HPS PARCEL G QUEENS COUNTY LONG ISLAND CITY, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: C241226

Prepared for:

GO HPS LLC

432 Park Ave South, 2nd Floor New York, New York

Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision	Date		NYSDEC
No.	Submitted	Summary of Revision	Approval Date

CERTIFICATION

I, Charles J. McGuckin, P.E., certify that I am currently a NYS registered professional engineer and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Charles MI Lich P.E.

November 20, 2020 DATE

3084.0001.145/SMP

i

HPS PARCEL G

QUEENS COUNTY

LONG ISLAND CITY, NEW YORK

SITE MANAGEMENT PLAN

TABLE OF CONTENTS

Certification	1
List of Acronyms	iv
Executive Summary	v
1.0 Introduction	1
1.1 General	1
1.2 Revisions	2
1.3 Notifications	
2.0 Summary of Previous Investigations and Remedial Actions	4
2.1 Site Location and Description	4
2.2 Physical Setting	4
2.2.1 Land Use	4
2.2.2 Geology	4
2.2.3 Hydrogeology	
2.3 Investigation and Remedial History	
2.4 Remedial Action Objectives	
2.4.1 Groundwater	
2.4.2 Soil	10
2.4.3 Soil Vapor	10
2.5 Remaining Contamination	10
2.5.1 Soil	
2.5.2 Groundwater	
2.5.3 Soil Vapor	12
3.0 Institutional and Engineering Control Plan	
3.1 General	13
3.2 Institutional Controls	
3.3 Engineering Controls	
3.3.1 Composite Cover	
3.3.2 Criteria for Completion of Remediation/Termination of Remedial Systems	
3.4 Site-Wide Inspection	
4.0 Operation and Maintenance Plan	
4.1 General	
5.0 Periodic Assessments/Evaluations	
5.1 Climate Change Vulnerability Assessment	
5.2 Soil Vapor Intrusion Evaluation	
6.0 Reporting Requirements	
6.1 Site Management Reports	
6.2 Periodic Review Report	
6.2.1 Certification of Institutional and Engineering Controls	
6.3 Corrective Measures Work Plan	24

7.0	References	26
List o	of Embedded Tables	
1.3	3: Notifications	3
2.5	.5.1a: Remaining SVOC Contamination in Soil	11
	.5.1b: Remaining Metals Contamination in Soil	
	.1: Schedule of Interim Monitoring/Inspection Reports	
List o	of Tables	
1.	. Groundwater Elevation Measurements	-
2.	. Summary of Volatile Organic Compounds in Soil	
3.	· · · · · · · · · · · · · · · · · · ·	
4.	•	
5.		
6.	. Summary of Pesticides and Herbicides in Soil	
7.	. Summary of PFAS in Soil	
8.	. Summary of Volatile Organic Compounds in Groundwater	
9.		
10	0. Summary of Metals in Groundwater	
11	1. Summary of Polychlorinated Biphenyls in Groundwater	
12	2. Summary of Pesticides and Herbicides in Groundwater	
13	3. Summary of PFAS in Groundwater	
14	4. Summary of Volatile Organic Compounds in Soil Vapor	
List o	of Figures	
1.	-	
2.	<u>.</u>	
3.	· · · · · · · · · · · · · · · · · · ·	
4.	. Remaining Soil Sample Exceedances	
5.		
6.	. Summary of Detections in Soil Vapor	
7.	. Engineering Control Locations	
List o	of Appendices	
A.		
В.		
C.		
D.	ϵ	
E.		
F.	·	

iii 3084.0001.145/SMP

LIST OF ACRONYMS

BCA Brownfield Cleanup Agreement
BCP Brownfield Cleanup Program
CAMP Community Air Monitoring Plan

COC Certificate of Completion

DER Division of Environmental Remediation

EC Engineering Control

ECL Environmental Conservation Law

EWP Excavation Work Plan HASP Health and Safety Plan IC Institutional Control

NYCDOHMH New York City Department of Health and Mental Hygiene NYSDEC New York State Department of Environmental Conservation

NYSDOH New York State Department of Health NYCRR New York Codes, Rules and Regulations

PID Photoionization Detector
PRP Potentially Responsible Party
PRR Periodic Review Report

QA/QC Quality Assurance/Quality Control
QAPP Quality Assurance Project Plan
RAO Remedial Action Objective
RAWP Remedial Action Work Plan

REC Recognized Environmental Condition

RI Remedial Investigation ROD Record of Decision RP Remedial Party

RSO Remedial System Optimization SCG Standards, Criteria and Guidelines

SCO Soil Cleanup Objective
SMP Site Management Plan
SVI Soil Vapor Intrusion
TAL Target Analyte List
TCL Target Compound List

TCLP Toxicity Characteristic Leachate Procedure
USEPA United States Environmental Protection Agency

3084.0001.145/SMP iV

EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan:

Site Identification: C241226 – HPS Parcel G

57-28 2nd Street, Long Island City

Institutional Controls:

- 1. The property may be used for restricted residential and commercial use:
- 2. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the NYCDOHMH to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department;
- 3. Data and information pertinent to Site management, including EC inspections, must be reported at the frequency and in a manner as defined in this SMP;
- 4. All ECs must be operated and maintained as specified in this SMP;
- 5. All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- 6. Access to the Site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
- 7. Maintenance, inspection, and reporting of any physical component of the remedy shall be performed as defined in this SMP;
- 8. The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 2, and appropriate actions to address exposures must be implemented;
- 9. Vegetable gardens and farming on the Site are prohibited.

Engineering Controls:	1. Cover system		
Inspections:		Frequency	
1. Site-Wide Inspection		Annually	
Evaluations:			
Climate Change Vulnerability Assessment		Upon observation of conditions that could impede ECs and reported in the PRR	
2. Soil Vapor Intrusion Evaluation		Upon change in use/as needed	
Reporting:			
1. Inspections		Annually	
2. Certifications/PRR		Annually until building construction is completed. Frequency thereafter to be determined by NYSDEC	
3. Final Construction Report		Upon completion of Soil Management/Excavation Activities	

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

vi 3084.0001.145/SMP

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the HPS Parcel G Site located at 57-28 2nd Street in Long Island City, New York (hereinafter referred to as the "Site"). See Figure 1. The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP), Site No. C241226 which is administered by New York State Department of Environmental Conservation (NYSDEC).

GO HPS LLC entered into a Brownfield Cleanup Agreement (BCA) on December 3, 2018 with the NYSDEC as a Volunteer to remediate the Site. A figure showing the Site location and boundaries of this Site is provided in Figure 2. The boundaries of the Site are more fully described in the metes and bounds Site description that is part of the Environmental Easement provided in Appendix A. A BCA Amendment #1 was executed on July 8, 2020 to transfer the Site ownership from New York City Housing Preservation and Development to South Point Housing Development Fund Corporation. A BCA Amendment #2 was executed on October 5, 2020 to add GO HPS LIHTC LLC as a requestor on the BCA. A BCA Amendment #3 was executed on November 5, 2020 to document that the Volunteer is eligible for tangible property tax credits.

After completion of the remedial work, some contamination was left at this Site, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the Site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the Office of the City Register, requires compliance with this SMP and all ECs and ICs placed on the Site.

This SMP was prepared to manage remaining contamination at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

• This SMP details the Site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the

Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC);

• Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the BCA (Index # C241226-11-18; Site #C241226) for the Site, and thereby subject to applicable penalties.

All reports associated with the Site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the Site is provided in Appendix B of this SMP.

This SMP was prepared by Roux Environmental Engineering & Geology, D.P.C., on behalf of GO HPS LLC, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and ECs that are required by the Environmental Easement for the Site.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, post-remedial removal of contaminated sediment or soil, or other significant change to the Site conditions. In accordance with the Environmental Easement for the Site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in Site use that are required under the terms of the BCA, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.

- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the Site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the Brownfield Cleanup Agreement (BCA), and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the Site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1.3 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Siterelated contact information is provided in Appendix B.

Table 1.3: Notifications*

Name	Contact Information
Christopher Allan Project Manager, NYSDEC Division of Environmental Remediation, Superfund and Brownfield Cleanup Section	(718) 482-4065 christopher.allan@dec.ny.gov
Jane O'Connell Chief, NYSDEC Division of Environmental Remediation, Superfund and Brownfield Cleanup Section	(718) 482-4599 jane.oconnell@dec.ny.gov
Kelly Lewandowski Chief, NYSDEC Division of Environmental Remediation, Site Control Section	(518) 402-9569 kelly.lewandowski@dec.ny.gov

^{*} Note: Notifications are subject to change and will be updated as necessary.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The Site is located in the Hunter's Point South section of Long Island City, Queens County, New York and is identified as Block 6 and Lot 20 on the New York City Tax Map (see Figure 2). The Site is an approximately 0.45-acre area and is bounded by 2nd Street to the north, public open space and Newtown Creek to the south, public open space to the east, and public open space and the East River to the west (see Figure 2 – Site Layout Map). The boundaries of the Site are more fully described in Appendix A –Environmental Easement. The owner(s) of the Site parcel at the time of issuance of this SMP is South Point Housing Development Fund Corporation.

2.2 Physical Setting

2.2.1 Land Use

Overall development construction is expected to be complete in 2021. Excavation is complete and concrete foundation elements are installed. The property will be developed into a mixed residential and commercial use development. The Site is part of the larger Hunter's Point South Project Area (HPSPA) redevelopment and is zoned residential (R10). R10 districts are high-density districts that permit a wide range of building types including towers.

The properties adjoining the Site and in the neighborhood surrounding the Site consist of multiple areas undergoing redevelopment and new construction as part of the HPSPA, and primarily include a mix of urban residential, public open space, and commercial properties. The Site is immediately surrounded by open space except for it is bounded by 2nd street to the north. Past the open space surrounding the Site to the south, east, and west is Newtown Creek, a parking lot and warehouse, and the East River, respectively.

2.2.2 Geology

Based on the environmental soil borings completed during the April/May 2019 Remedial Investigation (RI), the entire Site is covered with historic urban fill material, containing fine to coarse sand with varying amounts of silt, gravel, brick, and concrete fragments ranging in thickness of up to 26 to 34 feet throughout most of the Site. Bedrock was not encountered during the RI, however, during the geotechnical investigation performed in March 2018 by Mueser Rutledge

Consulting Engineers (MRCE), bedrock was encountered at elevations ranging from -54 to -70 feet relative to NAVD88, and consists of Paleozoic schist or gneiss. Site specific boring logs are provided in Appendix C.

2.2.3 Hydrogeology

The depth to groundwater in the monitoring wells installed during the RI was between approximately 12 to 17 feet bls. Based on this data, groundwater is presumed to flow southeast toward the East River. A groundwater contour map is shown in Figure 3. Groundwater elevation data is provided in Table 1. Groundwater monitoring well construction logs are provided in Appendix C. All monitoring wells installed during the RI were removed as part of construction.

