5" wide

Carrying Techniques

Preferred

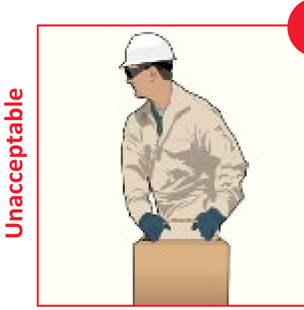
Keep the load close

Preferred

Stay in-line with the spine

Unacceptable

Unacceptable



Carrying Best Practices

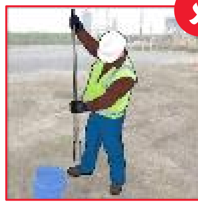
- Keep the object as close to your body as possible
- Use a two-person carry when objects weigh > 45lb
- Constantly maintain three (3) points of contact on the object: one hand on either side and making contact with the midsection
- Keep the load in-line with the spine and do not twist
- Make sure a clear path to your destination is provided before carrying any load

Ergonomics Guide ▪ Environmental Services

Ergonomics Guide

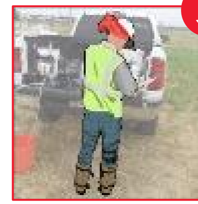
A Elbows Out

B Shoulders Too High / Too Low



C Butts Up

D Twist and Shout

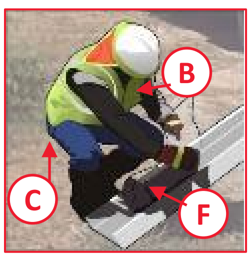


E Overreaching

F Awkward Legs

Sonic Drilling

Common Situations



Potential Issues

- 40-lb grout bags are carried too far
- 80-lb grout and cement bags are carried too far
- Heaviest casing storage height is too low, 18”
- Reach when aligning casing in drill is too high, 89”
- 40-lb grout bag pouring heights are too low
- Heavy cement is mixed by hand using a tarp and carried too far

Good Work Practices

- Park truck closer to destinations to reduce carry distances
- Raise grout retrieval height with empty pallets
- Deliver grout pallet to platform with forklift
- Place heaviest casings with 38” and 49” above standing surface
- Limit casing reaching heights to below shoulder
- Utilize a taller funnel and rest bag on its edge
- Utilize a portable cement mixer
- Mix cement closer to the well to reduce carry distances

Well Soil Sampling

Common Situations

Potential Issues

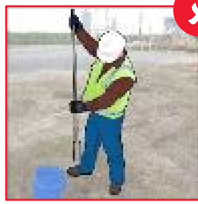
- Core sample bagging and retrieval heights are too low
- Tarp folding and cleaning heights are too low on the ground
- 39-lb soil samples lowered to low

Good Work Practices

- Elevate the bottom of the chute or install a stop to raise bag retrieval
- Raise casing height to allow bags to be filled between 38” and 49”
- Locate tarp atop of collapsible tables to raise working heights
- Sweep off debris from tarp on table with a push broom

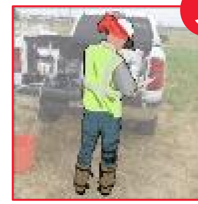
A Elbows Out

B Shoulders Too High / Too Low



C Butts Up

D Twist and Shout

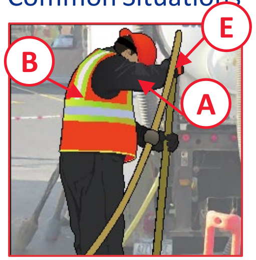


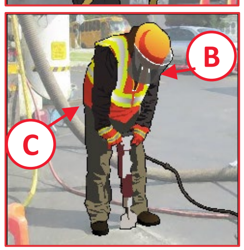
E Overreaching

F Awkward Legs

Soft Digging

Common Situations





Potential Issues

- Air Lance handling height is too low, often at ground level
- 25-lb vacuum hose lacks handles
- 50-lb pavement replacement bags are carried too far
- Jackhammer exposes operator to whole body vibration
- Beating hoses requires repetitive force
- Sample testing height is too low and too far away

Good Work Practices

- Store pavement replacement bags in Vac Truck to reduce carry distance
- Attach 3’ head on air lance during digging to increase hand working heights
- Replace hose material to prevent soil from clogging
- Utilize vibration dampening materials to reduce impact of jackhammer
- Provide a small stool to sit on
- Utilize sawhorse to support vacuum hose weight
- Provide a small collapsible table for testing samples
- Utilize movable handles to provide stronger grips

Auger Drilling

Common Situations

Potential Issues

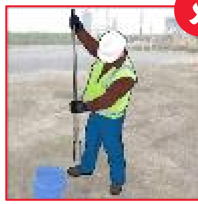
- 72-lb auger stems are frequently lifted and carried long distances
- 38-lb drill heads result in awkward pinch grips
- Auger sample tubes require high force to open
- Drill control panel is too high, 79"

Good Work Practices

- Investigate utilizing hoist on drill truck to move Auger stems
- Provide removable handles to carry drill head
- Lower height of control panel
- Provide handles for shovel and wheelbarrow

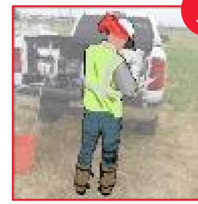
A Elbows Out

B Shoulders Too High / Too Low



C Butts Up

D Twist and Shout

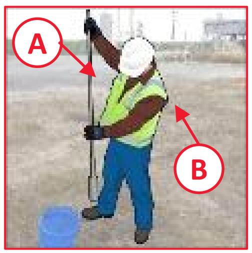


E Overreaching

F Awkward Legs

Hand Augering

Common Situations



Potential Issues

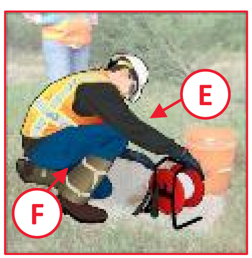
- Excessive auger turning and lift forces, 20 lb to 90 lb
- High hand auger handling heights
- Low auger sanitizing heights
- Buckets are located too low
- Low depth measuring heights

Good Work Practices

- Provide a hand auger with interchangeable heads that match the soil type, or provide a powered auger
- Limit auger handling heights to below the shoulder when lifting out samples
- Provide a stool to sit on or a kneel pad
- Provide a small collapsible table to store sample bucket on
- Indicate depth on auger to eliminate depth measurement rod use

Well Gauging

Common Situations



Potential Issues

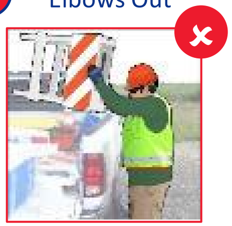
- Low gauging hand working heights, 3” above the ground
- Low well lid opening heights, 4” above the ground
- Far reach distance to depth probe, 20” forward
- Well interior is dark with limited lighting
- Far reach distance into truck, 35”

Good Work Practices

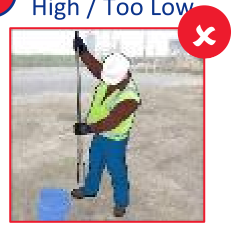
- Stand when gauging as much as possible
- Provide screwdriver with a longer handle to open lid
- Keep all reaches to the reel within 16” from the worker
- Provide all workers with flashlights
- Store frequently accessed items in the trunk within a 16” reach; less frequent items within a 22” reach

Ergonomics Guide

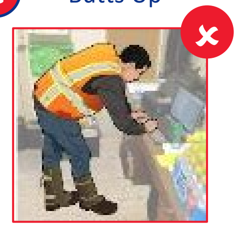
A Elbows Out



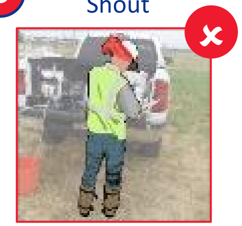
B Shoulders Too High / Too Low



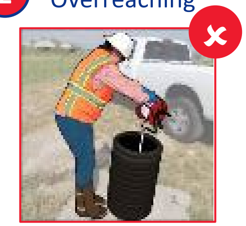
C Butts Up



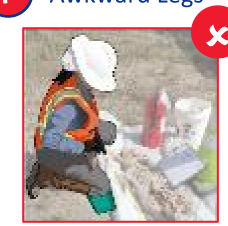
D Twist and Shout



E Overreaching



F Awkward Legs



Ground Water Sampling

Common Situations

Potential Issues

- Low flush mount well hand working heights
- Low well lid opening height, 4”
- >25-lb sampling equipment is double handled when sorted and stored on the ground
- Far equipment carrying distance
- Low sample bottle filling heights
- High material retrieval height from truck wall
- Keyboard is used while standing
- No writing surface in truck

Good Work Practices

- Park truck closer to destinations to reduce carry distances
- Pull out sleeve while standing
- Provide a stool to sit on or a kneel pad
- Provide longer-handled screwdriver
- Request vendor to ship equipment in kits
- Request vendor to label boxes of equipment to reduce equipment search time
- Park truck closer to equipment trailer to reduce carry distances
- Provide a shallower pail and locate it on tail gate during sampling
- Fill sample bottles while standing
- Provide an office chair
- Perform as much paper work in the trailer as possible

Soil Analysis

Common Situations

Potential Issues

- Low soil sample hand working heights on the ground
- Far reach distance into truck, 38”
- Laptop located on lap when typing in truck

Good Work Practices

- Provide collapsible tables to raise soil hand working heights to between 38” and 47” above the ground
- Provide a stool to sit on or a kneel pad
- Store frequently accessed items within a 16” reach, less frequent items within a 22” reach
- Provide a steering wheel laptop holder

APPENDIX D

Hearing Conservation Program

HEARING CONSERVATION MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**01/2019**
REVISION NUMBER	**:**	**4**

TABLE OF CONTENTS

1. PURPOSE

The Hearing Conservation Management Program (HCMP) has been established to evaluate noise exposures in the work place and to implement measures to prevent exposures equal to or in excess of the Occupational Safety and Health Administration (OSHA) standard of 90 decibels on the A-weighted scale (dBA) and monitor exposures equal to or greater than 85 dBA. Although noise on a project site is not usually considered to be the primary hazard, it still represents a danger to persons on the site, particularly those working around vehicles and machinery. There is also the danger of an explosion that can lead to serious hearing damage for those in close proximity. Testing for noise levels should be done periodically if there are any doubts that noise levels are lower than OSHA standards.

Work involving heavy equipment and vehicles often creates excessive noise. The effects of noise can include:

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

There are three main techniques employed to protect workers' hearing:

- Engineering Controls: Those physical means to lower the impact of sound damage, such as mufflers, enclosures and design innovations.
- Administrative Controls: Limiting the amount of exposure by decreasing the exposure time or positioning oneself at greater distance from the noise source.
- Hearing Protection Devices (HPDs): Devices that either fit in the ear, both disposable and reusable, or on the head covering the ears (See Appendix B).

The best approach is provided by engineering controls which eliminates the problem so that administrative controls or hearing protection are not needed.

2. SCOPE AND APPLICABILITY

The practices and procedures described here constitute the program by which employees will be made aware of the hazards associated with occupational noise exposure.

The OSHA Occupational Noise Exposure standards at 29 CFR 1910.95, 1926.52 and 1926.101 apply to all employees exposed to occupational noise. Employees subjected to noise levels exceeding an 8-hour time-weighted-average sound level of 90 dBA trigger the requirement to implement feasible engineering or administrative controls. If these controls fail to reduce the noise exposure to below the 90 dBA threshold, HPDs must be supplied to reduce the exposure to below the 90 dBA threshold. In addition, whenever employee noise exposures equal or exceed an 8-hour time-weighted-average sound level of 85 dBA (not including attenuation provided by the HPD), a continuing effective HCMP must be administered as described in the OSHA standards at 29 CFR 1910.95 and 1926.52.

3. CAUSES OF HEARING LOSS

3.1 Types

There are two types of hearing loss: conductive and sensory. Conductive loss involves the outer and middle ear while sensory loss involves the inner ear, auditory nerve, or brain. A conductive loss results in a decrease in loudness but not clarity. This would be similar to turning down the volume on a radio. Sensory losses are associated with a loss in clarity. Using our radio example, this would be similar to static on a radio station making it more difficult to understand speech.

3.2 Causes of Loss

There are many causes of conductive hearing loss. Many of these disorders can be medically or surgically treated and should be evaluated by an ear specialist. Some of the disorders include: middle ear infections, perforation of the ear drum, fixation of the ossicular chain, and osteosclerosis. Sensory hearing loss also has many causes and they are often more difficult to treat medically. Causes of sensorineural impairment include: Congenital: hereditary and damage to fetus and Acquired: aging, noise, disease, injury, and drugs.

3.3 Effects of Noise on Hearing

The effect of noise is subtle and we do not always know when noise may be damaging our hearing. Most noise induced hearing loss is a slow, gradual process and it may take years before hearing difficulties are recognized. Excessive noise can affect the inner ear (which sends the impulse to the brain) by destroying some of the hair (cilia) cells. Once the hair cells cannot regenerate and are therefore destroyed, they never function again. Initial exposure to high noise levels will cause fatigue of certain hair cells and a temporary loss in the higher frequency range. Hearing usually returns to normal after a period away from the noise (about 14 hours). This type of noise-induced hearing loss is referred to as a temporary threshold shift (TTS) in hearing. Most of us have experienced this after being in a noisy environment such as a rock concert. You may even have noticed ringing in the ears -- another sign of temporary threshold shift.

If you are repeatedly exposed to high noise levels for a prolonged period of time, changes may result in a permanent threshold shift (PTS). Permanent noise-induced hearing loss is irreversible. As exposures to high noise levels continue, the permanent loss also continues across more frequencies, eventually making it difficult to understand speech.

The effect of noise on hearing depends upon the following factors: intensity (loudness) of the noise, frequency of the noise, length of exposure, characteristics of the noise (continuous, impulse or intermittent), time intervals between exposures, and individual susceptibilities.

4. HEARING PROTECTION

At many sites, different activities may result in appreciable noise levels. It is required that a noise hazard assessment be conducted prior to initiating investigation, remediation, O&M, or other on-site activities. Types of activities that may produce excessive noise levels include but are not limited to: drilling; operation of heavy machinery; use of generators, pumps, and power tools; use of blowers; use of drop and vibration hammers; and field activities in or near noisy areas such as railroads and airports.

If these activities or other activities or conditions result in excessive noise exposure, hearing protection requirements will be included in the site-specific HASP. If a PM or SHSO is unsure as to whether or not hearing protection is needed, the most conservative approach (i.e., use of HPDs) will be used. If a person's exposure exceeds an 8-hour time weighted average (TWA) sound level of 85 dBA, personnel must be included in a hearing conservation management program in accordance with 29 CFR 1910.95. High noise operations will be evaluated by the SHSO and noise exposure will be controlled through the use of hearing protection such as ear plugs or ear muffs or by maintaining set-backs from high noise-producing equipment as warranted. A rule-of thumb that can be applied in the field is if you must raise your voice to be understood at arm's length, your noise level is approximately 85 dBA.

Hearing protectors will be made available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater at no cost to the employees. Hearing protectors will be replaced as necessary. Employees will be given the opportunity to select their hearing protectors from a variety of suitable hearing protectors and training in the use and care of hearing protectors.

Hearing protector attenuation will be evaluated for the specific noise environment in which the protector will be used and the hearing protectors must attenuate employee exposure at least to an 8-hour time-weighted-average of 90 decibels. For employees who have experienced a standard threshold shift, hearing protectors must attenuate employee exposure to an 8-hour time-weighted average of 85 decibels or below.

5. MONITORING

Roux's policy is to implement administrative controls or the use of HPDs whenever personnel will be exposed to noise levels greater than 85 dBA. Where situations arise that indicate the need for a monitoring program to be developed and implemented, the following factors should be considered:

- All continuous, intermittent and impulsive sound levels from 80 decibels to 130 decibels must be integrated into the noise measurements.
- Monitoring shall be repeated whenever a change in production, process, equipment or controls increases noise exposures.
- Each employee exposed at or above the 8-hour time-weighted-average sound level of 85 dBA shall be notified of the results of the monitoring.

6. AUDIOMETRIC TESTING

An audiometric testing program is in effect for all personnel involved in field activities. Audiometric testing is included as part of each employee's pre-employment and annual physical examinations. The program is provided at no cost to employees and the audiometric tests are performed by a licensed or certified audiologist, otolaryngologist or physician, or by a technician who is certified by the Council of Accreditation in Occupational Hearing Conservation, or who has satisfactorily demonstrated competence in administering audiometric examinations, obtaining valid audiograms, and properly using, maintaining and checking calibration and proper functioning of the audiometers being used. A technician who operates microprocessor audiometers does not need to be certified. A technician who performs audiometric tests must be responsible to an audiologist, otolaryngologist or physician.

Audiometric testing is the best and most accurate method for determining early hearing loss. The test determines the ability to hear pure tones at 500, 1,000, 2,000, 3,000, 4,000 and 6,000 Hertz. The poorer the ability to hear, the louder the pure tones will need to be. Each person scheduled to be tested is informed of the requirement not to be exposed to workplace noise for at least 14 hours prior to testing. After obtaining a valid baseline audiogram from affected employees, annual audiograms will be taken and compared to the baseline. If a comparison of the annual audiogram to the baseline audiogram determines a standard threshold shift, the employee will be informed of this fact in writing within 21 days of the determination. As defined in the OSHA regulations, a standard threshold shift is a change in hearing threshold relative to the baseline audiogram of an average of 10 decibels or more at 2,000, 3,000, and 4,000 Hertz in either ear. Unless a physician determines that the standard threshold shift is not work related or aggravated by occupational noise exposure, the following steps are taken when a standard threshold shift occurs:

- Employees not using hearing protectors shall be fitted with hearing protectors, trained in their use and care, and required to use them.
- Employees already using hearing protectors shall be refitted and retrained in the use of hearing protectors and provided with hearing protectors offering greater attenuation if necessary.
- The employee will be referred for a clinical audiological evaluation or an otological examination, as appropriate, if additional testing is necessary or if there is a suspicion that a medical pathology of the ear is caused or aggravated by the wearing of hearing protectors.
- The employee is informed of the need for an otological examination if a medical pathology of the ear that is unrelated to the use of hearing protection is suspected.

7. TRAINING

All employees exposed to noise levels at or above an 8-hour time-weighted-average of 85 decibels are required to participate in a training program. The training program will be repeated annually for each employee included in the hearing conservation management program. Each employee will be informed of the following:

- the effects of noise on hearing;
- the purpose of hearing protectors, the advantages, disadvantages and attenuation of various types, and instructions on selection, fitting, use and care; and
- the purpose of audiometric testing, and an explanation of the test procedures.

8. RECORDKEEPING

An accurate record of all employee exposure measurements will be retained and maintained by the CHSM. All employee audiometric test records will be retained and maintained by the HR Department. Noise exposure measurement must be retained for two years but should be maintained with the project records. Audiometric test records must be retained for the duration of the affected employee's employment. Audiometric tests taken as part of the medical surveillance program under 29 CFR 1910.120 will be maintained for length of employment plus 30 years. All records will be provided to employees, former employees, representatives designated by individual employees and the Assistant Secretary of Labor for OSHA upon request.

APPENDIX E

SDSs for Chemicals Used

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RENTAL EQUIPMENT

APPENDIX F

Job Safety Analysis (JSA) Forms

JOB SAFETY ANALYSIS (JSA) MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**01/19**
REVISION NUMBER	**:**	**2**

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Appendix B – Standard Job Safety Analysis Form

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1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has established this Job Safety Analysis (JSA) Program to provide practices and procedures to evaluate potential hazards associated with work tasks and develop preventive measures to eliminate and/or reduce the risk of injury/illness to personnel, property damage and/or environmental releases. A hazard is defined as a condition or activity that, if left uncontrolled, can result in an undesired consequence. This program utilizes a proactive and versatile tool, the JSA, which identifies hazards associated with a specific work task and applies mitigative actions to eliminate and/or reduce the hazards to an acceptable risk level. Moreover, the practices and procedures, herein, employ a stewardship approach to ensure that JSA updates are communicated throughout the company and represent best management practices.

2. SCOPE AND APPLICABILITY

The JSA Program applies to all Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") employees and their subcontractors. At a minimum, tasks for which a JSA is required include:

- Field work and processes;
- Non-routine activities;
- Activities that present higher potential for injury or illness;
- Where there has been a history of prior incidents; and/or
- New or modified activities, equipment usage or procedures.

The program is intended, in part, to meet Occupational Safety and Health Administration OSHA's Voluntary Protection Programs Policies and Procedures and their Job Hazard Analysis manual (Publication 3071, Revised 2002).

3. PROCEDURE

For many tasks, a generic or site-specific JSA may already exist. Generic JSAs can be found in the JSA Library (Clarity→Health and Safety→JSA Library). Site-specific JSAs can be found in the project files. However, prior to use of a generic JSA the following must be verified by the project Manager (PM):

1. The JSA includes all the site-specific (if applicable) job steps for the task;
2. The JSA cannot be combined with job steps from other JSA tasks to be considered as one working document; and
3. There are no equipment/tools changes since the last revision/review.

If the above conditions are met the generic JSA may be used. If the above conditions cannot be satisfied, then a new or revised JSA must be developed for the work task. The development process of a JSA is outlined below and is included as a flow chart as **Appendix A**.

3.1 JSA Process

Development Team

JSAs are developed by an individual or team of people who have conducted the task, are familiar with the JSA process, and have experience in general safety practices. Typically, one of these personnel includes a member of the project management team (e.g., PM, Site H&S Manager (SHSM) and/or the Project Principal). Based on the complexity of the operation, additional team members may be utilized in the development process.

JSA Form

To assist in the development process, a standard JSA form is provided as **Appendix B** of this program. Generic JSAs (available in the JSA Library) may be used as a starting point for similar tasks. In addition to documenting the job steps, potential hazards and mitigative actions (discussed below), the form documents the individuals who developed it, the reviewers and the date of the JSA. JSAs are to be limited to one or two pages. For complex operations where more than two pages may be needed, the job should be broken down into multiple tasks, each task having its own JSA. The steps are described below:

Step 1 – List Job Steps

The first step in developing a JSA is to identify each job step in order of occurrence. Job steps should be concise and clearly describe the individual safety critical tasks for the collective operation. *For example, a monitoring well gauging and sampling task may include the following job steps: 1) access well with hand tools, 2) gauge well using interface* probe*, 3) purge well with bailer, etc. Whereas, an example of a job step that is too generalized is "gauge and sample well."*

Step 2 – Identify Potential Hazards

Next, for each job step, determine potential hazards that may exist or occur while performing the associated job step. In helping determine safety critical job steps, the following questions should be assessed:

- "What could go wrong?"
- "What's the Worst that Can Happen?"
- "What are the consequences?"

Potential hazards should be identified by the following categories:

- Contact – struck by or against an object.
- Caught – caught on, in or between objects.
- Falls – slips, trips or falls to the ground or a lower level.
- Exertion – repetitive motion, excessive strain/stress, ergonomics, lifting/bending.
- Exposure – inhalation/ingestion/injection, cold/heat stress, noise/vibration.
- Energy Sources – electric lines or mechanical energy, including stored energy.

For each hazard category, the potential hazard should be further described. Refer to the JSA Quality Review Guidance Document provided as **Appendix C** for examples of potential hazards. *For instance, with the example described in Step 1 above, a potential hazard associated with the monitoring well gauging and sampling task – specifically, the job step to "access well with hand tools" – may include CAUGHT – pinch points when handling well cover.*

Step 3 – Determine Mitigative Actions

After the potential hazard(s) have been identified, evaluate if the job step can be performed in a manner where the hazard is eliminated, reduced or controlled. Common methods to eliminate, reduce or control potential hazards which follow the hierarchy of controls may include, but are not limited to, one or a combination of the following:

- Eliminating or substituting a job step with a less hazardous operation.
- Combining job steps or changing the sequence.
- Instituting engineering controls.
- Obtaining other tools or redesigning equipment.
- Performing ambient monitoring or screening.
- Obtaining additional safety equipment including personal protective equipment (PPE).
- Adding warning devices.

Mitigative actions should be specific and avoid using generalizations such as, "be careful" or "use caution." There must be at least one mitigative action for each potential hazard. PPE should never be the only mitigative action. It is the last line of defense. *Taking the example illustrated in Steps 1 & 2 above, mitigative actions for the potential hazard "CAUGHT – pinch points when handling well cover" may include 1) wear leather gloves, 2) use pry bar when accessing well cover, 3) keep hands/fingers clear between cover and collar, … etc.*

3.2 Review Process

Once a site-specific JSA has been developed, it is then submitted to the PM for review and approval prior to the start of a task. If the PM was involved in the development of the JSA then it will be provided to the OHSM for review and approval. When a quality review of JSAs are conducted by a member of management (e.g., Project Principals, CHSM) the review ensures that, at a minimum, the below "five rules" have been met:

1) JSA never more than 2 pages.

2) JSA authors listed should be people / titles who perform that type of work. Management should be reviewers / approvers.
3) Critical actions are always specific, observable actions – never “proper” or “appropriate” or “careful.”
4) PPE is considered a last line of defense and should be included in the critical actions. However, it cannot be the only critical action listed to mitigate a hazard; you must always identify other actions in addition to the applicable PPE (e.g., keep fingers clear of pinch points while closing cover; and wear cut resistant gloves).

In addition, at least annually, the PM and JSA Steward(s) are responsible for reviewing and updating (if necessary) the site-specific and generic JSAs, respectively, for which they are responsible. The review is carried out utilizing the JSA Quality Review Checklist which is provided in **Appendix C**. The JSA Stewards are assigned by the OM/CHSM for specific generic JSAs and are identified within the JSA Steward list posted within the JSA Library. These Stewards are appointed based on their knowledge and experience with specific work tasks. The JSA Library is updated routinely (min quarterly) by the CHSM to ensure that it contains only the most current version of each generic JSA.

3.3 JSA Library

JSA Stewards submit updated generic JSAs to the CHSM for filing in the JSA Library. As part of the annual review process, JSA Stewards must audit the JSA Library to ensure that it contains only the most current version of the JSA for which they are responsible. Approved site-specific JSAs are filed in the project files.

3.4 JSA Updates

JSAs can be updated based on a variety of factors or reasons, such as the examples provided below:

- Identification of inadequate procedures during a safety tailgate meeting.
- A Safe Performance Self-Assessment (SPSA) determining that the task should have a JSA or that procedures within the existing JSA are not adequate to address identified hazards.
- Change in site or environmental conditions.
- New or modified equipment or procedures.
- Observations or incident investigations that identify tasks requiring new or updated JSAs.

Changes to a generic JSA requires submittal and review by the JSA Steward appointed for that task to determine if the genetic JSA change is necessary. If changes are warranted, the JSA Steward forwards the updated generic JSA to the CHSM for review and uploading into the JSA Library.

Changes to Site-specific revisions need only approval from the PM.

3.5 Emergency Situations

In the absence of an existing JSA during an emergency situations, personnel should discuss with both the PM and SHSM the job steps, potential hazards and associated mitigative actions for tasks anticipated to be performed. As conditions, may change during the task(s), the personnel must reassess the job step(s) and potential hazards, and discuss any additional changes with the PM and SHSM prior to resuming the activity. For unplanned activities, it is critical that personnel do not proceed with performing task(s) without prior health and safety consideration and planning.

3.6 Subcontractors

Roux subcontractors are required to submit their JSAs for review in advance of the work. This allows time for Roux's PM to provide comments and suggestions to the subcontractors JSA's. Roux subcontractors should understand that no work may occur unless the JSAs for the work being performed have been reviewed by Roux. JSAs provided by subcontractors are maintained in the project files. For common tasks and to maintain consistency, the project management team may provide a similar or generic approved JSA to a subcontractor for use as a starting point for development of the subcontractors JSA.

Subcontractor JSAs are reviewed in the field daily prior to performing work. Roux oversight personnel and the project management team will assist subcontractors with updating JSAs as described in Section 3.4.

4. TRAINING

Every employee who may perform field work will be trained in this program and the proper use of the JSA. The training includes:

- A review of this Program.
- Development of a JSA.

This training is repeated as necessary to ensure that employees receive reinforcement of the value of the JSA Program as well as feedback on the health of the JSA Program. Office workers may receive training if an anticipated task will be performed that requires development of and training in a JSA.

5. RECORDS

The following records are maintained by the CHSM:

- A library of generic JSAs.
- Copies of all site field audits performed that assist with the evaluation of the effectiveness of the JSA program will be uploaded Quarterly and are located and stored at Clarity→Health & Safety→[Office Specific]→Field Audit Checklist (FAC). Key findings from these field audits will be communicated by the CHSM to OHSM for further communication to the office staff (typically during monthly lunch and learns).

The following record is to be maintained by each PM:

- Each site-specific JSA developed for their project. All JSAs are expected to be included in Appendix A in the project HASP.

The following record is to be maintained by each JSA Steward:

- The latest version of each generic JSA for which they have been assigned and stored in the JSA Library.

6. PROGRAM EVALUATION

The CHSM will evaluate the program's effectiveness during field audit(s). The CHSM should, at a minimum assess the overall effectiveness of the JSA Program quarterly. Records shall be maintained within the JSA Library. The assessment will include the adequacy of applicable JSAs and consistency in their use. Program adjustments will be made as necessary to reflect the evaluation results.

Appendix A – Job Safety Analysis Process Flowchart

Selection of Job for Analysis

- For all major jobs in the workplace
- Priority where jobs have had more frequent or severe losses (from loss experience)
- Priority of higher risk activities
- Where a procedure is not available or inadequate to do the work safely from SPSA process
- Roux Peer Observation (RPO) or Accident Report Form (ARF) tool identifies lack of operational procedure or work standard
- New equipment or procedure

Selection of Development Team Members

- Persons conducting the JSA must be familiar with the process and understand basic hazard analysis techniques
- Include employees who perform the operation
- Target a minimum of two team members
- For higher risk work CHSM should be included

Conduct the Job Safety Analysis (JSA)

- Visit the workplace to observe the actual performance of the job
- Break down the job into distinct steps/tasks (Column 1)
- Identify Hazards for each step separately by asking questions similar to SPSA process. Be specific listing the Hazard and the Consequence (Column 2)
- Review Hazards, then consider options:
  - Engineer to eliminate the hazard
  - Provide guards, safety devices, etc.
  - Provide training
  - Provide PPE and ensure good ergonomics
  - Maintain good housekeeping
- Develop critical actions to control hazards (Column 3)
- Organize the information into one or two pages

Review and Approve

- By Project Manager
- OHSM to review if PM is a part of design team for JSA

Referencing and Customizing JSA's

- Refer to JSA Generic Library located, Clarity→Health and Safety→JSA Library
- Each field location uses these generic JSAs and customizes them to meet site specific needs

Continuous Improvement

- Reviewed and updated at least once a year and
  - Following any significant Lessons Learned or incident
  - Introduction of new equipment or equipment modifications
  - Changes to job procedure- from RPO or SPSA
- Use JSA Quality review checklist (Appendix C)

Appendix B - Job Safety Analysis Form

JOB SAFETY ANALYSIS	**Cntrl. No.**	DATE:	☒ NEW ☐ REVISED	PAGE 8 of 2
JSA TYPE CATEGORY **GENERIC**		WORK TYPE	WORK ACTIVITY (Description)	
DEVELOPMENT TEAM		**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
	REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT			
☐ LIFE VEST ☐ HARD HAT ☐ LIFELINE / BODY HARNESS ☐ SAFETY GLASSES		☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☐ SAFETY SHOES	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☐ PPE CLOTHING:	☐ GLOVES: ☐ OTHER
	REQUIRED AND / OR RECOMMENDED EQUIPMENT			
	Required Equipment:			
	Commitment to LPS – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.			
	EXCLUSION ZONE: A _ foot exclusion zone will be maintained around (indicate equipment).			
Assess **[1]JOB STEPS**		**Analyze** **[2]POTENTIAL HAZARDS**	**Act** **[3]CRITICAL ACTIONS**	
1. [INSERT JOB STEP]		**1a. CONTACT:** [INSERT HAZARD]	1a.	
		1b. CAUGHT: [INSERT HAZARD]	1b.	
		1c. FALL: [INSERT HAZARD]	1c.	
		1d. EXPOSURE: [INSERT HAZARD]	1d.	

		1e. EXERTION: [INSERT HAZARD]	1e.
		1f. ENERGY SOURCE: [INSERT HAZARD]	1f.
2. [INSERT JOB STEP]		**2a. CONTACT:** [INSERT HAZARD]	2a.
		2b. CAUGHT: [INSERT HAZARD]	2b.
		2c. FALL: [INSERT HAZARD]	2c.
		2d. EXPOSURE: [INSERT HAZARD]	2d.
		2e. EXERTION: [INSERT HAZARD]	2e.
		2f. ENERGY SOURCE: [INSERT HAZARD]	2f.

Appendix C - Job Safety Analysis Quality Review

GUIDANCE DOCUMENT

JOB SAFETY ANALYSIS (JSA) QUALITY REVIEW

A Job Safety Analysis (JSA) is both a technique and a tool used to carefully study and record each step of a job or task, identify existing or potential hazards associated with each step and determine the best actions to follow in order to avoid those hazards. The JSA provides a standard for conducting work and Roux Peer Observations (RPOs) and also serves as an excellent safety training and daily site safety meeting reference tool. A JSA is applicable for routine and higher risk activities.

The following guidance provides items a Quality Reviewer should ask about or look for when reviewing and commenting on a JSA. Quality Review feedback should be specific and may be in writing or verbal. Written feedback ensures clear communication and better tracking. Verbal feedback allows discussion and can be conducted at group safety meetings, by telephone, etc. for sharing of learnings as well. Safety stewardship focuses on quality use of the tools and other activities that personnel can control. This guidance applies to all Quality Reviewers from the front-line supervisor to senior management. Feedback on the quality of a JSA should include several items that are done well in addition to areas to improve.

Administrative and Header Information

- Are all sections completed?
- Does header include appropriate information such as name of company who developed JSA, location and work activity JSA applies to, names/titles of development team and quality reviewer(s), and date?
- Does development team include job experts (field personnel who perform the task) along with personnel familiar with hazard analysis techniques, specifically the worker actually completing the task?
- Does PPE section include minimum required specific PPE for task and is it consistent with PPE requirements listed in Column 3?
- Was the JSA reviewed by Roux personnel?
- Is the JSA limited to two pages?
- Is the JSA written in terms that field personnel can follow rather than as a "reference document" written by office staff?

Column 1 Job Steps

- Does the JSA cover one main task and not multiple tasks that should be divided into separate JSAs? Designate job task steps not overall work flow process to complete job.
- Are the job steps clearly defined and in a logical sequence that aligns with how the work is performed in the field?
- Do the job steps only include those with associated SH&E hazards?

Column 2 Potential Hazards

- Are hazards listed to correspond with each job step in Column 1?

- Do the hazards listed consider all potential hazards (e.g. environmental conditions, injurious contact, overexertion, slips/trips/falls, exposure to hazardous materials, traffic, property/environmental impacts, etc.)?
- Are the hazards specifically stated (e.g. instead of stating hazard as "chemical exposure", state "exposure to sulfuric acid from leaking battery")?
- Are there "extra" hazards that do not apply indicating that the JSA may have been developed for another site and not revised to address site-specific hazards?

Column 3 Critical Actions to Mitigate Hazards

- Do the critical actions align horizontally with the job steps and hazards from Columns 1 and 2?
- Are the actions clear and specific? (e.g. "wear a reflective vest and place traffic cones around work area" rather than "watch out for traffic").
- Are the actions quantifiable when possible? (e.g. "use two people to lift objects over 40 pounds” rather than "get help with heavy objects").
- Are the actions observable and objective so that an RPO Observer who is unfamiliar with task can determine if it is being done correctly? (e.g. "maintain three points of contact when climbing ladder" rather than "use safe climbing techniques").
- Do the actions avoid ambiguous phrases such as "use caution", "be careful", "stay alert", "and watch out"?
- Do the actions avoid subjective phrases such as "use proper", "as needed", "as required", "as necessary" that leave it open to individual worker's interpretation of what is required to perform work safely?
- Do not list minimum required PPE without including in the mitigation for this task, think why the PPE is required.
- PPE cannot be the only line of defense, PPE always the last line of defense, so think through what other actions could mitigate hazards.

JSA QUALITY REVIEW CHECKLIST

Reviewer Name / Company / Title:		**Desktop Review?**		**Field Review?**		**Date:**	

Administrative and Header Information	**Yes**	**No**	**Comments**
Is the JSA limited to two pages?			
Are all sections completed?			
Does development team include job experts and personnel familiar with JSA development process?			
Was the JSA reviewed by a supervisor/manager?			
Does PPE section include PPE required for entire task with additional PPE listed in Column 3?			
Is the JSA written in terms that field personnel can follow?			
Column 1 - Job Steps	**Yes**	**No**	**Comments**
Does JSA cover one main job task and not overall work flow process or multiple tasks that should be in standalone JSAs?			
Are job steps clearly defined and in sequence that aligns with how the work is performed?			
Column 2 - Potential Hazards	**Yes**	**No**	**Comments**
Do hazards listed clearly correspond with each job step in Column 1?			
Are the hazards specifically stated (e.g. exposure from (what?), cut from (what?), slip from (what?)?)			
Do the hazards listed include all potential hazards?			
Does JSA avoid "extra" hazards that do not apply (may indicate generic JSA use without site revision)?			
Column 3 - Actions to Mitigate Hazards	**Yes**	**No**	**Comments**
Do the critical actions clearly match each listed hazard and job step from Columns 1 and 2?			
Are the actions clear and specific?			
Are the actions quantifiable when possible (e.g. include number, limit, amount or distance)?			
Are the actions observable and objective (e.g. explain "how to")?			
Do the actions avoid ambiguous phrases (e.g. "be careful", "watch out")?			
Do the actions avoid subjective phrases (e.g. "proper", "appropriate")?			
Additional Comments:			

Quality Review Feedback provided to (name/company):			
Quality Review Feedback Action Item(s)	**Responsible Person**	**Target Completion Date**	**Actual Completion Date**

JOB SAFETY ANALYSIS Ctrl. No. CVD-19	DATE: 04/16/2020	☒ NEW ☐ REVISED	
JSA TYPE CATEGORY **Generic**	WORK TYPE **Fieldwork**	WORK ACTIVITY (Description) **Working in Areas Affected by Coronavirus**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Kristina DeLuca	Health and Safety Specialist	Brian Hobbs	CHSM

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT – In field ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES – In field	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES – Steel/composite toe in fie	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING – High visibility vest in field	☒ GLOVES – Leather/cut-resistant in field and nitrile as needed ☐ OTHER

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Cloth face covering, nitrile gloves, hand soap, water source, hand sanitizer, disinfectant spray and disinfectant wipes.

Commitment to Safety – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

SOCIAL DISTANCING: Maintain 6' of distance between yourself and all other people at all times. If you do not believe the scope of work can be conducted while maintaining this distance, contact your Project Manager immediately.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Project Preplanning	N/A	• Review and follow COVID-19 CDC, Roux, Client and local orders/protocols. • Ensure all workers are fit for duty - anyone feeling sick should remain at home even if symptoms do not align with COVID-19. If a worker has been in contact with someone potentially positive or positive for COVID-19, contact your Office Manager. • Determine PPE needs and ensure adequate supply of disinfectant wipes/spray, soap and water or hand sanitizer at Site. Due to high demands and limited supply, plan ahead. • Use the minimum number of employees necessary to safely complete the work.
2. Mobilization	**Exposure:** Becoming infected or infecting co-workers	**Personal/Rental/Roux Owned Vehicle** • Do not carpool. • Use the same vehicle every day and do not share with co-workers. • Verify workers/other people are not approaching vehicle prior to exiting the vehicle. Maintain 6' of distance from others. • DO not valet your car or allow others to use your car. If necessary, don nitrile gloves and safety glasses and clean/disinfect all high touch surfaces (steering wheel, knobs, door handles, turn signals, radio, etc.) by wiping thoroughly with approved disinfectants (follow manufacturer's instructions). This cleaning and disinfection shall occur before and after each use of the vehicle. Aseptically remove gloves and dispose of them along with rags/wipes, appropriately. Wash hands or use hand sanitizer immediately after each episode of cleaning. **Public Transportation** • Public transit should not be used unless absolutely necessary. Consider renting a car rather than taking public transit. If public transit is required, wear appropriate PPE and apply social distancing (6 ft). Use proper donning and doffing procedures for nitrile gloves. Wash hands or use hand sanitizer immediately after. **Hotel Stay (Refer to COVID-19 H&S Guidance for more info)** • If a hotel stay is deemed necessary for the given field work, ensure that you disinfect your room upon initial arrival and returning each day. Disinfect all surfaces of your room with an appropriate disinfectant using nitrile gloves. Use proper donning and doffing procedures for nitrile gloves. • Place the "Do Not Disturb" placard on the room while away and limit housekeeping services to the extent feasible during your stay to minimize the reintroduction and spread of the virus from others. Minimize, or avoid entirely, time spent in hotel common areas (i.e., the lobby, dining areas, gyms, etc.). Wash hands or use hand sanitizer often.