2.3 Investigation and Remedial History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 7.0 - References.

According to previously completed Phase I and Phase II ESAs (described in detail in the following paragraphs), the Site has had industrial uses since the late 19th century when it was depicted on Sanborn Maps as a storage building for a dock yard and dry dock operation along Newtown Creek. From 1915 through 1924 the parcel was part of a lumber yard. Beginning in the 1930s, the parcel was part of a larger area developed as a sugar refinery, which expanded operations to cover the entire Site and immediately surrounding properties through 1962. The refinery included large warehouses, a boiler house with four boilers and coal conveyors to Newtown Creek, and an incinerator and ash pit to the south of the Site. The sugar refinery property was transferred to a newspaper publisher in 1965, and around this time the refinery was demolished. The Site remained vacant until the 1970s. The eastern portion of the former refinery, including the footprint of the Site, was developed with a newspaper publishing plant and associated parking from the mid-1970s through 2003. From 1974 through 1986, the Sanborn maps indicate an area of this parking lot was used for storage of solvents within an earthen berm. The maps depict three 10,000-gallon and one 4,000-gallon tanks in this area, which are likely associated with the printing operation at the Site.

A detailed description of previous environmental reports was included in Section III of the BCP Support Document in the BCP Application package, and a summary is provided below. Previous environmental assessment activities and reports that have been completed at the Site include:

- Phase I ESA prepared by TRC Environmental Corporation (TRC) on behalf of the New York City Economic Development Corporation (NYC EDC), October 26, 2006;
- Phase II ESA, prepared by TRC on behalf of the NYC EDC, January 2007;
- Phase II Environmental Site Investigation (ESI) prepared by Yu & Associates on behalf of the NYC EDC, February 2015;
- Phase I Environmental Site Assessment (ESA), prepared by Roux on behalf of GO HPS LLC, April 18, 2018;
- Memorandum on Soil Sampling Results, prepared by Roux provided to the NYSDEC on behalf of GO HPS LLC, May 14, 2018;
- Remedial Investigation Report/Remedial Action Work Plan (RIR/RAWP), prepared by Roux provided to the NYSDEC on behalf of GO HPS LLC, November 2019;

A summary of the findings of these assessments is provided below.

Phase I and II ESAs by TRC, 2006 and 2007

The Phase I & II ESAs completed by TRC identified the Site's historic industrial use as a Recognized Environmental Condition (REC). In order to conduct a general screening of the larger HPSPA, given its past industrial use, TRC conducted a Phase II ESA in January 2007. Phase II activities consisted of a geophysical survey, excavation of test pits, advancement of soil borings, and soil, groundwater, and soil vapor sampling. TRC's investigation across the larger HPSPA included collection of 55 soil samples, 21 groundwater samples, eight sediment samples from the shoreline of the adjacent East River, and five soil vapor samples at locations that were identified to be of potential concern during the Phase I ESA. Additionally, TRC performed field screening of soil vapor from 16 locations. Of these samples, one soil vapor and one groundwater sample were within the Site footprint. Groundwater samples were analyzed for the same parameters as soil with additional analysis of total and dissolved TAL metals samples. The analytical results

indicated elevated concentrations of polycyclic aromatic hydrocarbons (PAHs) and metals in soil and chlorinated volatile organic compound (CVOC) detections in soil vapor.

Phase II ESI prepared by Yu & Associates, February 2015

The Phase II ESI completed by Yu & Associates in February 2015 was performed for the public park area and roadway development as part of HPSPA. The ESI included a geophysical survey to identify subsurface utilities and potential underground storage tanks (USTs) and collection and analysis of 22 soil samples, eight groundwater samples, two soil vapor samples, and one ambient air sample of which five soil samples and two groundwater samples were completed within the Parcel G footprint. The analytical results indicated elevated concentrations of metals in soil and PAHs in groundwater at the Site.

Phase I ESA prepared by Roux, April 2018

The Roux Phase I ESA describes the Site as being an open, vacant lot with a graded soil surface. Roux did not identify any Controlled Recognized Environmental Conditions (CRECs) or Historic Recognized Environmental Conditions (HRECs) in relation with the Site; however, the following RECs were identified, as detailed below:

- Historic Industrial Use of Site and Surrounding Areas: The historic uses of the Site and surrounding area, namely sugar refinery operations including the presence of an incinerator and ash pit within or nearby the footprint of Parcel G and the storage of solvents on the adjacent property are identified as a REC for the Site.
- *Presence of Imported Fill:* The import of unknown soil and fill materials to the west of the Site to expand area into the East River by approximately 100,000 sq ft, the likely presence of fill material to the south of the Site into Newtown Creek, as well as the presence of stockpiles of material identified on aerial photographs, are identified as a REC for the Site.
- Subsurface Contamination in Previous Investigations: Based on the results of the previous Phase II ESAs for the HPSPA, which include the Site and surrounding areas, Roux has identified the presence of chlorinated volatile organic compound (CVOC) detections in soil vapor and polycyclic aromatic hydrocarbons (PAHs) and metals in soil as a REC for the Site.

Memorandum on Soil Sampling Results, prepared by Roux, May 2018

As part of the BCP pre-application process, Roux conducted soil sampling on behalf of GO HPS LLC as requested by the NYSDEC in order to compare results to previous Site conditions and to rule out the possibility that sampling results were based on soils that were recently disturbed (and not reflective of historic contamination at depth). Roux's investigation included collection of 8 soil samples from Parcel G. Soil samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides, PCBs, and TAL metals.

RIR/RAWP prepared by Roux, November 2019

The RI field work included the following:

- 1. Advancement of seven soil borings across the Site and collection of 14 discrete soil samples (excluding QA/QC samples) for laboratory analysis;
- Installation of three temporary groundwater monitoring wells (converted from three of the soil borings) and collection of three groundwater samples (excluding QA/QC samples); and
- 3. Installation of four soil vapor monitoring points and collection of four soil vapor samples (excluding QA/QC samples).

The following summary of environmental findings from the RI was included in the RIR/RAWP dated November 2019:

Soil

No VOCs, PCBs or pesticides were detected in exceedance of restricted residential soil cleanup objectives (RRSCOs). Several SVOCs were found throughout the Site to depths up to 18 feet, including: benzo(a)anthracene at a maximum concentration of 14 milligrams per kilogram (mg/kg) as compared to the RRSCO of 1 mg/kg; benzo(a)pyrene at 13 mg/kg (RRSCO is 1 mg/kg); benzo(b)fluoranthene at 16 mg/kg (RRSCO is 1 mg/kg); benzo(k)fluoranthene at 5.4 mg/kg (RRSCO is 3.9 mg/kg); chrysene at 13 mg/kg (RRSCO is 3.9 mg/kg); dibenz(a,h)anthracene at 1.8 mg/kg (RRSCO is 0.33 mg/kg); and indeno(1,2,3-cd)pyrene at 7.1 mg/kg (RRSCO is 0.5 mg/kg). Heavy metals were detected mostly in the southern portion of the Site at depths up to 18 feet, including: arsenic at 35.6 mg/kg (RRSCO is 400 mg/kg); barium at 779 mg/kg (RRSCO is 400 mg/kg); lead at 13,900 mg/kg (RRSCO is 400 mg/kg); and mercury at 7.9 mg/kg (RRSCO is 0.81

mg/kg). Emerging contaminants, specifically perfluorooctanesulfonic acid (PFOS), were detected in one boring at 1.25 micrograms per kilogram (μ g/kg). Data does not indicate any off-Site impacts in soil related to this Site.

Groundwater

No VOCs, SVOCs, PCBs or pesticides were detected in groundwater at concentrations exceeding the ambient water quality standards (AWQS). Several naturally-occurring metals, including sodium, magnesium and manganese, were detected at concentrations exceeding their respective AWQS; however, these can be attributed to the Site's proximity to saline surface water. Several emerging contaminants were detected in groundwater, including PFOS at 19.4µg/kg and perfluorooctanoic acid (PFOA) at 125µg/kg. Data does not indicate any off-Site impacts in groundwater related to this Site.

Soil Vapor

Several VOCs were detected in soil vapor, including tetrachloroethene at a maximum concentration of 11 micrograms per cubic meter ($\mu g/m^3$), tert-butyl alcohol at 150 $\mu g/m^3$, and toluene at 130 $\mu g/m^3$. Data does not indicate any off-Site impacts in soil vapor related to this Site.

Based on the findings from the RI, Roux prepared a RAWP to support the redevelopment plans. The RAWP proposed a combination Track 2 and Track 4 remedy. This remedy included excavation of the upper 15 feet of soil in the central portion of the Site for construction of the basement, with limited excavation and a cover system to achieve the Track 4 remedy along the perimeter of two sides of the Site. Approximately 8,000 cubic yards (CY) of contaminated soil were excavated. The RIR/RAWP proposed a remedy that included ICs and ECs which were implemented as described in Section 3.0.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Decision Document dated November 26, 2019 are as follows:

2.4.1 Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from contaminated groundwater.

RAOs for Environmental Protection

- Prevent the discharge of contaminants to surface water.
- Remove the source of ground or surface water contamination.

2.4.2 Soil

RAOs for Public Health Protection

• Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

• Prevent migration of contaminants that would result in groundwater or surface water contamination.

2.4.3 Soil Vapor

RAOs for Public Health Protection

• Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a Site.

2.5 Remaining Contamination

2.5.1 Soil

Tables 2 through 7 and Figure 4 summarize the results of all soil samples collected that exceed the Unrestricted Use SCOs and the Restricted Residential Use SCOs at the Site after completion of remedial action. Soil exceeding the Part 375 unrestricted use and restricted residential use SCOs are present onsite as identified during the RI (pre-excavation) and post-excavation endpoint soil sampling. All of the remaining soils have been contained under the Site cover system as described in Section 3.3.1. The March 2018 MRCE geotechnical investigation found that historic fill was present across the Site ranging in thickness of up to 26 to 34 feet which likely contains similar soil contaminants as described below.

Remaining soil contaminants in exceedance of RRSCOs include PAHs and metals and are further summarized in the tables below.

Table 2.5.1a Remaining SVOC Contamination in Soil

SVOCs	Number of Exceedances	Location of Maximum Exceedance	Concentration (mg/kg or ppm)	RRSCO (mg/kg or ppm)
Benzo(a)anthracene	8	BDS-4 (15-17 ft bls)	20	1
Benzo(a)pyrene	8	BDS-4 (15-17 ft bls)	32	1
Benzo(b)fluoranthene	9	BDS-4 (15-17 ft bls)	35	1
Benzo(k)fluoranthene	3	BDS-4 (15-17 ft bls)	13	3.9
Chrysene	2	BDS-4 (15-17 ft bls)	18	3.9
Dibenzo(a,h)anthracene	4	BDS-4 (15-17 ft bls)	3.5	0.33
Indeno(1,2,3-c,d)pyrene	8	BDS-4 (15-17 ft bls)	13	0.5

Table 2.5.1b Remaining Metals Contamination in Soil

Metal	Number of Exceedances	Location of Maximum Exceedance	Concentration (mg/kg or ppm)	RRSCO (mg/kg or ppm)
Arsenic	4	BDS-4 (15-17 ft bls)	43.7	16
Barium	2	RMW-G2 (8-10 ft bls)	779	400
Lead	3	RMW-G2 (8-10 ft bls)	1,440	400
Mercury	4	BDS-3 DUP (15-17 ft bls)	1.6	0.81

2.5.2 Groundwater

This section summarizes the remaining groundwater contamination based on laboratory analytical data that was generated during the RI. Tables 8 through 13 and Figure 5 summarize the results of the groundwater samples collected during the RI that exceeded the AWQSGVs. No VOCs, SVOCs, PCBs or pesticides were detected in groundwater at concentrations exceeding the AWQS. Several naturally-occurring metals, including sodium, magnesium and manganese, were detected at concentrations exceeding their respective AWQS; however, these can be attributed to the Site's proximity to saline surface water. The emerging contaminants PFOS and PFOA were detected at maximum concentrations of 19.4 ng/L and 125 ng/L, respectively.