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3. Tailgate Meeting	**Exposure:** Becoming infected or infecting co-workers	• Must occur outside or remotely (i.e. video or conference call). • Maintain at least a 6+ ft distance between you and others. • Discuss primary infection prevention measures listed below. • Do not require employees or subcontractors to sign in, the Site Supervisor shall record names on the attendance form. • If the Site has more than 10 workers, separate tailgate meetings should be performed. • Discuss COVID-19 symptoms with coworkers and subcontractors to ensure fitness for duty. Anyone exhibiting signs or symptoms should be instructed to leave the Site, contact your Project Manager.
4. Site Activities	**Exposure:** Becoming infected or infecting co-workers	• Coordinate field activities at the beginning of the day (i.e. Tailgate meeting) to minimize time spent in crowded spaces or overlap while completing job tasks. • Don cloth face coverings as appropriate. • Apply social distancing (6+ ft) when interacting with others. If anyone comes within 6 ft of you while conducting work and your work prevents you from moving away, politely ask them to move back. If others are unable to move from your space, stop work and leave area. • Do not shake hands or touch others. • Do not share equipment or other items with co-workers and subcontractors unless wearing appropriate PPE (e.g. nitrile gloves). Assume equipment and other surfaces are potentially contaminated and remove gloves aseptically (See Appendix A of Roux Interim H&S Guidance for proper glove removal). • If anyone is coughing or sneezing in your vicinity, stop work and leave the area. • Do not work in areas with limited ventilation with others. • Cover your mouth and nose with tissue or paper towel or with your elbow when coughing or sneezing and wash hands or use hand sanitizer immediately after. If sick contact SHSO/PM and leave Site immediately. • Disinfect work surfaces/areas with approved disinfectant you're responsible for (ex: desk, office doorknob, computer, etc.) at least once at the beginning of your shift and at least once at the end of your shift with either sanitizing wipes or disinfectant spray. • Phones should be operated hands free to extent feasible. Sanitize your phone on a regular basis. Disinfection should also take place whenever suspected contaminated material comes in contact with any work surfaces/areas. Wash hands or use hand sanitizer immediately after. • Avoid public spaces and going out to eat by bringing your own lunch to the Site. If performing work in high density urban areas, it is recommended all food must be consumed at or in your vehicle. Wash hands or use hand sanitizer before eating and immediately after.

Primary Infection Prevention Measures

- Wash your hands often with soap and water for at least 20 seconds.
  - If soap and water are not available, use an alcohol-based sanitizer that contains at least 60% ethanol or 70% isopropanol. Key times to wash hands include after blowing your nose, coughing or sneezing, after using the restroom, and before eating or preparing food.
- Do not touch your eyes, face, nose and mouth with unwashed hands.
- Cover your mouth and nose with a tissue when you cough or sneeze or use the inside of your elbow. Throw potentially contaminated items (e.g. used tissues) in the trash.
- Avoid close contact/secondary contact with people and potentially contaminated surfaces.
  - Apply appropriate social distance (6+ feet).
  - Stop handshaking/touching others and use caution when accessing public spaces.
- Clean and disinfect frequently touched surfaces daily. Commonly touched items can include but are not limited to tables, doorknobs, light switches, countertops, handles, desks, phones, keyboard, toilets, sinks and field equipment. If surfaces are dirty, they should be cleaned with soap and water prior to disinfection. If surface cannot be cleaned/disinfected, then wash hands or use sanitizer as soon as possible.

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JOB SAFETY ANALYSIS Ctrl. No. GEN-006	DATE 7/10/2020	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY: **Generic**	WORK TYPE: **Drilling**	WORK ACTIVITY (Description): **Direct Push Soil Borings / Well Installation**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Timothy Zei	Project Hydrogeologist	Raymond Olson	Office Health & Safety Manager
		Brian Hobbs	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing, Long Sleeve Shirt	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Geoprobe or Truck-Mounted Direct Push Drill Rig, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Macrocore liners, Liner Opening Tool, 20 lb. Type ABC Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs, Water

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ): Maintain Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, tip zone of the equipment, fall zone of the equipment and contents, distance that debris may travel during demolition activities and/or foot print of a structure to be demolished.

"SHOW ME YOUR HANDS"
Driller and helper should show that hands are clear from controls and moving parts

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed)	**1a. CONTACT:** Equipment/property damage. **1b. FALL:** Slip/trip/fall hazards. **1c. CONTACT:** Crushing from roll-over.	1a. The drill rig's tower/derrick will be lowered and secured prior to mobilization. 1a. A spotter should be utilized while moving the drill rig. If personnel move into the path of the drill rig, the drill rig will be stopped until the path is again clear. Use a spotter for all required backing operations. 1a. Set-up the work area and position equipment in a manner that eliminates or reduces the need for backing of support trucks and trailers. 1a. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility. 1a. Inspect the driving path for uneven terrain. Level or avoid if needed. 1a. Drill rig should have a minimum **exclusion zone which encompasses its tip radius** for non-essential personnel (i.e., driller helper, geologist) when the rig is moving/ in operation. 1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 1b. Use established pathways and walk on stable, secure ground. 1c Geoprobe should cross all hills/obstructions head on with the mast down to reduce risk of roll-over.
2. Raising tower/derrick of drill rig	**2a. CONTACT:** Overhead hazards. **2b. CONTACT:** Pinch Points/Amputation Points when raising the rig and instability of rig	2a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures, that could come in contact with the rig's tower and/or drilling rods or tools. 2a. Maintain a safe distance of 10' from overhead structures. 2b. Inspect the equipment prior to use and avoid pinch/amputation points. 2b. Lower outriggers to ensure stability prior to raising rig tower/derrick. 2b. If the rig needs to be mounted, be sure to use three points of contact.
3. Advancement of drilling equipment and well installation	**3a. CONTACT:** Flying debris **3b. EXPOSURE:** Noise and dust.	3a. Be aware of and avoid potential lines of fire and wear required PPE such as eye, ear, and hand protection. 3b. Wet borehole area with sprayer to minimize dust. 3b. Stand upwind and keep body away from rig. 3b. Dust mask should be worn if conditions warrant. 3b. Wear hearing protection when the drill rig is in operation.

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Assess ¹JOB STEPS	Analyze ²POTENTIAL HAZARDS	Act ³CRITICAL ACTIONS
3. Advancement of drilling equipment and well installation (Continued)	**3a. CONTACT:** Flying debris **3b. EXPOSURE:** Noise and dust. **3c. FALL:** Slip/trip/fall hazards. **3d. CAUGHT:** Limb/extremity pinching; abrasion/crushing. **3e. CONTACT:** Equipment imbalance during advancement of drill equipment. **3f. EXPOSURE:** Inhalation of contamination/vapors. **3g. EXERTION:** Potential for muscle strain/injury while lifting and installing well casings, lifting sand bags, and/or lifting rods.	3c. Contain drill cuttings and drilling water to prevent fall hazards from developing in work area. 3c. See 1b. 3d. Ensure all Emergency Safety Stop buttons function properly. 3d. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools. 3d. Inspect the equipment prior to use for potential pinch/amputation points. Keep hands away from pinch/amputation points and use of tools is preferable compared to fingers and hands. 3d. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt. 3d. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3d. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment. 3d. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3d. Spinning rods/casing have an **exclusion zone of tip radius** while in operation. 3e. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 3e. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred. 3e. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (**minimum exclusion zone**). 3f. Monitor ambient air for dangerous conditions using a calibrated photoionization detector (PID) to periodically monitor the breathing zone of the work area. 3f. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux PM of the condition. The Roux PM will then recommend additional precautions in accordance with the site specific health and safety plan. 3f. Use a multi-gas meter to monitor ambient air for dangerous conditions (i.e. unsafe levels of carbon monoxide when drilling indoors or the presence of explosive vapors). 3g. Keep back straight and bend at the knees. 3g. Utilize team lifting for objects over 50lbs. 3g. Use mechanical lifting device for odd shaped objects.
4. Remove sample liner.	**4a. EXERTION:** Potential for muscle strain/injury while removing liner from probe rod. **4b. CONTACT:** Pinch points and cuts **4c. EXPOSURE:** Inhalation and/or dermal contact with contaminants.	4a Utilize team lifting for objects over 50lbs. 4a. Use hydraulic liner extruder if available. 4b. Place liner on sturdy surface when opening. 4b. Don cut-resistant gloves and use appropriate liner cutter when opening liners. 4b. Always cut away from the body. 4c. Wear chemical-resistant disposable gloves when handling liners. 4c. See 3e.
5. Decontaminate equipment.	**5a. EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors). **5b. EXPOSURE:** To chemicals in cleaning solution including ammonia.	5a. Wear chemical-resistant disposable gloves and safety glasses. 5a. Contain decontamination water so that it does not spill. 5a. Use an absorbent pad to clean spills, if necessary. 5a. Spray equipment from side angle, not straight on, to avoid backsplash. 5a. See 3b. 5b. See 4a. Review SDS to ensure appropriate precautions are taken and understood.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-007	DATE 7/10/2020	☐ NEW ☒ REVISED
JSA TYPE CATEGORY **GENERIC**	WORK TYPE **General Site Activity**	WORK ACTIVITY (Description) **Driving**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Valerie Sabatasso	Staff Scientist	Brian Hobbs	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT: when outside vehicle ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES:when outside vehicle	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION ☒ SAFETY TOE BOOTS: when outside vehicle	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: high visibility vest, when outside vehicle	☒ GLOVES: Leather/ cut-resistant level 2 ☐ OTHER _____

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Motor Vehicle (i.e. car, truck, SUV)

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Driving to/leaving Site	**1a. CONTACT:** Severe injury/disability, property damage, monetary loss (insurance premiums, deductibles, loss of license/job) caused by collision with or struck by other vehicles, obstructions, pedestrians, animals, etc. *Common factors that may lead to CONTACT incident, but not limited to: • distracted driving (cell phone, GPS, radio, billboards, “rubber necking”) • lack of situational awareness • unfamiliarity with traffic patterns/road layout • weather conditions (wet/icy roads, hydroplaning, black ice) • weariness • high speeds • obstructed vision (solar glare, debris on windshield, blind spots) • changes in travel pathway (construction, snow banks, non-operational signals, potholes, detours, special events) • improper vehicle maintenance (non-operational signal light, worn tires, cracked windshield, ineffective wipers) • loose or unsecure objects	1a. PLAN AHEAD – review/make yourself familiar with maps and driving directions before beginning the drive to the Site. Do not attempt to drive and review maps/directions at the same time. Pull over and stop your vehicle before looking at maps/directions. 1a. Complete a basic vehicle inspection before driving. Verify Inspection and Registration are current, tires and wipers are in good condition, all lights are functional, all glass/mirrors are undamaged, the horn is functional, roof/hood/trunk are free from accumulated snow and visibility is not impaired due to snow/ice/frost/fog on windows. 1a. Do not hang items in car that can obstruct your view or become projectiles in a collision. 1a. Do not get distracted using touch screen radios or GPS units built into newer models. Keep your eyes on the road and stay alert. 1a. Follow posted speed limits and obey traffic signals and roadway signs. 1a. Always wear your seat belt and shoulder harness when driving. 1a. When driving around large vehicles and trucks, maintain extra space as these vehicles may not be able to see a smaller car too close. 1a. Follow the "Rules of the Road" including: using your turn signals, coming to a complete stop, and allowing vehicles the right of way (yield) when they are when traffic laws require. 1a. Apply the Smith Five Keys® of safe driving • Aim High in Steering® - Expand eye lead time to a minimum of 15 seconds • Get the Big Picture® - Maintain proper a 4 second minimum following distance at all times - Scan mirrors every 5-8 seconds to achieve a circle of awareness - Position your vehicle so you can see relevant/non-relevant objects • Keep Your Eyes Moving® - Try to maintain about 180 degrees of visibility - Avoid blank and fixed stares. Avoid focusing on one object for more than 2 seconds • Leave Yourself an Out® - Avoid traveling in traffic clusters - Surround yourself with space - Anticipate the actions of others

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Driving to/leaving Site (cont'd)	**1a. CONTACT:** Severe injury/disability, property damage, monetary loss (insurance premiums, deductibles, loss of license/job) caused by collision with or struck by other vehicles, obstructions, pedestrians, animals, etc.	• Make Sure They See You® - Maintain eye contact with on-coming vehicles/pedestrians - Use warning devices (e.g., hand signals, high-lights, horns etc.) - Proper timing is essential 1a. Do not perform reconnaissance or inspections while driving. Your vehicle should be parked in a safe location when viewing or surveying the Site and vicinity 1a. Avoid sudden turns and stops. Don't drive recklessly – be in control of vehicle at all times. 1a. In inclement weather, first determine if work can be POSTPONED. Otherwise, plan according to weather conditions including checking forecast along entirety of travel route (especially, for long distances). Reduce speed as road conditions warrant. Travelling with winter car equipment, in the winter, is strongly recommended (i.e., shovel, scraper, brush, blanket, extra clothing, flashlight, bag of sand). If your vehicle has 4-wheel drive, review to operators manual and understand operating procedure prior to engaging 4-wheel drive. If at any point on your drive weather becomes too severe to proceed safely pull over if safe to do so or seek nearest cover (e.g., overpass) 1a. If feeling drowsy or sleepy, do not drive. Pull over in a safe place to rest if you experience any signs of drowsiness. Make sure to get adequate sleep the night before an early drive. 1a. Never operate a vehicle under the influence of alcohol or illegal substances or medications affecting your performance. 1a. Keep your eyes on the road. Do not call or talk on cellular phones. Pull over to a safe location if you must answer or make a call. 1a. When parking, pull-through when possible. If backing is required visually inspect area to ensure it is free from obstructions prior to backing in and relying solely on mirrors; use spotters when available.
2. Entering/Exiting Vehicle.	**2a. CAUGHT:** Personal injury (broken fingers/hand) while entering or exiting vehicles **2b. FALL:** Personal injury (twisted ankle, deep contusion, concussion, broken wrist/arm, etc.) from slip/fall on uneven or unstable or slippery surface while exiting/entering vehicle **2c. CONTACT:** Severe injury/disability, property damage, monetary loss (insurance premiums, deductibles, loss of license/job) caused by collision with or struck by other vehicles, obstructions, pedestrians, animals, etc.	2a. Open and close doors slowly. Never put hands or feet in between door and vehicle to avoid pinch points. 2b. When exiting the vehicle make sure your feet are on firm footing and weight is evenly distributed before exiting/standing. In inclement weather use hands to support yourself, by holding the car door and/or steering wheel, when exiting the vehicle. 2c. Check both directions for traffic before opening door. Do not exit vehicle if traffic does not permit you to exit safely 2c. Check anticipated path of door prior to opening, do not open door into any obstructions (e.g., bollards, high curbing)

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JOB SAFETY ANALYSIS Ctrl. No. GEN-010	DATE 7/10/2020	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY **Generic**	WORK TYPE **Surveying**	WORK ACTIVITY (Description) **Elevation Surveying**	

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Mark M Emmons	Project Engineer	Brian Hobbs	Corporate Health & Safety Manager
Bjorn Wespestad	Senior Engineer		
William Hansen	Senior Engineer		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Steel-toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Cut-resistant or leather ☒ OTHER: Long sleeve Shirt

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Surveying equipment (i.e., leveling rod/measuring ruler, tripod and autolevel).

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Check in with Site manager/ property owner.	**1a. CONTACT/EXPOSURE/FALL:** Lack of communication could result in H&S incident.	1a. Inform Site personnel of work scope, timeline and location(s). 1a. Inquire about other activities taking place at the Site. 1a. If applicable, obtain General Work permit for the day.
2. Locate surveying position for instrument and rod and set-up work area	**2a. FALL:** Slip/trip hazards	2a. Inspect area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.) and obstructions prior to setting up at the survey location. Keep eyes engaged with walking surface while in movement. Remember “Walking is Working.” 2a. Conduct housekeeping and maintain clear paths to walk in and remove debris as required.
	2b. CONTACT: Traffic (surveying locations could potentially be in parking areas and sidewalks)	2b. Be aware of oncoming traffic. Utilize a flagman / spotter for locations in streets or high-traffic areas. 2b. Place 42 inch cones around the work area and delineate work zone with caution tape, snow fencing or safety bars, if necessary. 2b. Wear appropriate PPE including long sleeve high visibility clothing and or reflective safety vest. 2b. Face traffic, maintain eye contact with oncoming vehicles and establish a safe exit route.
	2c. OVEREXERTION: Hazard due to carrying, lifting, and bending while transporting equipment	2c. Use proper body positioning and lifting techniques; keep back straight, lift with legs, keep load close to body, and never reach with a load. 2c. Avoid carrying too much equipment at one time and team-lift equipment that is more than 50 lb.
	2d. CAUGHT/CONTACT: Pinch Points / sharp edges associated with setting up the tripod	2d. Wear cut resistant gloves when handling the tripod and keep fingers away from pinch points located near moving parts of the tripod. Don’t carry tripod by the pointed ends.
	2e. OVEREXERTION: Hazard due to bending awkwardly to look through the autolevel	2e. When practical, set the height of the autolevel optic as to minimize bending at the waist.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Open / close manhole cover to well that is being surveyed (if necessary).	**3a. OVEREXERTION:** Muscle strain **3b. CAUGHT:** Pinch points associated with removing / replacing manholes and working with hand tools **3c. EXPOSURE:** To potentially hazardous vapors To biological hazards **3d. CONTACT:** With traffic	3a. See 1c. Bend knees when reaching to open well. Use manhole lifting hook or pry bar to avoid bending. 3b. Wear leather gloves or cut resistant gloves when working with well cover and hand tools. 3b. Use proper tools (ratchet and crowbar or pry bar for well cover) and inspect before use. 3b. Do not put fingers under well cover. 3c. No open flames/heat sources. 3c. To minimize exposure to vapors, allow well to vent after opening it and before survey activities begin. 3c. Work on the upwind side of manhole/well. 3.c Use caution while opening lids to inspect work area for bees and insects inside of covers. 3c. Use insect/tick repellent as necessary. 3d. See 2b.
4. Perform survey.	**4a. FALL:** Slip/trip hazards **4b. CONTACT:** Traffic (surveying locations could be potentially located in parking areas and sidewalks) **4c. ENERGY SOURCES:** Electrical shock from survey rod striking overhead electric lines or lights	4a. See 2a. 4b. See 2b. 4b. Personnel using the scope will be devoting most of their attention to the surveying activity and shall be aware of vehicular and pedestrian traffic. Personnel holding the measuring stick should be extra vigilant of survey personnel and communicate any potential hazards to the instrument person via handheld radio or similar means. Ensure reflective safety vest is worn. 4c. Prior to raising and extending the survey rod, personnel should thoroughly inspect the area above the measuring point. If overhead electrical lines are encountered within 20 feet of the measuring point; stop work and consult with the office health and safety officer.
5. Break down work area.	**5a. CONTACT:** Traffic (surveying locations can potentially be in parking areas and sidewalks) **5b. EXERTION:** Hazard due to carrying, lifting, and bending while transporting equipment **5c. CONTACT:** Personal injury or equipment damage by striking surroundings with an extended rod or unsecured tripod leg	5a. See 2b. 5b. See 2c. 5c. Ensure rod is entirely collapsed prior to mobilization / demobilization between survey points. 5c. Ensure tripod legs are fully collapsed and secured with strap prior to mobilization / demobilization between set-ups.

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JOB SAFETY ANALYSIS Ctrl. No. GEN-013	DATE 7/10/2020	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE:	WORK ACTIVITY (Description):	
Generic	**Gauging and Sampling**	**Gauging and Sampling**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Brandon Tufano	Staff Geologist	Brian Hobbs	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☒ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Knee pads, Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

42-inch Safety Cones, Caution Tape, Interface Probe and/or Water Level Meter, 20-lb., Type ABC Fire Extinguisher, Buckets. Tools as needed: Socket Wrench, Screw Driver, Crow Bar, Mallet, and Wire Brush.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization to monitoring well(s).	**1a. FALL:** Personal injury from slip/trip/fall due to uneven terrain and/or obstructions.	1a. Inspect pathway and plan for most suitable designated pathway prior to mobilization. 1a. Use established pathways, walk and/or drive on stable, secure ground and avoid steep hills or uneven terrain. 1a. If working near open water with an unguarded edge, wear life vest.
	1b. CONTACT: With traffic/third parties.	1b. Identify potential traffic sources and delineate work area with 42-inch traffic safety cones. Position vehicle to protect against oncoming traffic. Use caution tape to provide a more visible delineation of the work area if necessary. 1b. Wear appropriate PPE including high visibility clothing or reflective vest. 1b. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route.
	1c. EXERTION: Muscle strain from lifting equipment	1c. Use proper lifting techniques when handling/moving equipment; bend knees and keep back straight. 4c. Use mechanical assistance or team lifting techniques when equipment is 50 lbs. or heavier. 4c. Make multiple trips to carry equipment.
	1d. EXPOSURE: To biological hazards.	1d. Inspect work area for bees and insects. 1d. Use insect/tick repellent as necessary.
2. Open/close well.	**2a. EXERTION:** Muscle strain.	2a. Use proper lifting techniques; keep back straight, lift with legs and bend knees when reaching to open/close well.
	2b. CAUGHT: Pinch/crush points associated with removing/replacing manholes and working with hand tools.	2b. Wear leather gloves or cut resistant gloves when working with well cover and hand tools. 2b. Use proper tools (ratchet and pry bar for well cover) and inspect before use. 2b. Do not put fingers under well cover.
	2c. CAUGHT: Pinch points associated with placing J-plug back onto PVC pipe.	2c. See 2b. 2c. Keep fingers out of line-of-fire when securing cap.
	2d. EXPOSURE: To potential hazardous vapors.	2d. No open flames/heat sources. 2d. To minimize exposure to vapors, allow well to vent after opening it and before sampling activities begin. 2d. Stand up-wind, if possible, to avoid inhaling vapors.
3. Gauge well.	**3a. CONTACT:** With contamination (e.g. contaminated groundwater).	3a. Wear chemical-resistant disposable gloves (over cut-resistant gloves) and safety glasses when gauging well. 3a. Insert and remove probe slowly to avoid splashing. 3a. Use an absorbent pad to clean probe.
	3b. CONTACT: With traffic.	3b. See 1b.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
4. Purge and sample well	**4a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors) and/or sample preservatives. **4b. CONTACT:** Personal injury from cuts, abrasions, or punctures by glassware or sharp objects. **4c. EXERTION:** Muscle strain while carrying equipment. **4d. CONTACT:** With traffic. **4e. CONTACT:** Pinch points with groundwater pump components (i.e., wheel, line, clamps). **4f. EXERTION:** Muscle strain from repetitive motion of bailing and sampling a well.	4a. Open and fill sample jars slowly to avoid splashing and contact with preservatives. 4a. Wear cut-resistant gloves and chemical-resistant disposable gloves when sampling. 4a. Fill sample containers over purge container to avoid spilling water onto the ground. 4a. Use an absorbent pad to clean spills. 4a. When using a bailer to purge a well, pull the bailer slowly from the well to avoid splash hazards. 4a. When sampling or purging the water using a bailer, pour out water slowly to reduce the potential for splash hazards with groundwater. 4a. When using a tubing valve always remove the valve slowly after sample collection to release any pressure and avoid pressurized splash hazards. 4a. When collecting a groundwater sample always point sampling apparatus (tubing, bailer, etc.) away from face and body. 4b. To avoid spills or breakage, place sample ware on even surface. 4b. Do not over tighten caps on glass sample ware. 4b. Wear chemical-resistant nitrile disposable gloves over cut-resistant (i.e., Kevlar) gloves when sampling and handling glassware (i.e., VOA vials) or when using cutting tools. 4c. Use proper lifting techniques when handling/moving equipment, bend knees and keep back straight. 4c. Use mechanical assistance or team lifting techniques when equipment is 50 lbs. or heavier. 4c. Make multiple trips to carry equipment. 4d. See 1b. 4e. Wear leather gloves when working with groundwater pumps. 4e. Never place hands on or near pinch points such as the wheel, clamps or other moving parts during pump operations. 4e. Use the correct mechanisms, such as a pump reel, to lower pump into well. 4e. Never attempt to manually stop any moving part of equipment including hose reels and/or tubing. 4f. See 4c. 4f. Include a stretch break when repetitive motions are part of the task.
5. Management of purge water.	**5a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors). **5b. EXERTION:** Muscle strain from lifting/carrying and moving containers.	5a. Do not overfill container and pour liquids slowly so that they do not splash. 5a. Properly dispose of used materials/PPE in appropriate container in designated storage area. 5b. Use proper lifting techniques when lifting / carrying or moving container(s) (see 4c.). 5b. Do not overfill container(s).
6. Decontaminate equipment.	**6a. EXPOSURE/CONTACT:** To contamination (e.g., SPH, contaminated groundwater, vapors). **6b. CAUGHT:** Pinch points associated with handling hand tools	6a. Work on the upwind side, where possible, of decon area. 6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Use an absorbent pad to clean spills. 6b. See 2b. 6b. Inspect hand tools for sharp edges before decontaminating.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-014	DATE: 7/10/2020	☐ NEW ☒ REVISED	

JSA TYPE CATEGORY: **Generic**	WORK TYPE: **Drilling**	WORK ACTIVITY (Description): **Hollow Stem Auger Soil Borings / Well Installation**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Douglas Ferraiolo	Staff Geologist	Brian Hobbs	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☒ GOGGLES: Spoggles required if winds exceed 15 mph. ☐ FACE SHIELD ☒ HEARING PROTECTION: (as needed). ☒ SAFETY SHOES: Steel or Composite Toe.	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent long-sleeve shirt or long-sleeve shirt and reflective safety vest.	☒ GLOVES: Leather, Cut-Resistant, and Nitrile. ☒ OTHER: Insect Repellant, Sunscreen (as needed).

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Truck-Mounted Drilling Rig or Track Rig, Saw, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Interface Probe, 20 lb. Type ABC Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs.

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ): Maintain Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, tip zone of the equipment, fall zone of the equipment and contents, distance that debris may travel during demolition activities and/or foot print of a structure to be demolished.

"SHOW ME YOUR HANDS"
Driller and helper should show that hands are clear from controls and moving parts

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization / demobilization and establish a work area.	**1a. See Mobilization/ Demobilization JSA GEN-015.**	1a. See Mobilization / Demobilization JSA GEN-015.
2. Raising tower / derrick of drilling rig.	**2a. CONTACT:** Overhead hazards. **2b. CONTACT:** Amputation / crush points when raising the rig and instability of rig.	2a. Prior to raising the tower / derrick, the area above the drilling rig will be inspected for overhead hazards (wires, tree limbs, piping or other structures) that may be contacted by the rig's tower or drilling rods. 2a. The tower / derrick must not be raised beneath overhead power lines unless approved by the Roux PM. 2a. Maintain a minimum of 10' from all overhead structures. 2a. Do not move the rig while the tower / derrick is raised. 2b. Inspect the equipment prior to use and avoid any potential amputation points. 2b. Lower outriggers to ensure stability prior to raising rig tower derrick. Keep feet and body out of the line of fire when lowering out-riggers. 2b. Inspect the set-up location for uneven terrain. Level or avoid area if needed. 2b. If the rig needs to be mounted, be sure to use three points of contact.
3. Advancement of augers for soil boring installation.	**3a. CONTACT:** Equipment imbalance during advancement of drill equipment. **3b. CONTACT:** Flying / spraying debris. **3c. CAUGHT:** Limb/extremity amputation, abrasion, and crushing.	3a. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and / or tip. 3a. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred. **3a. Drillers will maintain the "Purple Zone" policy surrounding augers to ensure no personnel come into contact with augers while in use. Workers will spray paint a 3' semi-circle surrounding the augers to visually show that no personnel should enter the "Purple Zone" while drilling activities are being conducted.** 3a. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (minimum exclusion zone of 20 feet). 3b. Wear all required PPE (especially hand, eye, and ear protection). 3b. Maintain minimum EZ distance (i.e. swing/tip radius of rig) when rig is in operation to avoid potential line of fire hazards from flying materials or debris. 3c. Inspect the equipment prior to use for potential pinch points. 3c. Test all emergency shutdown devices prior to drilling. 3c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt. 3c. Inspect augers, do not use if auger flight is damaged or bent.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Advancement of augers for soil boring installation (Continued).		3c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3c. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment particularly when installing auger flights and steel override casings. 3c. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3c. Spinning augers should have an exclusion zone of 20 feet when in operation.
	3d. FALL: Slip/trip/fall hazards.	3d. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 3d. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 3d. Use established pathways and walk on stable, secure ground. 3d. Use three points of contact when mounting or dismounting the rig. 3d. Remove soil cuttings to avoid a tripping hazard from developing near augers.
	3e. EXPOSURE: Inhalation of contamination / vapors.	3e. Air monitoring using a calibrated photoionization detector (PID) to periodically monitor the breathing zone of the work area. 3e. The Action Level for breathing zone air is five parts per million (sustained) as detected by the PID. 3e. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux PM of the condition. The Roux PM will then recommend additional appropriate precautions in accordance with the site specific health and safety plan.
	3f. EXPOSURE: Noise and dust.	3f. Wet borehole area with sprayer to minimize dust. Stand upwind and keep body positioned away from rig. 3f. Wear hearing protection while drill rig is operating and / or the noise levels exceed 85 dBA.
	3g. EXERTION: Installing well casings and lifting augers.	3g. Keep back straight and bend at the knees. 3g. Utilize team lifting for objects over 50lbs. 3g. Use mechanical lifting device for odd shaped objects.
4. Installation of well materials.	**4a. CONTACT:** Installing well materials while also pulling up augers. **4b. CAUGHT:** Possible pinch or crush hazard assembling PVC and sending down the borehole. **4c. FALL:** Slip/trip/fall hazards with hand tools and materials. **4d. EXPOSURE:** Potential contamination, harmful vapors, dust, and / or noise. **4e. EXERTION:** Lifting heavy bags of materials to backfill borehole.	4a. Potential contact with augers during installation of well materials. 4a. Keep distance from augers and do not place any materials while augers are in motion. 4b. Keep all body parts out of potential pinch points while placing PVC together and sending down borehole. 4c. See 3d. 4d. See 3e and 3f. 4d. Stand upwind to avoid exposure to dust generated from packing materials. 4e. Ergonomic hazard lifting bags of sand and bentonite while packing the well.
5. Cleaning the auger flights	**5a. CONTACT:** Cuts/scrapes or puncture wound from contacting auger.	5a. Follow "Show Me Your Hands" Procedure and make sure auger is out of gear before contacting auger with tool or hand. 5a. Pull cleaning tool across your body with handle away from body; do not push toward the auger. 5a. Do not clean more than ¾ turn around the auger at a time. 5a. Wear cut resistant and leather gloves. 5a. Always use two hands to operate cleaning tool. 5a. Inspect tool before use and remove from service if handle or metal are cracked/fatigued. 5a. Stand out of the line of fire.
6. Decontaminate equipment.	**6a. EXPOSURE / CONTACT:** To contamination (e.g., contaminated groundwater, vapors). **6b. EXPOSURE**: To chemicals in cleaning solution (including ammonia).	6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Contain decontamination water so that it does not spill. 6a. Use an absorbent pad to clean spills, if necessary. 6b. See 3e. Wear all appropriate PPE and stand upwind of any exposed cleaning solutions.

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<table>
<tr><td colspan="2">JOB SAFETY ANALYSIS Ctrl. No. GEN-015</td><td>DATE: 7/10/2020</td><td>☐NEW
☒REVISED</td><td></td></tr>
<tr><td>JSA TYPE CATEGORY
GENERIC</td><td>WORK TYPE
Site Recon</td><td colspan="3">WORK ACTIVITY (Description)
Mobilization/Demobilization</td></tr>
<tr><td>DEVELOPMENT TEAM</td><td>POSITION / TITLE</td><td>REVIEWED BY:</td><td colspan="2">POSITION / TITLE</td></tr>
<tr><td>Rebecca Lowy</td><td>Staff Assistant Geologist</td><td>Brian Hobbs</td><td colspan="2">Corporate Health & Safety Manager</td></tr>
<tr><td>Tally Sodre</td><td>OHSM</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="5">REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT</td></tr>
<tr><td>☐ LIFE VEST
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☒ SAFETY GLASSES</td><td>☐ GOGGLES
☐ FACE SHIELD
☒ HEARING PROTECTION (as needed)
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☐ SUPPLIED RESPIRATOR
☒ PPE CLOTHING: <u>Fluorescent reflective vest of high-visibility clothing; long sleeve shirt; long pants</u></td><td colspan="2">☒ GLOVES: <u>Leather, nitrile, and cut resistant (as needed)</u>
☐ OTHER</td></tr>
<tr><td colspan="5">REQUIRED AND / OR RECOMMENDED EQUIPMENT</td></tr>
<tr><td colspan="5">Required Equipment: Varies</td></tr>
<tr><td colspan="5">COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs</td></tr>
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[1]JOB STEPS</td><td>Analyze
[2]POTENTIAL HAZARDS</td><td colspan="3">Act
[3]CRITICAL ACTIONS</td></tr>
<tr><td>1. Mobilize/demobilize and establish work area</td><td>1a. FALL: Slip/trips/falls from obstructions, uneven terrain, weather conditions, heavy loads, and/or poor housekeeping.</td><td colspan="3">1a. Use 3 points-of-contact/ensure secure footing when entering and exiting vehicle.
1a. Inspect walking path for uneven terrain, steep hills, obstructions, and/or weather-related hazards (i.e., ice, snow, and puddles) prior to mobilizing equipment. Use established pathways. Walk on stable/secure ground.
1a. Do not climb over stored materials/equipment; walk around. Practice good housekeeping; organize and store equipment neatly in one area at its lowest potential energy.
1a. Wear boots with adequate treads.
1a. Delineate unsafe areas with 42” cones, caution tape and/or flagging.</td></tr>
<tr><td></td><td>1b. CONTACT: Personal injury and/or property damage caused by being struck by Site traffic or equipment used in Site activities.</td><td colspan="3">1b. Observe and maintain the posted speed limits.
1b. When first arriving onsite, park vehicles in designated parking space and/or out of the way locations. Use parking brake on all vehicles and tire chocks on work trucks and trailers.
1b. Check in with Site Manager/Supervisor to ensure coordination with other Site activities and to discuss any special hazards. Ensure that short-service employees (SSE) are identified.
1b. Identify potential traffic sources.
1b. Wear PPE including high visibility clothing or reflective vest.
1b. Use a spotter while moving work vehicles; plan ahead to avoid backing whenever possible.
1b. Maintain a minimum exclusion zone when vehicles are in motion (i.e. greater than swing/tip radius of equipment). When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver-to-spotter visibility.
1b. Delineate work area with 42” cones, flags, caution tape, and/or other barriers.
1b. Position “Work Area” signs at Site entrances, if possible, or at either side of work area.</td></tr>
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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
		1b. Position largest vehicle to protect against oncoming traffic. 1b. Face traffic, maintain eye contact with oncoming vehicles, use a spotter, and establish a safe exit route. 1b. Observe potential overhead and ground surface features that may interfere with moving equipment. Clear the path of physical hazards prior to initiating mobilization.
	1c. CAUGHT: Personal injury from pinch points and being in line-of-fire of vehicle and/or equipment.	1c. Make sure driver has engaged parking brake and placed wheel chocks in a position to prevent movement. Be sure that vehicle is parked in front/down gradient (positioned to best block oncoming traffic) of work area. 1c. Wear leather gloves when handling any tools or equipment. Wear cut-resistant gloves (Kevlar or similar) when handling sharp objects/cutting tools/glass. 1c. Keep body parts away from line-of-fire of equipment. 1c. Always carry tools by the handles and/or designated carrier. Ensure sharp-edged tools are sheathed/secure. 1c. Remove any loose jewelry. Avoid wearing loose clothing and/or ensure loose clothing is secure. 1c. Secure all items on the equipment, tighten up any items or features that have potential to shift or break during mobilization.
	1d. OVEREXERTION: Muscle strains while lifting/carrying equipment.	1d. Use body positioning and lifting techniques that avoid muscle strain; keep back straight, lift with legs, turn with whole body, keep load close to body, and never reach with a load. 1d. Ensure that loads are balanced. Use assistance (mechanical or additional person) to carry equipment that is either unwieldy or over 50 lbs.
	1e. EXPOSURE: Personal injury from exposure to biological and environmental hazards.	1e. Inspect area to avoid contact with biological hazards (i.e. poisonous plants, stinging insects, ticks, etc.). 1e. Wear long sleeved clothes treated with Permethrin, apply insect repellant containing DEET to exposed skin, and inspect clothes and skin for ticks during and after work. 1e. Apply sunscreen (SPF 15+) if exposure to sun for 30 minutes or more is expected.
	1f. EXPOSURE: Weather related injuries.	1f. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, nausea, rapid and shallow breathing). Take breaks in cool places and hydrate as needed. 1f. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks in warm areas as needed. 1f. Wear clothing appropriate for weather and temperature conditions (e.g., rain jackets, snow pants, multiple layers). 1f. If lightning is observed, wait 30 minutes in a sheltered location (car is acceptable) before resuming work.
	1g. EXPOSURE: Personal injury from noise hazards.	1g. Wear hearing protection if sound levels exceed 85 dBA (if you must raise your voice for normal conversation).

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETY ANALYSIS	Ctrl. No. GEN-019	DATE: 7/10/2020	☐NEW ☒REVISED	

JSA TYPE CATEGORY **GENERIC**	WORK TYPE **Site Recon**	WORK ACTIVITY (Description) **Site Walk and Inspection**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Sara Barrientos	Staff Geologist	Brian Hobbs	Corporate Health and Safety Manager
		Joe Duminuco	Vice President

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION: ear plugs as necessary ☒ SAFETY SHOES: <u>Steel or composite toed</u>	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: <u>High-visibility vest or high-vis outerwear</u>	☒ GLOVES: <u>Leather/cut-resistant/chemical resistant</u> ☒ OTHER: Tyvek and rubber boots as necessary, dust mask as necessary

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Site map, emergency contact list, documentation of urgent care/hospital routes and / or guide familiar with Site, operating cell phone or walkie-talkie if Site allows.

Commitment to Safety – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

EXCLUSION ZONE (EZ): Maintain Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, tip zone of the equipment, fall zone of the equipment and contents, distance that debris may travel during demolition activities and/or foot print of a structure to be demolished.

SITE SECURITY: Prior to site inspection verify appropriate method to address Site Security concerns as it relates to potential criminal activity, homeless population, and/or isolation concerns. Work with the Project Principal and/or Project Manager to address appropriately.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Check in with Site contact.	**1a. CONTACT/EXPOSURE/FALL:** Personal injury caused by lack of site specific hazards.	1a. Inquire about hazards and other activities taking place at the Site. 1a. Inform Site contact of work scope, timeline and location(s). 1a. Discuss emergency evacuation procedures and muster points with Site contact.
2. Traversing the Site	**2a. CONTACT:** Property damage and personal injury caused by obstructions/vehicles or unauthorized personnel at remote Sites.	2a. All equipment must be stowed and secured prior to moving. 2a. Maintain speed limit as posted on-site. 2a. When possible drive on established roadways. 2a. Yield to all pedestrians. 2a. Use pull-through spots or back into parking spots. 2a. Don high visibility clothing/safety vest. If working at remote Site, add orange accessories during hunting season.
	2b. FALL: Uneven terrain and weather conditions. Overgrown shrubs and vines. Equipment in the work zone.	2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 2b. When possible, use established pathways and walk on stable, secure ground. 2b. Communicate traversing hazards with others.
	2c. OVEREXERTION: Muscle strain while carrying equipment.	2c. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment.
	2d. EXPOSURE: Biological hazards – ticks; bees/wasps; poison ivy; insects; (Ticks are most active any time the temperature is above freezing, typically from March to November.)	2d. Inspect area to avoid contact with biological hazards. 2d. Ticks: • Treat outer clothing including pants, shirts, socks, boots and hats the evening before with Permethrin (allowing at least two hours before use). • Apply DEET to exposed skin before travelling to the Site and reapply after two hours. • Check for ticks during and after work. 2d. Bees: • Use bee spray as appropriate to deter/eliminate bees. • Protect exposed skin with insect repellent.