The remedial elements, including excavation of contaminated soil, were expected to improve groundwater quality by reducing or eliminating potential source material.

2.5.3 Soil Vapor

This section summarizes the remaining groundwater contamination based on laboratory analytical data that was generated during the RI. Table 14 and Figure 6 summarize the results of the soil vapor samples collected during the RI. As discussed in Section 2.3 above, VOCs were detected in soil vapor, including tetrachloroethene at a maximum concentration of $11 \mu g/m^3$, tertbutyl alcohol at $150 \mu g/m^3$, and toluene at $130 \mu g/m^3$.

The remedial elements, including excavation, addressed soil and groundwater contamination. This was expected to improve onsite soil vapor quality by reducing or eliminating potential source material. In addition, as part of construction, a waterproofing barrier was installed below the foundation and along the subsurface walls which will also act as a vapor barrier to prevent vapor intrusion.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since remaining contamination exists at the Site, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the Site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC.

This plan provides:

- A description of all IC/ECs on the Site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix D) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the Site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the Site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required by the November 26, 2019 Decision Document to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the Site to restricted residential and commercial uses only. Adherence to these ICs on the Site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figure 2. These ICs are:

- The property may be used for: restricted residential and commercial use;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP.

- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the New York State Department of Health (NYSDOH)or the NYC Department of Health and Mental Hygiene (NYCDOHMH) to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
- Data and information pertinent to Site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP:
- Maintenance, inspection, and reporting of any physical component of the remedy shall be performed as defined in this SMP;
- Access to the Site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 2, and appropriate actions to address exposures must be implemented; and
- Vegetable gardens and farming at the Site are prohibited.

3.3 Engineering Controls

3.3.1 Composite Cover

Exposure to remaining contamination at the Site is prevented by a cover system placed over the Site. The permanent cover system is comprised of a combination of concrete building foundation and slab and outdoor areas covered in pavement and hardscaping or exposed soil. Where a soil cover is to be used it will be a minimum of two feet of soil placed over a demarcation layer, with the upper six inches of soil of sufficient quality to maintain a vegetative layer. A temporary cover meeting this criteria will be utilized in the outdoor areas during the remainder of building construction at the Site until the area is ready for landscaping installation. The permanent cover system will be in place prior to building occupancy. Procedures outlined in this SMP and defined in the Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) (provided in Appendix E) will be implemented during installation of the final cover.

Figure 7 presents the location of the cover system and applicable demarcation layers. The EWP provided in Appendix D outlines the procedures required to be implemented in the event the

cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. The procedures in the EWP will also be followed during placement of the permanent Site cover. Procedures for the inspection of this cover are provided in the Section 6.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a HASP and associated CAMP prepared for the Site and provided in Appendix E.

3.3.2 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when end point sampling/monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

Composite Cover

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

3.4 Site-Wide Inspection

Site-wide inspections will be performed at a minimum of once per year. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs. During these inspections, an inspection form will be completed as provided in Appendix F – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including Site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General Site conditions at the time of the inspection;
- The Site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that Site records are up to date.

Inspections of all remedial components installed at the Site will be conducted. A comprehensive Site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If Site records are complete and up to date; and

Reporting requirements are outlined in Section 6.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the Site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the Site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be

provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.0 OPERATION AND MAINTENANCE PLAN

4.1 General

The Site remedy does not rely on any mechanical systems, such as groundwater treatment systems, sub-slab depressurization systems or air sparge/soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP.

5.0 PERIODIC ASSESSMENTS/EVALUATIONS

5.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given Site and associated remedial systems. Vulnerability assessments provide information so that the Site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the Site during periodic assessments, and briefly summarizes the vulnerability of the Site and/or engineering controls to severe storms/weather events and associated flooding.

- Flood Plain: The Site is not located in a flood plain, low lying or low-groundwater recharge area.
- Site Drainage and Storm Water Management: the building has its storm water directed to a storm water detention tank located in the cellar level. The tank is provided with pumps to discharge the water out to the street storm sewer main. The outgoing sewer lines are all provided with backwater valves to prevent the street sewer from backing up into the building. The tank has an overflow line that can discharge out of the face of the building if the street sewer main is not receiving water. The rest of the Site bypasses the internal building storm system and directly discharges to the street main.
- Erosion: The majority of the Site will be covered by the building footprint and outdoor areas will be hardscaped or contain planted beds, therefore, erosion at the Site is not anticipated during periods of severe rain events. In the event that erosion occurs, the areas will be repaired as needed to ensure a minimum of 2-foot cover.
- High Wind: No areas of the Site have been identified which may be susceptible to damage from the wind itself or falling objects, such as trees or utility structures during periods of high wind.
- Electricity: The Site is potentially susceptible to power loss and/or dips/surges in voltage during severe weather events, including lightning strikes, and the associated impact on Site equipment and operations. However, the surrounding area is highly developed and power outages will be rectified as soon as possible by the electricity provider. Due to the variability in annual weather patterns, it is assumed that emergency weather situations will be infrequent, and damages rectified by the appropriate relief agency.

• Spill/Containment Release: No areas of the Site have been identified that may be susceptible to a spill or other containment release due to storm-related damage caused by flooding, erosion, high winds, loss of power etc.

5.2 Soil Vapor Intrusion Evaluation

A soil vapor intrusion evaluation must be performed upon a change in use of the property that will result in occupancy of a previously unoccupied building or initial occupancy of a new building. The breadth of this evaluation will be determined based upon discussion with the NYSDEC Project manager and NYSDOH. Based upon these discussion and agency requirements, a work plan may need to be developed that requires that sampling be performed. At a minimum, a Soil Vapor Intrusion (SVI) sampling work plan would include the following information:

- A figure showing the soil vapor intrusion sample locations;
- Discuss the depths of the soil vapor samples;
- Include a table of sample locations and analytical parameters to be analyzed along with the minimum reporting limits to be achieved by the NYS Environmental Laboratory Approval Program (ELAP)-certified laboratory.

Upon completion of the evaluation, if an action is required, any actions taken or to be taken must be reflected in an updated SMP.

6.1 Site Management Reports

All Site management inspection and maintenance events will be recorded on the appropriate Site management forms provided in Appendix F. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including system maintenance reports, generated for the Site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 6.1 (below) and summarized in the Periodic Review Report.

Table 6.1: Schedule of Interim Monitoring/Inspection Reports

Task/Report	Reporting Frequency*		
Inspection Report	Annually		
	Annually until building construction is		
Periodic Review Report	completed. Frequency thereafter to be		
	determined by NYSDEC		
Climate Change Vulnerability	Upon observation of conditions that could		
Assessment	impede ICs and reported in the PRR		

^{*} The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and,
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

6.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the Department beginning sixteen (16) months after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the Department until building construction is completed. Once building construction is completed, another frequency may be required by the Department. In the event that the Site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the Site described in Appendix A -Environmental Easement. The report will be prepared in accordance

with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the Site.
- Results of the required annual Site inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the Site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any data and/or information generated during the reporting period, with comments and conclusions, if any.
- A Site evaluation, which includes the following:
 - The compliance of the remedy with the requirements of the Site-specific RAWP and Decision Document:
 - Any new conclusions or observations regarding Site contamination based on inspections;
 - Recommendations regarding any necessary changes to the remedy; and
 - The overall performance and effectiveness of the remedy.

6.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a Professional Engineer licensed to practice in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

"For each institutional or engineering control identified for the Site, I certify that all of the following statements are true:

- The inspection of the Site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;
- The institutional control and/or engineering control employed at this Site is unchanged from the date the control was put in place, or last approved by the Department;
- Nothing has occurred that would impair the ability of the control to protect the public health and environment;

- Nothing has occurred that would constitute a violation or failure to comply with any Site management plan for this control;
- Access to the Site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;
- *Use of the Site is compliant with the environmental easement;*
- The engineering control systems are performing as designed and are effective;
- To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Site remedial program and generally accepted engineering practices;
- No new information has come to my attention, including groundwater monitoring data from wells located at the Site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of off-Site contamination are no longer valid; and
- The information presented in this report is accurate and complete.

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner/Remedial Party or Owner's/Remedial Party's Designated Site Representative and I have been authorized and designated by all Site owners to sign this certification for the Site."

For BCP projects, every five years the following certification will be added:

• The assumptions made in the qualitative exposure assessment remain valid.

The signed certification will be included in the Periodic Review Report.

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the Site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

6.3 Corrective Measures Work Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work Plan will be submitted to the NYSDEC and NYSDOH for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to

correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC and NYSDOH.

7.0 REFERENCES

6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

NYSDEC DER-10 – "Technical Guidance for Site Investigation and Remediation".

- NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).
- Roux Environmental Engineering and Geology, D.P.C, 2018. Phase I ESA HPS Parcels F and G. April 18, 2018.
- Roux Environmental Engineering and Geology, D.P.C, 2018. Memorandum on Soil Sampling Results HPS Parcels F and G. May 14, 2018.
- Roux Environmental Engineering and Geology, D.P.C, 2019. Remedial Investigation Report/ Remedial Action Work Plan, HPS Parcel G. November 2019

TRC Environmental Corporation, 2006. Phase I ESA. October 26, 2006.

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Site Management Plan HPS Parcel G – 57-28 2nd Street, Long Island City, New York BCP Site #C241226

TABLES

- 1. Groundwater Elevation Measurements
- 2. Summary of Volatile Organic Compounds in Soil
- 3. Summary of Semivolatile Organic Compounds in Soil
- 4. Summary of Metals in Soil
- 5. Summary of Polychlorinated Biphenyls in Soil
- 6. Summary of Pesticides and Herbicides in Soil
- 7. Summary of PFAS in Soil
- 8. Summary of Volatile Organic Compounds in Groundwater
- 9. Summary of Semivolatile Organic Compounds in Groundwater
- 10. Summary of Metals in Groundwater
- 11. Summary of Polychlorinated Biphenyls in Groundwater
- 12. Summary of Pesticides and Herbicides in Groundwater
- 13. Summary of PFAS in Groundwater
- 14. Summary of Volatile Organic Compounds in Soil Vapor

3084.0001Y145/CVRS ROUX

Table 1. Summary of Water Level Measurements, HPS Parcel G, Queens, New York

Monitoring Well	Measurement Date	Measuring Point Elevation (ft NAVD 88)	Depth to Water (ft below measuring point)	Water Level Elevation (ft NAVD 88)
RMW-G1	5/29/2019	15.59	14.67	0.92
RMW-G2	5/29/2019	15.66	14.73	0.93
RMW-G3	5/19/2019	20.76	19.70	1.06

Notes:

ft - Feet

NAVD 1988 - North American Vertical Datum of 1988



Page 1 of 1 3084.0001Y145/WKB

	Notes Utilized Throughout Tables		
Soil Tables			
	Father standard control		
	Estimated value		
	Indicates that the compound was analyzed for but not detected		
	The analyte was found in an associated blank as well as in the sample		
	The RPD between the results for the two columns exceeds the method-specified criteria		
	Relative Percent Difference		
	Indicates that a quality control parameter has exceeded laboratory limits		
	Feet below land surface		
	Duplicate sample		
	Micrograms per kilogram		
	Milligrams per kilogram		
	New York State Department of Environmental Conservation		
	Soil Cleanup Objectives		
	No SCO available		
	at parameter was detected above the NYSDEC Part 375 Unrestricted Use SCO (UUSCO)		
	s that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO (RRSCO)		
Boxed data indicates	that parameter was detected above the NYSDEC Part 375 Protection of Groundwater SCO (PGW SCO)		
Groundwater Tabl			
	New York State Department of Environmental Conservation		
	Ambient Water-Quality Standards and Guidance Values		
	No NYSDEC AWQSGV available		
10	Micrograms per liter		
	Nanogram per liter		
Bold data indicates th	at parameter was detected above the NYSDEC AWQSGVs		
	Estimated Value		
	Compound was analyzed for but not detected		
	The analyte was found in an associated blank as well as in the sample		
	The RPD between the results for the two columns exceeds the method-specified criteria		
	The lower value for the two columns has been reported due to obvious interference		
	Relative Percent Difference		
	Indicates that a quality control parameter has exceeded laboratory limits		
	Sample results rejected by validator		
	Analyte was not detected. The associated reported quantitation limit is an estimate		
	Detection is tentative in identification and estimated in value		
	Duplicate		
NA -	Compound was not analyzed for by laboratory		
Soil Vapor/Ambier	nt Air		
J -	Estimated value		
U -	Indicates that the compound was analyzed for but not detected		
	A secondary analysis after dilution due to exceedance of the calibration range in the original sample.		
	Duplicate sample		
μg/m3 -	Micrograms per cubic meter		
	at parameter was detected		



Table 2. Summary of Volatile Organic Compounds in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	BDS-1	BDS-2	BDS-3	BDS-3 DUP	BDS-4	RMW-G1
Parameter	Part 375	Part 375	Part 375	Sample Date:		5/21/2020	5/21/2020	5/21/2020	5/20/2020	04/29/2019
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	10.5 - 12.5	0 - 2	15 - 17	15 - 17	15 - 17	10 - 12
1,1,1-Trichloroethane	0.68	100	0.68		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
1,1,2,2-Tetrachloroethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
1,1,2-Trichloroethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
1,1-Dichloroethane	0.27	26	0.27		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
1,1-Dichloroethene	0.27	100	0.27		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
1,2,3-Trichlorobenzene					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
1,2,4-Trichlorobenzene					0.0011 UT	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
1,2,4-Trimethylbenzene	3.6	52	3.6		0.0011 01	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
1,2-Dibromoethane	J.0 				0.0034 0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
1,2-Dichlorobenzene	1.1	100	1.1		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
1,2-Dichloroethane	0.02	3.1	0.02		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
1,2-Dichloropropane		J. I 			0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
	 8.4	 52	8.4		0.0011 0	0.0012 U	0.0013 U	0.0012 U 0.0012 U	0.0011 UT	0.0012 U
1,3,5-Trimethylbenzene		49	0. 4 2.4			0.0012 U				
1,3-Dichlorobenzene	2.4 1.8	49 13	2. 4 1.8		0.0011 U	0.0012 U 0.0012 U	0.0013 U 0.0013 U	0.0012 U 0.0012 U	0.0011 UT	0.0012 U
1,4-Dichlorobenzene					0.0011 U		0.0013 U 0.0066 U		0.0011 UT	0.0012 U 0.0092
2-Butanone (MEK)	0.12	100	0.12		0.0036 J	0.0061 U		0.0062 U	0.0056 U	
2-Hexanone					0.0056 U	0.0061 U	0.0066 U	0.0062 U	0.0056 UT	0.0062 U
4-Methyl-2-pentanone (MIBK)					0.0056 U	0.0061 U	0.0066 U	0.0062 U	0.0056 U	0.0062 U
Acetone	0.05	100	0.05		0.056	0.0073 U	0.019	0.026	0.016 T	0.086
Benzene	0.06	4.8	0.06		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Bromochloromethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Bromodichloromethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Bromoform					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Bromomethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Carbon disulfide					0.00087 J	0.00053 J	0.00087 J	0.0013	0.0011 UT	0.00063 J
Carbon tetrachloride	0.76	2.4	0.76		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Chlorobenzene	1.1	100	1.1		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Chloroethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Chloroform	0.37	49	0.37		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Chloromethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
cis-1,2-Dichloroethene	0.25	100	0.25		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
cis-1,3-Dichloropropene					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Cyclohexane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Dibromochloromethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Dibromochloropropane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Dichlorodifluoromethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Ethylbenzene	1	41	1		0.00024 J	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Freon 113					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Isopropylbenzene					0.00026 J	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U

Page 1 of 4

Table 2. Summary of Volatile Organic Compounds in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

-	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	BDS-1	BDS-2	BDS-3	BDS-3 DUP	BDS-4	RMW-G1
Parameter	Part 375	Part 375	Part 375	Sample Date:	4/28/2020	5/21/2020	5/21/2020	5/21/2020	5/20/2020	04/29/2019
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	10.5 - 12.5	0 - 2	15 - 17	15 - 17	15 - 17	10 - 12
m+p-Xylene					0.0010 J	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Methyl acetate					0.0056 U	0.0061 U	0.0066 U	0.0062 U	0.0056 U	0.0062 U
Methylcyclohexane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.00041 J
Methylene chloride	0.05	100	0.05		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
MTBE	0.93	100	0.93		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
n-Butylbenzene	12	100	12		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
n-Propylbenzene	3.9	100	3.9		0.00031 J	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
o-Xylene					0.0011	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
sec-Butylbenzene	11	100	11		0.00032 J	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Styrene					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
tert-Butylbenzene	5.9	100	5.9		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Tetrachloroethene	1.3	19	1.3		0.00026 J	0.00023 J	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Toluene	0.7	100	0.7		0.00051 J	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
trans-1,2-Dichloroethene	0.19	100	0.19		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
trans-1,3-Dichloropropene					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Trichloroethene	0.47	21	0.47		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 UT	0.0012 U
Trichlorofluoromethane					0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Vinyl chloride	0.02	0.9	0.02		0.0011 U	0.0012 U	0.0013 U	0.0012 U	0.0011 U	0.0012 U
Xylenes (total)	0.26	100	1.6		0.0021 J	0.0024 U	0.0026 U	0.0025 U	0.0023 UT	0.0025 U



Table 2. Summary of Volatile Organic Compounds in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	RMW-G2	RSV-G1	SB-G04
Parameter	Part 375	Part 375	Part 375	Sample Designation:		04/30/2019	04/02/2018
(Concentrations in mg/kg)	UUSCO	RRSCO		Sample Depth (ft bls):	8 - 10	0 - 2	16 - 18
(Concentrations in mg/kg)	00300	KKSCO	FGW 3CO	Sample Depth (it bis).	8 - 10	0-2	10 - 10
1,1,1-Trichloroethane	0.68	100	0.68		0.0013 UJ	0.0013 U	0.0012 U
1,1,2,2-Tetrachloroethane					0.0013 U	0.0013 U	0.0012 U
1,1,2-Trichloroethane					0.0013 UJ	0.0013 U	0.0012 U
1,1-Dichloroethane	0.27	26	0.27		0.0013 UJ	0.0013 U	0.0012 U
1,1-Dichloroethene	0.33	100	0.33		0.0013 UJ	0.0013 U	0.0012 U
1,2,3-Trichlorobenzene					0.0013 UJ	0.0013 U	0.0012 U
1,2,4-Trichlorobenzene					0.0013 UJ	0.00015 JB	0.0012 U
1,2,4-Trimethylbenzene	3.6	52	3.6		0.0013 UJ	0.00024 J	NA
1,2-Dibromoethane					0.0013 UJ	0.0013 U	0.0012 U
1,2-Dichlorobenzene	1.1	100	1.1		0.0013 UJ	0.0013 U	0.0012 U
1,2-Dichloroethane	0.02	3.1	0.02		0.0013 UJ	0.0013 U	0.0012 U
1,2-Dichloropropane					0.0013 UJ	0.0013 U	0.0012 U
1,3,5-Trimethylbenzene	8.4	52	8.4		0.0013 UJ	0.00025 J	NA
1,3-Dichlorobenzene	2.4	49	2.4		0.0013 UJ	0.0013 U	0.0012 U
1,4-Dichlorobenzene	1.8	13	1.8		0.0013 UJ	0.0013 U	0.0012 U
2-Butanone (MEK)	0.12	100	0.12		0.0066 U	0.0051 J	0.006 U
2-Hexanone					0.0066 UJ	0.0065 U	0.006 U
4-Methyl-2-pentanone (MIBK)					0.0066 UJ	0.0065 U	0.006 U
Acetone	0.05	100	0.05		0.0054 J	0.049	0.0083
Benzene	0.06	4.8	0.06		0.0013 UJ	0.0023	0.0012 U
Bromochloromethane					0.0013 UJ	0.0013 U	0.0012 U
Bromodichloromethane					0.0013 UJ	0.0013 U	0.0012 U
Bromoform					0.0013 UJ	0.0013 U	0.0012 U
Bromomethane					0.0013 UJ	0.0013 U	0.0012 U
Carbon disulfide					0.0013 UJ	0.0013	0.0012 U
Carbon tetrachloride	0.76	2.4	0.76		0.00096 JB	0.0008 JB	0.0012 U
Chlorobenzene	1.1	100	1.1		0.0013 UJ	0.0013 U	0.0012 U
Chloroethane					0.0013 UJ	0.0013 U	0.0012 U
Chloroform	0.37	49	0.37		0.0013 UJ	0.0013 U	0.0012 U
Chloromethane					0.0013 UJ	0.0041	0.0012 U
cis-1,2-Dichloroethene	0.25	100	0.25		0.0013 UJ	0.0013 U	0.0012 U
cis-1,3-Dichloropropene					0.0013 UJ	0.0013 U	0.0012 U
Cyclohexane					0.0013 UJ	0.0015	0.0012 U
Dibromochloromethane					0.0013 UJ	0.0013 U	0.0012 U
Dibromochloropropane					0.0013 UJ	0.0013 U	0.0012 U
Dichlorodifluoromethane					0.0013 UJ	0.0013 U	0.0012 U
Ethylbenzene	1	41	1		0.0013 UJ	0.00037 J	0.0012 U
Freon 113					0.0013 UJ	0.0013 U	0.0012 U
Isopropylbenzene					0.0013 UJ	0.0013 U	0.0012 U
ROUX				Page	3 of 4		