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	2e. EXPOSURE: Heat Stress & Cold Stress. Personal injury from working in inclement weather conditions.	2d. Poison Ivy: • Identify areas of poison ivy and spray with weed killer. Don Tyvek and rubber boots while traversing poison ivy areas. • If skin contacts poison ivy, wash skin thoroughly with soap and water. 2e. Wear sunscreen with SPF 15 or greater on exposed skin whenever 30 minutes or more of sun exposure is expected. 2e. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 2e. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 2e. Wear appropriate rain gear as needed. 2e. Take frequent breaks if tired, wet, or cold/hot. Drink water. 2e. If lightning is observed, wait 30 minutes after last thunder boom/lightning bolt in a sheltered location (car acceptable) before starting work again.
3. Walking near heavy equipment and machinery.	**3a. CONTACT:** Personal injury from Site and roadway traffic. Personal injury from flying debris **3b. OVEREXERTION:** Personal injury from lifting/moving/rotating equipment. **3c. EXPOSURE:** Hearing damage from noise generating equipment/processes. Inhalation/exposure to hazardous vapors and or dust. **3d. EXPOSURE:** Working in a remote area.	3a. See 2a. 3a. Maintain an exclusion zone of at least 10'-25' feet from all engaged equipment. 3a. Keep body parts out of the line of fire of pinch points. 3a. Wear appropriate PPE always. 3b. See 2c. 3c. Wear hearing protection if >85 dBA. (i.e. noise levels which require you to raise your voice to communicate) 3c. Always wear leather gloves when handling any tools or equipment. 3c. Always wear appropriate PPE based off chemicals present. 3d. Use the "buddy system" whenever possible. If working alone, contact PM upon arrival/departure, as well as during work activities prior to commencing work if applicable. 3d. Always carry a communication (i.e., cell phone, walkie-talkie) or directional (i.e., map, compass, etc.) device when traversing remote areas.
4. Working in adverse weather conditions.	**4a. EXPOSURE:** Heat Stress & Cold Stress. Personal injury from working in inclement weather conditions.	4a. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 4a. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 4a. Wear appropriate rain gear as needed. 4a. Take frequent breaks if tired, wet, or cold/hot. Drink water. 4a. If lightning is observed, wait 30 minutes after last thunder boom/lightning bolt in a sheltered location (car acceptable) before starting work again.
5. Departing Site.	**5a. EXPOSURE:** Exposure to unnecessary hazards should personnel believe Roux is on-Site during an emergency and conduct a search.	5a. Sign out or notify Site contact and Roux Project Manager of your departure.

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JOB SAFETYANALYSIS Ctrl. No. GEN-020		DATE: 7/10/2020	☐NEW ☒REVISED	PAGE 1 of 2
JSA TYPE CATEGORY: **GENERIC**	WORK TYPE: **Gauging & Sampling**	WORK ACTIVITY (Description): **Soil Sampling**		
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**	
MaryBeth Lyons	Project Scientist	Brian Hobbs	Corporate Health and Safety Manager	

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES ☒ FLAME RESISTANT CLOTHING (as needed)	☐ GOGGLES ☐ FACE SHIELD: ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Insect repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Recommended Equipment: 42” traffic cones, caution tape, trowel

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs.

EXCLUSION ZONE (EZ): Maintain Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, tip zone of the equipment, fall zone of the equipment and contents, distance that debris may travel during demolition activities and/or foot print of a structure to be demolished.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Secure location	**1a. CONTACT:** Personnel and vehicular traffic may enter the work area.	1a. If in an area with foot or vehicle traffic, delineate the work area with 42” traffic cones and/or caution tape to prevent exposure to traffic and inform others of work activity. 1a. Wear reflective vest and/or high visibility clothing. 1a. Face the direction of any vehicular traffic. Position vehicle to protect worker from traffic. 1a. Communicate work activity with adjacent work areas.
	1b. FALL: Tripping/falling due to uneven terrain or entry/exit from excavations.	1b. Inspect pathways and work area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions. 1b. Use established pathways and walk on stable, secure ground. 1b. Stage equipment and tools in a convenient, stable, and orderly manner. Store equipment at lowest potential energy. 1b. Roux employees should stay 5 feet from in-progress excavations and trenches. Should entry to an excavation be required (when stabilization is complete), ladders must be employed for steep embankments, excavations, pits, and trenches.
	1c. EXPOSURE: Exposure to sun and excessive heat, possibly causing sunburn, heat exhaustion or heat stroke. Exposure to cold temperatures possibly causing cold stress. Skin burn as a result of fire, if applicable. Exposure to explosive vapors due to tank farm operations. Exposure to airborne dust due to high wind speeds. Biological hazards - ticks, bees/wasps, poison ivy, thorns, insects, etc.	1c. Wear sunscreen with an SPF 15 or greater whenever 30 minutes or more of exposure is expected. 1c. Use a tent to shade the work area from direct sunlight particularly when warm temperatures are expected. 1c. Be aware of the location of all Site personnel. 1c. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). 1c. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). 1c. Take breaks for rest and water as necessary. Move to an area that is well shaded or a climate controlled area (i.e., car, site trailer, etc.). 1c. No open flames/heat sources. 1c. Flame retardant clothing must be worn when specified by Site policy. 1c. Cell phones should be disabled when specified by Site policy. 1c. Pre-treat field clothing with Permethrin prior to site visit to kill ticks and insects. 1c. Wear long sleeved shirts and tuck in (or tape) pant legs into socks or boots to prevent ticks from reaching skin. 1c. Spray insect repellant containing DEET on exposed skin when working in overgrown areas of the Site. 1c. Inspect area to avoid contact with biological hazards. 1c. Wear cut-resistant gloves when handling branches, shrubs, etc. that may lie within the walking path. 1c. Wear spoggles if the average wind speeds are above 15 mph. 1c. Personnel shall examine themselves and co-worker’s outer clothing for ticks periodically when onsite. 1c. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water. If rash persists after washing, immediately notify your supervisor, the OM and OHSM for possible consultation with a physician at an approved Occupational Health Clinic.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
2. Collect Soil Sample	**2a. CONTACT:** Personal injury from pinch points, cuts, and abrasions from sampling equipment tools, and material within soil sample. Personal injury from contact with moving equipment while sampling. Personal injury from contact with glass sample jars.	2a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant (nitrile) disposable gloves when handling soil samples and sampling jars. 2a. Where possible, use trowel or equivalent tool to avoid contact with soil. 2a. If sampling from bucket of heavy equipment, ensure all equipment is off and operator utilizes the “show me your hands” policy. 2a. See 1a.
	2b. EXPOSURE: Exposure to contamination (impacted soil) and/or lab preservatives.	2b. Wear chemical-resistant (nitrile) disposable gloves over cut resistant gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas. 2b. Wear safety glasses to protect eyes from dust or air-borne contaminants that may results from disturbing the soil. 2b. Where possible, remain upgradient from sample location if collecting soil sample from stockpile, drill rig, etc. to avoid breathing contaminant vapors, if they are present. 2b. When collecting soil sample from hand auger, put large zip lock bag over entire auger to prevent spillage of soil on to the ground. 2b. Open sample jars slowly and fill carefully to avoid contact with preservatives.
	2c. EXERTION: Exertion due to repetitive motion and ergonomics.	2c. Utilize a table or raised surface for soil sampling if multiple soil samples are going to be taken to minimize repetitive bending motion.
3. Decontaminate equipment	**3a. EXPOSURE/CONTACT:** Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated vapors and/or soil).	3a. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3a. Use an absorbent pad to clean spills. 3a. Properly dispose of used materials/PPE in provided drums in designated drum storage area. 3a. Remain upwind of sample and avoid breathing contaminant vapors, if they are present.
	3b. EXPOSURE: Chemicals in cleaning solution including ammonia.	3b. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3b. Work on the upwind side of decontamination area. 3b. Use an absorbent pad to clean spills. 3b. Properly dispose of used materials/PPE in provided drums in designated drum storage area. Ensure that all drums are properly labeled and secured.

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JOB SAFETY ANALYSIS	**Ctrl. No. GEN-023**	DATE: 7/10/2020	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Generic	**Construction**	**Spotting Heavy Machinery**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Levi Curnutte	Project Scientist	Brian Hobbs	Corporate Health & Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☒ LONG SLEEVED SHIRT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Steel-/Composite-toe boots/shoes	☐ Particulate Respirator ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective clothing	☒ GLOVES: Cut resistant / leather ☐ OTHER:

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Heavy Machinery (i.e. excavator, payloader, truck, forklift, etc.)

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ): Maintain Minimum Heavy Equipment Exclusion Zone around equipment and loads while it is in motion. The HEEZ must be greater than the swing zone of any moving part of the equipment, tip zone of the equipment, fall zone of the equipment and contents, distance that debris may travel during demolition activities and/or foot print of a structure to be demolished.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Prepare for machine activity.	**1a. CONTACT:** Obstructions in the work area may create contact hazards from machinery. **1b. Fall :** Slip/Trip/Fall	1a. Cordon off the work area with safety barrels/cones and a rigid barrier (snow fence, traffic bar, etc.). Communicate that only necessary personnel should be in the work area. Spotter and equipment operator shall enforce the **EZ**. Operator will not operate but shall remain in the hands-off mode while personnel are within the exclusion zone. 1b. Ensure that work area is flat, level and clear of any obstructions or debris before setting up work zone.
2. Spotting.	**2a. CONTACT:** Machine or load contact with personnel, property, or machinery.	2a. Discuss the specifics of the work with the operator and be clear about any hand signals that will be used. Clearly discuss the limits of the assigned work area and the machine's Exclusion Zone. Maintain Exclusion Zone. The Exclusion Zone shall be delineated by using 42-inch traffic cones/barrels and a fixed rigid barrier. 2a. The Minimum Heavy Equipment Exclusion zone is greater than the swing/tip radius of equipment. 2a. Both the spotter and equipment operators shall have 2-way radios/cellular devices on their persons to ensure audible communication in the event any changes or new hazards may arise. 2a. All workers should stay outside of the Exclusion Zone of all equipment unless operator is stopped and in "Hands Off" mode. **(This includes the spotter unless an exception has been established in the Site-specific JSA).** If the Exclusion Zone must be reduced due to work area restrictions then the spotter and operator shall enforce the reduced Exclusion Zone. 2a. Spotters must make eye contact with the machine operator or all movement ceases until visual contact can be reestablished. 2a. Spotter shall keep an eye out for any issues with the machine the operator may not see and communicate with other work crews and spotters on behalf of the operator. 2a. If the spotter needs to take a break, he must find a replacement before leaving or have the machine stop operations. **No heavy equipment shall operate without a spotter under any circumstances.** 2a. Wear fluorescent clothing/safety vest.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
	2b. FALL: Slip/Trip/Fall	2b. Look where walking to identify and avoid slip/trip/fall hazards. Avoid icy and/or wet surfaces. Remove obstacles if possible. 2b. Use designated walkways during spotting whenever possible.
	2c. CAUGHT: Caught between machinery and nearby objects.	2c. **Maintain Exclusion Zone.** Do not stand between large, loose or fixed objects or structures and the machinery while it is in motion. Keep in sight of operator at all times while being aware of surrounding structures.
	2d. EXPOSURE: Inhalation of exhaust from machinery.	2d. The spotter will position him/herself upwind of the working machinery, when possible. Spotter will also inform others working within the vicinity of the EZ of proper positioning, if applicable.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-029	DATE: 8/18/2021	☐ NEW ☒ REVISED	

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Preclearing/Sampling**	**Hand Augering**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Sean Owens	Senior Health & Safety Specialist	Brian Hobbs	Corporate Health & Safety Director

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: Steel or composite toed	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Long sleeve high visibility clothing	☒ GLOVES: Cut Resistant / Leather / Nitrile / Chemical resistant ☐ OTHER

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Hand Auger Tools (buckets, rods), 5-gallon buckets, hand tools (hammer, etc)

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Drive/walk to hand clearing/hand augering location	**1a. CONTACT:** Property damage and personal injury caused by obstructions/vehicles **1b. FALL:** Personal injury from tripping/falling due to uneven terrain, weather conditions, and materials/equipment stored at portions of the Site **1c. EXERTION:** Muscle strain/exhaustion while carrying equipment (i.e., hand auger, post-hole digger, shovel, pry bar) **1d. EXPOSURE:** Exposure to sun, possibly causing sunburn Biological hazards - bees/wasps, poison oak, thorns, insects, etc.	1a. Maintain speed limit on-site. 1a. All equipment must be stowed and secured prior to moving. 1a. Drive on established roadways. 1a. Do not back up vehicle without spotter where visibility is limited; use pull-through spots or back into parking spots; use an audible signal (horn/back-up alarm) when backing up vehicles.1c. 1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Use established pathways and walk on stable, secure ground. 1b. Use established ramp when descending into/ascending from impoundment areas. 1b. Keep tools and equipment in a designated area. When not in use, tools and equipment must be returned to their proper storage location. Keep work area clear of obstructions. 1c. When carrying equipment to/from work area, use proper lifting techniques; keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced to reduce the potential for muscle strain. Use mechanical assistance or make multiple trips to carry equipment. 1d. Wear sunscreen with an SPF of at least 15 whenever 30 minutes or more of exposure is expected. 1d. Inspect area to avoid contact with biological hazards. 1d. Wear cut resistant gloves when handling branches, shrubs, etc. that may lie within the walking path. 1d. Avoid any areas onsite that have poison oak.
2. Secure location	**2a. CONTACT:** Personnel and vehicular traffic may enter the work area. **2b. FALL:** Tripping/falling due to uneven terrain, and materials /equipment stored within the work area	2a. Delineate the work area with traffic cones and/or caution tape to prevent exposure to traffic and inform others of work activity. 2a. Wear reflective vest and/or fluorescent clothing. 2a. Face the direction of vehicular traffic. Position vehicle to protect worker from traffic. 2a. Communicate work activity with adjacent work areas. 2b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment to the impoundments. 2b. Equipment and tools will be staged in a convenient, stable, and orderly manner. 2b. Equipment and tools will be stored at the lowest point of potential energy and out of the walkway and immediate work area (i.e. tools should not be propped against walls or nearby equipment or vehicles). 2b. Equipment and tools that are not anticipated to be used will be returned to an appropriate storage area that is out of the immediate work area.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Verify pre-clearance protocol; review completed Subsurface Utility Checklist and utility verification site walkthrough.	**3a. ENERGY SOURCE:** Underground utility damage; property damage; personal injury	3a. Confirm that "Call Before You Dig" and local utility companies were contacted prior to hand augering. 3a. Walk the Site to evaluate utility markings and review maps.
4. Augering/advancing borehole	**4a. EXPOSURE:** Contaminated soil/water/vapor **4b. EXERTION:** Muscle strain from lifting, bending, repetitive motion. **4c. CAUGHT:** Personal injury as a result of jewelry/loose clothing caught on equipment, well covers, machinery, hand auger, pry bar etc.. **4d. CONTACT/CAUGHT:** Pinch points, abrasions	4a. Monitor breathing zone with a PID when VOCs area concern. If vapors sustain > 5 ppm, upgrade PPE as per HASP. 4a. Wear chemical-resistant disposable gloves and safety glasses when handling impacted materials. 4a. Place excavated soil on plastic sheeting and store soil waste in designated area. 4a. Work on the upwind side of the boring. 4b. Body positioning and rotating with the auger to reduce strain. Don't twist back. 4c. No form of jewelry should be worn while on-site. 4c. Clothing must be appropriately sized so it is not loose fitting. 4d. Keep head and upper body clear when lifting hand auger, pry bar/post-hole digger. Ensure to not be overly aggressive when using pry bar. 4d. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body.
5. Lithologic observation and soil sampling	**5a. EXPOSURE:** Contact with contamination (impacted soil and/or lab preservatives)	5a. Wear chemical-resistant disposable gloves to protect hands when handling samples; wear safety glasses when handling any preservatives; use containment material or plastic sheeting to protect surrounding areas. 5a. When collecting soil sample from hand auger, put large zip lock bag over entire auger to prevent spillage of soil on to the ground. 5a. Open sample jars slowly and fill carefully to avoid contact with preservatives.
6. Decontaminate equipment	**6a. EXPOSURE:** Contact with contamination (impacted soil and/or lab preservatives, decontamination solution) **6b. CONTACT/CAUGHT:** pinch points and cuts/abrasions	6a. Wear chemical-resistant disposable gloves and safety glasses. 6a. Use an absorbent pad to clean spills. 6a. Properly dispose of used materials/PPE trash bags. 6b. Keep fingers/hands out of pinch points when dis-assembling hand auger during decontamination.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

APPENDIX G

Biological Hazard Awareness Management Program

BIOLOGICAL HAZARD AWARENESS MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
REVISION NUMBER	:	**3**

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APPENDICES

1. PURPOSE AND APPLICABILITY

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C., and Remedial Engineering (collectively, "Roux") has established a Biological Hazard Awareness Management Program to properly identify and minimize associated risks, utilizing best management practices to provide the appropriate guidance for the protection of all employees from exposure to biological hazards during work activities. This Program focuses on the management of more common biological hazards encountered by Roux staff such as vector borne diseases, venomous wildlife/insects, poisonous plants but also identifies other dangerous wildlife which may be encountered by Roux in various work environments (i.e. wild dogs, bears, and alligators).

The program is applicable to Roux employees and their subcontractors who will be performing activities and/or work in areas which could result in potential contact with biological hazards. The potential contact with biological hazards varies based on geographic location and climatic conditions. Therefore, it is imperative that during the pre-planning of work activities all potential biological hazards and risks are identified, and proper mitigation programs are established for each within the project specific Health and Safety Plan (HASP).

Biological hazards are commonly encountered by Roux employees when conducting routine work activates. The most common and widely expected forms of exposure have historically been associated with TICKS, SPIDERS AND POISIONOUS PLANTS. This management program describes best management practices for these risk scenarios as well as other potential hazards encountered in our work environment. This program is intended to provide general awareness and guidance for management of these other biological hazards which you may encountered including reptiles and mammals. The site-specific HASP should incorporate procedures and project specific hazards mitigation procedures in a greater detail than provide in this Management Program.

Questions pertaining to this program can be addressed by your Office Health & Safety Manager (OHSM) or the Corporate Health & Safety Manager (CHSM). Key definitions pertaining to this program are provided in Appendix A.

2. PROGRAM PROCEDURES

The following sub-sections outline commonly found biological hazards potentially present during typical field activities. Such biological hazards include ticks, mosquitos, venomous spiders, venomous snake's poisonous plants, dogs, alligators, bears and mountain lions. For each hazard a detailed breakdown of identification, project pre-planning and avoidance, proper use of PPE and responses to suspected or known biological exposures are provided. It is understood that there are and will be other potential biological hazards present in the work environment which are not included within this Program. The program is intended to provide examples of biological risk and not intended to cover all potential risks.

2.1 Tick-Borne Disease

This section outlines management practices to reduce potential exposure situations along with the use of personal protective equipment (PPE), insect repellents usage, procedures for inspections of personnel, recommendations for personal showering and the washing and drying of work clothing that has been potentially exposed to a tick environment and the required response to a known or suspected tick bite.

The following diseases are of concern as it relates to ticks and include: Anaplasmosis, Babesiosis, Ehrlichiosis, Lyme Disease, Rocky Mountain Spotted Fever, Southern Tick-Associated Rash Illness, Tick-Borne Relapsing Fever, Tularemia, Colorado tick fever, Alpha-Gal Allergy and Powassan virus.

2.1.1 Project Pre-Planning and Tick Avoidance

Avoidance is the preferred management approach with respect to tick(s). Pre-planning at the beginning of a project is the first step in tick avoidance. Where possible, plan the work to avoid tick-infested areas as described below:

- Avoid brushy, overgrown grassy and wooded habitats, particularly in spring and through fall when ticks are most active.
- Remove leaves, tall grass and brush from areas surrounding work areas (to include residential sites), thereby potentially reducing tick, deer and rodent habitat.
- Consider having a licensed applicator apply tick-toxic chemicals (e.g., Damminix, Dursban, Sevin, etc.) to surrounding work or residential areas to suppress the tick population.
- Consider performing work during dormant seasons or not during active seasons (spring through fall) unless it is not practical or rescheduling may introduce other hazards.

2.1.2 Use of Personal Protective Equipment (PPE)

Where avoidance of tick habitat or clearing of the area is not possible, employees need to wear appropriate PPE and take measures to avoid tick bites. There are two defined PPE approaches which are discussed below, that when properly implemented will provide the required protection from tick bites.

2.1.3 Preferred PPE Method

The preferred approach is the use of permethrin treated clothing and an insect repellent containing n,n-diethyl m-toluamide (DEET) on exposed skin. With the use of permethrin there are critical and time sensitive steps which are required in advance of its proper use. Additional guidelines on permethrin are provided in Appendix B and should be reviewed at least 2 days prior to the scheduled work. The use of permethrin and DEET are further discussed below:

- Using permethrin on outer clothing (including a hat) and shoes to kill ticks on contact as per manufacturer’s instructions (requires pre-treatment of clothing 24 hours in advance of the scheduled work).
- Spraying the insect repellents containing DEET on exposed skin just prior to initiation of the work, in accordance with United States Environmental Protection Agency (EPA) guidelines and supplemental information which is provided in Appendix C. DEET should be used on exposed skin only as it may melt or dissolve synthetic fabrics such as polyester or rayon.
- Be sure to tuck your pant legs into your socks and your shirt into your pants.

Should you have any questions or concerns regarding the use of permethrin or DEET please contact the CHSM/OHSM. If you require assistance with obtaining approved repellents contact your OHSM.

2.1.3.1 Alternative PPE Method

An alternative approach to the use of permethrin would be the use of other PPE in conjunction with the application of DEET as discussed above in section 2.1.3 and as discussed below:

- Wearing non-coated Tyvek coveralls over light-colored long-sleeved shirts and pants. Tape ankle openings of coveralls and wrist if wearing gloves.

- Wear a light colored long sleeved shirt and pants and tuck your pant legs into your socks and your shirt into your pants. Socks should be a tight weave fabric to prevent exposure through the material.
- Spraying the insect repellents containing DEET just prior to initiation of the work on exposed skin, in accordance with manufacturer's instructions.

2.1.3.2 Proper Donning and Removal of PPE

The donning of the PPE is to occur prior to entering a potentially tick-infested area. This usually means that the PPE needs to be in place and properly worn before stepping off a paved or concrete area onto a grassy or wooded area.

The PPE needs to remain on with the tucking or taping of pant legs, all closures fastened, etc., until leaving the potentially tick-infested area. Again, this usually means upon return to the previously paved or concrete area. Upon leaving the area, remove the PPE appropriately and bag it (plastic bag) to prevent ticks from traveling and subsequently attaching themselves to your skin.

Workers are to inspect themselves and co-workers frequently during the work and again after exiting the work area.

It is also important to do another thorough examination upon arrival home prior to and during showering to further check for ticks. Areas of the body would include under arms, in/around ears, inside belly button, back of knees, around ankles, in and around your hair, between legs and around your waist. Also, it is recommended that any work clothes be immediately washed and dried at high temperatures.

2.1.4 Responding to Known or Suspected Tick Bites

If an embedded tick is discovered it should be promptly removed with tweezers. Please follow the following steps:

- Grasp the tick by the head or mouthparts where they enter the skin, utilizing a pair of pointed precision tweezers (provided in the on-site first aid kit). Do NOT grasp the tick by the body.
- Pull firmly and in a steady motion directly outward. Don't twist or jerk the tick as this can cause the mouth parts to break off and remain in the skin. If this occurs, remove the mouth-parts with tweezers. If you are unable to remove the mouth easily with clean tweezers leave alone and let skin heal.
- Do NOT apply petroleum jelly, a hot match, alcohol, or any other irritant to the tick to get it to back out of skin.
- Clean the bite area and your hands with antiseptic.

Preserve the tick for analysis (i.e., by placing in a zip lock bag, envelope or jar). Provide the tick to the OHSM; further testing may be required. If testing is warranted based on the circumstances the tick will be sent to an accredited laboratory (e.g. EMSL Analytical, Inc.) to be analyzed to determine if it contains the bacteria capable of causing Lyme disease.

The discovery of a tick embedded in the skin where the tick contact occurred at work will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart.

If you suspect you have been bitten by a tick while on the job and exhibit the following symptoms; circular rash, aches/pains and/or fever/chills contact your OHSM for additional guidance.

2.2 Mosquito-Borne Diseases

Mosquito-borne diseases are spread through the bite of an infected mosquito, such diseases include Zika virus, West Nile Virus, Chikungunya virus, dengue and malaria. In most cases individuals exposed to such diseases will only exhibit mild, short term illness however there is the possibility for severe or long-term illness which can be fatal.

2.2.1 Project Pre-Planning and Mosquito Avoidance

Avoidance is the preferred management approach with respect to mosquitos. Pre-planning at the beginning of a project is the first step. Since mosquitos breed in standing water the preferred method is to avoid such areas with standing water however if unavoidable and possible the following should be done as described below:

- Remove, turn over and/or cover equipment which may harbor standing water.
- Remove tires, buckets, bottles, and barrels that collect water.
- Place drain holes in containers that collect water and cannot be discarded.
- Consider having a licensed applicator apply tick-toxic chemicals (e.g., Damminix, Dursban, Sevin, etc.) to surrounding work or residential areas to suppress the mosquito population.
- Consider performing work during dormant seasons or not during active times (i.e. avoid dusk or dawn) unless it is not practical or rescheduling may introduce other hazards.

2.2.2 Use of Personal Protective Equipment (PPE)

Where avoidance of mosquito habitat or clearing of the area of standing water is not possible, employees must wear appropriate PPE to further mitigate potential mosquito bites. Please reference sections 2.1.3, 2.1.4 and 2.1.5 as PPE requirements outlined in these sections will provide the level of protection necessary to prevent potential mosquito bites.

2.2.3 Responding to Known or Suspected Mosquito Bites

The discovery of a mosquito bite on the skin where it likely occurred at work will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart.

If you suspect you have been bitten by a mosquito while on the job and exhibit the following symptoms; rash, aches/pains and/or fever/chills contact your OHSM for additional guidance.

2.3 Venomous Spiders

Venomous spiders can be found in various regions of North America, of specific concern are black widow and brown recluse spiders. Black widows can be found throughout North America, however are common in the southern and western areas of the United States. While the brown recluse is more commonly found in the midwestern and southern states. Both pose significant hazards due to their bites potency. Black widow spider venom is neurotoxic, which results in pain at the bite area and then spreads to the chest, abdomen, and potentially the entire body. The brown recluse produces severe lesions as the result of skin necrosis. These spiders can be found in and around wells, brush, outdoor toilets and areas where debris has accumulated. Spiders are typically by nature not aggressive however if trapped or unintentionally contacted they will bite.

- Black widow spiders can be identified by their red/orange/yellow hourglass marking on the underside of their abdomen, which can also present as dot. The body of an adult black widow female is about ½ inch long.
- Brown recluse spiders can be identified as golden brown with a dark violin/fiddle shape located on the top of the leg attachment region of the neck pointing backward toward the abdomen and are approximately ¼ to ¾ inches long.

2.3.1 Project Pre-Planning and Spider Avoidance

Avoidance is the preferred management approach with respect to potential spider contact. Since spiders are commonly found outdoors underneath stones, hollow stumps, rodent burrows, sheds, wells, within undisturbed cluttered areas (even indoors) care needs to be made to encountering areas that cannot be easily seen. If workers are unable to completely avoid potential contact then the following should be done to limit potential exposure:

- Remove well casings with tools, do not place hands in hidden areas that could harbor spider webs.
- Minimize empty spaces between stacked materials in the field.
- Remove leaves, tall grass and brush from areas surrounding work areas (to include residential sites), thereby potentially reducing spider habitat.
- Store apparel and outdoor equipment in tightly closed plastic bags.

2.3.2 Use of Personal Protective Equipment (PPE)

Where avoidance of spider habitats is not possible, employees must wear appropriate PPE to further prevent potential spider bites. Please reference sections 2.1.3, 2.1.4 and 2.1.5 as PPE requirements outlined in these sections will provide the level of protection necessary to minimize potential spider bites. Attention must be made to ensuring proper gloves are worn during intrusive work activities which would place hands in areas that cannot be visually inspected prior to hand placement (i.e. accessing wells).

2.3.3 Responding to Known or Suspected Spider Bites

The discovery of a spider bite on the skin where it likely occurred at work will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. Immediate notification to professional emergency services is essential to obtaining prompt medical care.

If you suspect you have been bitten by a spider while on the job and exhibit the following symptoms listed below contact must be made immediately as urgent professional medical care may be required.

- Black widow bites can be extremely painful or go unnoticed, displaying one/two bite marks with localized swelling, pain eventually progresses to the abdomen and back.
- Brown recluse bites can vary in severity from no pain to very severe, the bite will progress to become reddened within several hours resulting in a systemic reaction with 24-36 hours. Symptoms include restlessness, fever, chills nausea, weakness and joint pain. Tissue at the site of the bite will die due to necrosis over time.

2.3.3.1 First Aid

In addition to contacting the necessary personnel the following first aid measures should be carried out if bitten by a spider.

- Identify the type of spider if able to do so safely preserve the spider (i.e., by placing in a zip lock bag, envelope or jar) as this will be able to be used during identification as this will assist in medical treatment.
- Wash the area immediately with soap and water.
- Apply a cloth dampened with cold water or fill bag with ice and apply to the bite area to reduce swelling.
- Elevate the bite area if possible.
- Do NOT attempt to remove venom from the bite area.

2.4 Venomous Snakes

Venomous snakes can be found throughout the United States and include coral snakes, copperheads, cottonmouths/water moccasins and rattlesnakes. Below please find a table indicating the type of snake, visual description, geographic region and image to assist with identification of snakes in the field.

Type of Snake	Visual Description	U.S. Geographic Region	Visual
Coral Snake	Red, black and yellow. Red bands touch yellow bands. Adults 24 inches long.	Wooded, sandy, or marshy areas of the Southern U.S.	
Copperheads	Vary in color from reddish to golden tan. Colored bands are typically hourglass-shaped. Generally, 18-36 inches long.	Forests, rocky areas, swamps, or near sources of water in eastern states, extending west to Texas	

Type of Snake	Visual Description	U.S. Geographic Region	Visual
Cottonmouths/ Water Moccasins	Adult skin is dark tan, brown, or nearly dark black, with vague black or dark brown crossbands. Juveniles have a bold crossbanded pattern of brown or orange with a yellow tail. Adults 26-35 inches long.	Wetland areas, rivers, lakes, etc., in southeastern states	
Rattle Snake	There are many species, distinct identifier is use of their rattle/tail as a warning when they feel threatened. Size dependent on species can get up to 8 feet long.	Mountains, prairies, deserts, and beaches across U.S.	

2.4.1 Project Pre-Planning and Snake Avoidance

Avoidance is the preferred management approach with respect to snakes. Since snakes are commonly found outdoors underneath stones, hollow stumps, along rivers, swamps, marches, burrows, wells, within undisturbed cluttered areas (even indoors) care needs to be taken when encountering areas that cannot be easily seen. Additional guidance is listed below to assist with mitigating potential contact with snakes:

- Remove well casings with tools, do not place hands in hidden areas that could harbor snakes.
- Minimize empty spaces between stacked materials in the field.
- Remove leaves, tall grass and brush from areas surrounding work areas (to include residential sites), thereby potentially reducing snake habitat.
- Store apparel and outdoor equipment in tightly closed plastic bags.
- Never attempt to handle a snake directly.
- Avoid climbing on rocks or piles of wood and stay away from tall grass and piles of leaves where a snake may be hiding.

2.4.2 Use of Personal Protective Equipment (PPE)

Where avoidance of snake habitat is not possible, employees must wear appropriate PPE and take measures to prevent potential snake bites. Please reference section 2.1.4 as PPE requirements (excluding insecticides) to minimize potential snake bites. Heavy duty boots and pants must be worn as this area of the body will be more prone to potential snake bite. In addition, proper tools and gloves should be used during intrusive work activities which could place hands in areas that cannot be visually inspected prior to hand placement (i.e. accessing wells).

2.4.3 Responding to Known or Suspected Snake Bites

A snake bite will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. Immediate notification to professional emergency services is essential to obtaining prompt medical care. Signs and symptoms of a snake bite can vary considerably based on the type of snake, therefore a general list is provided below:

- A pair of puncture marks at the wound which are swollen and red.
- Severe pain at the site of the bite.
- Nausea and vomiting.
- Labored breathing (potential for breathing to stop).
- Disturbed vision.
- Increase in salivation and sweating.
- Numbness or tingling around the face and/or limbs.

2.4.3.1 First Aid

In addition to contacting the necessary personnel the following first aid measures should be carried out if bitten by a snake.

- Remain still and calm, additional movement and increased heart rate can spread venom throughout the body. Lay or sit down with the bite below the level of the heart.
- Wash the area immediately with soap and water.
- Cover the bite with a clean, dry dressing.

Do NOT do the following:

- Do not try to pick up or entrap the snake for identification purposes.
- Do not wait for symptoms to appear, seek medical attention immediately and notify Roux personnel immediately.
- Do not open the wound further or suck out venom.
- Do not apply ice or immerse the wound in water.
- Do not drink alcohol or caffeinated beverages.

2.5 Bees, Wasps, and Hornets

Bees, wasps, and hornets (stinging insects) can be found throughout the United States and include many difference species. These insects are most abundant and threatening during the warmer months. Stinging insects inflict harm by injecting venom through a stinger. The chemical makeups of their venom differ greatly between species, so a human's reaction to a sting can be variable. In general, wasps and hornets tend to be more aggressive than most bee species, and wasps can sting multiple times, while bees can only sting once.

2.5.1 Project Pre-Planning and Bee, Wasp, and Hornet Avoidance

Avoidance is the preferred management approach with respect to potential bee, wasp, and hornet contact. Stinging insects typical build nests and hives outdoors around sheds, wooden decks, flower beds, within stick-up and flush mount monitoring well casings, roof eaves, and trash cans, so care needs to be taken prior to entering certain work areas. Employees with a history of severe allergic reactions to insect bites or stings should consider carrying an epinephrine auto injector (EpiPen) and communicate their allergy with the OHSM and project teams prior to conducting field work.

If a work area cannot not be moved away from trigger locations, then the following should be done to limit attraction and potential exposure:

- Avoid excessive smelling perfumes, after shave, and deodorants.
- Property dispose of food waste and trash; excessive food waste can attract bees and wasps.
- Communicate with project team and OHSM any known sting allergies.
- Avoid bright colored clothing and floral patterns (when applicable).
- Remove well casings with tools, and allow adequate time to evaluate the presence of stinging insects prior to reaching into areas that could harbor hives or nests.
- Store apparel and outdoor equipment in tightly closed bins.
- Whenever possible, move work areas away from observed nests and hives.
- If a stinging insect lands on you, keep still or move slowly away. DO NOT SWAT at the insect, this will instigate aggression.

2.5.2 Use of Personal Protective Equipment (PPE)

Where avoidance of bees, wasps, and hornets is not possible, employees must wear appropriate PPE and take measures to prevent stings when encounters cannot be avoided. Gloves, long-sleeved shirts, and pants shall be worn to limit body areas susceptible to stings. Bee and wasp repellent sprays should be kept onsite if significant populations of nests and hives warrant treatment. Be sure to wear proper PPE (eye protection, nitrile gloves) when deploying such repellent sprays.

2.5.3 Responding to Known or Suspected Bee, Wasp, or Hornet Sting

A sting from any bee, wasp, or hornet requires adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. In the case of an employee with known bee or wasp sting allergies, immediate notification to professional emergency is required to ensure proper care. As mentioned in section 2.5, the venom associated with bees, wasps, and hornets can vary between species, as such, human reactions to stings can also vary. This fact can lead to instances with surprising allergic reactions.

Take immediate medical action if any of the following symptoms are observed:

- Severe swelling of the face, lips, or throat.
- Hives or inching in area of the body not affected by the sting.
- Breathing difficulties, such as wheezing or gasping.
- Dizziness.

- Sudden drop in blood pressure.
- Lightheadedness.
- Nausea or vomiting.

2.5.3.1 First Aid

If no severe allergic reactions are observed after a stinging encounter, and immediate professional medical treatment is deemed not warranted, the following personal medical treatment shall be conducted:

1. Remove the stinger by scraping a straight edge object across the wound.
2. Wash area thoroughly with soap.
3. Place ice wrap or washcloth or other suitable covering on the area of the sting for 10 minutes.
4. If needed, apply antihistamine to the affected area.

2.6 Scorpions

Scorpions are typically found in dry, arid desert regions of the southern and south western portions of the United States; however, some species can be found in grasslands, forests, and inside caves. Scorpions are nocturnal, and usually hide during the day and are active at night. During normal work hours, humans will typical encounter scorpions in their docile state often hidden away in dark enclosed features. They typically hide under rocks, wood, or anything else lying on the ground. Some species may also burrow into the ground. When threatened, a scorpion can choose to use either its pincers, or its venomous stinger to defend itself. The performance of either the pincers (pinchforce) or the stinger (venom strength) \ can depend on scorpion physical characteristics, like species, size and shape.

2.6.1 Project Pre-Planning and Scorpion Avoidance

General good housekeeping practices are the best way to avoid scorpion contact. When working and living in regions indigenous to scorpions, be sure to update the HASP and JSAs reflecting special conditions, and perform these general control measures to limit scorpion exposure:

- Shake out all clothing, boots, and hats prior to putting them on.
- Visually inspect vehicles prior to entry.
- Keep all equipment storage boxes and vehicles closed overnight.
- Employees with a history of severe allergic reactions to insect bites or stings should consider carrying an epinephrine auto injector (EpiPen) and communicate their allergy with the OHSM and project teams prior to conducting field work.
- Take caution prior to reaching hands into dark enclosed structures (monitoring well casings, drums, etc.).

2.6.2 Use of Personal Protective Equipment (PPE)

While avoidance is the best practice for dealing with scorpions, PPE is the last line of defense when scorpion encounters do occur. Gloves, long-sleeved shirts and pants shall be worn to limit body areas susceptible to stings. Care shall be taken to ensure all PPE is inspected prior to wear.

2.6.3 Responding to Known or Suspected Scorpion Sting

A scorpion sting requires adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. Immediate notification to professional emergency services is essential for proper medical care. Employees with a history of severe allergic reactions to insect bites or stings should consider carrying an epinephrine auto injector (EpiPen), and know how to administer the pen in case of emergency. Typical symptoms of a scorpion sting are as follows:

- A burning at the injection site, with very little swelling or inflammation.
- A positive “tap” test – Extreme pain when the sting site is tapped with a finger.
- Restlessness and convulsions.
- Inability to focus eyes.
- Staggering gait.
- Thick tongue sensation, with slurred speech and drooling.
- Muscle twitches.
- Abdominal pain and cramps.
- Respiratory depression.

2.6.3.1 First Aid

Scorpion stings can potentially be life threatening dependent on the scorpion species and/or personal human allergies. Immediately contact professional emergencies services and a poison control center following a scorpion pinch or sting. Prior to receiving professional medical advice to determine the next response action, the following actions should be taken:

- Apply ice to the sting site.
- DO NOT take any sedative antihistamines, as they can react negatively with the venom.
- Try to remain relaxed and calm.
- If possible, safely capture the scorpion for identification, this way proper anti-venom can be issued.

2.7 Poisonous Plants

The potential for contact with poisonous plants exists when performing fieldwork in a variety of areas although commonly found in undeveloped/wooded areas it can be present in urban environments. Poisonous plants come in a variety of shapes and sizes and have different modes of exposure (i.e. contact, ingestion, inhalation). For our purposes the major area of concern is contact with the sap oil of native poisonous plants which induces an allergic skin reaction. The major categories of native poisonous plants include poison ivy, poison oak and poison sumac.

2.7.1 Poison Ivy

Poison ivy is found across the United States, except California, Alaska and Hawaii. Poison ivy can be classified as eastern or western. Eastern poison ivy is typically a hairy, ropelike vine with three shiny green (red in fall) leaves budding from one small stem, whereas western poison ivy is a low shrub with three leaves that does not form a climbing vine.

2.7.2 Poison Oak

Poison Oak is classified into two categories based on geographic location as either Pacific or Atlantic. Pacific poison oak can be found in California, Nevada, Oregon, Washington and western Canada while Atlantic poison oak can be found in southeast states and as far west as Texas. Poison oak is typically a shrub with leaves of three (like poison ivy) and may have yellow or green flowers and clusters of green-yellow or white berries and pacific poison icy may be vine-like.

2.7.3 Poison Sumac

Poison sumac is present in eastern states and as far west as Texas. Poison sumac comes in the form of a woody shrub that has stems that contains 7-13 leaves arranged in pairs and may have a glossy, pale yellow, or cream-colored berries.

2.7.4 Exposure Types

Poisonous plants such as poison ivy/oak/sumac release oil (urushiol) when the leaf or parts of the plants are bruised, damaged and/or burned. The oil induces an allergic reaction when contact with skin, this exposure generally results in itchy red rash with bumps and/or blisters. Personnel need to take extra care with recognizing poisonous plants to avoid direct contact. There is also the possibility for indirect contact such as contaminating tools, or clothing and touching the contaminated site. Lastly, there is the potential for inhalation of particles containing oil from burning plants; however, this is less likely due to the nature of work performed.

2.7.5 Project Pre-Planning and Poisonous Plant Avoidance

Avoidance is the preferred management approach with respect to poisonous plants. Since poisonous plants are commonly found outdoors and in a variety of geographic locations (i.e. rural, suburban, urban) care needs to be taken when encountering areas which are overgrown especially if unable to clearly identify poisonous plants amongst other vegetation. Additional guidance is listed below to assist with avoidance of potential contact with poisonous plants:

- Avoid overgrown areas in which plants cannot be easily identified.
- After use, clean tools with rubbing alcohol or soap with lots of water. Wear appropriate PPE (i.e. nitrile gloves).
  - Urushiol can remain active on surfaces of objects for up to 5 years.
- Do not burn plants that may be poisonous.

2.7.6 Use of Personal Protective Equipment (PPE)

Where avoidance of poisonous plants is not possible, employees must wear appropriate PPE and take additional measures to prevent contact with poisonous plants. Please reference section 2.1.4 for PPE requirements (excluding insecticides) to minimize potential exposure to poisonous plants. In addition, barrier skin creams, such as lotion containing bentoquatum, can offer additional protection. Application of barrier creams should be administered as per manufacturers recommendations. Additionally, ensure tools and equipment are properly decontaminated in the case of potential contact with poisonous plants. Exposed clothing should be handled with appropriate gloves (i.e. nitrile gloves) and washed separately in hot water with detergent.

2.7.7 Responding to Known or Suspected Poisonous Plant Exposure

Exposure to poisonous plants will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. Signs and symptoms of exposure to poisonous plants can vary considerably based on the individual's sensitivity. Below please find general signs and symptoms associated with exposure to poisonous plants:

- Red rash within a few days of contact.
- Possible bumps, patches, streaks, or weeping blisters.
- Swelling and itching at the site.

2.7.7.1 First Aid

In addition to contacting the necessary personnel the following first aid measures should be carried out if exposed to poisonous plants:

- Immediately rinse affected area with rubbing alcohol, specialized poison plant washes and/or degreasing soap/detergent with copious amounts of water. Scrub underneath nails with a brush.
- Apply wet compress, calamine lotion, or over the counter (OTC) hydrocortisone. Follow directions of manufacturer, avoid applying to broken skin or open blisters.
- Take an OTC antihistamine such as diphenhydramine (Benadryl) to alleviate itching. Follow directions of manufacturer.
- Summon professional medical care immediately should someone suffer a severe allergic reaction such as swelling and/or difficulty breathing or has past medical issues surrounding exposure to poisonous plants.

2.8 Other Zoonotic Disease

Zoonotic diseases are caused by infections that shared between animals and people. These can be caused by a range of disease pathogens which include viruses, bacteria, fungi, and parasites. There is a wide list of zoonotic diseases which are prevalent however within this section we will be discussing primarily histoplasmosis and psittacosis.

2.8.1 Histoplasmosis

Histoplasmosis is an infectious disease which is caused by inhalation of Histoplasma capsulatum fungus spores. Instances of potential exposure can include encountering soils enriched with bat or bird excrement containing spores, which could include barnyards, chicken/turkey houses, construction sites and abandoned buildings. This disease is not contagious and cannot be transmitted from an infected to person or animal to someone else. Histoplasmosis primarily affects the lungs and symptoms can vary greatly. This fungus grows in soils throughout the world. The proportion of people infected is higher in central and eastern states. The fungus seems to grow best in soils which have elevated levels of nitrogen.

2.8.2 Psittacosis

Psittacosis is an infectious disease which is caused by inhalation of Chlamydia psittaci bacteria shed through bird excrement. Typically, these secretions dry and small dust particles which includes the bacteria can become airborne. Similar to histoplasmosis, typical areas of potential exposure could include barnyards, chicken/turkey houses, construction sites and abandoned buildings. This disease is not contagious and cannot be transmitted from an infected to person or animal to someone else. Histoplasmosis primarily affects the lungs and symptoms can vary which include fever and chills, headache, muscle aches and dry cough.

2.8.3 Project Pre-Planning

Avoidance is the preferred management approach with respect to exposure to bird and bat excrement. Since birds and bats are commonly found in a variety of geographic locations (i.e. rural, suburban, urban) care needs to be taken when encountering areas which have large populations of bats or birds. During the project planning phase make sure to take into account potential for colonies of bats or flocks of birds to be present. Should a colony of bats or flock of birds be discovered roosting in a building, immediate action should be taken to exclude the intruders by sealing entry points.

2.8.4 Controlling Aerosolized Dust

Next to avoidance the next best way to prevent potential exposure is to implement work practices and dust control methods that eliminate or reduce dust generation during work activities which may come into contact with impacted soil. For example, instead of dry sweeping or shoveling dusty material, wetting the area with a water spray can significantly reduce the amount of dust aerosolized. Dust mitigation plans shall be specified in the site-specific health and safety plan and/or job safety analysis.

2.8.5 Use of Personal Protective Equipment (PPE)

Where avoidance of soils impacted with bird and bat excrement is not possible, employees must wear appropriate PPE and take additional measures to prevent contact with impacted soils and dusts. Level D personal protective equipment along with disposable clothing and shoe coverings may be appropriate, however refer to your site-specific health and safety plan for further guidance. Additionally, the requirement for a NIOSH approved respirator may be necessary if identified consult with the Corporate Health and Safety Manager for further guidance.

2.8.6 Responding to Known or Suspected Zoonotic Exposure (Bird/Bat Excrement)

Exposure to impacted soil will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. Signs and symptoms of exposure to Histoplasma capsulatum fungus spores and Chlamydia psittaci bacteria can vary considerably based on the individual's sensitivity. Below please find general signs and symptoms associated with their exposures.

Histoplasmosis symptoms may appear 3 to 17 days after fungal spores are inhaled. Symptoms can include fever, cough, fatigue, chills, headache, chest pain and body aches. In immune-compromised individuals, histoplasmosis can develop into a long-term lung infection, or spread to other parts of the body such as the brain and spinal cord.

Psittacosis symptoms may appear within 5 to 14 days after exposure to the bacteria. In general, Psittacosis causes mild illnesses with the most common symptoms of headache, muscle aches, dry cough and fever and chills. In extreme cases it may result in pneumonia.

2.9 Additional Wildlife

The following subsections includes information on additional wildlife not previously covered that can be encountered by Roux staff during work activities. The following list is not meant to be all inclusive however provides general guidance and direction on how to avoid and what to do if encountered. These include dogs, alligators, bears and mountain lions. Based on the complexity standard PPE outlined within your project specific HASP shall be worn unless directed otherwise by this program.

2.9.1 Dogs

Wild and domestic dogs can be encountered at many of our worksites; they may express a variety of emotions (i.e. aggressive, playful or frightened). It is important to not approach these animals and keep a safe distance as dogs can be unpredictable.

2.9.1.1 Project Pre-Planning and Dog Avoidance

Avoidance is the preferred management approach with respect to dogs. Since dogs are commonly found in outdoor settings and can cover large territories careful pre-planning is essential to understanding inherent risks of outdoor work areas. Additional guidance is listed below to assist with mitigating potential contact with dogs and ensure not to get bitten:

- Don’t run past a dog as it is the dog’s instinct to chase and catch you.
- If a dog exhibits aggressive behavior, don’t scream. Avoid eye contact and attempt to remain motionless until the dog leaves, and then back away slowly until the dog is out of sight.
- Don’t approach a strange dog, especially one that is tethered or confined.
- Always have an out, understand your environment and utilize high ground or place material between yourself and the dog should a dog attack you.

2.9.1.2 Responding to a Dog Bite

Exposure to dog bites will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. Immediate notification to professional emergency services is essential to obtaining prompt medical care.

2.9.2 Alligators

Alligators and crocodiles can be found in various regions of North America. More specifically alligators can be found throughout the southeastern United States while crocodiles inhabit coastal areas such as southern Florida.

2.9.2.1 Project Pre-Planning and Crocodilian Avoidance

Avoidance is the preferred management approach with respect to alligators and crocodiles. Since these reptiles are commonly found in outdoor settings in southeastern United States careful pre-planning is essential to understanding inherent risks of performing work in such locations. Additional guidance is listed below to assist with mitigating potential contact with these reptiles and ensure not to get bitten:

- If seen do not provoke an alligator or crocodile.
- Avoid waters known to be home to alligators or crocodiles.

- Keep at least 30 feet away from an alligator or crocodile.

2.9.2.2 Responding to Alligator Bite

Exposure to bites will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. Immediate notification to professional emergency services is essential to obtaining prompt medical care.

2.9.3 Bears

Bears can be found in various regions of North America. For the purposes of this program the following bears will be addressed which are the American Black Bear and Grizzly/Brown Bear.

American Black Bear

The American Black Bear can be found in the east, along the west coast, Rocky Mountain region and in parts of Alaska. Black bears can also be found in a few small areas in the southwest and southeast.

Grizzly/Brown Bear

The Grizzly/Brown Bear can be found within northwestern portions of the United States, specifically Alaska, Idaho, Montana, Washington, Wyoming, and extending as far south as Yellowstone.

2.9.3.1 Project Pre-Planning and Bear Avoidance

Avoidance is the preferred management approach with respect to bears. Since bears are commonly found in various regions of United States. Careful pre-planning is essential to understanding inherent risks of performing work in such locations. Additional guidance is listed below to assist with mitigating potential bear attacks:

- Keep food storage organized and sealed.
- Never approach a bear or bear cub.
- Wear a bell or other noisemaker.
- Stay away from a bear's food supply.
- Carry bear pepper spray on you.

If encountered by a bear:

- Stay calm, speak in low tones as a scream or fast movement may trigger an attack.
- Travel in groups and make yourself look as large as possible (i.e. move to higher ground).
- Do NOT allow a bear to access food.
- Do NOT drop your pack if carrying.
- If the bear is stationary, move away slowly and sideways.
- Do NOT run, but if bear follows, stop and hold your ground.
- Leave the area or take a detour, or wait until the bear moves away. Always provide the bear an escape route.

If you are attacked by a bear:

- Use bear pepper spray to stop an aggressive, charging or attacking bear. If the bear does not concede use the following steps for each type of bear.
- **Brown/Grizzly Bears:** If you are attacked by a brown/grizzly bear, leave your pack on and **PLAY DEAD**. Lay flat on your stomach with your hands clasped behind your neck. Spread your legs to make it harder for the bear to turn you over. Remain still until the bear leaves the area. Fighting back usually increases the intensity of such attacks. However, if the attack persists, fight back vigorously. Use whatever you have at hand to hit the bear in the face.
- **Black Bears:** If you are attacked by a black bear, **DO NOT PLAY DEAD**. Try to escape to a secure place such as a car or building. If escape is not possible, try to fight back using any object available. Concentrate your kicks and blows on the bear's face and muzzle.

2.9.3.2 Responding to Bear Attacks

Attacks by a bear will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. Immediate notification to professional emergency services is essential to obtaining prompt medical care.

2.9.4 Mountain Lions

Mountain Lions can be found in various regions of North America, more specifically within the United States they are found predominately in Wyoming, California, parts of Texas and the Florida Everglades.

2.9.4.1 Project Pre-Planning and Mountain Lion Avoidance

Avoidance is the preferred management approach with respect to mountain lions. Since mountain lions are found in specific regions of United States careful pre-planning is essential to understanding inherent risks of performing work in such locations. Additional guidance is listed below to assist with mitigating potential mountain lion attacks:

- Do not corner a mountain lion.
- Make yourself look larger (i.e. seek higher ground, place arms overhead).
- Use a loud voice.
- Throw sticks or rocks.
- Carry pepper spray.

If you are attacked by a mountain lion:

- Use pepper spray to stop an aggressive, charging or attacking mountain lion.
- Do NOT run.
- Fight back.
- Protect your neck and head.
- Don’t play dead.

2.9.4.2 Responding to Mountain Lion Attacks

Attacks by a mountain lion will require adherence to the Incident Investigation and Reporting Program with all internal contacts being made through the standard notification protocol of the H&S Injury/Illness Notification Flowchart. Immediate notification to professional emergency services is essential to obtaining prompt medical care.

Appendix A - Definitions

Medical Treatment Treatment for an injury or illness related to Roux work activities that requires professional medical treatment beyond first aid. In the case of a work-related tick bite this includes any prescription including the use of antibiotics in response to the bite. This medical treatment classification will occur even if the antibiotics were prescribed merely for preventative treatment of a work-related tick bite (i.e., a suspected tick bite with no evidence or symptoms of disease).

Work-related Tick Bite A tick bite that occurs while working in a tick-infested work site containing a tick infected area. Any such tick bite would be identified within one day of working in the tick-infested area. There may be additional exceptions to this simple definition; therefore, it is imperative that the OHSM and CHSM be consulted immediately upon discovery of a potential tick bite. (Note: Any tick bite, or condition that develops due to a suspected tick bite, that may be attributable to contact with a tick outside of the work environment which would not be considered a work-related tick bite.)

Vectors Living organisms that can transmit infectious diseases between humans or from animals to humans. Many of these vectors are bloodsucking insects, which ingest disease-producing microorganisms during a blood meal from an infected host (human or animal) and later inject it into a new host during their subsequent blood meal. Ticks are considered a vector.

Appendix B - Permethrin Application Guidance [1]

Permethrin is registered with the EPA for use as an insecticide and repellent. Permethrin-treated clothing repels and kills ticks, chiggers, mosquitoes, and other biting and nuisance arthropods.

Clothing, hats, shoes, bed nets, jackets, and camping gear can be treated with permethrin for added protection. Permethrin should **NOT** be applied directly to the skin. Do **NOT** apply in a way that will allow for product to contact adults, children or pets either through direct contact or through drift. Remove pets and birds and cover fish aquariums before surface applications if using spray.

Ensure application of clothing occurs in a well-ventilated outdoor area protected from wind and lay out entire outfit to be treated. Gloves and safety glasses should be worn during the application process. Apply permethrin to clothing following manufacturer instructions. Once outfit is completely treated hang clothing to air-dry. The manufacturer will specify dry times however to ensure clothing is dried completely, Roux recommends all clothing and other items be treated 24–48 hours in advance of work to allow them to fully dry before handling and wearing.

Permethrin-treated materials retain repellency or insecticidal activity after repeated laundering but should be retreated, as described on the product label, to provide continued protection. Clothing that is pretreated prior to purchase has efficacy through 70 launderings.

Products such as Permanone and Sawyer, Permethrin, Repel, and Ultrathon Permethrin Clothing Treatment are registered with EPA specifically for use by consumers to treat clothing and gear. Alternatively, clothing pretreated with permethrin is commercially available, marketed to consumers in the United States as Insect Shield, BugsAway, or Insect Blocker.

[1] U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, "CDC Health information for International Travel 2018 (Yellow Book)."

Appendix C - Insect Repellent Guidance [2]

Always follow label directions and precautions when using insect repellent. When used as directed, products containing DEET are proven safe and effective. To avoid reaction to DEET or other ingredients in insect repellents, always read and follow the directions before use.

Choose a repellent that provides enough protection for time that you will be outdoors. The more active ingredient a repellent contains, the longer time it can protect you from potential bites. For example, 5% DEET will provide mosquito bite protection for one hour in comparison with 24% DEET for up to 5 hours. Studies suggest that concentrations of DEET above approximately 50% do not offer a marked increase in protection time against mosquitoes; DEET efficacy tends to plateau at a concentration of approximately 50%.

Do NOT spray insect repellent on skin that is under clothing. Do NOT apply insect repellent to skin that is already irritated, or to cuts/lacerations. Do NOT spray aerosol or pump products in enclosed areas. Do NOT spray a pump or aerosol product directly on the face. Do NOT apply DEET to clothing.

After returning indoors and before eating, drinking, or smoking, use soap and water to wash skin that has been treated with insect repellent. Reapply repellent when returning outdoors or after eating.

Outdoor workers may need to use sunscreen in conjunction with insect repellent. Repellents that are applied per label instructions may be used with sunscreen with no reduction in repellent activity. However, limited data show a one-third decrease in the sun protection factor (SPF) of sunscreens when DEET containing insect repellents are used after a sunscreen is applied. Products that combine sunscreen and repellent are not recommended, because sunscreen may need to be reapplied more often and in larger amounts than needed for the repellent component to provide protection from biting insects. The best option is to use separate products, applying sunscreen first and then applying the repellent.

[2] U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, "CDC Health information for International Travel 2018 (Yellow Book)."

APPENDIX H

Subsurface Utility Clearance Management Program

SUBSURFACE UTILITY CLEARANCE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**01/19**
REVISION NUMBER	**:**	**2**

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APPENDICES

1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, “Roux”) has instituted the following program for completing proper utility mark-outs and for conducting subsurface clearance activities. This establishes a method to ensure, to the greatest extent possible, that utilities have been identified and contact and/or damage to underground utilities and other subsurface structures will be avoided.

2. SCOPE AND APPLICABILITY

The Subsurface Utility Clearance Management Program applies to all Roux employees, its contractors and subcontractors. Employees are expected to follow this program for all intrusive work involving Roux or other personnel (e.g., contractors/subcontractors) working for Roux unless the client’s requirements are more stringent. Deviation from the program regardless of the specific work activity or work location must be pre-approved based on client’s site knowledge, site experience and client’s willingness for the use of this program. Any and all exceptions shall be documented and pre-approved by the Project Principal and the Office Manager.

3. PROCEDURES

3.1 Before Intrusive Activities

During the project kick-off meeting for intrusive activities the PM will review the Roux Subsurface Utility Clearance Checklist and Utility Verification (Appendix C) / Site Walkthrough Record (Appendix D) and the below bullet points with the project field team:

(Please note that these are intended as general reminders only and should not be solely relied upon.)

- Ensure the Mark-out / Stake-out Request Information Sheet (or one-call report) is complete and accurate for the site including address and cross streets and review for missing utilities. (Note: utility mark-out organizations do not have contracts with all utilities and it is often necessary to contact certain utilities separately such as the local water and sewer authorities).
- Have written confirmation prior to mobilizing to the site that the firm or Roux personnel performing the intrusive activity has correctly completed the mark-out notification process including requesting mark-outs, waiting for mark-outs to be applied to ground surfaces at the site, and receiving written confirmation of findings (via fax or email) from utility operators for all known or suspected utilities in the proposed area of intrusive activity, and provided utility owner written confirmation to Roux personnel for review and project files documentation.
- Do not begin any intrusive activity until all utilities mark-out has been completed (i.e., did all utilities mark-out the site?) and any unresolved mark-out issues are finalized. Perform a site walk to review the existing utilities and determine if said utilities have been located by the utility locators.

  (Note: The Tolerance Zone is defined as two feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks and other non-cylindrical utilities) of a utility and two feet from the outside edge of any subsurface structure.)
- Install Pre-Clearance exploratory test holes (e.g., hand-dug test holes or other soft digging techniques) for the first 5-ft below land surface (BLS) at each location prior to conducting mechanized intrusive activities. The size of the pre-clearance exploratory test hole should be at a minimum twice the diameter of any downhole tool or boring device. (Note: Pre-Clearance exploratory test holes should be defined in the SOW/proposal provided to the client to prevent project delays and to allow adequate time for PM and PP to evaluate alternative approaches for the project. Alternative approaches will need to be pre-approved by the OM.

- For excavations, all utilities need to be marked and then exposed by hand following the protocols in this program. Pre-clearing for excavations may be performed by the “moat” technique (i.e., soft digging around the perimeter). In these cases, dig in small lifts (<12” for first 5 feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes performed to expose the utility. Once structures have been verified a minimum clearance of two feet must be maintained between the utility and any powered equipment.
- In addition, the following activities should be conducted:
  - Review the work scope to be performed with the site owner/tenant to determine if it may impact any utilities;
  - Attempt to procure any utility maps or historic drawings of subsurface conditions of the site;
  - **Determine the need for utility owner companies to be contacted or to have their representatives on site**;
  - Where mark-outs terminate at the property boundary, consider the use of private utility locating / GPR / geophysical-type services which may be helpful in locating utilities. Use of private utility locating firms, however, does not eliminate the legal requirement for the Excavator firm to submit a request for Public Utility Mark-outs. Also, the information provided by the service may be inaccurate and unable to locate subsurface utilities and structures in urban areas, landfills, urban fill areas and below reinforced slabs, etc. They should not be relied upon as the only means of performing utility clearance;
  - Documented description of the dig site which is included in the projects Health and Safety Plan (HASP) and one call report will be maintained in the field and distributed amongst Roux personnel its contractors and subcontractors; and
  - Documentation of the actual placement of mark outs in the field shall be collected using dated pictures, videos and/or sketches with distance from markings to fixed objects. All documentation shall be maintained within the project file.

3.2 During Intrusive Activities

The PM, field team lead or personnel performing oversight is to:

- Ensure the mark-out remains valid. (In certain states there are limits regarding the duration of time after the mark-out was applied to the ground surface work can be started or interrupted.) Additionally, the mark-outs must be maintained, documented, and in many cases refreshed periodically to be considered valid, this will be accomplished through calls to the one call center.
- Ensure intrusive activities are only performed within the safe boundaries of the mark-out as detailed in the One-Call Report.
- Halt all work if intrusive activities have resulted in discovery of an unmarked utility. Roux personnel shall notify the facility owner/operator and the one call center. All incidents such as this will be reported as per Roux Incident Investigation and Reporting Management Program.
- Halt all work if intrusive activities must take place outside of the safe boundaries of a mark-out and only proceed after new mark-outs are performed.
- Halt the intrusive activities and immediately consult with the PP if an unmarked utility is encountered.
- Completing any subsurface utility clearance incident reports that are necessary.

- If a utility cannot be found as marked Roux personnel shall notify the facility owner/operator directly or through the one call center. Following notification, the excavation may continue, unless otherwise specified in state law.
- Contractors/subcontractors must contact the one-call center to refresh the ticket when the excavation continues past the life of the ticket. Ticket life shall be dictated by state law however at a maximum ticket life shall not exceed 20 working days.

3.3 Stop Work Authority

Each Roux employee has Stop Work Authority which he or she will execute upon determination of any imminent safety hazard, emergency situation, or other potentially dangerous situation, such as hazardous weather conditions. This Stop Work Authority includes subsurface clearance issues such as the adequacy of a mark-out or identification during intrusive operations of an unexpected underground utility. Authorization to proceed with work will be issued by the PM/PP after such action is reviewed and resolved. The PM will initiate and execute all management notifications and contact with emergency facilities and personnel when this action is appropriate.

Appendix A - Definitions

Intrusive Work Activities	All activities such as digging or scraping the surface, including but not limited to, excavation, test pitting or trenching, soil vapor sampling or the installation of soil borings, soil vapor monitoring points and wells, or monitoring wells, and drilling within the basement slab of a recently demolished building.
Mark-out / Stake Out	The process of contracting with a competent and qualified company to confirm the presence or absence of underground utilities and structures. This process will clearly mark-out and delineate utilities that are identified so that intrusive work activities can be performed without causing disturbance or damage to the subsurface utilities and structures. After utility mark-outs are completed the soft digging will be completed prior to intrusive work.
Tolerance Zone	Defined as two feet on either side of the designated centerline of an identified utility, plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct backs and other non-cylindrical utilities) of that utility and two feet from the outside edge of any subsurface structure.
Structure	For the purpose of this program a structure is defined as any underground feature that may a present potential source(s) of energy such as, but not limited to, utility vaults, bunkers, piping, electrical boxes, wires, conduits, culverts, utility lines, underground tanks and ducts.
Soft Digging	The safest way to remove material from unknown obstructions or services is by using tools such as a vactor or air knife, non-mechanical tools, or hand tools. The methods are clean and non-evasive and used for uncovering and exposing buried services, excavating and for providing a quick method of soil removal from sensitive areas.
Verification	Exploratory test-hole dug with hand tools within the Tolerance Zone to expose and verify the location, type, size, direction-of-run and depth of a utility or subsurface structure. Vacuum excavation (soft dig) methods can further facilitate exposure of a subsurface utility and accurately provide its location and identification prior to intrusive work approaching the Tolerance Zone.

Appendix B - Example of Completed One Call Report

Example Completed One-Call Report

New York 811

Send To: C_EMAIL Seq No: 744

Ticket No: 133451007 ROUTINE

Start Date: 12/16/13 Time: 7:00 AM Lead Time: 20

State: NY County: QUEENS Place: QUEENS
Dig Street: 46TH AVE Address:
Nearest Intersecting Street: VERNON BLVD
Second Intersecting Street: 11TH ST

Type of Work: SOIL BORINGS
Type of Equipment: GEOPROBE
Work Being Done For: ROUX

In Street: X On Sidewalk: X Private Property: Other:
On Property Location if Private: Front: Rear: Side:

Location of Work: MARK THE ENTIRE NORTH SIDE OF THE STREET AND SIDEWALK OF:
46TH AVE BETWEEN VERNON BLVD AND 11TH STREET

Remarks:

Nad: Lat: Lon: Zone:
ExCoord NW Lat: 40.7475399 Lon: -73.9534811 SE Lat: 40.7457406 Lon: -73.9493680

Company : ZEBRA ENVIROMENTAL Best Time: 6AM-5PM
Contact Name: DAVID VINES Phone: (516)596-6300
Field Contact: DAVID VINES Phone: (516)596-6300
Caller Address: 30 N PROSPECT AVE Fax Phone: (516)596-4422
LYNBROOK, NY 11563
Email Address: david@zebraenv.com

Additional Operators Notified:
ATTNY01 AT&T CORPORATION (903)753-3145
CEQ CONSOLIDATED EDISON CO. OF N.Y (800)778-9140
MCINY01 MCI (800)289-3427
PANYNJ01 PORT AUTHORITY OF NY & NJ (201)595-4841
VZQ VERIZON COMMUNICATIONS (516)297-1602

Link to Map for C_EMAIL: http://ny.itic.occinc.com/XGMZ-DF2-L23-YAY

Original Call Date: 12/11/13 Time: 1:15 PM Op: webusr
IMPORTANT NOTE: YOU MUST CONTACT ANY OTHER UTILITIES DIRECTLY

Appendix C - Roux Subsurface Utility Clearance Checklist

Roux Subsurface Utility Clearance Checklist ***Date of Revision – 12/3/14***

Work site set-up and work execution

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
Daily site safety meeting conducted, SPSAs performed, JSAs reviewed, appropriate work permits obtained.				
HASP is available and reviewed by site workers / visitors.				
Subsurface Utility Clearance Procedure has been reviewed with all site workers.				
Work area secured; traffic control established as needed. Emergency shut-off switch located. Fire extinguishers / other safety equipment available as needed.				
Utility mark-outs (public / private) clear and visible. Provide Excavator's Stake-Out Reference Number / Request Date / Time.				
Tolerance zone work identified.				
Work execution plan reviewed and adhered to (ground disturbance methods, clearance depths, any special utility protection requirements, or any other execution requirements; especially for Tolerance Zone work).				
Verbal endorsement received from Roux PM for any required field deviations to work execution plan.				

<u>Key reminders for execution</u>:

The Subsurface Utility Clearance Protocol should be referenced to determine all requirements while executing subsurface work. The bullet points below are intended as general reminders only and should not be solely relied upon.

- Tolerance zone is defined as two feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks and other non-cylindrical utilities) of a utility and two feet from the outside of any subsurface structure.
- Install Pre-Clearance exploratory test holes (e.g., hand-dug test holes or vacuum excavation) must be performed for the first five feet below land surface (BLS) at each location prior to conducting mechanized intrusive activities. The size of the pre-clearance exploratory test hole should be at a minimum twice the diameter of any downhole tool or boring device. (Note: Pre-clearance exploratory test holes should be defined in the SOW/proposal provided to the client to prevent project delays and to allow adequate time for PM and PP to evaluate alternative approaches for the project. Alternate approaches will need to be pre-approved by the OM.
- For excavations, all utilities need to be marked and then exposed by hand following the protocols in this program. Pre-clearing for excavations may be performed by the "moat" technique (i.e., soft

digging around the perimeter). In these cases, dig in small lifts (<12" for first five feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes to expose the utility. Once structures have been verified a minimum clearance of two feet must be maintained between the utility and any powered equipment.

Appendix D - Utility Verification/Site Walkthrough Record

Employee Name:____

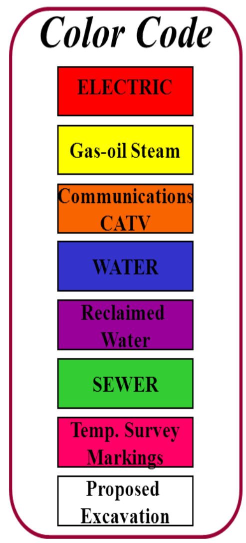
Date: ____

Instructions: For each utility suspected at the job site, indicate location on the job site, approximate burial depth, and means of detecting the utility. Leave blank if that utility is not believed to be present.

Utility	Description of Utility Location Identified Onsite	Approx. Depth (bls)	Method / Instrumentation used to determine Utility Location	Utility Owner Response (Date/Time)	Mark Out Indicates (Clear / Conflict)
Electrical Lines					
Gas Lines					
Pipelines					
Steam Lines					
Water Lines					
Sanitary and Stormwater Sewer lines					
Pressured Air-Lines					
Tank Vent Lines					
Fiber Optic Lines					
Underground Storage Tanks					
Phone Lines/ Other					

* bls - below land surface

Site Sketch Showing Utilities:



Other Comments / Findings:

Completed by: ____________________

Signature: ____________________ Date: __________

Subsurface Utility Clearance Checklist

Date of Revision – 07/10/2020

Work site set-up and work execution

ACTIVITY	Yes	No	N/A	COMMENTS INCLUDING JUSTIFICATION IF RESPONSE IS NO OR NOT APPLICABLE
Daily site safety meeting conducted, SPSAs performed, JSAs reviewed, appropriate work permits obtained.				
HASP is available and reviewed by site workers / visitors.				
Subsurface Utility Clearance Procedure has been reviewed with all site workers.				
Work area secured; traffic control established as needed. Emergency shut-off switch located. Fire extinguishers / other safety equipment available as needed.				
Utility mark-outs (public / private) clear and visible. Provide Excavator's Stake-Out Reference Number / Request Date / Time.				
Tolerance zone work identified.				
Work execution plan reviewed and adhered to (ground disturbance methods, clearance depths, any special utility protection requirements, or any other execution requirements; especially for Tolerance Zone work).				
Verbal endorsement received from Roux PM for any required field deviations to work execution plan.				

Key Reminders for Execution:

The Subsurface Utility Clearance Protocol should be referenced to determine all requirements while executing subsurface work. The bullet points below are intended as general reminders only and should not be solely relied upon.

- Tolerance zone is defined as two feet plus half of the diameter or half of the greatest dimension (for elliptical sewers, duct banks and other non-cylindrical utilities) of a utility and two feet from the outside of any subsurface structure.
- Install Pre-Clearance exploratory test holes (e.g., hand-dug test holes or vacuum excavation) must be performed for the first five feet below land surface (BLS) at each location prior to conducting mechanized intrusive activities. The size of the pre-clearance exploratory test hole should be at a minimum twice the diameter of any downhole tool or boring device. (Note: Pre-clearance exploratory test holes should be defined in the SOW/proposal provided to the client to prevent project delays and to allow adequate time for PM and PP to evaluate alternative approaches for the project. Alternate approaches will need to be pre-approved by the OM.
- For excavations, all utilities need to be marked and then exposed by hand following the protocols in this program. Pre-clearing for excavations may be performed by the "moat" technique (i.e., soft digging around the perimeter). In these cases, dig in small lifts (<12" for first five feet) using a dedicated spotter.) For Tolerance Zone work, unless otherwise agreed upon with the Utility Operator, work within the tolerance zone requires verification by means of hand-dug test holes to expose the utility. Once structures have been verified a minimum clearance of two feet must be maintained between the utility and any powered equipment.

Utility Verification/Site Walkthrough Record

Employee Name:____

Date: ____

Instructions: For each utility suspected at the job site, indicate location on the job site, approximate burial depth, and means of detecting the utility. Leave blank if that utility is not believed to be present.

Utility	Description of Utility Location Identified Onsite	Approx. Depth (bls)	Method / Instrumentation used to determine Utility Location	Utility Owner Response (Date/Time)	Mark Out Indicates (Clear / Conflict)
Electrical Lines					
Gas Lines					
Pipelines					
Steam Lines					
Water Lines					
Sanitary and Stormwater Sewer lines					
Pressured Air-Lines					
Tank Vent Lines					
Fiber Optic Lines					
Underground Storage Tanks					
Phone Lines/ Other					

* bls - below land surface

APPENDIX I

COVID-19 Interim Health and Safety Guidance

COVID-19 INTERIM HEALTH AND SAFETY GUIDANCE

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**03/2020**
REVISION DATE	**:**	**06/11/2021**
REVISION NUMBER	**:**	**7**

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1. PURPOSE

This guidance has been implemented to establish work practices, administrative procedures, and engineering controls to minimize potential exposure to SARS-CoV-2, the virus that causes COVID-19. The following guidance has been developed based on local, state and federal recommendations/requirements regarding COVID-19. The purpose of this document is to supplement existing site-specific Health and Safety Plans (HASPs) and provide interim health and safety guidance to minimize potential exposure to SARS-CoV-2. Should additional scientific information or regulatory information change, this document shall be updated accordingly.

2. SCOPE AND APPLICABILITY

This guidance covers all Roux employees and the subcontractors that Roux oversees. Site specific HASPs shall be developed to incorporate elements of mitigative measures against COVID-19 exposure. If work cannot be carried out in compliance with this guidance, the project shall be further evaluated by the Project Principal (PP), Office Manager (OM), and Corporate Health and Safety Director (CHSD) prior to work authorization.

Roux subcontractors are required to review, comply with, and implement Roux's COVID-19 Interim Health and Safety Guidance while on Site. Subcontractors may implement additional preventative measures as they see fit. All work shall be conducted in a manner consistent with the federal, state, and local guidance as it relates to COVID-19.

3. BACKGROUND

What is COVID-19?

COVID-19 is a respiratory illness that can spread from person to person. The virus that causes COVID-19 is a novel coronavirus that was first identified during an investigation into an outbreak in Wuhan, China. This virus continues to spread internationally and within the United States. Multiple variants of the virus that causes COVID-19 are circulating globally. There are currently several vaccines which have been developed which are authorized, recommended and effective at protecting you from getting sick.

What are the symptoms of COVID-19?

Reported illnesses have ranged from mild symptoms to severe illness and death for confirmed COVID-19 cases. Symptoms may appear 2 to 14 days following exposure to the virus. People with these symptoms or combinations of symptoms may have COVID-19:

- Fever or chills
- Cough
- Shortness of breath or difficulty breathing
- Fatigue
- Muscle or body aches
- Headache
- New loss of taste or smell
- Sore throat
- Congestion or runny nose
- Nausea or vomiting
- Diarrhea

This list is not all possible symptoms. The CDC will continue to update this list as they learn more about the virus. For an updated symptom list please reference the following link for CDC Symptoms of Coronavirus.

If someone develops emergency warning signs for COVID-19, they should be instructed to get medical attention immediately. Emergency warning signs can include those listed below; however, this list is not all inclusive. Please consult your medical provider for any other symptoms that are severe or concerning.

- Trouble breathing
- Persistent pain or pressure in the chest
- New confusion
- Inability to wake or stay awake
- Pale, gray, or blue-colored skin, lips, or nail beds, depending on skin tone

How does COVID-19 spread?[1]

Individuals who are within close contact (within 6 feet) of a person with COVID-19 or have direct contact with that person are at greatest risk of infection.

- When people with COVID-19 cough, sneeze, sing, talk, or breathe they produce respiratory droplets. These droplets can range in size from larger droplets (some of which are visible) to smaller droplets. Small droplets can also form particles when they dry very quickly in the airstream.
- Infections occur mainly through exposure to respiratory droplets when a person is in close contact with someone who has COVID-19.
- Respiratory droplets cause infection when they are inhaled or deposited on mucous membranes, such as those that line the inside of the nose and mouth.
- As the respiratory droplets travel further from the person with COVID-19, the concentration of these droplets decreases. Larger droplets fall out of the air due to gravity. Smaller droplets and particles spread apart in the air.
- With passing time, the amount of infectious virus in respiratory droplets also decreases.

Transmission of SARS-CoV-2 from inhalation of virus in air farther than six feet from an infectious source can occur.

Some infections can be spread by exposure to virus in small droplets and particles that can linger in the air for minutes to hours. These viruses may be able to infect people who are further than 6 feet away from the person who is infected or after that person has left the space. This kind of spread is referred to as **airborne transmission** and is an important way that infections like tuberculosis, measles, and chicken pox are spread.

- There is evidence that under certain conditions, people with COVID-19 seem to have infected others who were more than 6 feet away. These transmissions occurred within enclosed spaces that had inadequate ventilation. Sometimes the infected person was breathing heavily, for example while singing or exercising.
    - Under these circumstances, scientists believe the amount of infectious smaller droplet and particles produced by the people with COVID-19 became concentrated enough to spread the virus to other people. The people who were infected were in the same space during the same time or shortly after the person with COVID-19 had left.
- Available data indicate it is much more common for the virus that causes COVID-19 to spread through close contact with a person who has COVID-19 than through airborne transmission.[2]

Per published reports, factors that increase the risk of SARS-CoV-2 infection under these circumstances include:

- Enclosed spaces with inadequate ventilation or air handling within which the concentration of exhaled respiratory fluids, especially very fine droplets and aerosol particles, can build-up in the air space.
- Increased exhalation of respiratory fluids if the infectious person is engaged in physical exertion or raises their voice (e.g., exercising, shouting, singing).
- Prolonged exposure to these conditions, typically more than 15 minutes.

Spread from contact with contaminated surfaces or objects is less common.

Respiratory droplets can also land on surfaces and objects. It is possible that a person could get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or eyes. Spread from touching surfaces is not thought to be a common way that COVID-19 spreads.

1 How COVID-19 Spreads https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html#edn1

2 Scientific Brief: SARS-CoV-2 and Potential Airborne Transmission | CDC https://www.cdc.gov/coronavirus/2019-ncov/more/scientific-brief-sars-cov-2.html

4. TRAINING REQUIREMENTS

All employees with potential exposure to COVID-19 shall be provided training that incorporates COVID-19 exposure mitigation strategies, such as implementation of proper social distancing, personal hygiene (e.g., handwashing), as well as disinfection procedures, as outlined by CDC guidelines.