Table 2. Summary of Volatile Organic Compounds in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NIVODEO	NIVODEO	NIVODEO	0 1 5 1 1	D1414 00	501/04	00.004
_	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	RMW-G2	RSV-G1	SB-G04
Parameter	Part 375	Part 375	Part 375	Sample Date:		04/30/2019	04/02/2018
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	8 - 10	0 - 2	16 - 18
m+p-Xylene					0.0013 UJ	0.0011 J	0.0012 U
Methyl acetate					0.0066 U	0.0065 U	0.006 U
Methylcyclohexane					0.00043 J	0.0043	0.0012 U
Methylene chloride	0.05	100	0.05		0.0013 UJ	0.0013 U	0.0012 U
MTBE	0.93	100	0.93		0.0013 U	0.0013 U	0.0012 U
n-Butylbenzene	12	100	12		0.0013 UJ	0.0013 U	NA
n-Propylbenzene	3.9	100	3.9		0.0013 UJ	0.0013 U	NA
o-Xylene					0.0013 UJ	0.00085 J	0.0012 U
sec-Butylbenzene	11	100	11		0.0013 UJ	0.0013 U	NA
Styrene					0.0013 UJ	0.0013 U	0.0012 U
tert-Butylbenzene	5.9	100	5.9		0.0013 UJ	0.0013 U	NA
Tetrachloroethene	1.3	19	1.3		0.0013 UJ	0.0013 U	0.0012 U
Toluene	0.7	100	0.7		0.0013 UJ	0.003	0.0012 U
trans-1,2-Dichloroethene	0.19	100	0.19		0.0013 UJ	0.0013 U	0.0012 U
trans-1,3-Dichloropropene					0.0013 UJ	0.0013 U	0.0012 U
Trichloroethene	0.47	21	0.47		0.0013 UJ	0.0013 U	0.0012 U
Trichlorofluoromethane					0.0013 UJ	0.0013 U	0.0012 U
Vinyl chloride	0.02	0.9	0.02		0.0013 UJ	0.0013 U	0.0012 U
Xylenes (total)	0.26	100	1.6		0.0026 UJ	0.0019 J	NA
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Table 3. Summary of Semivolatile Organic Compounds in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	BDS-1	BDS-2	BDS-3	BDS-3 DUP	BDS-4	RMW-G1
Parameter	Part 375	Part 375	Part 375	Sample Date:		5/21/2020	5/21/2020	5/21/2020	5/20/2020	04/29/2019
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	10.5 - 12.5	0 - 2	15 - 17	15 - 17	15 - 17	10 - 12
1,1'-Biphenyl					0.066 J	0.034 J	0.050 J	0.25 J	4.1 UT	NA
1,2,4,5-Tetrachlorobenzene					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
1,4-Dioxane	0.1	13	0.1		0.12 U	0.12 U	0.12 U	0.61 U	1.3 UT	0.11 U
2,3,4,6-Tetrachlorophenol					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
2,4,5-Trichlorophenol					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
2,4,6-Trichlorophenol					0.16 U	0.16 U	0.16 U	0.81 U	1.7 UT	0.15 U
2,4-Dichlorophenol					0.16 U	0.16 U	0.16 U	0.81 U	1.7 UT	0.15 UJ
2,4-Dimethylphenol					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 UJ
2,4-Dinitrophenol					0.31 U	0.32 U	0.32 U	1.6 U	3.3 UT	0.3 U
2,4-Dinitrotoluene					0.078 U	0.080 U	0.080 U	0.41 U	0.84 UT	0.075 U
2,6-Dinitrotoluene					0.078 U	0.080 U	0.080 U	0.41 U	0.84 UT	0.075 U
2-Chloronaphthalene					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
2-Chlorophenol					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 UJ
2-Methylnaphthalene					0.15 J	0.11 J	0.18 J	0.63 J	0.52 JT	0.11 J
2-Methylphenol	0.33	100	0.33		0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.024 J
2-Nitroaniline					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
2-Nitrophenol					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 UJ
3&4-Methylphenol	0.33	100	0.33		0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.049 J
3,3'-Dichlorobenzidine					0.16 U	0.16 U	0.16 U	0.81 U	1.7 U	0.15 UJ
3-Nitroaniline					0.39 U	0.39 U	0.39 U	2.0 U	4.1 U	0.37 U
4,6-Dinitro-2-methylphenol					0.31 U	0.32 U	0.32 U	1.6 U	3.3 UT	0.3 UJ
4-Bromophenyl phenyl ether					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
4-Chloro-3-methylphenol					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
4-Chloroaniline					0.39 U	0.39 UT	0.39 UT	2.0 UT	4.1 U	0.37 U
4-Chlorophenyl phenyl ether					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
4-Methylphenol	0.33	100	0.33		0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.049 J
4-Nitroaniline					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
4-Nitrophenol					0.78 U	0.80 U	0.80 U	4.1 U	8.4 UT	0.75 U
Acenaphthene	20	100	98		0.67	0.22 J	0.41	3.8	1.9 JT	0.13 J
Acenaphthylene	100	100	107		0.076 J	0.084 J	0.13 J	0.11 J	0.14 JT	0.11 J
Acetophenone					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
Anthracene	100	100	1000		1.5	0.62	1	7.6	4.9 T	0.39
Atrazine					0.16 U	0.16 U	0.16 U	0.81 U	1.7 U	0.15 U
Benzaldehyde					0.037 J	0.39 U	0.39 U	2.0 U	4.1 U	0.37 U
Benzo[a]anthracene	1	1	1		3.1	2.3	3.4	9.4	20	1.2
Benzo[a]pyrene	1	1	22		3.8	2.2	3.5	8.6	32	1.1
Benzo[b]fluoranthene	1	1	1.7		4.5	3.1	4.5	10	35	1.7 J
Benzo[g,h,i]perylene	100	100	1000	ļ	1.6	0.7	1.1	2.1	8.8 T	0.77
Benzo[k]fluoranthene	0.8	3.9	1.7		1.3	1.2	2	5.2	13 T	0.53

ROUX Page 1 of 4

Table 3. Summary of Semivolatile Organic Compounds in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

_	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	BDS-1	BDS-2	BDS-3	BDS-3 DUP	BDS-4	RMW-G1
Parameter	Part 375	Part 375	Part 375	Sample Date:	4/28/2020	5/21/2020	5/21/2020	5/21/2020	5/20/2020	04/29/2019
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	10.5 - 12.5	0 - 2	15 - 17	15 - 17	15 - 17	10 - 12
Bis(2-chloro-1-methylethyl)ether					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.025 J
Bis(2-chloroethoxy)methane					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
Bis(2-chloroethyl) ether					0.039 U	0.039 U	0.039 U	0.20 U	0.41 UT	0.037 U
Bis(2-ethylhexyl) phthalate					0.077 J	0.044 J	0.069 J	2.0 U	4.1 UT	0.057 J
Butylbenzyl phthalate					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.04 J
Caprolactam					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
Carbazole					0.36 J	0.29 J	0.39	3.6	2.8 JT	0.1 J
Chrysene	1	3.9	1		3	2	2.7	7.8	18	1.2
Dibenzo[a,h]anthracene	0.33	0.33	1000		0.53	0.24	0.31	0.66	3.5 T	0.15 J
Dibenzofuran	7	59	210		0.43	0.17 J	0.28 J	2.5	1.0 JT	0.088 J
Diethyl phthalate					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
Dimethyl phthalate					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
Di-n-butyl phthalate					0.39 U	0.083 J	0.39 U	2.0 U	4.1 UT	0.37 U
Di-n-octyl phthalate					0.39 U	0.39 U	0.39 U	2.0 U	4.1 U	0.37 U
Fluoranthene	100	100	1000		5.7	4.1	6.3	23	23	2.2
Fluorene	30	100	386		0.62	0.24 J	0.46	4.2	1.4 JT	0.13 J
Hexachlorobenzene	0.33	1.2	3.2		0.039 U	0.039 U	0.039 U	0.20 U	0.41 UT	0.037 U
Hexachlorobutadiene					0.078 U	0.080 U	0.080 U	0.41 U	0.84 UT	0.075 U
Hexachlorocyclopentadiene					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
Hexachloroethane					0.039 U	0.039 U	0.039 U	0.20 U	0.41 UT	0.037 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	8.2		2	0.83	1.3	3	13 T	0.85
Isophorone				!	0.16 U	0.16 U	0.16 U	0.81 U	1.7 UT	0.15 U
Naphthalene	12	100	12		0.26 J	0.18 J	0.42	1.6 J	1.1 JT	0.17 J
Nitrobenzene					0.039 U	0.039 U	0.039 U	0.20 U	0.41 UT	0.037 U
n-Nitrosodi-n-propylamine					0.039 U	0.039 U	0.039 U	0.20 U	0.41 UT	0.037 U
n-Nitrosodiphenylamine					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 U
Pentachlorophenol	0.8	6.7	0.8		0.31 U	0.32 U	0.32 U	1.6 U	3.3 UT	0.3 U
Phenanthrene	100	100	1000		5.6	2.8	3.3	24	15 T	1.3
Phenols (Total)					0.39 U	0.39 U	0.39 U	2.0 U	4.1 UT	0.37 UJ
Pyrene	100	100	1000		6.9	3.5	5.1	18	21	1.9



Table 3. Summary of Semivolatile Organic Compounds in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

-	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	RMW-G2	RSV-G1	SB-G04
Parameter	Part 375	Part 375	Part 375	Sample Date:		04/30/2019	04/02/2018
(Concentrations in mg/kg)	UUSCO	RRSCO		Sample Depth (ft bls):	8 - 10	0 - 2	16 - 18
(Concontrations in mg/kg)	00000	TUTOGO	1 011 000	Campio Doptii (it bio).	0 10	0 2	10 10
1,1'-Biphenyl					NA	NA	NA
1,2,4,5-Tetrachlorobenzene					0.38 U	0.38 U	1.9 U
1,4-Dioxane	0.1	13	0.1		0.12 UJ	0.11 U	NA
2,3,4,6-Tetrachlorophenol					0.38 U	0.38 U	1.9 U
2,4,5-Trichlorophenol					0.38 U	0.38 U	1.9 U
2,4,6-Trichlorophenol					0.15 U	0.15 U	0.75 U
2,4-Dichlorophenol					0.15 UJ	0.15 U	0.75 U
2,4-Dimethylphenol					0.38 UJ	0.38 U	1.9 U
2,4-Dinitrophenol					0.31 UJ	0.3 U	1.5 U
2,4-Dinitrotoluene					0.077 UJ	0.077 U	0.38 U
2,6-Dinitrotoluene					0.077 UJ	0.077 U	0.38 U
2-Chloronaphthalene					0.38 U	0.38 U	1.9 U
2-Chlorophenol					0.38 UJ	0.38 U	1.9 U
2-Methylnaphthalene					0.14 J	0.078 J	0.59 J
2-Methylphenol	0.33	100	0.33		0.38 UJ	0.38 U	1.9 U
2-Nitroaniline					0.38 UJ	0.38 U	1.9 U
2-Nitrophenol					0.38 UJ	0.38 U	1.9 U
3&4-Methylphenol	0.33	100	0.33		0.014 J	0.38 U	NA
3,3'-Dichlorobenzidine					0.15 UJ	0.15 U	0.75 U
3-Nitroaniline					0.38 UJ	0.38 U	1.9 U
4,6-Dinitro-2-methylphenol					0.31 UJ	0.3 U	1.5 U
4-Bromophenyl phenyl ether					0.38 U	0.38 U	1.9 U
4-Chloro-3-methylphenol					0.38 UJ	0.38 U	1.9 U
4-Chloroaniline					0.38 UJ	0.38 U	1.9 U
4-Chlorophenyl phenyl ether					0.38 U	0.38 U	1.9 U
4-Methylphenol	0.33	100	0.33		0.014 J	0.38 U	0.063 J
4-Nitroaniline					0.38 UJ	0.38 U	1.9 U
4-Nitrophenol					0.77 UJ	0.77 U	3.8 U
Acenaphthene	20	100	98		0.23 J	0.15 J	0.81 J
Acenaphthylene	100	100	107		0.065 J	0.097 J	0.79 J
Acetophenone					0.38 U	0.38 U	1.9 U
Anthracene	100	100	1000		0.27 J	0.57	3.9
Atrazine					0.15 UJ	0.15 U	0.75 U
Benzaldehyde					0.13 03 0.019 J	0.13 U	1.9 U
Benzo[a]anthracene	1	1	1		0.81 J	1.9	1.5 0
Benzo[a]pyrene	1	1	22		0.79 J	1.8	13
Benzo[b]fluoranthene	1	1	1.7		1.2 J	2.4	16
Benzo[g,h,i]perylene	100	100	1000		0.31 J	0.69	5.7
Benzo[k]fluoranthene	0.8	3.9	1.7		0.31 J 0.42 J	0.88	5. <i>1</i>
Denzo[k]nuoranthene	0.0	5.5	1.7		∪. 4 ∠ J	0.00	5.4



Page 3 of 4

Table 3. Summary of Semivolatile Organic Compounds in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	RMW-G2	RSV-G1	SB-G04
Parameter	Part 375	Part 375	Part 375	Sample Date:	04/29/2019	04/30/2019	04/02/2018
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	8 - 10	0 - 2	16 - 18
Bis(2-chloro-1-methylethyl)ether					0.046 J	0.025 J	0.19 J
Bis(2-chloroethoxy)methane					0.38 UJ	0.38 U	1.9 U
Bis(2-chloroethyl) ether					0.038 UJ	0.038 U	0.19 U
Bis(2-ethylhexyl) phthalate					0.38 UJ	0.38 U	1.9 U
Butylbenzyl phthalate					0.38 UJ	0.61	1.9 U
Caprolactam					0.38 UJ	0.38 U	1.9 U
Carbazole					0.12 J	0.19 J	1.4 J
Chrysene	1	3.9	1		0.8 J	1.8	13
Dibenzo[a,h]anthracene	0.33	0.33	1000		0.071 J	0.21	1.8
Dibenzofuran	7	59	210		0.22 J	0.13 J	0.8 J
Diethyl phthalate					0.38 UJ	0.38 U	1.9 U
Dimethyl phthalate					0.38 UJ	0.38 U	1.9 U
Di-n-butyl phthalate					0.38 UJ	0.38 U	1.9 U
Di-n-octyl phthalate					0.38 U	0.38 U	1.9 U
Fluoranthene	100	100	1000		1.9 J	3.3	28
Fluorene	30	100	386		0.19 J	0.19 J	1.6 J
Hexachlorobenzene	0.33	1.2	3.2		0.038 U	0.038 U	0.19 U
Hexachlorobutadiene					0.077 U	0.077 U	0.38 U
Hexachlorocyclopentadiene					0.38 UJ	0.38 U	1.9 U
Hexachloroethane					0.038 UJ	0.038 U	0.19 U
Indeno[1,2,3-cd]pyrene	0.5	0.5	8.2		0.4	0.87	7.1
Isophorone					0.15 UJ	0.15 U	0.75 U
Naphthalene	12	100	12		0.25 J	0.12 J	1.1 J
Nitrobenzene					0.038 UJ	0.038 U	0.19 U
n-Nitrosodi-n-propylamine					0.038 UJ	0.038 U	0.19 U
n-Nitrosodiphenylamine					0.38 UJ	0.38 U	1.9 U
Pentachlorophenol	0.8	6.7	8.0		0.31 UJ	0.3 U	1.5 U
Phenanthrene	100	100	1000		1.6 J	2.2	19
Phenols (Total)					0.38 UJ	0.38 U	1.9 U
Pyrene	100	100	1000		1.6 J	3.2	28



Table 4. Summary of Metals in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	BDS-1	BDS-2	BDS-3	BDS-3 DUP	BDS-4	RMW-G1	RMW-G2
Parameter	Part 375	Part 375	Part 375	Sample Date:	4/28/2020	5/21/2020	5/21/2020	5/21/2020	5/20/2020	04/29/2019	04/29/2019
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	10.5 - 12.5	0 - 2	15 - 17	15 - 17	15 - 17	10 - 12	8 - 10
Aluminum					6940	10900	13300	6090	6050	6930	5680
Antimony					1.0 J	1.0 J	0.60 J	0.40 J	0.48 JT	0.47 J	0.4 J
Arsenic	13	16	16		13.4	23.9	24.4	12.1	43.7 T	9.1	20.3 J
Barium	350	400	820		151	488	277	132	99.6	109	779
Beryllium	7.2	72	47		0.55	0.53	0.79	0.51	0.56	0.41 J	0.39 J
Cadmium	2.5	4.3	7.5		0.59 J	2.2	1.1	0.55 J	0.45 J	1.1 U	1.2
Calcium					31400	54400	44200	24500	12700	46800	9520
Chromium, Hexavalent	1	110	19		2.4 U	2.4 U	2.4 U	2.4 U	2.5 UT	2.3 U	2.3 UJ
Chromium	30	180			25.8	33	48.7	18.1 B	19.3 T	24.8	17.5
Cobalt					9.6	13.8	14.8	7.2	14.7	7.4	4.7
Copper	50	270	1720		82.6	202	126	71	178	66	71.7
Cyanide	27	27	40		1.3	0.87	0.76	3.2	0.20 J	0.76	0.27
Iron					21700	29500	35100	14900	26700	18100	20600
Lead	63	400	450		242	425	377	917	152	246	1440
Magnesium					4980	10200	8310	3430	2490	10100	1780 J
Manganese	1600	2000	2000		297	503	490	214	212 T	252	85.4
Mercury	0.18	0.81	0.73		0.82	0.95	0.71	1.6	0.29 T	1.2	0.23 J
Nickel	30	310	130	•	20.8	37.5	39.8	19.8	35.3 T	22	13
Potassium					1850	2400	3340	1300	1460 T	2240	908
Selenium	3.9	180	4		0.89 J	2.1 J	1.8 J	0.51 J	1.2 J	0.69 J	1.5 J
Silver	2	180	8.3		1.1 U	1.1 U	1.1 U	0.94 U	1.3 U	1.1 U	1.2 U
Sodium					560	1760	1070	526	623	361	289
Thallium					0.16 J	0.20 J	0.46	0.18 J	0.28 J	0.15 J	0.46 U
Vanadium					31.9	55	50.2	23	35.4 T	23.3	25.4
Zinc	109	10000	2480		226	1090	371	318	217 T	214	133



Table 4. Summary of Metals in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	RSV-G1	SB-G04
Parameter	Part 375	Part 375	Part 375	Sample Date:		04/02/2018
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	0 - 2	16 - 18
				•		
Aluminum					7880	3520
Antimony					0.74 J	1.1 U
Arsenic	13	16	16		11.2	4.8
Barium	350	400	820		277	45.8
Beryllium	7.2	72	47		0.46	0.33 J
Cadmium	2.5	4.3	7.5		0.9 J	1.1 U
Calcium					35900	8960
Chromium, Hexavalent	1	110	19		2.3 U	NA
Chromium	30	180			24.6	9.6
Cobalt					9.1	3.6
Copper	50	270	1720		105	79.1
Cyanide	27	27	40		0.57	NA
Iron					38600	7420
Lead	63	400	450		287	54.8
Magnesium					11800	2680
Manganese	1600	2000	2000		470	192
Mercury	0.18	0.81	0.73		0.38	0.065
Nickel	30	310	130		25.2	8.8
Potassium					2330	726
Selenium	3.9	180	4		0.94 J	5.3 U
Silver	2	180	8.3		1.1 U	1.1 U
Sodium					887	141
Thallium					0.18 J	0.42 U
Vanadium					39.5	12.1
Zinc	109	10000	2480		384	52.2



Table 5. Summary of PCBs in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	BDS-1	BDS-2	BDS-3	BDS-3 DUP	BDS-4	RMW-G1	RMW-G2
Parameter	Part 375	Part 375	Part 375	Sample Date:	4/28/2020	5/21/2020	5/21/2020	5/21/2020	5/20/2020	04/29/2019	04/29/2019
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	10.5 - 12.5	0 - 2	15 - 17	15 - 17	15 - 17	10 - 12	8 - 10
Aroclor-1016					0.078 U	0.080 U	0.080 U	0.081 U	0.084 UT	0.075 U	0.077 U
Aroclor-1221					0.078 U	0.080 U	0.080 U	0.081 U	0.084 U	0.075 U	0.077 U
Aroclor-1232					0.078 U	0.080 U	0.080 U	0.081 U	0.084 U	0.075 U	0.077 U
Aroclor-1242					0.078 U	0.080 U	0.080 U	0.081 U	0.084 U	0.075 U	0.077 U
Aroclor-1248					0.11	0.13	0.12	0.18	0.084 U	0.075 U	0.077 U
Aroclor-1254					0.078 U	0.080 U	0.080 U	0.081 U	0.084 U	0.075 U	0.077 U
Aroclor-1260					0.071 J	0.12	0.082	0.11	0.084 UT	0.075 U	0.077 U
Aroclor-1262					0.078 U	0.080 U	0.080 U	0.081 U	0.084 U	0.075 U	0.077 U
Aroclor-1268					0.078 U	0.080 U	0.080 U	0.081 U	0.084 U	0.075 U	0.077 U
PCBs, Total	0.1	1	3.2		0.18	0.25	0.2	0.29	0.084 U	0.075 U	0.077 U



Table 5. Summary of PCBs in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	RSV-G1	SB-G04
Parameter	Part 375	Part 375	Part 375	Sample Date:	04/30/2019	04/02/2018
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	0 - 2	16 - 18
Aroclor-1016					0.076 U	0.076 U
Aroclor-1221					0.076 U	0.076 U
Aroclor-1232					0.076 U	0.076 U
Aroclor-1242					0.076 U	0.076 U
Aroclor-1248					0.076 U	0.076 U
Aroclor-1254					0.076 U	0.076 U
Aroclor-1260					0.29	0.076 U
Aroclor-1262					0.076 U	0.076 U
Aroclor-1268					0.076 U	0.076 U
PCBs, Total	0.1	1	3.2		0.29	0.076 U