5. EXPOSURE RISK POTENTIAL

Worker risk of occupational exposure to COVID-19 can vary from very high, high, medium, or lower (caution) risk. This level of exposure is dependent on several factors, which can include industry type; need for contact within 6 feet of people known to be or suspected of being infected with COVID-19; density of work environment; and industrial setting (i.e., healthcare building, occupied interior work area, minimal ventilation).

Provided below is background risk level information taken from the U.S. Department of Labor Occupational Safety and Health Administration Guidance on preparing workplaces for COVID-19. Risk evaluations for each project shall be conducted by the PP and OM in consultation with the CHSD to ensure Roux employees and subcontractors remain within the lower exposure (caution) category. If it is identified there is a medium exposure risk or higher, further evaluation and mitigative measures shall be evaluated to reduce overall exposure risk prior to work authorization.

Very High Exposure Risk (Activities not conducted by Roux)

Very high exposure risk includes occupations/work activities with high potential for exposure to known or suspected sources of COVID-19 during specific medical, postmortem, or laboratory procedures. This can include but is not limited to:

- Healthcare workers (e.g., doctors, nurses, dentists, paramedics, emergency medical technicians) performing aerosol-generating procedures (e.g., intubation, cough induction procedures, bronchoscopies, some dental procedures and exams, or invasive specimen collection) on known or suspected COVID-19 patients.
- Healthcare or laboratory personnel collecting or handling specimens from known or suspected COVID-19 patients (e.g., manipulating cultures from known or suspected COVID-19 patients).
- Morgue workers performing autopsies, which generally involve aerosol-generating procedures on the bodies of people who are known to have, or suspected of having, COVID-19 at the time of their death.

High Exposure Risk (Activities not conducted by Roux)

High exposure risk occupations/work activities include exposure to known or suspected COVID-19 positive individuals. This can include but not limited to:

- Healthcare delivery and support staff (hospital staff who must enter patients' rooms) exposed to known or suspected COVID-19 patients.
- Medical transport workers (ambulance vehicle operators) moving known or suspected COVID-19 patients in enclosed vehicles.
- Mortuary workers involved in preparing bodies for burial or cremation of people known to have, or suspected of having, COVID-19 at the time of death.

- Those who have frequent or sustained contact with coworkers, including under close working conditions indoors or in poorly ventilated spaces in various types of industrial, manufacturing, agriculture, construction, and other critical infrastructure workplaces.
- Those who have frequent indoor or poorly ventilated contact with the general public, including workers in retail stores, grocery stores or supermarkets, pharmacies, transit and transportation operations, law enforcement and emergency response operations, restaurants, and bars.

Medium Exposure Risk

Medium exposure risk occupations/work activities include those that require frequent and/or close contact with (i.e., within 6 feet for a cumulative total of 15 minutes or more over a 24-hour period)) people who may be infected with COVID-19, but who are not known or suspected to be COVID-19 positive. For most of our worksites, it is assumed there is on-going community transmission for COVID-19. Therefore, workers who work at sites and may have contact with the general public, other contractors, high-population-density work environments (i.e., greater than 10 people) fall within medium exposure risk group category. This can include, but is not limited to, sampling events that require two or more workers to collect and log samples in close contact or work occurring in an interior space with limited ventilation and several workers present.

Lower Exposure Risk (Caution)

Lower exposure risk (caution) occupations/work activities are those that do not require close contact (within 6 feet for a cumulative total of 15 minutes or more over a 24-hour period) with other people. During these activities, there is limited contact (i.e., within 6 feet of) the general public or other workers. Workers in this category have minimal occupational contact with the public and other coworkers. This includes construction oversight that does not require close contact, sampling or gauging events performed by one worker and our remote workers as well as office workers who do not have frequent close contact with coworkers, clients, or the public.

6. CDC FULLY VACCINATED GUIDANCE

Roux has adopted the updated CDC guidance for those fully vaccinated, where state/local jurisdictions and clients allow. This is based on growing evidence that the vaccine is highly effective at protecting those vaccinated and preventing further spread. Roux Human Resources shall collect information on vaccination status of employees who have been vaccinated to make informed decisions and ensure conformance with state/local requirements, as appropriate. Should employees want to go without wearing a mask or applying social distancing, etc. they must provide proof of vaccination to Human Resources at HR@rouxinc.com.

In general, employees shall be considered fully vaccinated:

- 2 weeks after their second dose in a 2-dose series, such as the Pfizer or Moderna vaccines, or
- 2 weeks after a single-dose vaccine, such as Johnson & Johnson's Janssen vaccine.

If you do not meet these requirements, regardless of age, you are not fully vaccinated and are asked to continue to take all precautions until you are fully vaccinated.

If you have been fully vaccinated:

- You can resume activities without wearing a mask or staying 6 feet apart, except where required by federal, state, local, tribal, or territorial laws, rules, and regulations, including local business and workplace guidance.
- If you travel in the United States, you do not need to get tested before or after travel or self-quarantine after travel.

- You need to pay close attention to the situation at your international destination before traveling outside the United States.
  - You do NOT need to get tested before leaving the United States unless your destination requires it.
  - You still need to show a negative test result or documentation of recovery from COVID-19 before boarding an international flight to the United States.
  - You should still get tested 3-5 days after international travel.
  - You do NOT need to self-quarantine after arriving in the United States.
- If you have been around someone who has COVID-19, you do not need to stay away from others or get tested unless you have symptoms.

7. COVID-19 HEALTH SCREENING

7.1. Roux Employees

All Roux employees are required to self-attest to a COVID-19 Daily Health Questionnaire which is to be completed at home through a mobile application on scheduled workdays. The purpose of this program is to ensure business continuity as well as mitigate any potential exposure to our employees and others if it is determined employees are at-risk for contracting COVID-19. As part of this self-attestation, all employees are required to take their temperatures daily at home to confirm they do not have a fever (≥ 100.4). Employees who answer yes to any of these questions are instructed to contact their Office Manager and/or Department Head immediately and should not enter the office or go to a field site. Information shall be used to determine appropriate internal response in consultation with the Human Resources Director (HRD) and CHSD.

Below, you will find our COVID-19 Daily Health Questionnaire that all Roux employees are required to self-attest to **every scheduled workday by 9:30 AM.** If employees do not promptly fill out the questionnaire by the time listed above, there will be additional follow up by HR, H&S, and/or OMs.

According to the U.S. Centers for Disease Control and Prevention & the World Health Organization, COVID-19 Symptoms include:

- *Fever (≥100. 4°F) or chills*
- *Cough*
- *Shortness of breath or difficulty breathing*
- *Fatigue*
- *Muscle or body aches*
- *Headache*
- *New loss of taste or smell*
- *Sore throat*
- *Congestion or runny nose*
- *Nausea or vomiting*
- *Diarrhea*

Have you experienced any of the COVID-19 related symptoms noted above in the last 14 days? Please Note: We do not expect employees to answer "yes" to the symptoms question if these are symptoms you normally experience due to another condition or medication.

- *Yes*
- *No*

Have you been in close contact with someone who is suspected or confirmed to have COVID-19 or who is under investigation for COVID-19 within the last 14 days? * Close contact as defined by the CDC is being within 6 feet of someone who has COVID-19 for a cumulative total of 15 minutes or more over a 24-hour period.*

- *Yes*
- *No*

Have you traveled outside of the country, been on a cruise ship and/or traveled to areas within the United States which have state mandated travel restrictions in the last 14 days?

- *Yes*
- *No*

Have you tested positive for COVID-19 within the last 14 days?

- *Yes*
- *No*

7.2. Subcontractors

In an effort to mitigate the risk of transmission of COVID-19, Subcontractors who shall perform work onsite are required to attest to the fitness of their work crew on a daily basis. This requires each worker to self-assess by asking themselves the four questions listed in the section above and also contained within the Roux Subcontractor Work Crew COVID-19 Daily Health Attestation. If any crew member answers “Yes” to any of the questions, that worker is not to report to the field site and should seek proper medical advice in accordance with local, state and federal guidelines. In addition, the Sub-Contractor shall self-attest to vaccination status in order for the Field Team to ensure conformance with updated guidance for fully vaccinated individuals should state/local/client requirements allow. See Section 6. CDC Fully Vaccinated Guidance.

On a daily basis, the subcontractor supervisor must provide the Subcontractor Work Crew COVID-19 Daily Health Attestation complete with the names of all work crew fit to be on the Site for that day (i.e., who have answered “No” to all questions on the self-assessment) to Roux’s Project Manager or Site Supervisor. The Subcontractor must notify Roux if there have been any “Yes” responses daily. Subcontractors shall not be required to provide the name or any other personal information of any employee who has answered “Yes” to any of the self-assessment questions, however, the Subcontractor should provide the date and times that the employee has been onsite in the prior 14 days. Records shall be maintained within the project files indicating health screening has been performed, records shall be retained for not less than 14 days following the date of submission. The Roux Subcontractor Work Crew COVID-19 Daily Health Check Attestation can be found within Appendix A.

8. SELF-ISOLATION & QUARANTINE

8.1. Self-Isolation

What if I am asked to self-isolate at home and when can I return from home isolation?

Depending on the situation, if you are COVID-19 positive or suspected to have COVID-19, employees may be required to self-isolate in their homes, as per CDC or local health department guidelines. As per CDC guidance, return from isolation has been broken out into two categories. The first includes confirmed or suspected COVID-19 individuals exhibiting symptoms, and the second includes those who have not had COVID-19 symptoms (i.e., asymptomatic), but tested positive and are under self-isolation. Both categories, along with strategies to return from home isolation, are outlined below.

People with COVID-19 under home isolation:

Accumulating evidence supports ending isolation and precautions for persons with COVID-19 using a symptom-based strategy. Specifically, researchers have reported that people with mild to moderate COVID-19 remain infectious no longer than 10 days after their symptoms began, and those with more severe illness or those who are severely immunocompromised remain infectious no longer than 20 days after their symptoms began. Therefore, CDC has updated the recommendations for discontinuing home isolation as follows:

1. **Persons with COVID-19 who have symptoms** and were directed to care for themselves at home may discontinue isolation under the following conditions:
   a. At least 10 days* have passed since symptom onset;
   b. At least 24 hours have passed since resolution of fever without the use of fever-reducing medications; and
   c. Other symptoms of COVID-19 have improved.

   * *A limited number of persons with severe illness may produce replication-competent virus beyond 10 days, which may warrant extending the duration of isolation for up to 20 days after symptom onset. Consultation with your healthcare provider will be warranted in such cases of severe illness.*
2. **Persons infected with SARS-CoV-2 who never develop COVID-19 symptoms** may discontinue isolation and other precautions 10 days after the date of their first positive RT-PCR test for SARS-CoV-2 RNA.

8.2. Quarantine

Employees may be required to self-quarantine due to potential exposure with a suspected and/or confirmed COVID-19 positive individual as well as recent travel as per local/state guidelines. People in quarantine should stay home, separate themselves from others, monitor their health, and follow directions from their state or local health department.

8.2.1. Close Contact Quarantine

Employees who have come into close contact with someone who has COVID-19 are required to self-quarantine for 14 days following their last contact with the COVID-19 positive person. Close contact as defined by the CDC is being within 6 feet of someone who has COVID-19 for a cumulative total of 15 minutes or more over a 24-hour period. A person is still considered a close contact even if they were wearing a mask while they were around someone with COVID-19. Please note an infected person can spread SARS-CoV-2 starting from 2 days before they have any symptoms (or, for asymptomatic patients, 2 days before the positive specimen collection date) until they meet the criteria for discontinuing home isolation.

Employees who have been fully vaccinated (as per CDC guidance) or who were previously diagnosed with COVID-19 within the last three months and show no symptoms are not required to quarantine. If there is a need to reduce quarantine as allowed by local public health authorities, additional consultation with the HRD and CHSD shall occur in these circumstances.

8.2.2. Travel Related Quarantine/Testing

All travel out of state must be communicated with the OM and/or Department Head prior to departure. Please note, some federal/state/local entities require submissions of traveler health forms and potentially require additional testing for COVID-19. It is expected all Roux employees will comply with such federal/state/local travel requirements.

9. WORKPLACE CONTROLS

During the project planning phase, worksite evaluations shall be carried out by the PP and OM in consultation with the CHSD to determine risk exposure levels for work activities. If it is determined there is a medium exposure risk level or higher, additional workplace controls shall be evaluated and implemented as required in addition to the basic infection prevention measures outlined below in Section 10. Additional workplace controls can include engineering controls (i.e., ventilation, physical barriers), administrative controls (i.e., minimizing contact between workers, rotating shifts, site specific training), and additional personal protective equipment (i.e., respiratory protection). If exposure risk cannot be mitigated, potential project postponement may be necessary at the discretion of the OM in consultation with the CHSD.

A Job Safety Analysis (JSA) has been developed and is provided in Appendix B, which summarizes and applies concepts within this guidance, including the infection prevention measures listed below. This JSA shall be required for all fieldwork in areas where there is community-based transmission of COVID-19.

10. INFECTION PREVENTION MEASURES

The following is basic infection prevention and personal hygiene practices which shall be implemented for all Roux field activities as well as in the office setting.

- ***Personal Hygiene***
  - Wash your hands often with soap and water for at least 20 seconds.
    - If soap and water are not available, use an alcohol-based sanitizer that contains at least 60% alcohol.
    - Key times to wash your hands include after blowing your nose, coughing or sneezing, after using the restroom, and before eating or preparing food.
  - Do not touch your eyes, face, nose and mouth with unwashed hands.
  - Cover your mouth and nose with a tissue when you cough or sneeze or use the inside of your elbow.
  - Throw potentially contaminated items (e.g., used tissues) in the trash.
- ***Avoid Close Contact/Secondary Contact with People and Potentially Contaminated Surfaces***
  - Apply appropriate social distance (6+ feet), if unvaccinated.
  - Do not work in areas with limited ventilation with other Site workers (e.g., small work trailer which lacks HVAC system).
  - Morning tailgate/safety meetings are recommended to occur outside and not within work trailers.
  - Contact your lab/equipment vendor to confirm equipment is properly disinfected prior to being shipped.
  - Do not carpool with others unless all individuals are fully vaccinated and are comfortable with traveling together. In circumstances when carpooling is required and does not meet this criteria please consult with your OM and CHSD.
  - For company owned vehicles limit sharing of vehicles with coworkers. If unable to limit sharing of company owned vehicles, properly clean vehicle before driving with a focus on commonly touched surfaces (e.g., steering wheels, shifters, buttons, etc.).
  - Use caution when using public restrooms, portable toilets. Use paper towel as a barrier when touching door handles and faucets.
- ***Cleaning and Disinfecting***
  - Clean high touched surfaces daily. Examples of high-touch surfaces include: counters, tables, doorknobs, handles, stair rails, desks, toilets, faucets, and sinks. In most situations, regular cleaning (at least once a day) is enough to sufficiently remove virus that may be on surfaces. However, if certain conditions apply, you may choose to disinfect after cleaning. When there is no confirmed or suspected COVID-19 cases known to have been in a space, cleaning once a day is usually enough to sufficiently remove virus that may be on surfaces and help maintain a healthy facility.
  - Under certain circumstances additional cleaning and/or disinfection shall take place in shared spaces in consultation with the OM and CHSD. The following conditions will be evaluated to determine cleaning and/or disinfection frequency:
    - High transmission of COVID-19 within community,
    - Low number of unvaccinated people wearing masks,
    - Infrequent hand hygiene, or

    - The space is occupied by individuals at increased risk for severe illness.

The following below outlines cleaning and disinfection protocols for specific types of surfaces as required. Please consult with the CHSD when developing site-specific cleaning and disinfection protocols.

- ***Hard (Non-porous) Surfaces***
  - If surfaces are dirty, they should be cleaned with a detergent/soap and water prior to disinfection.
  - Refer to the manufacturer's instructions to ensure safe and effective use of the product and wear appropriate personal protective equipment (e.g., gloves, safety glasses, face shield).
  - Many products require:
    - Keeping surface wet for a period of time (i.e., contact time)
      - Refer to manufacturer's instructions outlining adequate contact time.
    - Precautions such as wearing gloves and making sure you have good ventilation during use of the product.
  - Disposable gloves should be removed aseptically and discarded after cleaning. Wash hands immediately following removal of gloves. Refer to Appendix C for how to remove gloves aseptically.
  - If products on EPA List N: Disinfectants for Coronavirus (COVID-19) are not available, bleach solutions can be used if appropriate for the surface and will be effective against coronaviruses when properly diluted.
    - Most household bleach contains 5%–9% sodium hypochlorite. Do not use a bleach product if the percentage is not in this range or is not specified, such as some types of laundry bleach or splash-less bleach as these are not appropriate for disinfection.
    - Follow the directions on the bleach bottle for preparing a diluted bleach solution. If your bottle does not have directions, you can make a bleach solution for disinfecting by mixing:
      - 5 tablespoons (1/3 cup) of bleach per gallon of room temperature water OR
      - 4 teaspoons of bleach per quart of room temperature water
    - Follow the manufacturer's application instructions for the surface. If instructions are not available, leave the diluted bleach solution on the surface for at least 1 minute before removing or wiping. This is known as the "contact time" for disinfection. The surface should remain visibly wet during the contact time.
    - Ensure proper ventilation during and after application (for example, open windows).
    - Never mix household bleach (or any disinfectants) with any other cleaners or disinfectants. This can cause vapors that may be very dangerous to breathe in.
    - Make a new diluted bleach solution daily. Bleach solutions will not be as effective after being mixed with water for over 24 hours. Products with EPA-approved emerging viral pathogen claims are expected to be effective against COVID-19. Follow the manufacturer's instructions for all cleaning and disinfecting products (e.g., concentration, application method and contact time, etc.).
- ***Soft (Porous) Surfaces***
  - For soft (porous) surfaces, remove visible contamination if present and clean with appropriate cleaners indicated for use on the surfaces. After cleaning:
    - Launder items as appropriate in accordance with the manufacturer's instructions. If possible, launder using the warmest appropriate water setting for the item and dry items completely; or
    - Use products with the EPA-approved emerging viral pathogens that claim they are suitable for porous surfaces.

- ***Electronics***
  - For electronics such as tablets, touch screens, keyboards, remote controls, etc. remove visible contamination if present.
    - Follow the manufacturer's instructions for all cleaning and disinfection products.
    - Consider use of wipeable covers for electronics.
    - If no manufacturer guidance is available, consider the use of alcohol-based wipes or sprays containing at least 70% alcohol to disinfect touch screens. Dry surfaces thoroughly to avoid pooling of liquids.
- ***Linens, Clothing, and Other Items that Go in the Laundry***
  - Although it is unlikely field clothing would become potentially contaminated with COVID-19, it is recommended that field staff regularly launder field clothing following any field event upon returning home.
  - In order to minimize the possibility of dispersing the virus from potentially contaminated clothing, do not shake dirty laundry.
  - Wash items as appropriate in accordance with the manufacturer's instructions. If possible, launder items using the warmest appropriate water setting for the items and dry items completely.
  - Clean and disinfect hampers or other containers used for transporting laundry according to guidance listed above.
- ***Office/Site Specific-Cleaning and Disinfection Protocols***
  - Each office and long-term field site has developed internal cleaning and disinfecting practices, which are broken into three categories: routine cleaning; enhanced cleaning and disinfecting; and deep cleaning and disinfecting.
  - In the instance there is someone who is suspected or confirmed positive for COVID-19 and has worked at the office or field site within the last 24 hours, deep cleaning and disinfecting shall be considered. The CHSD shall work with the OM and Office Health and Safety Manager (OHSM) to evaluate site-specific measures that shall be carried out prior to deep cleaning and disinfecting. If more than 24 hours have passed since the person who is sick or diagnosed with COVID-19 has been in the space, cleaning shall be carried out. You may choose to also disinfect depending on certain conditions and in consultation with the CHSD. If more than 3 days have passed since the person who is sick or diagnosed with COVID-19 has been in the space, no additional cleaning (beyond regular cleaning practices) is needed.
  - If deep cleaning and disinfection is carried out the following will be considered:
    - Closing off all areas potentially affected and wait at least several hours before you clean and disinfect.
    - Areas should remain closed off until cleaning and disinfecting takes place; if able, ventilation shall be increased in the space (e.g., opening doors, windows, increasing CFM).

11. CLOTH FACE COVERINGS

The CDC recommends the use of cloth face coverings/masks in public settings where other social distancing measures are difficult to maintain. Masks are required on planes, buses, trains and other forms of public transportation traveling into, within, or out of the United States and in U.S. indoor transportation hubs such as airports and stations. The use of cloth face coverings is to supplement and NOT replace the existing practices outlined above.

Based on existing studies and on-going recommendations and/or requirements from federal, state, and local entities, Roux is recommending the use of cloth face coverings, when appropriate. Appropriate use is defined when local authorities or clients require the use of cloth face coverings in conjunction with established social distancing, or if an employee elects to use a cloth covering on their own accord. Roux will provide cloth face coverings that shall meet the basic requirements outlined by the CDC guidance.

Cloth Face Coverings (i.e., masks) should:

- Have two or more layers of washable, breathable fabric;
- Completely cover the nose and mouth;
- Fit snugly against the sides of the face and not have any gaps; and
- Have a nose wire to prevent air from leaking out of the top of the mask.

When donning and doffing the cloth face covering, individuals should avoid touching their eyes, nose, and mouth. Following removal of the cloth face covering, employees should wash their hands immediately using the guidelines described in Section 10 Infection Prevention Measures-Personal Hygiene above. Cloth face coverings should be routinely washed depending on the frequency of use.

Additional information on improving the fit and filtration of your mask can be found at the following CDC website.

12. HOTEL SELECTION PROCESS AND OVERNIGHT/REMOTE WORK

Hotel Selection

If there is a project requiring the overnight stay at a hotel, accommodations shall be made only after the hotel and hotel's location have been vetted in accordance with Roux's established guidance as defined below. The Project Team, which includes the Project Manager (PM) and PP shall verify the hotel has appropriate protocols in place to limit the potential exposure and spread of COVID- 19 through proper cleaning and disinfection practices. Discussions with the hotel shall include, but are not limited to, measures taken to keep guests safe during their stay, guest room sanitization schedule, training of staff regarding disinfecting protocols using EPA-approved disinfectants, hotel staff fitness for duty requirements, etc. Some example questions are listed below.

Sample Questions for Evaluating Hotels

1. Is there an established COVID-19 guidance/policy your location is following?
2. What additional measures are being implemented to keep workers and customers safe?; (e.g. signs/placards, social-distancing/mask reminders)
3. Is there a guest room sanitization schedule?
4. Have staff been trained on properly cleaning/disinfecting areas?
5. What types of disinfectants are in use at your location?
6. How are you evaluating staff fitness for duty? (e.g., temperature checks, not reporting to work when sick, etc.)

Employees staying overnight should abide by the following guidance:

- Ensure you properly clean your room upon arrival, as appropriate. This should include a wipe down of all commonly touched surfaces. If disinfecting use appropriate PPE (e.g., nitrile gloves).
- Place the "Do Not Disturb" placard on the room while away and consider limiting hotel housekeeping service to the extent feasible (e.g., not having the room cleaned each day) to minimize potential secondary contact with others.
- Do not spend any more time in hotel common areas (i.e., lobby, hallways, etc.) than is necessary.
- Follow proper Infection Prevention Measures found within Section 10 above.

- If the hotel has a restaurant or café, do not have your meal in a common area; instead order food to be picked up or delivered to your room.
- Employees may also pick up food from takeout locations, order groceries or food for delivery to the hotel. Call local restaurants to order food for delivery (call the hotel lobby for recommendations) or use food ordering apps. Some apps have options for contactless delivery.

13. TRANSPORTATION-RENTAL CARS AND ROUX-OWNED VEHICLES

Rental Cars

If there is a project requiring the use of a rental car (e.g., truck/van), accommodations shall be made only after the rental car company and their store's location have been vetted in accordance with Roux's established guidance, as defined below. The Project Team (PM and PP) shall verify the rental company where you are picking up your vehicle has appropriate protocols in place to limit the potential exposure and spread of COVID- 19 through proper cleaning and disinfection practices. Discussions with the rental car company shall include, but are not limited to, measures to be taken to keep customers safe during pickup/drop-off, rental car disinfection protocols, training of staff regarding disinfecting protocols using EPA-approved disinfectants, rental car company staff fitness for duty requirements, etc. Some example questions are listed below.

Sample Questions for Evaluating Rental Car Companies

1. Is there an established COVID-19 guidance your location is following?
2. What additional measures are being implemented to keep workers and customers safe?
3. Is there a car sanitization schedule?
4. Have staff been trained on properly cleaning/disinfecting vehicles?
5. What types of disinfections are in use at your location?
6. How are you evaluating staff fitness for duty? (e.g., temperature checks, not reporting to work when sick, etc.)

Roux-Owned Vehicles

Roux-owned vehicles should be dedicated to individual employees to the extent feasible, and if authorized by the OM. In the case this cannot be accommodated, employees shall clean all high-touch surfaces (steering wheel, knobs, door handles, turn signals, radio, etc.). Wash hands or use hand sanitizer immediately after each episode of cleaning.

Carpooling

Do not carpool with others unless all individuals are fully vaccinated and are comfortable with traveling together. In circumstances when carpooling is required and does not meet this criteria please consult with your OM and CHSD.

APPENDIX A

Roux Subcontractor Work Crew
COVID-19 Daily Health Screening Questionnaire

Subcontractor Work Crew
COVID-19 Daily Health Attestation

Date:
Company Name:
Supervisor Name: Signature:
Project Name:
Site Address:
Number of Workers on site:
Prior to entry onto a field site, the following questions shall be asked by the Subcontractor Supervisor to their work crew. **Subcontractors and Field Teams shall self-attest to vaccination status in order to ensure compliance with state/local guidance for fully vaccinated and unvaccinated individuals.** It is preferred this questionnaire is completed for each individual prior to their arrival at the field site. If the answer to any of these questions is YES, the worker is not to report to the field site and seek proper medical advice, in accordance with CDC Guidelines. **The Subcontractor Supervisor must provide this form on a daily basis to the Roux primary contact for the project and notify Roux of any YES responses.**
1. Have you experienced any signs/symptoms of COVID-19 such as fever ($\geq$100.4^{o}F), cough, shortness of breath, chills, fatigue, muscle/body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea/vomiting or diarrhea in the last 14 days?
2. Have you been in close contact* with someone who is suspected or confirmed to have COVID-19 or who is under investigation for COVID-19 within the last 14 days? *Close contact as defined by the CDC is being within 6 feet of someone who has COVID-19 for a cumulative total of 15 minutes or more over a 24-hour period.
3. Have you traveled outside of the country, been on a cruise ship and/or traveled to areas within the United States which have state mandated travel restrictions in the last 14 days?
4. Have you tested positive for COVID-19 within the last 14 days?
Please list the crew member's names on site for the day.

1.	9.
2.	10.
3.	11.
4.	12.
5.	13.
6.	14.
7.	15.
8.	16.

APPENDIX B

Job Safety Analysis-Working in Areas Affected by COVID-19

JOB SAFETY ANALYSIS Ctrl. No. CVD-19	DATE: 06/11/2021	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)	
Generic	**Fieldwork**	**Working in Areas Affected by Coronavirus**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Kristina DeLuca	Health and Safety Specialist	Brian Hobbs	CHSD
REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT			
☐ LIFE VEST ☒ HARD HAT – In field ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES – In field	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES – Steel/composite toe in fie	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING – High visibility vest in field	☒ GLOVES – Leather/cut-resistant in field and nitrile as needed ☐ OTHER
REQUIRED AND / OR RECOMMENDED EQUIPMENT			
Cloth face covering, nitrile gloves, hand soap, water source, hand sanitizer, disinfectant spray and disinfectant wipes.			
Commitment to Safety – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.			
SOCIAL DISTANCING: Maintain 6' of distance between yourself and all other people at all times. If you do not believe the scope of work can be conducted while maintaining this distance, contact your Project Manager immediately.			

Assess **[1]JOB STEPS**	**Analyze** **[2]POTENTIAL HAZARDS**	**Act** **[3]CRITICAL ACTIONS**
1. Project Preplanning	N/A	• Review and follow COVID-19 CDC, Roux, Client and local orders/protocols. • Ensure all workers are fit for duty - anyone feeling sick should remain at home even if symptoms do not align with COVID-19. If a worker has been in contact with someone potentially positive or positive for COVID-19, contact your Office Manager. • Determine PPE needs and ensure adequate supply of disinfectant wipes/spray, soap and water or hand sanitizer at Site. Due to high demands and limited supply, plan ahead. • Use the minimum number of employees necessary to safely complete the work.
2. Mobilization	**Exposure:** Becoming infected or infecting co-workers	**Personal/Rental/Roux Owned Vehicle** • Do not carpool, unless all individuals are fully vaccinated. • Verify workers/other people are not approaching vehicle prior to exiting the vehicle. Maintain 6' of distance from general public, as appropriate. **Public Transportation** • Public transit should not be used unless absolutely necessary. Consider renting a car rather than taking public transit. If public transit is required, wear appropriate face covering/mask and apply social distancing (6 ft). Wash hands or use hand sanitizer immediately after. **Hotel Stay (Refer to COVID-19 H&S Guidance for more info)** • If a hotel stay is deemed necessary for the given field work, ensure that you clean your room upon initial arrival. • Place the "Do Not Disturb" placard on the room while away and limit housekeeping services to the extent feasible during your stay to minimize the reintroduction and spread of the virus from others.. Wash hands or use hand sanitizer often.
3. Tailgate Meeting	**Exposure:** Becoming infected or infecting co-workers	• Perform outside or indoors in areas with ample ventilation. • If unvaccinated, maintain at least a 6+ ft distance between you and others. • Discuss primary infection prevention measures listed below. • Discuss COVID-19 symptoms with coworkers and subcontractors to ensure fitness for duty. Anyone exhibiting signs or symptoms should be instructed to leave the Site, contact your Project Manager.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards, energy source; Energy Source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

4. Site Activities	**Exposure:** Becoming infected or i nfecting co-workers	• Coordinate field activities at the beginning of the day (i.e. Tailgate meeting) to minimize time spent in crowded spaces or overlap while completing job tasks. • Don cloth face coverings as appropriate. • Apply social distancing (6+ ft) when interacting with others if unvaccinated. If anyone comes within 6 ft of you while conducting work and your work prevents you from moving away, politely ask them to move back. If others are unable to move from your space, stop work and leave area. • Minimize shaking hands or touching others. • Minimize sharing of equipment or other items with co-workers and subcontractors unless wearing appropriate PPE (e.g. nitrile gloves), as appropriate. • If anyone is experiencing COVID-19 signs or symptoms in your vicinity, stop work and leave the area. • Do not work in areas with limited ventilation with others. • Cover your mouth and nose with tissue or paper towel or with your elbow when coughing or sneezing and wash hands or use hand sanitizer immediately after. If sick contact SHSO/PM and leave Site immediately. • Clean work surfaces/areas with approved cleaners you're responsible for (ex: desk, office doorknob, computer, etc.) at least daily. • Avoid public spaces and going out to eat by bringing your own lunch to the Site. If performing work in high density urban areas, it is recommended all food must be consumed at or in your vehicle or within designated work trailer. Wash hands or use hand sanitizer before eating and immediately after.

Primary Infection Prevention Measures

- Wash your hands often with soap and water for at least 20 seconds.
  - If soap and water are not available, use an alcohol-based sanitizer that contains at least 60% alcohol. Key times to wash hands include after blowing your nose, coughing or sneezing, after using the restroom, and before eating or preparing food.
- Do not touch your eyes, face, nose and mouth with unwashed hands.
- Cover your mouth and nose with a tissue when you cough or sneeze or use the inside of your elbow. Throw potentially contaminated items (e.g. used tissues) in the trash.
- Avoid close contact/secondary contact with people and potentially contaminated surfaces.
  - Apply appropriate social distance (6+ feet).
  - Minimize handshaking/touching others and use caution when accessing public spaces.
- Clean frequently touched surfaces daily. Commonly touched items can include but are not limited to tables, doorknobs, light switches, countertops, handles, desks, phones, keyboard, toilets, sinks and field equipment. If surfaces are dirty, they should be cleaned with soap and water prior to disinfection. If surface cannot be cleaned/disinfected, then wash hands or use sanitizer as soon as possible.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.
[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object;
Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy source – electricity, pressure, compression/tension.
[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

APPENDIX C

How to Remove Gloves

How to Remove Gloves

To protect yourself, use the following steps to take off gloves

Grasp the outside of one glove at the wrist.
Do not touch your bare skin.

Peel the glove away from your body,
pulling it inside out.

Hold the glove you just removed in
your gloved hand.

Peel off the second glove by putting your fingers
inside the glove at the top of your wrist.

Turn the second glove inside out while pulling
it away from your body, leaving the first glove
inside the second.

Dispose of the gloves safely. Do not reuse the gloves.

Clean your hands immediately after removing gloves.

APPENDIX J

Incident Management Program

INCIDENT INVESTIGATION AND REPORTING MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/19**
REVISION NUMBER	:	**4**

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Appendix B – Near Loss Form

Appendix C – Injury Illness Reporting Flow Chart

1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following management program for reporting Environmental Health and Safety (EHS) incidents and near losses, investigation and correcting the causes of incidents, tracking incidents and corrective actions taken, and sharing the cause and corrective actions with Roux personnel. These practices and procedures establish a method to track progress and improvements to the company EHS performance.

2. SCOPE AND APPLICABILITY

These procedures apply to all Roux employees. Employees are required to follow these procedures for all incidents involving Roux personnel, or other personnel (e.g., subcontractors) working for Roux, regardless of the specific work activity or work location.

This program is intended, in part, to fulfill the Occupational Safety and Health Administration (OSHA) occupational injury and illness reporting and recording requirements cited in the Code of Federal Regulations (CFR) at 29 CFR 1904.

3. RESPONSIBILITIES

It shall be the responsibility of all Roux employees to report all incidents as soon as possible to the PM (or Administrative Manager for office-related incidents), SHSO, OHSM and OM, regardless of severity. Additionally, the following positions have specific responsibilities for implementing this specific SOP.

3.1 Corporate Health and Safety Manager (CHSM)

- The CHSM has the responsibility of ensuring that a system is in place for reporting, investigation, correction, and communicating of EHS incidents and near losses.
- The CHSM has the overall responsibility of implementing and communicating the contents of this program to Office Health and Safety Managers (OHSMs).
- The CHSM will review all incidents and corrective actions taken. The CHSM will provide a summary of serious incidents to the Board of Directors.
- The CHSM will communicate learnings from incidents and corrective actions taken to all personnel, through quarterly communications.
- The CHSM will periodically review and evaluate the effectiveness of this procedure.

3.2 Office Manager (OM)

- The OM will designate the individual to serve as the OHSM responsibility for ensuring that requirements in this procedure are met.
- The OM will ensure that sufficient resources are allocated to fulfill the requirements of this procedure.
- The OM will conduct final review of all incident reports prepared under this procedure.

3.3 Office Health and Safety Manager (OHSM)

- It is the responsibility of the OHSM to review draft incident reports and assist the OM in finalizing reports of all accidents, illnesses and incidents related to work activity, and to assist the SHSO when necessary.

- The OHSM may not approve a site-specific HASP unless the HASP includes incident reporting procedures and forms.
- The OHSM will suggest and implement corrective actions to prevent the same type of incident from re-occurring.
- The OHSM will keep all incident reports, corrective action taken, and follow-up forms on file. The OHSM will provide copies of all final reports and forms to the CHSM within one week of the incident. If a serious incident occurs, the CHSM will be notified as soon as possible.
- The occurrence of a serious incident will trigger an EHS audit by the OHSM.

3.4 Project Manager (PM)

- It shall be the PM's responsibility to promptly correct any deficiencies that were determined to cause or contribute to the incident investigated.
- If a site-specific HASP is not utilized, the PM must ensure that field personnel have copies of the Roux Accident Reporting and Investigation Forms.
- The PM has the responsibility of ensuring that the SHSO and other field personnel understand the need for timely incident reporting.
- In the event of an incident, the PM will determine the root cause of the incident with the assistance of the SHSO and/or OHSM. The PM should provide input as to corrective preventative measures.

3.5 Site Health and Safety Officer (SHSO)

- The SHSO shall provide the details of the incident to the OHSM, PM and OM. The OM or his delegate will provide additional notifications, such as, in the event of a work-related motor vehicle accident, to include Roux Legal.
- It is the SHSO's responsibility to immediately notify the OHSM and the PM when any incident occurs. Such notification should take place immediately following the completion of any emergency actions required by the HASP.
- The SHSO should provide input as to corrective preventative measures.
- The SHSO must ensure that corrective actions proposed by the OHSM or OM are carried out.

3.6 All Personnel

- All personnel are responsible for reporting and describing the details of any incident in which they are involved to the SHSO and PM. Such notification should take place immediately following the completion of any emergency actions required by the HASP and after the loss and before the scene is disturbed or vehicles moved.

4. PROCEDURE

4.1 Incident Investigation

On receiving a report of incident or near loss occurrence from a Roux employee, the SHSO or OHSM shall immediately investigate the circumstances and shall make appropriate recommendations to prevent recurrence. The Incident Report form can be found in **Appendix A**, and Near Loss form can be found in **Appendix B**. The OHSM may participate in the investigation of more serious accidents and incidents that occur on-site. The Corporate Health and Safety Manager (CHSM) shall also be immediately notified by telephone on occurrence of a serious accident or incident. At the CHSM's discretion, he may also participate in the investigation.

4.2 Incident Report

Details of the incident shall be documented using the Accident Report and Investigation Forms (Appendix A) within twenty-four (24) hours of the incident and shall be distributed to the SHSO, the OHSM, PM, OM and the CHSM. The CHSM will update OSHA Forms 301 and the 300 log when necessary.

Appendix A – Accident Report and Investigation Form

☐ Roux Environmental Engineering and Geology, D.P.C.
☐ Roux Associates, Inc. ☐ Remedial Engineering, P.C.

ACCIDENT REPORT

Brian Hobbs, Corporate Health and Safety Manager
Cell: (631) 807-0193; Office: (631) 630-2416

PART 1: ADMINISTRATIVE INFORMATION

Project #: ____________________
Project Name: ____________________
Project Location (street address/city/state): ____________________

Client Corporate Name / Contact / Address / Phone #: ____________________

Immediate Verbal Notifications Given To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No
Client Contact	☐Yes	☐No

REPORT STATUS (time due):
☐ Initial (24 hr) Date: ________ ☐ Final (5-10 days) Date: ________

Accident Report Delivered To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No

REPORT TYPE: ☐ Loss ☐ Near Loss Estimated Costs: $ _____ _______

OSHA CASE # Assigned by Corporate Health & Safety if Applicable:

Corporate Health & Safety Confirmed Final Accident Report ☐Yes ☐No

DATE OF INCIDENT: ____________

TIME INCIDENT OCCURRED: ____________ ☐AM ☐PM

INCIDENT LOCATION – City, State, and Country (If outside U.S.A.) ____________

INCIDENT TYPES: (Select most appropriate if Loss occurred.)
From lists below, please select the option that best categories the incident. When selecting an injury or illness, also indicate the severity level.

☐**INJURY** ☐**ILLNESS**

------------------------**Severity Level**---------------------------

☐Fatality ☐First Aid ☐Medical Treatment
☐Restricted Work ☐Lost Time

OTHER INCIDENT TYPES

☐Spill / Release
Material involved: ____________
Quantity (U.S. Gallons): ____________

☐Misdirected Waste ☐Consent Order ☐NOV
☐Property Damage ☐Exceedance
☐Motor Vehicle ☐Fine / Penalty

ACTIVITY TYPE (Check most appropriate one.)

☐CAMP ☐Gauging ☐Subsurface Clearance
☐Construction ☐O&M ☐Trucking
☐Drilling ☐Other Soil Work (e.g. Compaction) ☐Waste Mgmt.
☐Driving ☐Sampling ☐Work Area Prep.
☐Excavation / Trenching ☐Site Walk/Inspection ☐Other

INJURY TYPE (Check all applicable.)

☐Abrasion ☐Occupational Illness
☐Amputation ☐Puncture
☐Burn ☐Rash
☐Cold/Heat Stress ☐Repetitive Motion
☐Inflammation ☐Sprain/Strain
☐Laceration ☐Other________

BODY PART AFFECTED (Check all applicable.)

☐Respiratory ☐Shoulder ☐Face
☐Neck ☐Arm ☐Leg
☐Chest ☐Wrist ☐Knee
☐Abdomen ☐Hand/Fingers ☐Ankle
☐Groin ☐Eye ☐Foot/Toes
☐Back ☐Head ☐Other______

I. PERSON(S) DIRECTLY / INDIRECTLY INVOLVED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Directly/Indirectly Involved in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:
1)				
2)				

II. PERSONS INJURED IN INCIDENT (Attach additional information as necessary/applicable.)					
Name/Phone # of Each Person Injured in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:	Description of Injury:
1)					
2)					

III. PROPERTY DAMAGED IN INCIDENT (Attach additional information as necessary/applicable.)				
Property Damaged:	Property Location:	Owner Name, Address & Phone #:	Description of Damage:	Estimated Cost:
1)				
2)				$

IV. WITNESSES TO INCIDENT (Attach additional information as necessary/applicable.)		
Witness Name:	Address:	Phone #:
1)		
2)		

PART 2: WHAT HAPPENED AND INCIDENT DETAILS

PROVIDE FACTUAL DESCRIPTION OF INCIDENT (e.g., describe loss/near loss, injury, response / treatment).

I. AUTHORITIES/GOVERNMENTAL AGENCIES NOTIFIED (Attach additional information as necessary/applicable.)				
Authority/Agency Notified:	Name/Phone #/Fax # of Person Notified:	Address of Person Notified:	Date & Time of Notification:	Exact Information Reported/Provided:

II. PUBLIC RESPONSES TO INCIDENT (if applicable)				
Response/Inquiry By: (check one)	Entity Name:	Name/Phone # of Respondent/ Inquirer:	Address of Entity/Person:	Date & Time of Response/Inquiry:
☐Newspaper ☐Television ☐Community Group ☐Neighbors ☐Other ___________________				
Describe Response/Inquiry:				
Roux/Remedial Response:				

(Check all that apply.) (Attach photos, drawings, etc. to help illustrate the incident.)
ATTACHED INFORMATION: ☐Photo ☐Sketches ☐Vehicle Acord Form ☐Police Report ☐Other

Name(s) of person(s) who prepared Initial and Final Report:	**Title(s):**	**Phone number(s):**

PART 3: INVESTIGATION TEAM ANALYSIS

Date Investigation Started (MM/DD/YYYY):

Factors, Root Causes, and Solution (FRCS): Complete FRCS form and answer all 7 factor questions. If answering NO to Factors 1 – 4 identify root cause(s) and explain why QIs) occurred. If answering YES to Factors 5 – 7 circle the root cause(s). Transfer the solutions guidance that addresses each root cause from the FRCS form to this form. Attach your completed FRCS Worksheet. If Factors 1-7 do not apply to the incident, write "External Cause" in the Factor column below and leave the remaining fields blank.

DESCRIPTION OF UNDESIRABLE BEHAVIOR/CONDITION

1.

2.

FACTOR(S) AND SOLUTION(S): HOW TO REDUCE POSSIBILITY OF INCIDENT RECURRING

Selection of factors and solutions reflects the analysis of investigation team and is not meant to be a legally binding conclusion as to the Root Cause and/or solution.

CAUSAL FACTOR/ BEHAVIOR/ CONDITION	ROOT CAUSE	SOLUTION(S) [Must Match Root Cause(s)]	PERSON RESPONSIBLE	AGREED DUE DATE	ACTUAL COMPLETION DATE

INVESTIGATION TEAM:

PRINT NAME	JOB POSITION	DATE	SIGNATURE

QUALITY REVIEW Correct root cause(s) identified? Do root cause(s) and solution(s) match? Are solution(s) feasible / maintainable?

Name: **Job Title:**

PART 4: Date Solutions were Implemented & Validated (Were Solutions Effective?)

Date	Solution	Verifier / Validator Name and Job Title	**Details** (of I & V performed)

Appendix B – Near Loss Form

HEALTH & SAFETY NEAR LOSS
ROUX REPORT FORM

☐ **Roux Environmental Engineering and Geology, D.P.C.**
☐ **Roux Associates, Inc.** ☐ **Remedial Engineering, P.C.**

(Check applicable company name)

PART 1: ADMINISTRATIVE INFORMATION	
Office: ☐ New York ☐ Massachusetts ☐ New Jersey ☐ Illinois ☐ CA - Los Angeles ☐ CA - Oakland	
Project Manager:	**Project Principal:**
Project Name:	**Project Location:**

PART 2: NEAR LOSS INCIDENT DETAILS	
Date\Time Occurred (MM/DD/YYYY HH:MM):	**Date\Time Submitted** (MM/DD/YYYY HH:MM):
NEAR LOSS INCIDENT TYPE - What could have happened? - Select all that apply (1-7)	
1. ☐ Fire / Explosion 2. ☐ Injury / Illness 3. ☐ Security (e.g., theft, trespassing, vandalism)	4. ☐ Environmental (Spill, permit exceedance, etc.) 5. ☐ Transportation of personnel (vehicle accident) 6. ☐ Property/Equipment Damage 7. ☐ Business Interruption
Event Leading to Potential Injury/Illness:	
Job Task*:	**Equipment Involved*:**
WHAT HAPPENED? Do not include individuals' names. Ensure photos, sketches, etc. are not personally identifiable unless written consent has been obtained.	
Summary (1-2 sentences. Provide brief description of the incident. Provide facts only, no speculation or opinion)**:** **Incident Details** (Brief factual details of what, where, when; include photos, sketches, etc. as attachments)**:** **Immediate Corrective Actions Taken:**	
SERIOUS INJURY OR FATALITY (SIF):	**IF AN ACTUAL SIF, USE EXISTING ROUX ACCIDENT REPORTING FORM**
Could this have resulted in a SIF? ☐ **Yes** ☐**No**	
A potential SIF is defined as likely to have caused an injury resulting in significant physical body damage with probable long term and/or life altering complications.	
INCIDENT INVOLVED:	
Roux Employee: ☐ **Yes** ☐ **No** **Subcontractor Company Name:**	

INVESTIGATION TEAM			
NAME	**JOB TITLE**	**NAME**	**JOB TITLE**

PART 3: INCIDENT INVESTIGATION FINDINGS AND REPORT QUALITY REVIEW

Date Investigation Started (mm/dd/yyyy):

Factors, Root Causes, and Solution (FRCS): Complete FRCS form and answer all 7 factor questions. If answering NO to Factors 1 – 4 identify root cause(s) and explain why QIs) occurred. If answering YES to Factors 5 – 7 circle the root cause(s). Transfer the solutions guidance that addresses each root cause from the FRCS form to this form. Attach your completed FRCS Worksheet. If Factors 1-7 do not apply to the incident, write "External Cause" in the Factor column below and leave the remaining fields blank. Do not include individuals' names.

DESCRIPTION OF UNDESIRABLE BEHAVIOR/CONDITION

1.

2.

FACTOR(S) AND SOLUTION(S): HOW TO REDUCE POSSIBILITY OF INCIDENT RECURRING
Selection of factors and solutions reflects the analysis of investigation team and is not meant to be a legally binding conclusion as to the Root Cause and/or solution.

Behavior / Condition	Root Cause	Solution(s) (Must Match Root Cause)	Person Responsible for Completion	Completion Target Date	Completion Actual Date

QUALITY REVIEW Correct root cause(s) identified? Do root cause(s) and solution(s) match? Are solution(s) feasible / maintainable?

Name: **Job Title:**

PART 4: Date Solutions were Implemented & Validated (Were Solutions Effective?)

Date	Solution	Verifier / Validator Name and Job Title	Details (of I & V performed)

***JOB TASK - Select the most appropriate one** (primary job associated with incident-related work activity, avoid "Other" if possible)

1. CAMP
2. Construction
3. Drilling
4. Driving
5. Excavation/Trenching
6. Gauging
7. O&M
8. Other Soil Work (e.g. Compaction)
9. Sampling
10. Site Walk/ Inspection
11. Subsurface Clearance
12. Trucking
13. Waste Management
14. Work Area Preparation
15. Other

***EQUIPMENT INVOLVED THAT CONTRIBUTED TO H&S NEAR LOSS - Select all that apply**

1. Air Stripper
2. API Separator
3. Automobile
4. Boom Material
5. Bulldozer
6. Cable
7. Carbon Drum / Vessel
8. Chain Block
9. Compressor, Air
10. Control Panel (local)
11. Crane (mobile)
12. Drill Rig
13. Drilling Equipment, Vacuum
14. Drum, Vertical
15. Dump Truck
16. Electric Heater
17. Electrical Power Supply
18. Engine, Combustion
19. Equipment Safety Grounding
20. Excavator / Power Shovel
21. Exclusion Zone Equipment
22 Fan / Blower
23 Fencing
24 Filter
25. Fire Extinguisher
26. Forklift
27. Front End Loader
28. Grader
29. Hammer
30. Knife
31. Non-Powered Equipment
32. Powered Equipment
33. Drill
34. Grinder
35. Hydraulic Torque Wrench
36. Powered Saw
37. Impact Wrench
38. Saw
39. Screwdriver
40. Shears
41. Shovel
42. Snip
43. Wrench
44. Hoist
45, Hook/Clamp/Buckle, etc.
46. Jack
47. Ladder, Extension
48. Ladder, Platform
49. Ladder, Step
50. Lock Out / Tag Out
51. Maintenance Tool, General
52. Manifold
53, Manlift/Basket/Cherry Picker
54. Motor, Electric
55. Oxidizer
56. Pallet
57. Piping
58. Piping, Hose
59. Piping, Injection/Mixing Point
60. Hydrojet
61. Centrifugal Pump
62. Diaphragm Pump
63. Reciprocating Pump
64. Regenerative Pump
65. Rotary Pump
66. Transfer Pump
67. Submersible Pump
68. Face Shield
69. Fall Protection
70. Gloves
71. Hard Hat / Helmet
72. Hearing Protection
73. Respiratory PPE (Chemical)
74. Respiratory PPE (Particulate)
75. Safety Glasses
76. Safety Goggles
77. Safety Shoes / Boots
78. Safety Vest / Clothing
79. Rope
80. Bailer
81. Geoprobe
82. Hand Auger
83. PID
84. Multi-Gas Meter
85. Sample Container
86. Split-Spoon Sampler
87. Sling
88. Snow Blower
89. Snow Plow
90. Space Heater
91. Air Sparging System
92. Carbon Treatment Sys
93. Chemical Oxidation S
94. Dual Phase Product Recovery System
95. Groundwater Pump and Treat System
96. POET System
97. Shed or Trailer
98. Vapor Extraction System
99. Vapor-Phase Treatment System
100. Other System, Type:____
101. Surge Tank
102. Underground Tank
103. Telemetry System
104. Testing Devices
105. Tractor Trailer
106. Truck, Flatbed
107. Truck, Pickup
108. Truck, Tank Truck
109. Truck, Vacuum
110. Safety Valve
111. Block Valve
112. Extraction Well
113. Monitoring Well
114. Recovery Well
115. Winch
116. Wire Rope
117. No Equipment Involved
118. MPT – Traffic Control Devices
118. Not in List (describe):____

Appendix C – Injury Illness Reporting Flow Chart

Health & Safety Near/Loss – Loss (Incident)*
Notification Flow Chart

Incident*
Occurs

↓

Involved Employees
Immediately Notify**
SHSO

↓

SHSO Immediately Notifies**
OHSM and/PM

↓

OHSM and PM (Conduct Invest.)
Immediately Notify** PP and OM

↓

OM Notifies**
CHSM

↓

CHSM and/or OM Notify**
COO & CEO

* Incident – any work or site-related occurrence that resulted in, or could potentially have resulted in, the need for medical care or in property damage (i.e., all injuries or illnesses, exposure to toxic materials or any other significant occurrence resulting in property damage or in a "near loss")

** Verbal Notification

Initial Incident Report (written) to SHSO, OHSM, OM and CHSM within 24 hours
Follow-up Report within one week.

APPENDIX K

Personal Protective Equipment (PPE) Management Program

PERSONAL PROTECTIVE EQUIPMENT MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/19**
REVISION NUMBER	:	**4**

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1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following program to establish guidelines for the selection of personal protective equipment (PPE) for use by Roux personnel performing field activities in hazardous environments. PPE is not meant to be a substitute for engineering, work practice, and/or administrative controls, but PPE should be used in conjunction with these controls to protect the employees in the work place. Clothing, body coverings, and other accessories designed to prevent worker exposure to workplace hazards are all types of PPE. To ensure adequate PPE employee-owned PPE is evaluated on a case-by-case basis to insure its adequacy, maintenance and sanitation.

2. SCOPE AND APPLICABILITY

These guidelines apply to all PPE selection decisions to be made in implementing the Roux program. The foundations for this program are the numerous Occupational Health and Safety Administration (OSHA) standards related to PPE cited in 29 CFR 1910 Subpart I, 29 CFR 1926 Subpart E, and the hazardous environment work employee protection requirements under the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 and 1926.65. To ensure hazard assessments are documented the levels of protection, types of protection and tasks requiring protection are covered in site-specific Health and Safety Plans (HASPs) and Job Safety Analyses (JSAs).

3. PROCEDURES

Due to the varied nature of site activities and the different potential hazards associated with different sites, several aspects must be considered when selecting PPE. The following text describes PPE selection logic and provides guidelines and requirements for the appropriate selection and use of PPE.

3.1 Introduction

To harm the body, chemicals must first gain entrance. The intact skin and the respiratory tract are usually the first body tissues attacked by chemical contaminants. These tissues provide barriers to some chemicals but in many cases, are damaged themselves or are highly permeable by certain chemical compounds. Personal protective equipment therefore is used to minimize or eliminate chemical compounds coming into contact with these first barrier tissues.

The proper selection of equipment is important in preventing exposures. The PM making the selection will have to take several factors into consideration. The level of protection, type and kind of equipment selected depends on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors must be made before work can be safely carried out.

3.2 Types of PPE

The type and selection of PPE must meet certain general criteria and requirements as required under OSHA 29 CFR 1910.132 and 1926.95. In addition to these general requirements, specific requirements and specifications exist for some types of PPE that form the basis of the protective clothing scheme. Following is a list of the common types of specific PPE and the specific requirements for the PPE type, where applicable:

1. Hard Hats - Regulated by 29 CFR 1910.135 and 1926.100; and, specified in ANSI Z89.1.

2. Face Shields and Safety Glasses - Regulated by 29 CFR 1910.133 and 1926.102; and, specified in ANSI Z87.1.
3. Respiratory Protection - Regulated by 29 CFR 1910.134 and 1926.103.
4. Hand Protection - Not specifically regulated.
5. Foot Protection - Regulated by 29 CFR 1910.136 and 1926.96; and, specified in ANSI Z41.1.
6. Protective Clothing (e.g., fully encapsulated suits, aprons) - Not specifically regulated.

3.3 Protective Clothing Selection Criteria

3.3.1 Chemicals Present

The most important factor in selecting PPE is the determination of what chemicals the employee may be exposed to. On field investigations, the number of chemicals may range from a few to several hundred. The exact chemicals or group of chemicals present at the site (certain groups tend to require similar protection) can be determined by collecting and analyzing samples of the air, soil, water, or other site media. When data are lacking, research into the materials used or stored at the site can be used to infer chemicals possibly on the site.

Once the known or suspected chemicals have been identified, and taking into consideration the type of work to be performed, the most appropriate clothing shall be selected.

Protective garments are made of several different substances for protection against specific chemicals. There is no universal protective material. All will decompose, be permeated by, or otherwise fail to protect under given circumstances. Fortunately, most manufacturers make guides to the use of their products (i.e., Dupont's Tyvek™ Permeation Guide). These guides are usually for gloves and coveralls and typically provide information regarding chemical degradation rates (failure of the material to maintain structural integrity when in contact with the chemical), and may provide information on the permeation rate (whether or not the material allows the chemical to pass through). When permeation tables are available, they shall be used in conjunction with degradation tables to determine the most appropriate protective material.

During most site work, chemicals are usually in mixed combinations and the protective materials are not in continuous contact with pure chemicals for long periods of time; therefore, the selected material may be adequate for the particular chemical and type of work being performed, yet not the "best" protecting material for all site chemicals and activities. Selection shall depend upon the most hazardous chemicals based on their hazards and concentrations. Sometimes layering, using several different layers of protective materials, affords the best protection.

3.3.2 Concentration of the Chemical(s)

One of the major criteria for selecting protective material is the concentration of the chemical(s) in air, liquid, and/or solid state. Airborne and liquid chemical concentrations should be compared to the OSHA standards and/or American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines to determine the level of skin or other absorptive surface (e.g., eyes) protection needed. While these standards are not designed specifically for skin exposed directly to the liquid, they may provide skin designations indicative of chemicals known to have significant skin or dermal absorption effects. For example, airborne levels of PCB on-site may be low because it is not very volatile, so the inhalation hazard may be minimal; however, PCB-containing liquid coming in direct contact with the skin may cause overexposure. Thus, PCB has been assigned a skin designation in both the OSHA and ACGIH exposure limit tables.

3.3.3 Physical State

The characteristics of a chemical may range from nontoxic to extremely toxic depending on its physical state. Inorganic lead in soil would not be considered toxic to site personnel, unless it became airborne, since it is generally not absorbed through the intact skin. Organic lead in a liquid could be readily absorbed. Soil is frequently contaminated with hazardous materials. Concentrations will vary from a few parts per million to nearly one hundred percent. The degree of hazard is dependent on the type of soil and concentration of the chemical. Generally speaking, "dry" soils do not cause a hazard to site personnel if they take minimal precautions such as wearing some type of lightweight gloves.

3.3.4 Length of Exposure

The length of time a material is exposed to a chemical increases the probability of breakthrough. Determinations of actual breakthrough times for short-term exposures indicate that several different materials can be used which would be considered inadequate under long-term exposures. It should be kept in mind that during testing, a pure (100% composition) liquid is usually placed in direct contact with the material producing a worst-case situation.

3.3.5 Abrasion

When selecting protective clothing, the job the employee is engaged in must be taken into consideration. Persons moving drums or performing other manual tasks may require added protection for their hands, lower chest and thighs. The use of leather gloves and a heavy apron over the other normal protective clothing will help prevent damage to the normal PPE and thus reduce worker exposures.

3.3.6 Dexterity

Although protection from skin and inhalation hazards is the primary concern when selecting PPE, the ability to perform the assigned task must be maintained. For example, personnel cannot be expected to perform work that requires fine dexterity if they must wear a thick glove. Therefore, the PPE selection process must consider the task being performed and provide PPE alternatives or techniques that allow dexterity to be maintained while still protecting the worker (e.g., wearing tight latex gloves over more bulky hand protection to increase dexterity).

3.3.7 Ability to Decontaminate

If disposable clothing cannot be used, the ability to decontaminate the materials selected must be taken into consideration. Once a chemical contacts the material, it must be cleaned before it can be reused. If the chemical has completely permeated the material, it is unlikely that the clothing can be adequately decontaminated and the material should be discarded.

3.3.8 Climactic Conditions

The human body works best with few restraints from clothing. Protective clothing adds a burden by adding weight and restricting movement as well as preventing the natural cooling process. In severe situations, a modified work program must be used.

Some materials act differently when they are very hot and very cold. For example, PVC becomes almost brittle in very cold temperatures. If there are any questions about the stability of the protective materials under different conditions, the manufacturer should be contacted.

3.3.9 Work Load

Like climactic conditions, the type of work activity may affect work duration and the ability or personnel to perform certain tasks. Similarly, the amount of protective materials a person wears will affect their ability to perform certain tasks. For example, a person in a total encapsulating suit, even at 72 ^{o}F, cannot work for more than a short period of time without requiring a break.

The work schedule should be adjusted to maintain the health of the employees. Special consideration should be given to the selection of clothing that both protects and adds the least burden when personnel are required to perform strenuous tasks. Excessive bodily stress frequently represents the most significant hazard encountered during field work.

3.4 Types of Protective Materials

1. Cellulose or Paper
2. Natural and Synthetic Fibers
   a. Tyvek™
   b. Nomex™
3. Elastomers
   a. Polyethylene
   b. Saran
   c. Polyvinyl Chloride (PVC)
   d. Neoprene
   e. Butyl Rubber
   f. Viton

3.5 Protection Levels

3.5.1 Level A Protection

Level A protection (a fully encapsulated suit) is used when skin hazards exist or when there is no known data that positively rule out skin and other absorption hazards. Since Level A protection is extremely physiologically and psychologically stressful, the decision to use this protection must be carefully considered. At no time will Level A work be performed without the consent of the OM. The following conditions suggest a need for Level A protection:

- confined facilities where probability of skin contact is high;
- sites containing known skin hazards;
- sites with no established history to rule out skin and other absorption hazards;
- atmosphere immediately dangerous to life and health (IDLH) through the skin absorption route;
- site exhibiting signs of acute mammalian toxicity (e.g., dead animals, illnesses associated with past entry into site by humans);

- sites at which sealed drums of unknown materials must be opened;
- total atmospheric readings on the Photoionization Detector (PID), Flame Ionization Detector (FID), and similar instruments indicate 500 to 1,000 ppm of unidentified substances; and
- extremely hazardous substances (e.g., cyanide compounds, concentrated pesticides, Department of Transportation Poison "A" materials, suspected carcinogens and infectious substances) are known or suspected to be present and skin contact is possible.

The following items constitute Level A protection:

- open circuit, pressure-demand self-contained breathing apparatus (SCBA);
- totally encapsulated suit;
- gloves, inner (surgical type);
- gloves, outer;
- chemical protective;
- boots, chemical protective, steel toe and shank;
- radiation detector (if applicable); and
- communications.

3.5.2 Level B Protection

Level B protection is utilized when the highest level of respiratory protection is needed but hazardous material exposure to the few unprotected areas of the body is unlikely.

The following conditions suggest a need for Level B protection:

- the type and atmospheric concentration of toxic substances have been identified and they require the highest level of respiratory protection;
- IDLH atmospheres where the substance or concentration in the air does not present a severe skin hazard;
- the type and concentrations of toxic substances do not meet the selection criteria permitting the use of air purifying respirators; and
- it is highly unlikely that the work being done will generate high concentrations of vapors, gases or particulates, or splashes of materials that will affect the skin of personnel.

Personal protective equipment for Level B includes:

- open circuit, pressure-demand SCBA;
- chemical protective clothing:
- overalls and long-sleeve jacket; or
- coveralls;
- gloves, inner (surgical type); gloves, outer, chemical protective;
- boots, chemical protective, steel toe and shank; and
- communications optional.

3.5.3 Level C Protection

Level C protection is utilized when both skin and respiratory hazards are well defined and the criteria for the use of negative pressure respirators have been fulfilled (i.e., known contaminants and contaminant concentrations, acceptable oxygen levels, approved filter/cartridge available, known cartridge service life, etc.). Level C protection may require carrying an emergency escape respirator during certain initial entry and site reconnaissance situations, or when applicable thereafter.

Personal protective equipment for Level C typically includes:

- full facepiece air-purifying respirator;
- emergency escape respirator (optional);
- chemical protective clothing:
  - overalls and long-sleeved jacket; or
  - coveralls;
- gloves, inner (surgical type);
- gloves, outer, chemical protective; and
- boots, chemical protective, steel toe and shank.

3.5.4 Level D Protection

Level D is the basic work uniform. Personal protective equipment for Level D includes:

- coveralls;
- safety boots/shoes;
- eye protection;
- hand protection;
- reflective traffic safety vest (mandatory for traffic areas or railyard);
- hard hat (with face shield is optional); and
- emergency escape respirator is optional.

3.5.5 Level E Protection

Level E protection is used when radioactivity above 10 mr/hr is detected at the site. Personal protective equipment for Level E includes:

- coveralls;
- air purifying respirator;
- time limits on exposure;
- appropriate dermal protection for the type of radiation present; and
- radiation dosage monitoring.

3.5.6 Additional Considerations

Field work will contain a variety of situations due to chemicals in various concentrations and combinations. These situations may be partially ameliorated by following the work practices listed below:

1. Some sort of foot protection is needed on a site. If the ground to be worked on is contaminated with liquid and it is necessary to walk in the chemicals, some sort of protective "booties" can be worn over the boots. This cuts down on decontamination requirements. They are designed with soles to help prevent them from slipping around. If non-liquids are to be encountered, a Tyvek™ bootie could be used. If the ground contains any sharp objects, the advantage of booties is questionable. Boots should be worn with either cotton or wool socks to help absorb the perspiration.
2. If the site situation requires the use of hard hats, chin straps should be used if a person will be stooping over where his/her hat may fall off. Respirator straps should not be placed over the hard hats. This will affect the fit of the respirator.

   Some types of protective materials conduct heat and cold readily. In cold conditions, natural material clothing should be worn under the protective clothing. Protective clothing should be removed prior to allowing a person "to get warm". Applying heat, such as a space heater, to the outside of the protective clothing may drive the contaminants through. In hot weather, under clothing will absorb sweat. It is recommended that workers use all cotton undergarments.
3. Body protection should be worn and taped to prevent anything from running into the top of the boot. Gloves should be worn and taped to prevent substances from entering the top of the glove. Duct tape is preferred, but masking tape can be used. When aprons are used, they should be taped across the back for added protection. However, this should be done in such a way that the person has mobility.
4. Atmospheric conditions such as precipitation, temperature, wind direction, wind velocity, and pressure determine the behavior of contaminants in air or the potential for volatile material getting into the air. These parameters should be considered in determining the need for and the level of protection.
5. A program must be established for periodic monitoring of the air during site operations. Without an air monitoring program, any changes would go undetected and might jeopardize response personnel. Monitoring can be done with various types of air pumps and filtering devices followed by analysis of the filtration media; personnel dosimeters; and periodic walk-throughs by personnel carrying real-time survey instruments.
6. For operations in the exclusion zone, different levels of protection may be selected, and various types of chemical-resistant clothing may be worn. This selection should be based on the job function, reason for being in the area, and the potential for skin contact with, or inhalation of, the chemicals present.
7. Escape masks must be readily available when levels of respiratory protection do not include a SCBA and the possibility of an IDLH atmosphere exists. Their use can be made on a case-by-case basis. Escape masks could be strategically located at the site in areas that have higher possibilities of vapors, gases or particulates.

APPENDIX L

Community Air Monitoring Program

ACTION LIMIT REPORT

Project Location: ____________________

Date: ____________________ Time: ____________________

Name: ____________________

Contaminant: PM-10: ____________ VOC: ____________

Wind Speed: ____________ Wind Direction: ____________

Temperature: ____________ Barometric Pressure: ____________

DOWNWIND DATA

Monitor ID #: ____________ Location: ____________ Level Reported: ____________

Monitor ID#: ____________ Location: ____________ Level Reported: ____________

UPWIND DATA

Monitor ID #: ____________ Location: ____________ Level Reported: ____________

Monitor ID#: ____________ Location: ____________ Level Reported: ____________

BACKGROUND CORRECTED LEVELS

Monitor ID #: ____________ Location: ____________ Level Reported: ____________

Monitor ID#: ____________ Location: ____________ Level Reported: ____________

SITE ACTIVITIES

CORRECTIVE ACTIONS TAKEN

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Appendices

1.0 INTRODUCTION

Roux Associates, Inc. (Roux) on behalf of MJ Painting Contractor Corp. (MJ Painting), has prepared the following Community Air Monitoring Plan (CAMP) to ensure the drilling and soil sampling ~~and remediation (i.e., excavation and in-situ stabilization)~~ activities (collectively, hereafter referred to as "intrusive activities") to be performed at 350 Franklin Street, Olean, NY (hereafter referred to as the "Site") do not adversely affect the Site residents and downwind community, and to preclude or minimize airborne migration of Site contaminants. The proposed remediation activities include ~~excavation~~advancing soil borings, ~~soil transport,~~ and soil ~~waste~~ characterization sampling~~, and in-situ soil stabilization~~.

Compliance with this CAMP is required during all intrusive activities that have the potential to generate airborne particulate matter and volatile organic compounds (VOCs). ~~Intrusive activities include both excavation and in-situ soil stabilization.~~ This CAMP has been prepared to ensure that intrusive activities do not adversely affect residents, bystanders or workers at the Site and in the area immediately surrounding the Site and to preclude or minimize airborne migration of particulate matter and VOCs.

This CAMP is consistent with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan, which is included as Appendix 1A of the New York State Department of Environmental Conservation (NYSDEC) "DER-10 Technical Guidance of Site Investigation and Remediation" (DER-10), dated May 3, 2010.

2.0 Air Monitoring Procedures During Intrusive Activities

Semi-volatile organic compounds (SVOCs), metals and VOCs all may be constituents of concern at the Site. The appropriate method to monitor air for these constituents during intrusive activities is through real-time VOC and air particulate (dust) monitoring. As discussed, the intrusive activities planned at the Site all require continuous monitoring for VOC and dust concentrations. Specific air monitoring procedures required during intrusive activities are described below.

Ground Intrusive Activities

Continuous VOC and particulate monitoring will be required for all ground intrusive activities conducted at the Site including ~~excavation and in-situ soil stabilization~~soil boring advancement with hand augers and/or direct push drill rig, and soil sampling. Note that ground intrusive work areas are not expected to be within 20 feet of potentially exposed populations or occupied structures and therefore special requirements CAMP procedures will not be required.

2.1 Wind Direction

Wind direction will be evaluated, at a minimum, at the start of each workday, noon of each workday, and the end of each workday. These readings will be utilized to determine the positioning of the monitoring equipment in appropriate upwind and downwind locations. A Site figure will be marked daily to record the wind direction and monitoring equipment locations.

2.2 Volatile Organic Compound Monitoring

During all ground intrusive activities, VOCs will be monitored periodically at the upwind perimeter and continuously at the downwind perimeter of the designated work areas. A portable handheld Photoionization Detector (PID) will be used to periodically monitor conditions at upwind locations. Monitoring equipment capable of measuring total VOC concentrations (PID) and capable of integrating (averaging) over periods of 15 minutes or less will be set up at the downwind location, at a height of approximately 4-5 feet above land surface (i.e., the breathing zone). The audible alarm on the PID will be set at 5 parts per million (ppm). Monitoring equipment will be a MiniRAE 2000 portable VOC monitor or similar.

VOC concentrations will be measured at monitoring stations located along the upwind and downwind perimeters of all ground intrusive work areas. Locations of both upwind and downwind monitoring stations will be determined based upon the meteorological data collected throughout the workday and are subject to change in response to changes in wind direction and speed.

The following summarizes VOC action levels and the appropriate responses:

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area exceeds 5 ppm above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities must be halted. While continuing to monitor, the source of vapors must be identified, and corrective actions must be taken to abate

vapor emissions. After these steps are performed, work activities can resume, provided the total organic vapor level 200 feet downwind of the work area or half the distance to the nearest potential receptor or residential/commercial structure – whichever is less but in no case less than 20 feet – is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down, the source of vapors identified, and corrective measures taken to abate emissions, as described below in **Section 2.2.1**.

All readings will be recorded and made available for NYSDEC and NYSDOH personnel to review upon request. If an exceedance of the Action Limits occurs, an Action Limit Report, as shown in **Appendix A**, will be completed.

2.2.1 Potential Corrective Measures and VOC Suppression Techniques

If the 15-minute integrated VOC level at the downwind location persists at a concentration that exceeds the upwind level by more than 5 ppm but less than 25 ppm during ground intrusive activities, then vapor suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive organic vapors:

- Limiting the excavation size;
- Backfilling portions of the excavation;
- Covering soil stockpiles (if any) with 6-mil polyethylene sheeting;
- Hauling waste materials off-Site in properly covered container;
- Odor masking; and/or
- Pausing operations until the wind conditions change such that VOCs and/or odors due to the work are not migrating toward downwind receptors.

All air monitoring readings will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review upon request.

2.3 Particulate Monitoring

Air monitoring for particulates (i.e., dust) will be performed continuously during intrusive activities using both air monitoring equipment and visual observation at upwind and downwind locations. Monitoring equipment capable of measuring particulate matter smaller than 10 microns (PM_{10}) and capable of integrating (averaging) over periods of 15 minutes or less will be set up at upwind (i.e., background) and downwind locations, at heights approximately 4-5 feet above land surface (i.e., the breathing zone). Monitoring equipment will be MEI Data Ram monitors, or equivalent. The audible alarm on the particulate monitoring device will be set at 90 micrograms per cubic meter ($\mu g/m^3$). This setting will allow proactive evaluation of worksite conditions prior to reaching the action level of 100 $\mu g/m^3$ above background. The monitors will be calibrated at least once per day prior to work activities and recalibrated as needed thereafter. In addition, fugitive dust migration will be visually assessed during all intrusive activities.

The following summarizes particulate action levels and the appropriate responses:

- If the downwind PM_{10} particulate level is 100 μg/m^3 above background (upwind perimeter) for the 15-minute period, or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM_{10} particulate levels do not exceed 150 μg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM_{10} particulate levels are greater than 150 μg/m^3 above the upwind level, work must be stopped, and an evaluation of activities initiated. Work can resume provided that dust suppression measures (as described in **Section 2.3.1** below) and other controls are successful in reducing the downwind PM_{10} particulate concentrations to within 150 μg/m^3 of the upwind level and in preventing visible dust migration.

All readings will be recorded and available for NYSDEC and NYSDOH personnel to review upon request. If an exceedance of the Action Limits occurs, an Action Limit Report (**Appendix A**), will be completed.

2.3.1 Potential Particulate Suppression Techniques

If the integrated particulate level at the downwind location exceeds the upwind level by more than 100 μg/m^3 at any time during intrusive activities, then dust suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive dusts:

- Spraying water on the equipment;
- Placing/hauling materials in properly tarped containers or vehicles;
- Limiting vehicle/equipment activity and speeds on Site; and/or
- ~~Hydro-seeding of disturbed areas (as needed).~~

Work may continue with dust suppression techniques provided that downwind PM_{10} levels are not more than 150 μg/m^3 greater than the upwind levels.

There may also be situations where the dust generated by intrusive activities migrates to downwind locations and is not detected by the monitoring equipment at or above the action level. Therefore, if dust is observed leaving the work area, dust suppression techniques such as those listed above will be employed.

If dust suppression techniques do not lower particulates to below 150 μg/m^3, or visible dust persists, work will be suspended until appropriate corrective measures are identified and implemented to remedy the situation.

All air monitoring readings will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review upon request.

3.0 References

NYSDOH, 2010. New York State Department of Health Generic Community Air Monitoring Protocol, May 3, 2010 (also included as Appendix 1A to the Draft Technical Guidance for Site Investigation and Remediation, NYSDEC, May 2010).

APPENDIX C

Roux Procedures

SITE OPERATING PROCEDURE MJP.001 FOR REMOVING SEPARATE-PHASE ORGANIC LIQUIDS FROM MONITORING WELLS USING AN ABSORBENT SOCK

Date: November 2, 2020

1.0 PURPOSE

The purpose of this site operating procedure (SOP) is to establish guidelines for removal of separate-phase hydrocarbons/separate-phase organic liquids using absorbent socks. The removal of immiscible, separate-phase organic liquids with absorbent socks requires special health and safety considerations, equipment, and procedures.

Separate-phase hydrocarbons can be present in the environment as non-aqueous phase liquids (NAPL) and classified as either light non-aqueous phase liquids (LNAPLs) or dense non-aqueous phase liquids (DNAPLs). LNAPLs are separate-phase liquids that are less dense than water and float on water. DNAPLs are separate-phase liquids that are denser than water and tend to migrate downward through aquifers due to gravitational forces until a low permeability layer is encountered (i.e., DNAPLs typically accumulate at the bottom of an aquifer, above an impermeable layer). This SOP is only for the removal of LNAPL.

Note that NAPL, LNAPL, and product are used interchangeably throughout this document.

Absorbent socks are passive product skimmers used to remove LNAPL from monitoring wells. These socks consist of permeable non-reactive oleophilic fibers that are engineered to absorb oils and separate-phase hydrocarbons. They are 1 to 3 feet in length with a diameter slightly smaller than that of the monitoring well. The socks are suspended in the well across the oil/water interface and removed periodically to be wrung out and disposed of and replaced.

The objectives for absorbent material use in wells containing LNAPL (e.g., petroleum, petroleum products) may include the following: 1) removal of product before groundwater sampling; and/or 2) remediation technique.

2.0 CONSIDERATIONS

The primary considerations when implementing use of absorbent socks in wells are health and safety, and waste collection and disposal.

2.1 Health and Safety

All separate-phase products must be assumed to possess health and safety hazards equivalent to the most hazardous suspected on-site source. For example, if fuel oil is being removed from wells where polychlorinated biphenyls (PCBs) are known (or suspected) to be present, then the potential for PCBs to be present in the fuel oil must be considered. When handling flammable materials, it is imperative that all possible sources of ignition be eliminated. Minimum requirements include (NO EXCEPTIONS) no smoking or open flames, use of intrinsically safe downhole monitoring equipment, and use of properly vented and grounded product collection containers. When product collection containers will be stored on-site, the local fire code official must be consulted regarding product storage requirements (e.g. venting, grounding, labeling, permits, secondary containment, etc.). A detailed, comprehensive explanation of health and safety procedures must be outlined in the site health and safety plan (HASP).

2.2 Waste Collection and Disposal

All product and product-contaminated waste materials must be properly stored, characterized, and disposed. A detailed, comprehensive explanation of waste (product) collection and disposal must be developed in accordance with regulatory agency requirements and must be outlined in the work plan/scope of work. Minimum requirements will include:

a. Collection of solid waste materials in a Department of Transportation (DOT) approved open-top drum (17C).

b. Collection of separate-phase product in a properly grounded and vented, DOT approved closed-top drum (17E).

c. Appropriate labeling of all drums in accordance with Resource Conservation and Recovery Act (RCRA) and DOT requirements.

d. Collection and analysis of product sample for characterization prior to disposal, as required.

e. Any product removal operations which generate more than 100 kilograms per month (or approximately half of a 55-gallon drum) or that involve the storage of more than 1,000 kg of a RCRA hazardous waste must meet additional RCRA storage and disposal requirements (see 40CFR 261.5). Additional state or municipality requirements should also be considered.

3.0 EQUIPMENT AND MATERIALS

The list of equipment and materials which may be needed for removal of LNAPL by an absorbent sock from a well includes, but may not be limited to, the following:

a. Site HASP.

b. Appropriate health and safety equipment, as specified in the HASP.

c. A work plan which describes sock replacement requirements.

d. Oil/water interface probe.

e. Absorbent sock (e.g. polypropylene).

f. Absorbent, nonstatic cord/twine (e.g., cotton).

g. Sorbent pads.

h. Disposable nitrile gloves.

i. Well construction log(s).

j. Two graduated containers and funnels (dedicated to separate-phase product measurement activities).

k. Two product transfer buckets with lids (dedicated for temporary separate-phase product collection and transfer activities).

l. DOT approved NAPL collection drum(s) (properly grounded).

m. DOT approved solid waste collection drum(s).

n. Roux Associates' field forms and field notebook.

o. Simple Green® All Purpose Cleaner, or similar.

p. Distilled/deionized water.

q. Potable water.

r. Paper towels, clean rags.

s. Calculator.

t. Black pen and indelible marker.

u. Well location and site map.

v. Hand tools (e.g., pipe wrench, screwdrivers, hammer, pliers, pen knife, etc.).

w. Extra batteries (interface probe, flashlight).

x. Steel tape measure with 0.01-foot measurement increments, graduated measurement stick.

y. Plastic sheeting.

4.0 DECONTAMINATION

4.1 The oil/water interface probe must be thoroughly cleaned before entering each well. Based on historical data, the order of measuring separate-phase thickness should be from the wells which typically do not contain LNAPL to wells which normally contain LNAPL to further reduce the potential for cross-contamination.