Table 6. Summary of Pesticides in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	BDS-1	BDS-2	BDS-3	BDS-3 DUP	BDS-4	RMW-G1	RMW-G2
Parameter	Part 375	Part 375	Part 375	Sample Date:	4/28/2020	5/21/2020	5/21/2020	5/21/2020	5/20/2020	04/29/2019	04/29/2019
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	10.5 - 12.5	0 - 2	15 - 17	15 - 17	15 - 17	10 - 12	8 - 10
0.4.5.7					0.000.11	0.040.11	0.040.11	0.040.11	0.040.11	0.007.11	0.000.11
2,4,5-T					0.039 U	0.040 U	0.040 U	0.040 U	0.042 U	0.037 U	0.038 U
2,4,5-TP	3.8	100	3.8		0.039 U	0.040 U	0.040 U	0.040 U	0.042 U	0.037 U	0.038 UJ
2,4-D					0.039 U	0.040 U	0.040 U	0.040 U	0.042 U	0.037 U	0.038 U
4,4'-DDD	0.0033	13	14		0.0078 U	0.0029 J	0.0060 J	0.0081 U	0.0084 U	0.0075 U	0.0085
4,4'-DDE	0.0033	8.9	17		0.0078 U	0.0046 JP	0.0085	0.0075 J	0.0084 U	0.0028 J	0.003 J
4,4'-DDT	0.0033	7.9	136		0.011 P	0.015	0.019	0.0081 U	0.0084 U	0.0046 J	0.0052 J
Aldrin	0.005	0.097	0.19		0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U	0.0075 U	0.0077 U
alpha-BHC	0.02	0.48	0.02		0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0025 U	0.0022 U	0.0023 U
alpha-Chlordane	0.094	4.2	2.9		0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U		
beta-BHC	0.036	0.36	0.09		0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0025 U	0.0022 U	0.0023 U
Chlordane (Technical)					0.078 U	0.080 U	0.080 U	0.081 U	0.084 U	0.075 U	0.077 U
delta-BHC	0.04	100	0.25		0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0025 U	0.0022 U	0.0023 U
Dieldrin	0.005	0.2	0.1		0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0025 U	0.0022 U	0.0023 U
Endosulfan I	2.4	24	102		0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U	0.0075 U	0.0077 U
Endosulfan II	2.4	24	102		0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U	0.0075 U	0.0077 U
Endosulfan sulfate	2.4	24	1000		0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U	0.0075 U	0.0077 UJ
Endrin aldehyde					0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 UT	0.0075 U	0.0077 UJ
Endrin ketone					0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U	0.0075 U	0.0077 UJ
Endrin	0.014	11	0.06		0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U	0.0075 U	0.0077 U
gamma-BHC (Lindane)	0.1	1.3	0.1		0.0023 U	0.0024 U	0.0024 U	0.0024 U	0.0025 U	0.0022 U	0.0023 U
gamma-Chlordane					0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U		
Heptachlor epoxide					0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U	0.0075 U	0.0077 U
Heptachlor	0.042	2.1	0.38		0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U	0.0075 U	0.0077 U
Methoxychlor					0.0078 U	0.0080 U	0.0080 U	0.0081 U	0.0084 U	0.0075 U	0.0077 U
Toxaphene					0.078 U	0.080 U	0.080 U	0.081 U	0.084 U	0.075 U	0.077 U



Table 6. Summary of Pesticides in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

		NYSDEC	NYSDEC	Sample Designation:	RSV-G1	SB-G04
Parameter	Part 375	Part 375	Part 375	Sample Date:	04/30/2019	04/02/2018
(Concentrations in mg/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	0 - 2	16 - 18
2,4,5-T					0.038 U	NA
2,4,5-TP	3.8	100	3.8		0.038 U	NA
2,4-D					0.038 U	NA
4,4'-DDD	0.0033	13	14		0.0076 U	0.0076 U
4,4'-DDE	0.0033	8.9	17		0.0076 U	0.0076 U
4,4'-DDT	0.0033	7.9	136		0.017	0.0076 U
Aldrin	0.005	0.097	0.19		0.0076 U	0.0076 U
alpha-BHC	0.02	0.48	0.02		0.0023 U	0.0023 U
alpha-Chlordane	0.094	4.2	2.9			
beta-BHC	0.036	0.36	0.09		0.0023 U	0.0023 U
Chlordane (Technical)					0.074 J	0.076 U
delta-BHC	0.04	100	0.25		0.0023 U	0.0023 U
Dieldrin	0.005	0.2	0.1		0.0023 U	0.0023 U
Endosulfan I	2.4	24	102		0.0076 U	0.0076 U
Endosulfan II	2.4	24	102		0.0076 U	0.0076 U
Endosulfan sulfate	2.4	24	1000		0.0076 U	0.0076 U
Endrin aldehyde					0.0076 U	0.0076 U
Endrin ketone					0.0076 U	0.0076 U
Endrin	0.014	11	0.06		0.0076 U	0.0076 U
gamma-BHC (Lindane)	0.1	1.3	0.1		0.0023 U	0.0023 U
gamma-Chlordane						
Heptachlor epoxide					0.0076 U	0.0076 U
Heptachlor	0.042	2.1	0.38		0.0076 U	0.0076 U
Methoxychlor					0.0076 U	0.0076 U
Toxaphene					0.076 U	0.076 U



Table 7. Summary of Per- and Polyfluoroalkyl Substances in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	BDS-1	BDS-2	BDS-3	BDS-3 DUP	BDS-4
Parameter	Part 375	Part 375	Part 375	Sample Date:		5/21/2020	5/21/2020	5/21/2020	5/20/2020
(Concentrations in ug/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	10.5 - 12.5	0 - 2	15 - 17	15 - 17	15 - 17
1H,1H,2H,2H-Perfluorodecane Sulfonate (8:2)					0.032 U	0.035 U	0.042 J	0.035 U	0.033 U
1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2)					0.094 BJ	0.033 U 0.027 U	0.042 3 0.078 BJ	0.053 BJ	0.035 U
2-(N-methyl perfluorooctanesulfonamido) acetic acid					0.037 U	0.027 U	0.070 D3 0.041 U	0.033 D3 0.041 U	0.023 U
N-Ethyl-N-((heptadecafluorooctyl)sulphonyl) glycine					0.057 U 0.065 J	0.042 U 0.040 J	0.041 U	0.041 U 0.093 J	0.035 U
PERFLUOROBUTANESULFONIC ACID					0.005 J 0.0096 U	0.040 J 0.011 U	0.030 J 0.011 U	0.093 J 0.013 BJ	0.035 U 0.046 BJ
PERFLUOROBUTYRIC ACID (PFBA)					0.0090 U 0.21 U	0.011 U	0.011 U	0.013 B3 0.23 U	0.040 B3 0.22 U
PERFLUOROBOTTRIC ACID (PFBA) PERFLUORODECANE SULFONIC ACID					0.21 U 0.021 U	0.23 U 0.11 J	0.23 U	0.23 U 0.023 U	0.22 U
					0.021 U 0.030 J	0.11 J	0.023 U 0.061 J	0.023 U 0.044 J	0.022 U 0.025 J
PERFLUORODECANOIC ACID (PFDA)									
PERFLUORODODECANOIC ACID (PFDoA)					0.035 J	0.028 BJ	0.018 BJ	0.025 BJ	0.017 U
PERFLUOROHEPTANE SULFONATE (PFHpS)					0.016 U	0.018 U	0.018 U	0.018 U	0.017 U
Perfluoroheptanoic Acid (PFHpA)					0.025 U	0.028 U	0.028 U	0.028 U	0.044 J
PERFLUOROHEXANESULFONIC ACID					0.055 BJ	0.048 BJ	0.11 BJ	0.093 BJ	0.047 BJ
PERFLUOROHEXANOIC ACID (PFHxA)					0.027 J	0.029 U	0.029 U	0.029 U	0.067 J
PERFLUORONONANOIC ACID					0.035 J	0.044 J	0.048 J	0.062 J	0.031 J
Perfluorooctane Sulfonamide (FOSA)					0.0097 J	0.012 BJ	0.012 BJ	0.014 BJ	0.010 U
PERFLUOROOCTANE SULFONIC ACID					0.61	1.42	0.93	0.8	0.29
Perfluorooctanoic acid (PFOA)					0.16 BJ	0.19 BJ	0.24 B	0.23 BJ	0.26 B
PERFLUOROPENTANOIC ACID (PFPeA)					0.069 BJ	0.086 J	0.055 J	0.022 U	0.13 BJ
PERFLUOROTETRADECANOIC ACID (PFTeA)					0.023 J	0.023 U	0.023 U	0.023 U	0.022 U
PERFLUOROTRIDECANOIC ACID (PFTriA)					0.015 J	0.019 BJ	0.016 U	0.016 U	0.015 U
PERFLUOROUNDECANOIC ACID (PFUnA)					0.036 J	0.12 J	0.048 J	0.052 J	0.028 U



Table 7. Summary of Per- and Polyfluoroalkyl Substances in Soil, Endpoint Confirmation Samples, HPS Parcel G, Queens, New York

	NYSDEC	NYSDEC	NYSDEC	Sample Designation:	RMW-G1	RMW-G2	RSV-G1	SB-G04
Parameter	Part 375	Part 375	Part 375	Sample Date:	04/29/2019	04/29/2019	04/30/2019	04/02/2018
(Concentrations in ug/kg)	UUSCO	RRSCO	PGW SCO	Sample Depth (ft bls):	10 - 12	8 - 10	0 - 2	16 - 18
1H,1H,2H,2H-Perfluorodecane Sulfonate (8:2)					0.25 U	0.27 U	0.27 U	0.27 U
1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2)					0.15 U	0.16 U	0.16 U	0.16 U
2-(N-methyl perfluorooctanesulfonamido) acetic acid					0.4 U	0.42 U	0.43 U	0.42 U
N-Ethyl-N-((heptadecafluorooctyl)sulphonyl) glycine					0.38 U	0.4 U	0.4 U	0.4 U
PERFLUOROBUTANESULFONIC ACID					0.025 U	0.027 U	0.027 U	0.027 U
PERFLUOROBUTYRIC ACID (PFBA)					0.028 U	0.03 U	0.14 BJ	0.03 U
PERFLUORODECANE SULFONIC ACID					0.04 U	0.042 U	0.043 U	0.042 U
PERFLUORODECANOIC ACID (PFDA)					0.039 J	0.069 J	0.042 J	0.059 J
PERFLUORODODECANOIC ACID (PFDoA)					0.068 U	0.072 U	0.073 U	0.072 U
PERFLUOROHEPTANE SULFONATE (PFHpS)					0.036 U	0.037 U	0.038 U	0.037 U
Perfluoroheptanoic Acid (PFHpA)					0.032 J	0.032 J	0.032 U	0.031 U
PERFLUOROHEXANESULFONIC ACID					0.088 J	0.081 J	0.12 J	0.039 J
PERFLUOROHEXANOIC ACID (PFHxA)					0.061 J	0.052 J	0.047 J	0.045 U
PERFLUORONONANOIC ACID					0.037 U	0.05 J	0.039 U	0.038 U
Perfluorooctane Sulfonamide (FOSA)					0.083 U	0.088 U	0.09 U	0.088 U
PERFLUOROOCTANE SULFONIC ACID					0.62	0.97	1.02	0.63
Perfluorooctanoic acid (PFOA)					0.21	0.2 J	0.22	0.15 J
PERFLUOROPENTANOIC ACID (PFPeA)					0.078 U	0.082 U	0.084 U	0.082 U
PERFLUOROTETRADECANOIC ACID (PFTeA)					0.055 U	0.058 U	0.059 U	0.058 U
PERFLUOROTRIDECANOIC ACID (PFTriA)					0.052 U	0.055 U	0.056 U	0.055 U
PERFLUOROUNDECANOIC ACID (PFUnA)					0.041 J	0.039 U	0.039 U	0.047 J