5.0 PROCEDURE

Task Preparation:

5.1 Document site conditions on appropriate field form and in the field notebook.

5.2 Ensure that all equipment is properly decontaminated and cleaned.

5.3 Inspect and document the condition of the product collection drum or tank, and note any items of concern such as dents, holes, leaks, deformation, rust, unauthorized access, etc.

5.4 Measure the initial LNAPL in the drum using an oil/water interface probe and record on appropriate field form and in the field notebook.

Set Up at Monitoring Well:

5.4 Place plastic sheeting adjacent to the well to protect decontaminated equipment.

5.5 Remove the padlock and protective well cover. Remove the gripper plug and clean it off with a clean sorbent pad. Place the gripper plug on the plastic sheeting. If fumes or gases are present, then diagnose these with the proper safety equipment (e.g., gas monitoring equipment) per the HASP. Always stand upwind of the well and never inhale the vapors.

Refer to Section 2.1 for the minimum health and safety considerations to prevent fire or explosion. Additional health and safety precautions based on site specific considerations are outlined in the site HASP.

5.6 Place sorbent pads around the well (on top of the plastic sheeting) to prevent any loss of LNAPL in the event of spillage. Place dedicated LNAPL recovery graduated container next to well on top of sorbent pads.

Gauge Monitoring Well:

5.7 Measure the depth to product (DTP) and depth to water (DTW) using an oil/water interface probe, and calculate the product thickness within the well.

If there is no absorbent sock present in the well, continue to step 5.12.

Remove Used Absorbent Sock:

5.8 Slowly remove absorbent sock from well by gently pulling on cotton twine. Immediately place sock (and twine if stained) in graduated bucket to contain any dripping LNAPL.

5.9 Determine the amount of product removed from the well and record in the field notebook. Three possible methods of quantifying the volume of LNAPL removed from the well are provided below:

1. Wring out the contents (LNAPL) of the absorbent sock into an empty, appropriately sized, graduated container (e.g., graduated bucket, 250 mL graduated cylinder, etc.). After recording the volume, transfer the contents of the graduated container into a dedicated bucket (transfer bucket with lid), which will be used to transfer recovered LNAPL from multiple wells to the DOT approved NAPL collection drum.

2. Estimate the volume recovered based on the stained length of the sock and the approximate saturation level associated with the stained portion of the sock. Absorbent socks are white and typically change to the color of the LNAPL that is absorbed. The amount of LNAPL absorbed by the sock can be approximated using a tape measure to determine the length of the stained portion of the absorbent sock (LSat), and visually estimating the level of LNAPL saturation within that stained portion (%Sat). The volume of LNAPL recovered (LNAPL Rec) with the sock is calculated with the following equation which also includes the normal length of the sock (LSock), and nominal LNAPL capacity of the sock (LNAPLCap) from the manufacturer:

LNAPL Rec = (LSat * %Sat * LNAPLCap / LSock).

Definitions:

LSat:	Amount of LNAPL absorbed by the sock
%S:	Level of LNAPL saturation within the stained portion
LNAPLCap:	Capacity of absorbent sock (from manufacturer)
LSock:	Length of absorbent sock (from manufacturer)

3. Weigh the sock and subtract the dry weight (“tare weight”) of the sock from the weight of the sock with LNAPL.

5.10 Dispose of used absorbent sock in solid waste transfer bucket to be disposed of in solid waste DOT approved collection drum(s).

Gauge the Monitoring Well a Second Time:

5.11 Measure the DTP and DTW using an oil/water interface probe, and calculate the product thickness within the well.

Secure New Absorbent Sock in Monitoring Well:

5.12 If new twine is needed, cut appropriate length of twine so that the sock will be suspended in the oil/water interface. Tie twine to the loop at the top of a new absorbent sock. Secure the end of the twine to the gripper plug or the protective well cover with a slip knot.

5.13 Slowly lower the absorbent sock into the well.

5.14 Wipe the gripper plug with a clean rag, replace the gripper plug and protective well cover. Lock the padlock onto the protective well cover.

Cleanup and Disposal:

5.15 Transfer the spent absorbent socks and/or LNAPL collected in the transfer buckets to the on-site DOT approved solid waste collection drum(s) and the NAPL collection drum(s), respectively. If present, record the total volume of LNAPL collected and confirm the total by measuring the on-site DOT approved collection drum(s) contents with an oil/water interface probe both before and after transferring the LNAPL from the transfer bucket.

5.16 Report any significant problems or deviations in product thickness measurements immediately (e.g., significant increase in product thickness or a substantial change in appearance) to the project manager.

5.17 Place all contaminated absorbent socks, sorbent pads, twine, and other solid waste materials into the open top DOT approved solid waste collection drum(s).

5.18 Decontaminate all equipment as discussed in the decontamination section (4.0). Discard rags, gloves, etc. in a manner consistent with accepted procedures.

5.19 Document all data (e.g., DTP, DTW, product thickness, volume of product removed and disposed) on an appropriate field form and in the field notebook, and initial and date entries.

5.20 Secure all DOT approved collection drum(s) and verify integrity.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to explain the quality control (QC) measures taken to ensure the integrity of the samples collected and to establish the guidelines for the collection of QC samples. The objective of the QC program is to ensure that water-quality data of known and reliable quality are developed.

Because valid water-chemistry data are integral to a hydrogeologic investigation that characterizes water-quality conditions, the data will be confirmed by QC samples. Without checks on the sampling and analytical procedures, the potential exists for contradictory or incorrect results. The acceptance of water-quality data by regulatory agencies and in litigation-support investigations depends heavily on the proper QC program to justify the results presented. The QC sampling requirements must be determined by the project manager and be clearly defined in the work plan. If data validation (for in-house purposes or for compliance with the United States Environmental Protection Agency [USEPA] regulations) is stipulated as part of the hydrogeologic investigation, QC sampling must be conducted.

2.0 QUALITY CONTROL SAMPLES

2.1 Samples taken for analysis of compounds require the use of quality control samples to monitor sampling activities and laboratory performance. Types of quality control samples may include replicate and/or replicate split, trip blank, field equipment blank, matrix spike and matrix spike duplicate, and fortification. A discussion pertaining to each quality control sample follows:

a. Replicate and Replicate Split - Replicate sample analysis is done to check on the reproducibility of results either within a laboratory or between laboratories. A replicate sample is called a split sample when it is collected with or turned over to a second party (e.g., regulatory agency, consulting firm) for an independent analysis. Replicate samples are aliquots (equal portions) from a sample in a common container.

To collect a replicate sample, water from the bailer or pump will be distributed first to fill one container and then to fill the second container. Adequate water should be available to fill the bottles completely before they are capped. If the water is insufficient to fill all the bottles at once, then incrementally fill each bottle with water from two or more bailer volumes or pump cycles.

For some test substances, water may have to be accumulated in a common container and then decanted slowly into the sample bottles. The work plan should be checked for a description of how replicate samples are to be collected. Additionally, in the case of wells that recover slowly and produce insufficient water to fill all the replicate sample containers, the containers should be filled incrementally and kept on ice in the cooler in between filling periods.

b. Trip Blank - A trip blank sample is a sample bottle that is filled with "clean" (e.g., distilled/deionized) water in the laboratory, and travels unopened with the sample bottles. (The USEPA now uses the phrase "demonstrated analyte free water.") It is opened in the laboratory and analyzed along with the field samples for the constituent(s) of interest to detect if contamination has occurred during field handling, shipment, or in the laboratory. Trip blanks are primarily used to check for "artificial" contamination of the sample caused by airborne volatile organic compounds (VOCs) but may also be used to check for "artificial" contamination of the sample by a test substance or other analyte(s). One trip blank per cooler containing VOC samples, or test substance of other analyte(s) of interest would accompany each day's samples.

c. Field Equipment Blank - A field equipment blank (field blank) sample is collected to check on the sampling procedures implemented in the field. A field blank is made with "clean" (e.g., distilled/deionized/demonstrated analyte free) water by exposing it to sampling processes (i.e., the clean water must pass through the actual sampling equipment). For example, if samples are being collected with a bailer, the field blank would be made by pouring the clean water into a bailer which has been decontaminated and is ready for sampling, and then pouring from the bailer into the sample containers. If a metals equipment blank is to be made, and the water was filtered, then the sample must be filtered (i.e., exposed to the sampling process). One equipment blank would be incorporated into the sampling program for each day's collection of samples and analyzed for the identical suite of constituents as the sample. In some situations one equipment blank will be required for each type of sampling procedure (e.g., split-spoon, bailer, hand auger).

A special type of field blank may be needed where ambient air quality may be poor. This field blank sample would be taken to determine if airborne contaminants will interfere with constituent identification or quantification. This field blank sample is a sample bottle that is filled and sealed with "clean" (e.g., distilled/deionized/demonstrated analyte free) water in the analytical laboratory, and travels unopened with the sample bottles. It is opened in the field and exposed to the air at a location(s) to check for potential atmospheric interference(s). The field blank is resealed and shipped to the contract laboratory for analysis.

d. Matrix Spike and Matrix Spike Duplicate - Spikes of compounds (e.g., standard compound, test substance, etc.) may be added to samples in the laboratory to determine if the ground-water matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples for spikes are collected in the identical manner as for standard analysis, and shipped to the laboratory for spiking. Matrix spike duplicate sample collection, and laboratory spiking and analysis is done to check on the reproducibility of matrix spike results.

e. Fortification - A fortification, which is performed in the field, is used to check on the laboratory's ability to recover the test substance (analyte) added as well as its stability between fortification and analysis.

A field fortification (spike) is prepared by filling the container(s) with field or distilled/deionized/demonstrated analyte free water (as specified by the laboratory) to a predetermined volume (as specified by the laboratory) and adding the spike (supplied by the laboratory). The predetermined volume of water is measured with a clean (decontaminated) graduated cylinder. Field spikes will be prepared following the collection, labeling, and sealing of nonspiked samples in a separate cooler. The spike is kept at a safe distance from the sampling point (e.g., in the hotel room).

2.2 The work plan must be referred to for details regarding the type of QC samples to be collected and the QC sample collection method.

3.0 PROCEDURE

3.1 Implement QC sampling as outlined above, depending on the type of QC sample(s) specified in the work plan.

3.2 Ensure unbiased handling and analysis of replicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected or additional monitoring wells are installed. For example, if there are three existing monitoring wells (MW-1, 2 and 3), do not label the QC blank MW-4. If an additional monitoring well were installed, confusion could result.

3.3 Label matrix spike and field fortification (spike) QC samples so that the analytical laboratory knows which samples are to be spiked in the laboratory and which samples were fortified (spiked) in the field, respectively. In certain situations, the field fortification will be "blind" or undisclosed to the laboratory to independently verify their analytical ability.

3.4 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container (holder) in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory. Consult the site work plan to determine if a particular ice is specified as the preservative for transportation (e.g., the USEPA prefers the use of wet ice because they claim that blue ice will not hold the samples at 4° Centigrade/Celsius).

3.5 Document the QC samples on the appropriate field form and in the field notebook. On the chain-of-custody form, replicate and blank QC samples will be labeled using the codes (Number 3.2, above), and matrix spike and field fortification QC samples will be identified as such (Number 3.3, above).

3.6 Follow standard shipping procedures for samples (i.e., retain one copy of the chain-of-custody form, secure the cooler with sufficient packing tape and a custody seal, forward the samples via overnight [express] mail or hand deliver to the designated analytical laboratory preferably within 24 hours but no later than 48 hours after sampling). However, check the site work plan for information on the analyte(s), as some have to be analyzed immediately (e.g., CN).

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in the field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Because field notes are the legal record of site activities, they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting hydrogeologic field activities.

2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Appropriate Roux Associates' forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).

c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)

d. Work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

h. Camera and film.

3.0 DOCUMENTATION

3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

a. List of Roux Associates personnel on site.

b. Name, date, and time of arrival on site by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.

c. Client and project number.

d. Name and location of study area.

e. Date and time of arrival on site by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.

f. List of non-Roux Associates personnel on site.

g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.

h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).

i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).

j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).

k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).

l. Task designation and work progress.

m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, plant personnel, the general public, and Roux Associates personnel.

n. Delays, unusual situations, problems and accidents.

o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

q. Equipment and instrument problems.

r. Decontamination and calibration procedures.

s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.

t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.

u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.); make all observations as objectively as possible (e.g., grey-blue, oil-like sheen; black and orange, rust-like stain; fuel-like odor; etc.) and avoid using nontechnical or negative-sounding terms (e.g., slimy, goopy, foul-smelling).

v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual "zip-lock" bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly contaminated, these should be placed in an individual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

a. Sample bottles of proper size and type with labels.

b. Cooler with ice (wet or blue pack).

c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.

d. Black pen and indelible marker.

e. Packing tape, "bubble wrap", and "zip-lock" bags.

f. Overnight (express) mail forms and laboratory address.

g. Health and safety plan (HASP).

h. Work plan/scope of work.

i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

a. Graduated pipettes.

b. Pipette bulbs.

c. Litmus paper.

d. Glass stirring rods.

e. Protective goggles.

f. Disposable gloves.

g. Lab apron.

h. First aid kit.

i. Portable eye wash station.

j. Water supply for immediate flushing of spillage, if appropriate.

k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure that the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

END OF PROCEDURE

FOR MEASURING WATER-LEVELS AND SOUNDING A WELL WITH A STEEL TAPE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using steel measuring tapes. A steel tape is used to measure the depth to ground water below an established (surveyed) measuring point (MP) and/or to sound a well (i.e., to measure the depth of well). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow. A well is sounded to determine the total depth of the well (i.e., to provide information regarding potential siltation problems [filling-in with sediment]). This can be used to eliminate possible confusion concerning identification of the well in cases where there are several similar, adjacent, unlabeled wells. Depth to water and sounding data can also be used to calculate the volume of standing water in the well (which is a prerequisite for purging a well before well sampling, and will be addressed in respective SOPs).

A steel tape is the preferred water-level measuring device because it is the most accurate, especially when measurements are taken under static conditions. However, this technique may be inappropriate under nonstatic (changing) conditions such as aquifer tests when water levels may be changing rapidly or when water is cascading into a well. These conditions would require the use of an electronic sounding device (refer to SOP for Measuring Water Levels using an Electronic Sounding Device (M-Scope).

2.0 DECONTAMINATION

The steel tape must be precleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 PROCEDURE

3.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

3.2 The tape will be equipped with a weight to ensure the tape is held vertically and is kept taut when lowered into the well. Measure and record the distance from the bottom of the tape to the bottom of the weight to ensure the proper depth is measured when sounding a well.

3.3 If a water-level measurement is to be taken, then apply chalk (e.g., carpenter's chalk) to the bottom few feet of the tape and lower it into the water.

3.4 The top of the tape is held at an even-foot increment at the MP. This is the "held" value, and is recorded as such.

3.5 The tape is rolled up, and the cut (i.e., the mark between the dry and wet chalk) is noted. This "wet" value is measured accurately to the nearest 0.01 foot, and is recorded as such. The difference between the "held" value and the "wet" value is the DTW.

3.6 After measuring all wells in an area, always re-measure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.). If a significant change has occurred, it may be necessary to re-measure the wells.

3.7 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to see if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

3.8 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Remeasure the well(s) where anomalies are found as a check on the initial measurement(s).

3.9 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

3.10 If the well is being sounded (depth measured), then lower the tape to the bottom of the well and measure its length accurately from the MP to the nearest 0.01 foot. Compare the sounded depth to the as-built well construction log (diagram). This will determine if siltation has occurred and redevelopment is necessary to establish a good hydraulic connection between the well screen and the aquifer.

3.11 All pertinent data will be recorded in the field notebook and on appropriate field forms, and initialed and dated.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using m-scopes. A m-scope is an electronic sounding device used to measure the depth to ground water below an established (surveyed) measuring point (MP). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow.

M-scopes can be less accurate than a steel tape because the wire can kink, measurement increment marks can shift, and the tip may have been cut off and replaced without proper documentation. Thus, it is mandatory that a m-scope be calibrated before use.

2.0 DECONTAMINATION

The m-scope must be pre-cleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 CALIBRATION

The m-scope must be calibrated before being used to measure water levels. Calibration is accomplished by measuring the water level with the m-scope followed by a measurement using a steel tape. This dual measurement procedure is continued until the individual is confident that measurements taken using both devices are similar and the m-scope is reliable. The calibration procedure is documented in the field notebook or on an appropriate field form, and initialed and dated.

4.0 PROCEDURE

4.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

4.2 The manufacturer's model must be noted because some have switches, lights, beepers, or a combination of the above.

4.3 The 1-foot or 5-foot marked intervals on the electrical line must be checked to ensure that they have not shifted, and the bottom of the probe has not been cut. Check on a periodic basis that the cord has not kinked.

4.4 The water-level measurement is taken by lowering the probe into the well until the instrument-specific detection method (e.g., light, beeper, or both) is activated by contacting the water.

4.5 The electrical line is held at the MP and, using a ruler (e.g., carpenter's folding ruler) or an engineer's scale, the distance from the "held" point to the nearest marked interval is measured. The distance measured is added to, or subtracted from, the marked interval reading. The result is the DTW.

4.6 Measurements will be taken accurately and to the nearest 0.01 foot.

4.7 After measuring all wells in an area, always re-measure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.). If a significant change has occurred, it may be necessary to re-measure other wells.

4.8 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to see if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

4.9 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Re-measure the well(s) where anomalies are found as a check on the initial measurement(s).

4.10 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

4.11 All pertinent data will be documented in the field notebook, and initialed and dated.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for purging a well prior to the collection of a ground-water sample. Purging (evacuating) a well involves the removal of the standing column of water in the well to allow “fresh” (representative) formation water to enter the well. Two conventionally used methods for well purging include: 1) discharge of a specified number of casing volumes of water (which is more commonly used); and 2) pumping until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. Wells must be purged prior to sampling to ensure the collection of representative formation ground water for water-quality analysis.

For accepted, existing sampling and analysis programs, the same purging method will be used each time to maintain consistency. For new sampling and analysis programs, the basis for the purging technique(s) will be site-specific field conditions, client input, the experience of Roux Associates, Inc. and regulatory agency(ies) guidelines (e.g., some states permit purging a low-yield well to dryness while others insist that some water remains in the well).

2.0 EQUIPMENT AND MATERIALS

2.1 The following equipment may be needed to purge a monitoring well before sampling:

a. Bailers.

b. Centrifugal pumps.

c. Electrical submersible pumps.

d. Peristaltic pumps.

e. Positive gas-displacement devices.

f. Bladder pumps.

g. Hand-operated diaphragm or bilge pump(s).

h. Teflon™ tape, electrical tape.

i. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (e.g., blue carpenter’s) or m-scope.

j. Appropriate discharge hose and valves.

k. Appropriate discharge tubing (e.g., polypropylene) if using a peristaltic pump.

l. Appropriate compressed gas if using bladder-type or gas-displacement device.

m. Extension cord(s) or portable generator (and fuel) if using an electric submersible pump.

n. Non-absorbent cord (e.g., polypropylene, etc.), cotton (absorbent) cord.

o. Tripod(s).

p. Water Well Handbook.

q. Explosimeter.

r. Flow meter.

2.2 Bailers or centrifugal pumps are recommended for shallow, small diameter monitoring wells. For deep wells, or large diameter wells, a submersible pump is recommended.

3.0 DECONTAMINATION

Each piece of equipment that is used to evacuate wells (e.g., bailers, pumps, hoses) will be decontaminated thoroughly prior to the introduction of the equipment into the well and prior to leaving the site. Additionally, disposable items (e.g., cord, tubing) will be changed between each well purged and discarded in an appropriate manner.

4.0 PROCEDURE

4.1 The depth to water (DTW) is measured and subtracted from the sounded (total) depth of the well to calculate the length of the column of standing water in the well (in feet).

4.2 The volume of the standing water in the well is calculated by multiplying the length of standing water by a coefficient which equates the diameter of the well to gallons per linear foot. (Refer to the attached table from the Water Well Handbook for the coefficient or use the following equation [V=(7.48 gal/ft3)(r2h), where V is volume of water in gallons, r is the radius of the well casing in feet, and h is the height of the water column in the well in feet].)

4.3 If purging is performed by evacuating a specified number of casing volumes, then three to five volumes are purged (typical regulatory agency requirement).

4.4 If wells are screened in low permeability formations, then the well may go dry prior to removing the specified volume of water. If the recovery rate is fairly rapid and time allows, then remove more than one casing volume; otherwise, the evacuation of one casing volume may suffice. (Refer to the site sampling and analysis plan [SAP] for details of purging a low-yield well.)

4.5 Evacuation will occur from the top of the water column in the well to ensure that "fresh" formation water enters the bottom of the well through the screen, moves up as standing water is removed from the top, and all standing water is removed (i.e., only representative formation water is in the well).

4.6 The volume of water purged from the well must be measured and can be calculated directly by discharging into containers of known volume or can be calculated by multiplying rate of flow by time.

4.7 If a submersible or centrifugal pump is used, then the intake is set just below the dynamic (pumping) water level in the well. The rate of flow in gallons per minute (gpm) can be measured using a calibrated bucket (e.g., 5-gallon) if the rate is relatively low, or a 55-gallon drum if the rate is relatively high, and a watch capable of measuring time in second intervals. A precalibrated flow meter may also be used if available.

4.8 After the specified number of casing volumes have been evacuated from the well, the pump intake is lifted slowly until it breaks suction to confirm that any standing water above the intake has been purged.

4.9 If a bailer is used, then the bailer is lowered only deep enough to remove water from the top of the water column and a 5-gallon bucket is used to measure the volume of water evacuated.

4.10 If purging is not executed by evacuating a specified number of well volumes, then purging is performed by pumping or bailing the well until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. The volume of water removed is documented on an appropriate field form or in the field notebook.

4.11 Water purged from the well will be disposed of in accordance with the appropriate method outlined in the site SAP.

4.12 If historic site data indicate that explosive gases could be present and accumulate in the well, then an explosimeter will be used to check vapor concentrations in wells at the site prior to beginning the purging procedure. Vapor concentrations in a well that exceed the 25 percent lower explosive limit (LEL) will require specific precautionary measures to allow purging the well without danger of explosion or fire (e.g., use of cotton cord for bailers or lowering pumping devices, non-electric powered pumps). These conditions will be addressed in the site health and safety plan (HASP) and/or SAP.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of ground-water monitoring wells for dissolved constituents. As part of the SOP for the sampling of ground-water monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, sounding wells, and purging wells) must be implemented. Sampling objectives must be firmly established in the work plan before considering the above.

Valid water-chemistry data are integral to a hydrogeologic investigation that characterizes ground-water quality conditions. Water-quality data are used to evaluate both current and historic aquifer chemistry conditions, as well as to estimate future conditions (e.g., trends, migration pathways). Water-quality data can be used to construct ground-water quality maps to illustrate chemical conditions within the flow system, to generate water-quality plots to depict conditions with time and trends, and to perform statistical analyses to quantify data variability, trends, and cleanup levels.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. Bailers (Teflon™ or stainless steel).

b. Pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.).

c. Gas-displacement device(s).

d. Air-lift device(s).

e. Teflon™ tape, electrical tape.

f. Appropriate discharge hose.

g. Appropriate discharge tubing (e.g., polypropylene, teflon, etc.) if using a peristaltic pump.

h. Appropriate compressed gas if using bladder-type or gas-displacement device.

i. Portable generator and gasoline or alternate power supply if using an electric submersible pump.

j. Non-absorbent cord (e.g., polypropylene, etc.).

k. Plastic sheeting.

l. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (blue carpenter's).

m. Electronic water-level indicators (e.g., m-scope, etc.) or electric water-level/product level indicators.

n. Non-phosphate, laboratory-grade detergent.

o. Distilled/Deionized water.

p. Potable water.

q. Paper towels, clean rags.

r. Roux Associates' field forms (e.g., daily log, well inspection checklist, sampling, etc.) and field notebook.

s. Well location and site map.

t. Well keys.

u. Stop watch, digital watch with second increments, or watch with a second hand.

v. Water Well Handbook.

w. Calculator.

x. Black pen and water-proof marker.

y. Tools (e.g., pipe wrenches, screwdrivers, hammer, pliers, flashlight, pen knife, etc.).

z. Appropriate health and safety equipment, as specified in the site health and safety plan (HASP).

aa. pH meter(s) and buffers.

bb. Conductivity meter(s) and standards.

cc. Thermometer(s).

dd. Extra batteries (meters, thermometers, flashlight).

ee. Filtration apparatus, filters, pre-filters.

ff. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

gg. Disposable gloves.

hh. Water jugs.

ii. Laboratory-supplied sample containers with labels.

jj. Cooler(s).

kk. Ice (wet, blue packs).

ll. Masking, duct, and packing tape.

mm. Chain-of-custody form(s) and custody seal(s).

nn. Site sampling and analysis plan (SAP).

oo. Site health and safety plan (HASP).

pp. Packing material (e.g., bubble wrap)

qq. "Zip-lock" plastic bags.

rr. Overnight (express) mail forms.

3.0 DECONTAMINATION

3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the SOP for Decontamination of Field Equipment for detailed decontamination methods, summaries for bailers and pumps are provided below). Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.

a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.

b. Decontaminate a pump by: 1) wearing disposable gloves, 2) flushing the pump and discharge hose (if not disposable) first with a non-phosphate, laboratory-grade detergent and potable water solution in an appropriate container (clean bucket, garbage can, or 55-gallon drum) and then with distilled/deionized water or potable water, and 3) wiping pump-related equipment (e.g., electrical lines, cables, discharge hose) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for bailers and pumps are the minimum that must be performed. Check the work plan to determine if chemicals specified by individual state regulatory agencies must also be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc.). Refer to the specific SOP for field analysis for each respective piece of equipment. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

5.0 PROCEDURE

5.1 Document, and initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.2 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.3 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.4 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.

5.5 Measure the depth to water (DTW) from the measuring point (MP) on the well using a steel tape and chalk or an electronic sounding device (m-scope). Refer to the specific SOPs for details regarding the use of a steel tape or a m-scope for measuring water levels. Calculate the water-level elevation. Document, and initial and date the information on the appropriate field form and in the field notebook.

5.6 Measuring the total depth of the well from the MP with a weighted steel tape. Calculate and record the volume of standing water in the well casing on the appropriate field form and in the field notebook.

5.7 Decontaminate the equipment used to measure the water level and sound the well with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.

5.8 Purge the well prior to sampling (refer to the SOP for Purging a Well). The well should be pumped or bailed to remove the volume of water specified in the work plan. Usually three to five casing volumes are removed if the recharge rate is adequate to accomplish this within a reasonable amount of time.

If the formation cannot produce enough water to sustain purging, then one of two options must be followed. These include: 1) pumping or bailing the well dry, or 2) pumping or bailing the well to "near-dry" conditions (i.e., leaving some water in the well). The option employed must be specified in the work plan and be in accordance with regulatory requirements.

If the well is purged dry, then all the standing water has been removed and upon recovery the well is ready for sampling. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented: 1) the well may have to be sampled over a period of more than one day; 2) the well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected; or 3) the well may not recover which will preclude sampling. Regardless of the option that must be followed, the sampling procedure must be fully documented. When preparing to conduct a sampling round, review drilling, development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

5.9 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.

5.10 If a bailer is used to collect the sample, then:

a. Flush the decontaminated bailer three times with distilled/deionized water.

b. Tie the non-absorbent cord (polypropylene) to the bailer with a secure knot and then tie the free end of the bailer cord to the protective casing or, if possible, some nearby structure to prevent losing the bailer and cord down the well.

c. Lower the bailer slowly down the well and into the water column to minimize disturbance of the water surface. If a bottom-filling bailer is used, then do not submerge the top of the bailer; however, if a top-filling bailer is used, then submerge the bailer several feet below the water surface.

d. Remove and properly discard one bailer volume from the well to rinse the bailer with well water before sampling. Again, lower the bailer slowly down the well to the appropriate depth depending on the bailer type (as discussed above in 5.11 c). When removing the bailer from the well, do not allow the bailer cord to rest on the ground but coil it on the protective plastic sheeting placed around the well. Certain regulatory agencies require that the first bailer volume collected be utilized for the samples.

5.11 If a pump is used to collect the sample, then use the same pump used to purge the well and, if need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers (as listed in Number 5.14, below). Alternately, the purge pump may be removed and a thoroughly decontaminated bailer can be used to collect the sample.

5.12 Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.

5.13 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lock bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

5.14 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.15 Filter water samples (Procedure 4.6) collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering.

In the event that the regulatory agency(ies) want unfiltered samples for metals analysis, a second set of filtered samples should also be collected. Because unfiltered samples are indications of total metals (dissolved and suspended) they are not representative of aquifer conditions because ground water does not transport sediment (except in some rare cases). Thus, the results for dissolved metals in ground water should be based on filtered samples even if both filtered and unfiltered sets are presented in a report.

5.16 Add any necessary preservative(s) to the appropriate container(s) prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added by the laboratory before shipment.

5.17 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance. Refer to the SOP for Collection of Quality Control Samples.

5.18 Conduct field analyses after sample collection is complete by measuring and recording the temperature, conductivity, pH, etc. (as called for in the work plan). Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.

5.19 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.

5.20 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

5.21 Decontaminate bailers, hoses, and pumps as discussed in the decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with site conditions.

5.22 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

5.23 Samples collected from Monday through Friday will be delivered within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Consult the work plan to determine if any of the analytes require a shorter delivery time.

END OF PROCUDURE

FOR FILTRATION OF GROUNDWATER AND SURFACE-WATER SAMPLES FOR DISSOLVED METALS ANALYSIS

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the field filtration of groundwater samples for dissolved metals analysis prior to sample preservation. Filtering is implemented when the water sample contains suspended fine-grained materials (fines) that cannot be prohibited from entering the water sample by well development or well design. However, as fines are not always distinctly visible in the water sample, all water samples to be analyzed for dissolved metals will undergo filtration. Groundwater samples from bedrock formations to be analyzed for dissolved metals must also be filtered.

It should be noted that filtration of groundwater for metals analysis has been a standard practice with the United States Geological Survey (USGS) for many years. However, it should also be noted that certain regulatory agencies insist that groundwater samples for metals analysis are not filtered. In this case, the analytical results are actually representative of total metals (i.e., dissolved and suspended). Nevertheless, in order to quantify the concentrations of dissolved metals in groundwater, filtration will be employed.

Within this framework, filtration refers to the filtering of water either directly or at the end of a filtration series through a 0.45 micrometer (micron) membrane filter. The presence of a large quantity of fines may require the prefiltering of the sample with a larger-size membrane filter prior to the 0.45 micron filter to avoid clogging the 0.45 micron filter and using an exorbitant amount of time to filter the sample.

Filtration must be done as soon as possible after a water sample is collected, preferably at the same time that the water is produced. If there is a delay between the time that the water sample is collected and the time that filtration occurs, then the time lag and reason for the delay must be documented. The filtering equipment and membrane must be suitable for the intended analysis. Where permitted by regulatory agencies, disposable in-line filters and disposable funnel-type filters may be used. Depending upon the sampling needs, sterile disposable filtering devices may be preferable since they eliminate the need for field decontamination. Materials known to adversely affect the analytical procedure must not be used. The site sampling and analysis plan (SAP) must be referred to for these and other site specific filtration conditions.

In the event that surface water is being analyzed for dissolved metals, the filtration process described below is also used.

2.0 MATERIALS AND EQUIPMENT

To field filter groundwater samples, specific equipment and materials are required. The equipment and materials listed below may be needed in addition to the materials and equipment listed in various sampling SOPs.

a. Non-phosphate, laboratory-grade detergent.

b. Distilled/Deionized water.

c. Potable water.

d. Field forms (e.g., daily log, sampling, etc.) and field notebook.

e. Filtration apparatus (e.g., disposable plastic filtering apparatus, disposable in-line filters, Gelman apparatus, Buchner funnel, etc.), filters, prefilters.

f. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

g. Teflon™ tape.

h. Vacuum pump (e.g., hand-operated or electric).

i. Appropriate tubing and fittings.

j. Disposable gloves.

k. Sample jars with appropriate preservative (e.g., nitric acid) and labels.

3.0 DECONTAMINATION

3.1 Decontamination is not necessary if sterile, disposable plastic filtering equipment is utilized. If applicable, it may be useful to collect a distilled water field blank through a representative disposable filter to demonstrate proper "decontamination." If re-usable filtering equipment is being used, the following is the minimum decontamination procedure:

a. Wear disposable gloves while cleaning filtering equipment to avoid contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and distilled or deionized water in a bucket.

c. Remove vacuum tubing from flask.

d. Remove filter membrane from funnel.

e. Disassemble filtering apparatus (flask and funnel) and scrub each piece of equipment with a brush and solution.

f. Rinse with potable water.

g. Rinse with copious amounts of distilled or deionized water.

h. Allow to dry and wrap equipment with a suitable material (e.g., clean plastic bag) in preparation for the next use.

3.2 The decontamination procedure must consider regulatory agency(ies) specifications which must be provided in the site SAP, and may include decontamination variations such as nitric acid rinses, acetone rinses, etc.

4.0 PROCEDURE

4.1. Ensure that the filtering equipment is disposable and dedicated or is properly decontaminated before each use.

4.2. Assemble the filtering apparatus (funnel and flask), and connect the vacuum pump in case it is needed to augment gravity filtration.

4.3. Place a clean (new) 0.45-micron pore-size filter in the funnel. Use larger, pore-size filters if prefiltering is required (i.e., if significant suspended sediment is present that would quickly clog the 0.45-micron filter and prevent continuous filtration or result in excessive time for filtration).

4.4. Obtain the water sample using an appropriate, decontaminated sample-collection device (e.g., bailer, pump).

4.5. Pass the unpreserved water sample through the 0.45 micron filter into the flask. If the sample contains significant sediment, then pass it through a prefilter before using the 0.45 micron filter. Apply a vacuum using the vacuum pump if needed to facilitate filtering.

4.6. Transfer the filtered water sample to the appropriate, prelabeled sample container containing the preservative (e.g., nitric acid) being careful not to overfill the container and dilute the preservative.

4.7. Follow standard operating procedures for sample documentation, shipping, and tracking (i.e., record keeping).

4.8. Decontaminate all reusable filtering (and sampling) equipment that came in contact with the water sample. Properly disposal of all non-reusable equipment in a manner appropriate with site conditions.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for measuring the thickness of floating separate-phase organic liquids in a well, tank or drum. Measuring the thickness of floating, separate-phase organic liquids requires special health and safety considerations, equipment, and procedures.

Separate-phase layers can either be "floaters" or "sinkers". "Floaters" (non-aqueous phase liquids [NAPLs]) are separate-phase liquids that are less dense than water and float on the ground-water surface. "Sinkers" (dense non-aqueous phase liquids [DNAPLs]) are separate-phase liquids that are more dense than water and tend to migrate downward through aquifers due to gravitational forces until a low permeability layer is encountered (i.e., they accumulate at the bottom of the aquifer). For the purpose of this SOP, only measuring the thickness of floating separate-phase liquids will be addressed.

The objectives for measuring separate-phase organic liquids may include the following: 1) determination of the thickness of the free product in a well, tank or drum; 2) estimation of the volume of free product to be removed from a well before sampling, or from a tank or drum before removal; and 3) calculation of the "true" (non-free product depressed) elevation of the water table.

2.0 CONSIDERATIONS

The primary considerations when measuring the thickness of floating separate-phase liquids are health and safety, and proper equipment selection.

2.1 Health and Safety

All separate-phase products must be assumed to possess health and safety hazards equivalent to the most hazardous suspected on-site source. For example, if fuel oil is being measured in wells where polychlorinated biphenyls (PCBs) are known (or suspected) to be present, then the potential for PCBs to be present in the fuel oil must be considered. When measuring the thickness of flammable materials, it is imperative that all possible sources of ignition be eliminated. Minimum requirements include (NO EXCEPTIONS) no smoking or open flames, use of intrinsically safe downhole monitoring equipment, use of static free bailing cord (e.g., absorbent cord [cotton]), and use of properly vented and grounded product collection containers. When product collection containers will be stored onsite, the local fire code official must be consulted regarding product storage requirements (e.g. venting, grounding, labeling, permits, secondary containment, etc.). A detailed, comprehensive explanation of health and safety procedures must be outlined in the site health and safety plan (HASP).

2.2 Equipment Selection

There are several methods which may be employed to measure the thickness of separate-phase petroleum product in a monitoring well, tank or drum. The actual method to be utilized should be outlined in the work plan. Considerations in selecting a method shall include: the type and consistency of the product; the level of accuracy desired; the expected depth and thickness of the product; and the diameter of the well or port.

Measurements of floating separate-phase product thicknesses can be performed using 1) an electronic oil/water interface probe; 2) a graduated, clear acrylic bailer; or 3) a weighted steel measuring tape (or graduated "stick") in conjunction with oil and water paste.

An oil/water interface probe is capable of providing rapid and accurate (±0.01 foot) results under most field situations. However, viscous product or oil/water emulsions may interfere with performance by coating the probe and/or disguising the interface. In these situations, a clear, acrylic bailer may be used in wells, or oil and water paste in a tank or drum.

A clear, acrylic bailer may be used if simply the presence or absence of product or an approximate product thickness is desired. In certain situations (e.g., viscous product or product/water emulsions) a clear acrylic bailer may be the best available method. However, when product thicknesses are greater than approximately three feet, a bailer will be unable to provide approximate product thickness measurements. If the oil/water interface probe will not work, and the product thickness is too great to be measured by a bailer, then the best available technique may be oil and water paste.

A graduated "stick" or weighted steel tape in conjunction with oil and water paste may be appropriate for measuring residual water or product in a tank or drum. This method is not recommended for use in monitoring wells because of possible cross-contamination from the paste itself. In certain situations where no other method can provide the necessary data, oil and water paste may be used in monitoring wells containing product. This method is less accurate than an oil/water interface probe, but frequently more accurate than a clear, acrylic bailer.

It should be noted that erroneous data may be collected by all three methods when measurements are collected through the fill ports of tanks which are equipped with drop tubes. Whenever possible, product thickness measurements should be collected from ports with unobstructed access to the tank contents. When measurements must be collected from a fill port with a drop tube, it should be understood that there may be significant differences between the drop tube measurements and the actual thicknesses of the water and product in the tank.

3.0 CALIBRATION

3.1 Oil/Water Interface Probe

There is no specific calibration procedure for an oil/water interface probe. However, you should verify that the unit operates properly prior to taking it out in the field by testing it in a jar containing product and water. This jar should be stored in a flammable liquid cabinet and be dedicated to oil/water interface probe testing. Since most oil/water interface probes have a heavy probe assembly and a rigid graduated tape, kinking, stretching or twisting of the tape is not a significant concern. In order to ensure proper operation, the unit should be kept warm prior to use (e.g. hotel room or cab of truck).

3.2 Clear Acrylic Bailer

There is no specific calibration procedure for an acrylic bailer. However, since you only get one chance to measure the thickness correctly, you should verify that the check valve operates properly with distilled water. Based on previous data, if available, you should ensure that the length of the bailer is sufficient to measure the entire thickness of the product.

3.3 Oil/Water Paste

There is no specific calibration procedure for using oil and water paste. However, these pastes may not behave reliably if they are old or have been exposed to extreme temperatures. The pastes should be tested prior to taking them out in the field to confirm they work. The stick measure or weighted steel tape should be carefully examined to confirm that it is properly graduated and has not been damaged or modified.

4.0 DECONTAMINATION

4.1 Complete decontamination of a clear acrylic bailer which is dedicated to the measurement of separate-phase product thicknesses can be very difficult. Decontamination should involve removal of gross contamination before entering and exiting the site or moving to different areas of separate-phase product accumulation. Special care must be taken to make sure that a “product bailer” never enters a “clean” well which does not contain separate-phase product. This can be ensured by measuring separate-phase thickness in all wells before starting bailing operations. The oil/water interface probe must be thoroughly cleaned according to the field equipment decontamination SOP before entering each well. If historical data are available, then the order of measuring separate-phase thickness should be from the cleanest well to the dirtiest well to further reduce the potential for cross-contamination. If samples are also being collected for constituent or characterization analysis, then a disposable, dedicated bailer may be necessary for product collection.

5.0 EQUIPMENT AND MATERIALS

Depending on the method used to measure the thickness of separate-phase organic liquids, both method-specific and general equipment and materials are needed.

5.1 Regardless of the method used, general equipment and materials will include, but may not necessarily be limited to, the following:

a. Site Health and Safety Plan (HASP).

b. Appropriate health and safety equipment, as specified in the HASP.

c. Roux Associates' field forms and field notebook.

d. Non-phosphate, laboratory-grade detergent.

e. Distilled/deionized water.

f. Potable water.

g. Paper towels, clean rags.

h. Plastic sheeting.

i. Sorbent pads.

j. Well location and site map.

k. Well keys.

l. Disposable gloves.

m. Calculator.

n. Black pen and indelible marker.

o. Tools (e.g., pipe wrench, screw drivers, hammer, pliers, flashlight, pen knife, etc.).

p. Buckets for decontamination.

5.2 Clear Acrylic Bailer - the following will also be needed:

a. Clear acrylic bailer

b. Non-static cotton cord

c. Steel tape (10 foot)

5.3 Oil/Water Interface Probe - the following will also be needed:

a. Oil/water interface probe

5.4 Oil/Water Paste - the following will also be needed:

a. Oil paste

b. Water paste

c. Graduated stick or weighted steel tape

6.0 PROCEDURE

6.1 Oil/Water Interface Probe

6.1.1 Make sure the bottom five (5) feet of the probe and measuring tape have been decontaminated according to the field equipment decontamination SOP before entering each well.

6.1.2 Based on previous data, if any, ensure that non-product wells are measured prior to product wells to reduce the possibility of cross-contamination.

6.1.3 Remove the well cap or plug and clean the top of the well with a clean rag. Place the cap or plug on clean plastic on the ground to protect it from potential contamination.

6.1.4 Slowly lower the thoroughly decontaminated probe to the product surface. A distinct tone or beep will indicate the presence and level of product. The depth to product (DTP) from the measuring point will be recorded in the field notebook and on appropriate field forms. Continue lowering the probe until the tone or beep indicates the presence of water. The oil/water interface is best measured by lowering the probe about six inches into the water and then raising it to the interface. The depth to water (DTW) from the measuring point will be recorded in the field notebook and on appropriate field forms. The product thickness is the difference between the DTW and DTP.

6.1.5 Replace locking and/or protective caps on the well.

6.1.6 Thoroughly clean the probe and the portion of the tape which entered the product according to the field equipment decontamination SOP.

6.2 Clear Acrylic Bailer

6.2.1 Make sure all equipment is cleaned of gross contamination before entering and exiting the site or moving to different areas of product accumulation.

6.2.2 Remove the well cap or plug and clean the top of the well with a clean rag. Place the cap or plug on clean plastic on the ground to protect it from potential contamination.

6.2.3 Slowly lower a clear, decontaminated bottom-filling acrylic bailer into the well until the bottom of the bailer contacts the fluid surface.

6.2.4 Using a reference point on the bailer line, slowly lower the bailer into the fluid a distance less than the bailer length so that at its deepest point the top of the bailer remains above the air/fluid contact.

6.2.5 Slowly raise the bailer out of the well.

6.2.6 The thickness of the floating free product will be approximated by placing a tape measure along side the bailer. The data will be documented in the field notebook and on appropriate field forms.

6.2.7 Dispose of the product in an appropriate manner as specified in the work plan. This may include draining the product back into the well or tank, or containerization if the measurement is in conjunction with bailing for removal purposes.

6.2.8 Replace locking and/or protective caps on the well.

6.2.9 Thoroughly clean the bailer as described in Section 6.2.1. Discard the cotton cord in an appropriate manner. Wrap decontaminated bailer in a suitable material (e.g., clean plastic bag, aluminum foil).

6.2.10 If the free product is extensive or thicker than the height of the bailer, then an electronic interface probe should be used to measure product thickness.

6.3 Oil/Water Paste - (Generally not applicable for monitoring wells)

6.3.1 Make sure all equipment is decontaminated and cleaned before use according to the field equipment decontamination SOP.

6.3.2 Secure access to the tank or drum to be measured only after the contents are known and properly addressed in the HASP. Attempt to estimate the depth and thickness of product and the depth to water so the entire stick or weighted steel tape does not have to be coated with oil and water paste.

6.3.3 Coat one side of the stick or steel tape with oil paste and the other with water paste. Since these are typically different colors, confusion should not result. Depending upon information needs, lower the tape to just below the water interface or to the bottom of the tank or drum.

6.3.4 If only DTP and DTW data is required, then the top of the tape is held at an even-foot increment at the measuring point (MP). This is called the "held" value, and is recorded as such. If the depth to the bottom of the tank is also required, then the held value can't be specifically selected at an even-foot increment.

6.3.5 The steel tape or graduated stick is removed and the "water cut" and "product cut" levels are recorded. The difference between the "held" value and the "product cut" value is the DTP. The difference between the "held" value and the "water cut" is the DTW. The difference between the "product cut" and the "water cut" is the product thickness. If the diameter of a horizontal tank is desired, then the difference between the "held" value (to the bottom of the tank) and the depth of the fill pipe is required.

6.3.6 All pertinent data will be recorded in the field notebook and on appropriate field forms.

6.3.7 Make sure all equipment is decontaminated before use in the next tank or drum according to the field equipment decontamination SOP. All disposable materials must be discarded in a manner consistent with site conditions.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines soil sampling requirements.

b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable sampling gloves.

g. Laboratory-supplied sample containers with labels.

h. Cooler with blue or wet ice.

i. Plastic sheeting.

j. Black pen and indelible marker.

k. Zip-lock bags and packing material.

l. Tape measure.

m. Paper towels or clean rags.

n. Masking and packing tape.

o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for screening soil samples for volatile organic vapors using a portable photoionization detector (PID). This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, and grab samples from stockpiled soils.

2.0 CONSIDERATIONS

The primary objective of photoionization screening of soil samples is to obtain a qualitative understanding of the distribution of volatile organic compounds (VOCs) in soil. The proper design of an organic vapor screening program requires an understanding of site hydrogeology, potential source areas, and potential constituents of concern. Sample locations and frequency must be fully defined in the work plan. The work plan should outline the type of lamp to be utilized in the PID based on the ionization potentials and response factors of the constituents of concern. The work plan must also clearly describe the heating or equilibration procedures to be employed if they differ from those described in this SOP. Regardless of the specific equilibration procedure employed, it is imperative that each sample be treated identically to allow the photoionization results from different locations to be compared. Observations such as water, clay, and organic content should be noted to facilitate interpretation of the data. Every effort should be made to collect a representative portion of soil from the sampling device.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines photoionization screening requirements.

b. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents [e.g., acetone, nitric acid, hexane, etc.], aluminum foil, plastic sheeting, etc.).

c. Field notebook, field form(s), maps, chain-of-custody forms.

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable plastic spoons.

g. Plastic sheeting.

h. Aluminum foil.

i. Mason jars or driller's jars.

j. Water bath (hot plate, extension cord, water tray, thermometer).

k. Photoionization detector with charging unit.

l. Calibration gases with regulator.

m. Indelible marker.

n. Masking tape.

o. Disposable sampling gloves.

4.0 DECONTAMINATION

Where possible, thoroughly pre-cleaned and wrapped sampling equipment must be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and sample jars will be changed after each use and discarded in an appropriate manner. If only photoionization results are to be obtained, then split-spoon samples and hand augers may be cleaned with a soap and water wash and potable water rinse or steam cleaning, and a final distilled water rinse. However, if samples are to be collected concurrently for laboratory analytical results, then all reusable sampling equipment must be thoroughly decontaminated according to the SOP for decontamination of field equipment.

5.0 CALIBRATION

The PID must be calibrated according to the manufacturer's specifications at a minimum frequency of once per day prior to collecting photoionization readings. In addition, periodic checks (e.g., every 2 hours or every ten samples) with the standard gas will be conducted to confirm that the calibration has not drifted. The time, date, and calibration procedure must be clearly documented in the field notebook and the calibration log. If at any time the photoionization results appear erratic or inconsistent with field observations, then the unit must be recalibrated. If calibration is difficult to achieve, then the unit's lamp should be checked for dirt or moisture and cleaned, as necessary. During humid or wet conditions, the unit should be calibrated on a more frequent basis as determined by field personnel.

6.0 PROCEDURE

6.1 Extract the soil sample from the sampler, quickly measure the recovery, and separate the wash from the true sample by using a dedicated, stainless steel spatula. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

6.2 Place the sample in a pre-cleaned glass jar (as quickly as possible to avoid loss of VOCs) filling the jar half full. Place an aluminum foil seal between the glass and metal cap and screw tight.

6.3 Label jars with the boring number, depth of sample, date of collection and blow counts. In addition, the field personnel will ensure the following: samples are taken at appropriate depths; unrepresentative portions of the sample are discarded properly; that the sampler is decontaminated properly between use; and the driller uses proper methods during sample collection and does not use oil or grease on tools entering the borehole.

6.4 Log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, and layering).

6.5 After the sample has been collected, heat the sample under controlled conditions in a water bath for a 2 minute period.

6.6 Ensure that the PID has been calibrated and that the calibration information is documented in the field book. Pierce the aluminum foil seal with the probe from the PID and measure the relative concentration of VOCs in the headspace of the soil sample. The initial (peak) reading must be recorded.

6.7 Record the PID reading in the field notebook, on an appropriate field form, and on the base map, if appropriate.

6.8 Place any material not representative of the interval sampled in a pile with the other cuttings from the borehole.

6.9 If only photoionization results are to be obtained, then reusable sampling devices may be cleaned with a soap and water wash and a potable water rinse. The sampler will then be rinsed with distilled water, assembled and placed on plastic sheeting for reuse. A more rigorous decontamination procedure is required when samples are also being collected for laboratory analysis. Refer to the SOP for collection of soil samples for laboratory analysis for additional information.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the pH of water in the field. The pH is measured in the field using a pH meter which should have the ability to compensate for temperature (automatically or manually). The pH will be measured in standard units (SU) and can be recorded with or without the SU designation. The conventional means of recording a pH value is without a unit designation (e.g., 7.0); however, the SU designation may be used provided the term is defined as standard units when first referenced. The manufacturer's instrument manual for each particular pH meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The pH is measured in the field to provide the pH of the water under ambient (in situ) conditions. The pH is a measure of acidic (<7.0) or basic (>7.0) nature of the water and is used to assist in evaluating the mobility of contaminants. In addition, pH measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when pH readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration of the pH meter is to be performed at the beginning and end of each day's use in accordance with the manufacturer's specific instructions. Usual procedures are given below.

2.2 Recalibration must occur if: 1) the pH of the samples being measured is outside the previous calibration range; 2) the procedure or use conditions warrant frequent calibrations; 3) four or more hours have elapsed; or 4) the instrument has been moved from one area to another (e.g., offsite or out of the study area).

2.3 Two buffer calibrations bracketing the expected pH range of samples are to be performed prior to its use in a study. Three pH buffers (4.0, 7.0, and 10.0) are read after standardization at pH of 7.0 to evaluate the linearity and electrodes.

2.4 The measurements of sample and buffers are made while stirring. The samples and buffers are measured at the same temperature; therefore, the pH meter must be temperature compensated. If not, then record the temperature.

2.5 The following information is documented in the calibration logbook at the time of calibration:

a. Date.
b. pH meter identification.

c. Calibration results using pH standards.
d. Initials of the individual performing calibration.

3.0 PROCEDURE

3.1 A warm-up period may or may not be necessary for the instrument, depending on instrument requirements. The manufacturer's instrument manual must be followed.

3.2 The pH electrodes must be kept in good working order as follows:

a. Proper levels of electrolyte solution are maintained. The electrolyte solution level should be at least 1 inch above the solution being measured.

b. The electrodes must be carefully rinsed with distilled or deionized water before each measurement.

3.3 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature and pH are measured immediately.

3.4 The temperature of the sample is measured and the pH meter is compensated for the water temperature. If compensation is not possible, then record the temperature.

3.5 The electrodes are immersed in a water sample and stirred continuously until the pH reading equilibrates. The pH will be measured and recorded in increments of 0.1 or 0.1 SU.

3.6 Pertinent data are documented in the field notebook or appropriate field form, and initialed and dated.

3.7 The electrodes are rinsed with distilled or deionized water and the unit stored properly in accordance with the manufacturer's instructions (e.g., capping and storing in a buffer such as altex electrode storage solution). The electrodes are not to be stored in potable water, or distilled or deionized water.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the electrical conductance (conductivity) of water in the field. The conductivity is measured in the field using a conductivity meter which compensates for temperature (automatically or manually). Some conductivity meters measure directly in micromhos/ centimeter (µmhos/cm) while others have to be converted to this unit. Conductivity will be recorded in µmhos/cm. The manufacturer's instrument manual of each particular conductivity meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The specific conductivity is measured in the field as a measure of the total dissolved solids (TDS) in the ground water or surface water. TDS data can then be used as a qualitative measure of contamination and to assist in evaluating electrical resistivity and borehole geophysical data. In addition, specific conductivity measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when conductivity readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration is in accordance with the manufacturer's specific directions.

2.2 Calibration of the conductivity meter is to be performed at the beginning and end of each day's use.

2.3 Recalibration must occur if: 1) the specific conductivity of samples being measured is outside the calibration standard solution range; or 2) the instrument has been moved from one area to another (e.g., offsite or out of the study area).

2.4 Choose a conductivity calibration solution that is near the conductivity of the water samples to be measured.

2.5 Select the appropriate conductivity calibration solution and adjust the span on the instrument to the conductivity calibration solution value.

2.6 Rinse the probe in distilled or deionized water and store the probe according to the manufacturer's specifications (e.g., distilled or deionized water, or a buffer solution).

2.7 The following information is documented in the calibration logbook:

a. Date.

b. Conductivity meter identification.

c. Initials of individual performing calibration.

d. Calibration results.

3.0 PROCEDURE

3.1 The conductivity electrodes must be kept in good working order as specified by the manufacturer.

3.2 The water sample is placed in a clean, appropriate container(s) and the temperature and conductivity are measured immediately.

3.3 The temperature of the sample is taken and the conductivity meter is compensated for the water temperature.

3.4 The probe is immersed in a water sample until the meter equilibrates.

3.5 In reading the conductivity meter scale, one or more of the following may have to be considered:

a. The reading may have to be multiplied appropriately (e.g., the reading is expressed in micromhos/centimeter).

b. If the conductivity meter is not capable of compensating for temperature differences, then note that the conductance measurements are not temperature compensated and document the temperatures.

c. If the conductivity meter can be compensated for temperature, then adjust the temperature control before reading the conductance measurement. (Some meters automatically compensate for temperature, and this should be documented.)

3.6 Conductivity measurements are recorded in the field notebook and on the appropriate field form, and initialed and dated. Units of µmhos/cm are used to represent conductivity.

3.7 The probe will be cleaned with distilled or deionized water after each use and will be stored according to the manufacturer's specifications (e.g., conductivity cells may have to be stored in distilled or deionized water, or a buffer solution).

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring water temperature in the field. Temperature measuring devices may include thermometers, and pH and/or conductivity meters equipped with a temperature probe. The temperature measuring device must be rapidly equilibrating, precision-grade, and meet or exceed National Bureau of Standards (NBS) specifications for accuracy. Temperature will be measured and recorded in degrees Celsius/Centigrade (° C). If the temperature measuring device is a meter, then the manufacturer's instrument manual, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

Temperature data is collected in the field to determine the temperature of the water sample under ambient (in situ) conditions. Temperature data can be used to evaluate the mobility of compounds in ground water and flow conditions. In addition, temperature measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when temperature readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

2.1 Calibration of thermometers and temperature measuring meters will be performed before entering the field and checked upon return to the office.

2.2 Temperature measuring devices will be calibrated against a NBS-traceable thermometer.

2.3 If a thermometer is used to measure temperature, then the thermometer must read within 1° C to 1.5° C of the NBS-traceable thermometer. If the thermometer does not read within this range and the thermometer cannot be calibrated, then it will not be used for temperature measurements and will be disposed of in an appropriate manner. If the thermometer does not read within this range and the thermometer can be calibrated, then the thermometer will be calibrated to the NBS-traceable thermometer.

2.4 If a temperature measuring meter is used to measure temperature, then the meter must read within 1° C to 1.5° C of the NBS-traceable thermometer. If the meter does not read within this range and the meter cannot be calibrated, then it will not be used for temperature measurements and will be sent to the manufacturer for service and repair. If the meter does not read within this range and the meter can be calibrated, then the meter will be calibrated to the NBS-traceable thermometer.

2.5 The following information is documented in the calibration logbook at the time of calibration:

a. Date.

b. Thermometer and/or Meter identification.

c. Calibration results relative to NBS-traceable thermometer.

d. Initials of individual performing calibration.

3.0 PROCEDURE

3.1 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature is measured immediately.

3.2 If a thermometer is used, then the thermometer is first rinsed with distilled or deionized water and is then immersed in water until the temperature equilibrates. The temperature is read in °C. The thermometer is rinsed again after measuring the temperature.

3.3 If a temperature measuring meter is used, then the probe is first carefully rinsed with distilled or deionized water. The probe is then immersed in water according to the manufacturer's specifications (e.g., specified submergence, stirred) until the temperature equilibrates. The temperature is read in °C. The probe is rinsed again after measuring the temperature.

3.4 Temperature data are recorded in the field notebook or appropriate field form, and initialed and dated.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.

2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.

2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.

2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.

2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.6 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.8 Reassemble the cleaned sampler, as necessary.

3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil.

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble bailer (if applicable) and discard cord in an appropriate manner, and scrub each part of the bailer with a brush and solution.

d. Rinse with potable water and reassemble bailer.

e. Rinse with copious amounts of distilled or deionized water.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures, and to establish the guidelines for drilling (soil borings, wells, or piezometers) and formation sampling activities in unconsolidated formations. There are several drilling techniques available which include hollow-stem auger, cable tool, hydraulic rotary, cased-hole rotary, and air rotary. Formation (sediment/soil) sample collection include disturbed (drill cuttings), intact (split-spoon), and undisturbed (Shelby-tube or Denison-core). Borehole abandonment (closure) procedures will also be addressed in this SOP.

The objective of drilling is to collect accurate subsurface information and to prepare a borehole for potential completion as a well or piezometer. Consequently, the lithologic data is the all important, most essential information that can be collected. The lithologic data characterizes subsurface conditions, describes hydrogeologic coefficients qualitatively and/or quantitatively, and identifies optimum locations for screen zones if wells are constructed.

Data can be obtained through the physical examination and testing of formation samples, as well as knowledge regarding ground-water levels. Thus, drill fluid mix, fluid loss, rate of drilling, lengths of split-spoon and Shelby-tube/Denison-core recovery, etc. must be monitored by the on-site hydrogeologist or geologist.

2.0 DRILLING TECHNIQUE-SELECTION

Verify that the drilling technique is the one specified in the investigation work plan, and that the drilling equipment mobilized by the driller is in good condition and proper working order. Do not permit the driller to use a drilling rig that appears to be substandard, in disrepair, etc., and/or is questionable as to whether or not the rig has the capabilities to accomplish the goals of the drilling program. The drilling rig must be capable of:

a. Penetration of all anticipated subsurface materials and formations at a desired rate, and construction of a borehole of desired diameter (for the anticipated well, if applicable, including the placement of a gravel or sand pack through a tremie pipe and necessary formation sealing material such as bentonite or cement).

b. Identification of lithology for development of a geologic log of all unconsolidated formations and materials penetrated, including physical characteristics and visual description of color, grain sizes, sorting and mineralogy.

c. Collection of samples of aquifer fluids during the drilling process and prior to well construction, while at the same time minimizing potential for cross-contamination. The method used should prevent cross-contamination between surface soils and ground water or between different hydrogeologic units.

d. Collection of intact and/or undisturbed soil samples from the center line or sidewall of the borehole. This objective requires the drilling to be halted while soil samples are taken from the bottom or side of the incomplete borehole.

e. Completion of the borehole into a well (monitoring or observation) or piezometer during the initial construction process (i.e., constructing a well or piezometer as the borehole is drilled, or constructing a well or piezometer in the borehole immediately after the drilling tools are removed).

f. Implementation of borehole geophysical logging (when applicable and possible) to enable more accurate vertical and horizontal extrapolation of borehole data to the lithology of the hydrogeologic system.

g. Completion of a well or piezometer, if applicable, in the borehole following a time lapse for interpretation of geologic or geophysical data from the borehole.

3.0 DRILLING TECHNIQUE - DESCRIPTION

3.1 Hollow-Stem Auger - This drilling method is rapid and extremely effective in most cohesive sediments but less so in loose sandy material. Penetration may be up to 150 feet below land surface (bls) depending on the size of the rig, drilling conditions, and the diameter of the auger flight; however, depths up to 250 feet bls have been achieved under compatible conditions. A major advantage of this technique is that normally no fluids are introduced into the formation. If the auger flights can be removed and the integrity of the borehole maintained, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If the auger flights must remain in the borehole, then only radiation geophysical logs can be run. Casing, screen, and sampling devices can then be lowered through the hollow stem by removing the removable plug at the bottom of the auger flights, and gravel packing and cementing can be accomplished within the hollow stem. However, this can be difficult especially below the water table. Auger flight outside diameters (OD) range from 5 inches (in.) to 12 in. The diameter of a well that can be constructed inside the hollow stem is limited, however, to about 4 in.

3.2 Cable Tool (Percussion) - This drilling method is slow because the borehole is advanced by lifting and dropping a heavy string of drilling tools. Cuttings accumulate in the drill casing and are removed by a sand bailer. A steel casing is driven in as the hole is deepened. Cable-tool rigs can be used in unconsolidated sediment and bedrock to depths of hundreds or thousands of feet and often employ telescoping techniques for drilling deep boreholes. Electrical geophysical logs cannot be run through the steel cased borehole, but radiation logs (e.g., gamma, neutron, etc.) can be run. Well casing and screen can be installed within the cased hole after which the outer casing is pulled back (removed). Because the boring is cased as it is being drilled, cross-contamination between various depths is practically eliminated. The method provides an excellent means to collect good, representative formation samples.

3.3 Hydraulic Rotary - This drilling method uses a rotating bit to drill (advance) the borehole. Drill cuttings are removed using a recirculating drilling fluid (mud or water). Although setting up the drilling equipment is slow, the drilling process is reasonably fast. In the mud-rotary method, drilling mud forms a cake on the borehole wall which prevents excessive loss of fluid to the formation being drilled. The hydrostatic pressure combined with the weight and density of the mud slurry keeps the hole open. This allows the drill rods to be removed from the borehole and geophysical logs (electric and radiation) to be run in the open borehole.

In reverse hydraulic rotary drilling, the drilling fluid moves downward through annular space and then upward inside the drill pipe. If the drilling fluid does not contain mud, then sufficient water flow is required as make-up water because the borehole wall is not sealed; therefore, significant water loss can occur to the formation being drilled. The borehole is held open by hydrostatic pressure only. A serious obstacle to this drilling method occurs when the static water level is less than 15 feet below land surface because of insufficient hydrostatic head difference between the borehole and the water table. However, the problems of excessive water loss and shallow depths to water may be overcome by using mud as the drilling fluid.

In mud-rotary drilling, the drilling fluid (mud) moves downward through the drill pipe and then upward through the annular space. Therefore, the borehole is held open by hydrostatic pressure and the mud cake lining the wall of the borehole. The mud-rotary method can be used to construct moderate to deep wells in unconsolidated (and consolidated material), while the reverse rotary technique can be used to construct moderate to deep wells in unconsolidated materials. The principal disadvantage may be the difficulty in removing mud cake from the formation at the screened zone. Extensive well development may be required to remove the mud cake.

3.4 Cased-Hole Rotary - Several new rotary drilling techniques have been developed in which a steel casing is advanced with an air-rotary or mud-rotary drill. This technique is highly desirable for use in exploratory drilling at monitoring sites because water and soil samples may be collected under conditions which preclude contamination from shallower depths. Furthermore, this technique is extremely effective in boulder or cavernous zones which would inhibit or preclude drilling using other techniques. Drilling results are comparable to cable-tool drilling but with greatly enhanced speeds. In all the cased-hole techniques, the main benefit is that the only portion of the borehole which is open, is at the bottom of the drill casing; thus, no soil or water from shallower depths can move down and impact the depth drilled and/or sampled. Electrical geophysical logs cannot be run through the steel-cased borehole, however, radiation logs (e.g., gamma, neutron, etc.) can be run.

Presently, there are three cased-hole rotary techniques which include:

a. The drill-thru casing hammer technique in which the casing is advanced by percussion with a casing hammer or vibratory driver similar to the method used in a borehole drilled by the air-rotary method. The casing hammer can also pull out the casing (air drilling only).

b. The Odex™ Drilling System (European system) which “pulls” the casing using a fixture attached to an air-hammer type drill bit (air drilling only).

c. The Barber™ Drilling System in which drilling is done with a top-head drive and a rotary table that spins casing into the ground. Casing can be fitted with a carbide “shoe” to cut boulders and an air hammer can be used above the bit. Air or mud rotary can be used to lift cuttings.

Two potential problems may be encountered using the cased-hole rotary technique which include: 1) “sand heave” when drilling stops (which can be quickly drilled or bailed out) and 2) possible aeration of water in the cased borehole if volatiles are being tested (which can be overcome by pumping or bailing the standing water out before sampling). The minimum drill casing diameter is 6 inches and depth is limited to approximately 450 feet.

3.5 Air Rotary - This drilling method uses a rotating bit to drill, and high-velocity compressed air to remove cuttings from the borehole. A pneumatic down-hole hammer is often used to add percussion to the rotary drilling action. This drilling method is very fast and, although it is most suitable for penetrating hard bedrock, it can be used in unconsolidated formations. The borehole may be cased or uncased depending on geologic conditions. If an open borehole is drilled, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If a cased borehole is drilled, then only radiation geophysical logs can be run.

Four potential problems may be encountered when using the air-rotary technique:

a. When a prolific aquifer is tapped, the compressed air may not be able to lift the water to the surface.

b. Aeration of water in the borehole (and finished well) immediately prior to sampling can interfere with a number of inorganic and organic water-quality parameters.

c. Low yield water entry zones may not be identified because the air pressure prevents water from entering the borehole. Care should be taken to prevent overdrilling of the borehole.

d. Air rotary drilling can induce the migration of volatile organics to the surface or adjacent structures causing potential aesthetic or health and safety concerns.

If the air-rotary technique is used then the following special procedures will be implemented:

a. The type of air compressor and lubricating oil will be documented on an appropriate field form and in the field notebook and a 1-pint sample of the oil will be retained for characterization in the event organic compounds are detected in a well sample.

b. An air line oil filter will be required and changed per manufacturer's recommendations during operation with documentation of this maintenance on an appropriate field form and in the field notebook. More frequent oil filter changes will be made if oil is visibly detected in the filtered air.

c. The use of any additive will be prohibited, except approved water (e.g., potable water) for dust control and cuttings removal.

4.0 DECONTAMINATION

Drilling equipment decontamination procedures are outlined in the field equipment decontamination SOP. Proper decontamination in accordance with regulatory guidelines must be clearly documented in the field notebook.

5.0 PROCEDURE FOR DRILLING

5.1 Document all drilling-related activities (e.g., starting, stopping, footage, problems, decontamination, etc.) on the daily log form and in the field notebook. Record dates and times of activities, and names of Roux Associates personnel providing oversight.

5.2 Monitor and record drill fluid mix, speed of rotation, pressure on the drill fluid, rate of drilling, and length of drill rods or casing in the borehole.

5.3 Confirm that the drill rods and core barrel are straight, or discontinue drilling.

5.4 Pay particular attention to the advancement of the boring because differences in the rate of drilling may be indicative of differences in subsurface geologic conditions (e.g., sand and gravel versus clay).

5.5 Maintain a continuous dialogue with the driller to track and keep informed of all drilling activities (e.g., the speed of the drill and drilling pressure, difficult and easy drilling conditions, etc.).

5.6 Collect formation samples as described below in Section 6.0. Sample jars must be labeled appropriately (e.g., project number and name, site location, boring number, date, sample interval, blow counts, and initials of Roux Associates personnel collecting sample).

5.7 Record geologic information in the geologic log form and in the field notebook.

5.8 Handle and ship split-spoon sample jars carefully to avoid breakage and handle and ship tubes or cores carefully to prevent disturbance.

6.0 PROCEDURE FOR FORMATION SAMPLING

6.1 Intact formation sampling will be implemented using split-spoon samplers (which are driven), Shelby-tube samplers (which are pushed), or Denison-core samplers (which are rotated) depending on the drilling technique employed. Formation samples will be retained in suitable size (e.g., 1-pint or 0.5-pint) jars for physical descriptions and potential physical and chemical analysis. The appropriately labeled jars and tubes will be stored in a safe place to avoid breakage, agitation, and freezing. Intact formation samples will be collected as described in the work plan at specified intervals (e.g., at 5-foot increments below land surface) and at each major change in subsurface materials. Hydrogeologic information will be recorded on a geologic log form and in the field notebook. Detailed descriptions of the type(s) of intact sample(s) collected, sampling intervals and conditions, and objective(s) of the sample collection will be provided in the work plan.

6.2 Disturbed formation samples (drill cuttings) will be examined continuously throughout the entire depth of the borehole. If applicable to the study and/or stated in the work plan, borehole cuttings will be collected from the circulating auger flights which lift cuttings to land surface (hollow-stem auger technique), from the sand bailer (cable-tool technique), from the recirculating drilling fluid (mudflume) which transports cuttings to land surface (mud-rotary and related techniques), or from the compressed air used to carry cuttings to land surface (air-rotary and related techniques). Formation samples will be retained in appropriate size (e.g., 1-pint or 0.5-pint), properly labeled jars and stored in a safe place to avoid breakage, agitation, and freezing. Hydrogeologic data will be recorded on a geologic log form and in the field notebook.

6.3 The soil cores from the wells drilled at the site are used for lithologic identification. The first 18 inches of soil for each borehole will be collected intact using a split-spoon sample, Shelby-tube sampler, or Denison-core sampler. Split-spoon samples may be collected continuously from boreholes for cluster wells; single well and/or piezometer boreholes may be split-spooned throughout drilling or at specified intervals or changes in lithology. The conditions for sampling will be specified in the work plan.

6.4 Before collecting and retaining soil and/or sediments collected with the split-spoon sampler, the top several inches will be removed from the sampler and discarded to eliminate any sediment that may have caved into the bottom of the borehole.

6.5 Sediment sampling equipment such as split-spoon samplers, spatulas, etc. (but not including Shelby-tube or Denison-core samplers, which area not re-usable) will be decontaminated by steam cleaning and/or a non-phosphate, laboratory-grade and distilled/deionized wash followed by a distilled/deionized water rinse. (Refer to the SOP for Decontamination of Field Equipment for a detailed description of minimum and special decontamination procedures.) Decontamination of sediment sampling equipment will take place prior to the collection of the first sample and following the collection of each subsequent sample.

7.0 BOREHOLE ABANDONMENT OR CLOSURE

7.1 Upon the completion of the investigation, a determination will be made as whether to maintain the borehole (for a well or piezometer) or to close it (i.e., abandon and seal it). If the client and Roux Associates agree to abandon the borehole, then the state will be notified and a request will be presented for borehole abandonment. Upon state approval to seal the borehole, appropriate state borehole abandonment forms will be completed, if required. Following state approval, the abandonment of any borehole (or boring) will be in accordance with local, state and/or Federal regulations.

7.2 For each abandoned borehole, the procedure will be documented on an appropriate field form or in the study notebook. Documentation may include, where appropriate, the following:

a. Borehole designation.

b. Location with respect to the replacement borehole, if replaced (e.g., 30 ft north and 40 ft west of Borehole B-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Drill casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned borehole using a supplemental geologic log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i. The date of grouting.

j. The level of water or mud prior to grouting and the date and time measured.

k. Any other state or local well abandonment reporting requirements.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures for constructing ground-water monitoring or observation wells in unconsolidated (e.g., gravel, sand, silt, and clay) formations. Well development and well abandonment (closure) procedures will also be addressed in this SOP. The United States Environmental Protection Agency (USEPA), the United States Geological Survey (USGS), and state regulatory agency procedures will be reviewed and considered in conjunction with the extensive experience of Roux Associates, Inc. (Roux Associates) to determine appropriate well construction and abandonment procedures. Discussions will be held with appropriate agencies to resolve conflicting procedures and finalize well construction or abandonment methods. The well construction plan and, if necessary, abandonment will be detailed in the work plan.

Monitoring wells will be completed in unconsolidated formations for the purposes of measuring ground-water levels and collecting ground-water samples. Ground-water level data will be used to calculate ground-water elevations which will be used, to construct water-level elevation and ground-water flow direction maps to illustrate head and flow relationships. Ground-water samples will be used to quantify water-quality conditions.

Observations wells will be completed in unconsolidated formations for the purpose of collecting water-level data from aquifer tests. Slug tests, step-drawdown tests, and constant-rate pumping tests (refer to the respective SOPs) may be conducted to qualitatively or quantitatively characterize flow system hydraulic parameters and/or intra-aquifer and inter-aquifer hydraulic connection.

2.0 PROCEDURE FOR WELL CONSTRUCTION

The installation of each unconsolidated well will begin immediately after borehole completion (and geophysical logging, if implemented). Once well installation has begun, no breaks in the process will be made until the well has been completed and secured against unauthorized access. In cases of unscheduled delays, such as personal injury, equipment breakdowns or sudden inclement weather, installation will be resumed as soon as practical.

2.1 The well will be constructed of appropriate type and diameter casing and screen (stainless steel and/or PVC) and will be at least 2 inches in diameter to accommodate most water-sampling and water-level measuring devices. However, if the well's purpose is multiple (pumping tests, remote sensing, water-level recorder station, etc.), a larger diameter monitoring well (4 inches, 6 inches, or greater) may be needed to accommodate pumps, floats, or sensors. The preferred minimum diameter for a well is 4 inches because larger diameter wells (greater than 2 inches) facilitate well purging and sampling procedures (e.g., they can accommodate pumps which 2-inch diameter wells may not).

2.2 Fittings (couplings) will not restrict the inside well diameter, as stainless steel casing will be welded and/or flush-joint threaded, and PVC joints will be internally threaded. Glues, solvents, or chemical cleaners will not be used in the construction of the wells. All casings, fittings, and screens will be new material. The well screens will be fabricated and have an inside diameter equal to the well casing. The lengths of casing and screen will be measured and recorded on an appropriate field form and in the field notebook by the field hydrogeologist prior to installation.

2.3 Wells in unconsolidated formations will be installed as described below unless depth to water or total depth require modifying the thickness of emplaced materials.

a. The screen and casing will be lowered into the borehole to the appropriate depth. Screen and casing materials may be either stainless steel or PVC. A bottom plug, well cap, and flush-joint sections will be used.

b. A gravel pack (quartz sand or pea gravel) will be filled in around the screen from a few feet below the bottom of the screen to several feet (approximately 5) above the screen to avoid applying the weight of the casing on the screen. The size of the uniformly graded gravel pack will be selected based on the grain size of the formation material in the screened interval. The placement of the gravel pack may require the use of a tremie pipe.

c. A 1-foot to 3-foot layer of clean, fine-grained silica sand may be placed above the selected gravel pack to isolate the coarse-grained gravel pack (below) from the fine-grained bentonite seal (above). Again, a tremie pipe may be used in the placement of the sand layer.

d. Several feet (approximately 1-3) of bentonite (powder or pellets) will be placed on top of the sand layer to seal the top of the gravel-packed screen zone.

e. The remainder of the annulus will be grouted to within a few feet of land surface. If PVC casing is used for the construction of deep wells, then extreme care must be taken in grouting the annular space in lifts (specified lengths) to avoid deformation of the PVC casing by the heat of curing and/or the weight of the grout. This is especially important if there are large voids which will serve as reservoirs for the grout.

f. A locking steel protective casing or curb box will be set over the well and cemented in place or welded to the steel casing to prevent water from ponding at the top of the well or directly entering the well, and safeguard the well from accidental damage or vandalism.

2.4 Each well will be properly identified with the appropriate information (e.g., local well number, state permit number [if applicable], etc.). The top of the well casing will serve as the measuring point (MP) for ground-water level measurements. The measuring point will be surveyed to the nearest 0.01 foot relative to a common datum (e.g., mean sea level) by trained Roux Associates personnel or a professional, state-licensed surveyor as defined in the work plan.

2.5 If required, well clusters will be constructed. A well cluster is defined as a group of two or more wells, located adjacent to or very near each other, which penetrate different depths of the aquifer or formation. Each well is screened at a different depth to obtain data defining the vertical distribution of water levels and quality in the aquifer or formation. In the event that a well cluster is drilled, then one large-diameter (e.g., 6-inch, 8-inch, 10-inch, etc.) borehole may be drilled and each well in the cluster will be individually cased within that one borehole; however, the preferred method is to drill individual boreholes for each well in the cluster.

2.6 Each well will have a location sketch, a well construction log, and a geologic log showing the casing placement and materials used to fill the annular space between the well casing and borehole. The appropriate log will show the depths of each casing material and discuss the geologic variability at the site. A description of the surface soils and unsaturated zone materials down to and including the water table is required.

The following information, if applicable, will be included on the well log:

a. Project number.

b. Date and initials of scientist documenting the well information.

c. Date and time of construction.

d. Well location.

e. Well and permit numbers.

f. Borehole diameter.

g. Well depth.

h. Casing material.

i. Screen material.

j. Screen slot size and length.

k. Gravel pack type and size (depths from _____ to _____).

l. Sand pack (depths from _____ to _____).

m. Bentonite pellets (depths from _____ to _____).

n. Bentonite grout (depths from _____ to _____).

o. Cement grout (depths from _____ to _____).

p. Ground-surface elevation.

q. Measuring point elevation.

r. Well height above or depth below land surface.

s. Depth where ground water was encountered.

3.0 DESCRIPTION OF WELL DEVELOPMENT

3.1 Before a newly constructed well can be used for water-quality sampling, measuring water levels, or aquifer testing, it must be developed. Well development refers to the procedure used to clear the well and formation around the screen of fine-grained materials (sands, silts, and clays) produced during drilling or naturally occurring in the formation. Well development continues until the well responds to water-level changes in the formation (i.e, a good hydraulic connection is established between the well and formation) and the well produces clear, sediment-free water to the extent practical.

3.2 Depending on the drilling technique used, composition of the formation screened, and well diameter and construction materials, well development may include one or more of the following techniques.

a. Bailing.

b. Pumping (centrifugal, submersible, or air).

c. Backwashing.

d. Surging (mechanical).

e. Jetting.

f. A combination of the above.

3.3 A 1-pint sample of the last water removed during development will be obtained and inspected by the field hydrogeologist for relative clarity to determine whether development is complete. A turbidimeter may be used to evaluate the clarity of the water removed from the well during development (and its use may also be stipulated by a regulatory agency). Well development procedures will be recorded on the well construction log form and in the field notebook.

3.4 Dispersing agents, acids, disinfectants, or other additives will not be used during development nor will they be introduced into the well at any other time unless specifically stipulated in the work plan. During development, water will be removed from the entire column of water standing in the well by periodically lowering and raising the pump intake. Well development will include the rinsing of the interior well casing above the water column in the well using only water from that well.

4.0 WELL ABANDONMENT OR CLOSURE

4.1 Upon the completion of the investigation, a determination will be made whether to maintain the well or to close it (i.e., abandon and seal it). If the client and Roux Associates agree to abandon the well, then the state will be notified and a request will be presented for well abandonment. Upon state approval to seal the well, appropriate state well abandonment forms will be completed. Following state approval, the abandonment of any well will be in accordance with local, state and/or Federal regulations.

4.2 For each abandoned well, the procedure will be documented on an appropriate field form and in the field notebook. Documentation may include, where appropriate, the following:

a. Well designation.

b. Location with respect to the replacement well, if replaced (e.g., 30 ft north and 40 ft west of Monitoring Well MW-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Well casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned well using the well construction log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i The date of grouting.

j. The level of water prior to grouting and the date and time measured.

k. The remaining casing, size, and composition above or below ground surface reported in depths or heights from ground surface.

l. Any other state or local well abandonment reporting requirements.

END OF PROCEDURE