Table 8. Summary of Volatile Organic Compounds in Groundwater, HPS Parcel G, Queens, New York

	Sample Desig	nation:	RMW-G1	RMW-G2	RMW-G2	RMW-G3
	Sampl	e Date:	05/08/2019	05/08/2019	05/08/2019	05/08/2019
	Normal or Field Du	plicate:	N	N	FD	N
	NYSDEC Ambient					
	Water-Quality					
	Standards and					
Parameter	Guidance Values	Units				
1,1,1-Trichloroethane (TCA)	5	μg/L	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	μg/L	1 U	1 U	1 U	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane		μg/L	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	μg/L	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	μg/L	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	μg/L	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	5	μg/L	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	μg/L	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	μg/L	1 U	1 U	1 U	1 U
1,2-Dibromoethane (Ethylene Dibromide)		μg/L	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	μg/L	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	μg/L	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	μg/L	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	μg/L	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	μg/L	1 U	1 U	1 U	1 U
2-Hexanone	50	μg/L	5 U	5 U	5 U	5 U
Acetone	50	μg/L	5 U	9.1	10	5 U
Benzene	1	μg/L	1 U	1 U	1 U	1 U
Bromochloromethane	5	μg/L	1 U	1 U	1 U	1 U
Bromodichloromethane	50	μg/L	1 U	1 U	1 U	1 U
Bromoform	50	μg/L	1 U	1 U	1 U	1 U
Bromomethane	5	μg/L	1 U	1 U	1 U	1 U
Carbon Disulfide	60	μg/L	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	μg/L	1 U	1 U	1 U	1 U
Chlorobenzene	5	μg/L	1 U	1 U	1 U	1 U
Chloroethane	5	μg/L	1 U	1 U	1 U	1 U
Chloroform	7	μg/L	1 U	1 U	1 U	1 U
Chloromethane		μg/L	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethylene	5	μg/L	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	5	μg/L	1 U	1 U	1 U	1 U
Cyclohexane		μg/L	1 U	1 U	1 U	1 U
Dibromochloromethane	50	μg/L	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	μg/L	1 U	1 U	1 U	1 U



Table 8. Summary of Volatile Organic Compounds in Groundwater, HPS Parcel G, Queens, New York

	Sample Desig	nation:	RMW-G1	RMW-G2	RMW-G2	RMW-G3
	Sample	e Date:	05/08/2019	05/08/2019	05/08/2019	05/08/2019
	Normal or Field Du	plicate:	N	N	FD	N
Ethylbenzene	5	μg/L	1 U	1 U	1 U	1 U
Isopropylbenzene (Cumene)	5	μg/L	1 U	1 U	1 U	1 U
m,p-Xylene	5	μg/L	1 U	1 U	1 U	1 U
Methyl Acetate		μg/L	5 U	5 U	5 U	5 U
Methyl Ethyl Ketone (2-Butanone)	50	μg/L	5 U	5 U	5 U	5 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)		μg/L	5 U	5 U	5 U	5 U
Methylcyclohexane		μg/L	1 U	1 U	1 U	1 U
Methylene Chloride	5	μg/L	1 U	1 U	1 U	1 U
O-Xylene (1,2-Dimethylbenzene)	5	μg/L	1 U	1 U	1 U	1 U
Styrene	5	μg/L	1 U	1 U	1 U	1 U
Tert-Butyl Methyl Ether	10	μg/L	1 U	1 U	1 U	1 U
Tetrachloroethylene (PCE)	5	μg/L	1 U	1 U	1 U	1 U
Toluene	5	μg/L	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	5	μg/L	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene		μg/L	1 U	1 U	1 U	1 U
Trichloroethylene (TCE)	5	μg/L	1 U	1 U	1 U	1 U
Trichlorofluoromethane	5	μg/L	1 U	1 U	1 U	1 U
Vinyl Chloride	2	μg/L	1 U	1 U	1 U	1 U



Table 9. Summary of Semivolatile Organic Compounds in Groundwater, HPS Parcel G, Queens, New York

	Sample Desig	nation:	RMW-G1	RMW-G2	RMW-G2	RMW-G3
	•	e Date:	05/08/2019	05/08/2019	05/08/2019	05/08/2019
	Normal or Field Du	olicate:	N	N	FD	N
	NYSDEC Ambient					
	Water-Quality					
	Standards and					
Parameter	Guidance Values	Units				
1,2,4,5-Tetrachlorobenzene		μg/L	10 U	10 U	10 U	10 U
1,4-Dioxane (P-Dioxane)		μg/L	0.2 U	0.2 U	0.2 U	0.2 U
2,3,4,6-Tetrachlorophenol		μg/L	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol		μg/L	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol		μg/L	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	5	μg/L	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	50	μg/L	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	10	μg/L	20 U	20 U	20 U	20 U
2,4-Dinitrotoluene	5	μg/L	2 U	2 U	2 U	2 U
2,6-Dinitrotoluene	5	μg/L	2 U	2 U	2 U	2 U
2-Chloronaphthalene	10	μg/L	10 U	10 U	10 U	10 U
2-Chlorophenol		μg/L	10 U	10 U	10 U	10 U
2-Methylnaphthalene		μg/L	10 U	10 U	10 U	10 U
2-Methylphenol (O-Cresol)		μg/L	10 U	10 U	10 U	10 U
2-Nitroaniline	5	μg/L	10 U	10 U	10 U	10 U
2-Nitrophenol		μg/L	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	5	μg/L	10 U	10 U	10 U	10 U
3-Nitroaniline	5	μg/L	10 U	10 U	10 U	10 U
4,6-Dinitro-2-Methylphenol		μg/L	20 U	20 U	20 U	20 U
4-Bromophenyl Phenyl Ether		μg/L	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol		μg/L	10 U	10 U	10 U	10 U
4-Chloroaniline	5	μg/L	10 U	10 U	10 U	10 U
4-Chlorophenyl Phenyl Ether		μg/L	10 U	10 U	10 U	10 U
4-Methylphenol (P-Cresol)		μg/L	10 U	10 U	10 U	10 U
4-Nitroaniline	5	μg/L	10 U	10 U	10 U	10 U
4-Nitrophenol		μg/L	20 U	20 U	20 U	20 U
Acenaphthene	20	μg/L	10 U	10 U	10 U	10 U
Acenaphthylene	20	μg/L	10 U	10 U	10 U	10 U
Acetophenone		μg/L	10 U	10 U	10 U	10 U
Anthracene	50	μg/L	10 U	10 U	10 U	10 U
Atrazine		μg/L	2 U	2 U	2 U	2 U
Benzaldehyde		μg/L	10 U	10 U	10 U	10 U
Benzo(A)Anthracene	0.002	μg/L	1 U	1 U	1 U	1 U



Table 9. Summary of Semivolatile Organic Compounds in Groundwater, HPS Parcel G, Queens, New York

	Sample Desig	nation:	RMW-G1	RMW-G2	RMW-G2	RMW-G3
	Sampl	e Date:	05/08/2019	05/08/2019	05/08/2019	05/08/2019
	Normal or Field Du	plicate:	N	N	FD	N
Benzo(A)Pyrene	0	μg/L	1 U	1 U	1 U	1 U
Benzo(B)Fluoranthene	0.002	μg/L	2 U	2 U	2 U	2 U
Benzo(G,H,I)Perylene		μg/L	10 U	10 U	10 U	10 U
Benzo(K)Fluoranthene	0.002	μg/L	1 U	1 U	1 U	1 U
Benzyl Butyl Phthalate	50	μg/L	10 U	10 U	10 U	10 U
Biphenyl (Diphenyl)		μg/L	10 U	10 U	10 U	10 U
Bis(2-Chloroethoxy) Methane	5	μg/L	10 U	10 U	10 U	10 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	1	μg/L	1 U	1 U	1 U	1 U
Bis(2-Chloroisopropyl) Ether	5	μg/L	10 U	10 U	10 U	10 U
Bis(2-Ethylhexyl) Phthalate	5	μg/L	2 U	2 U	2 U	2 U
Caprolactam		μg/L	10 U	10 U	10 U	10 U
Carbazole		μg/L	10 U	10 U	10 U	10 U
Chrysene	0.002	μg/L	2 U	2 U	2 U	2 U
Dibenz(A,H)Anthracene		μg/L	1 U	1 U	1 U	1 U
Dibenzofuran		μg/L	10 U	10 U	10 U	10 U
Diethyl Phthalate	50	μg/L	10 U	10 U	10 U	10 U
Dimethyl Phthalate	50	μg/L	10 U	10 U	10 U	10 U
Di-N-Butyl Phthalate	50	μg/L	10 U	10 U	10 U	10 U
Di-N-Octylphthalate		μg/L	10 U	10 U	10 U	10 U
Fluoranthene	50	μg/L	10 U	10 U	10 U	10 U
Fluorene	50	μg/L	10 U	10 U	10 U	10 U
Hexachlorobenzene	0.04	μg/L	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	μg/L	1 U	1 U	1 U	1 U
Hexachlorocyclopentadiene	5	μg/L	10 U	10 U	10 U	10 U
Hexachloroethane	5	μg/L	2 U	2 U	2 U	2 U
Indeno(1,2,3-C,D)Pyrene	0.002	μg/L	2 U	2 U	2 U	2 U
Isophorone	50	μg/L	10 U	10 U	10 U	10 U
Naphthalene	10	μg/L	10 U	10 U	10 U	10 U
Nitrobenzene	0.4	μg/L	1 U	1 U	1 U	1 U
N-Nitrosodi-N-Propylamine		μg/L	1 U	1 U	1 U	1 U
N-Nitrosodiphenylamine	50	μg/L	10 U	10 U	10 U	10 U
Pentachlorophenol	1	μg/L	20 U	20 U	20 U	20 U
Phenanthrene	50	μg/L	10 U	10 U	10 U	10 U
Phenol	1	μg/L	10 U	10 U	10 U	10 U
Pyrene	50	μg/L	10 U	10 U	10 U	10 U



Table 10. Summary of Metals in Groundwater, HPS Parcel G, Queens, New York

	Sample Design	nation:	RMW-G1	RMW-G1	RMW-G2	RMW-G2	RMW-G2	RMW-G2	RMW-G3	RMW-G3
	Sample	Date:	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
	Normal or Field Dup	licate:	N	N	N	N	FD	FD	N	N
			Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	NYSDEC Ambient									
	Water-Quality									
	Standards and									
Parameter	Guidance Values	Units								
Aluminum		μg/L	28.1 J	40 U	89.9	40 U	64.6	40 U	37.6 J	40 U
Antimony	3	μg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Arsenic	25	μg/L	1.2 J	1.3 J	1.7 J	0.82 J	1.6 J	2 U	3.2	1.4 J
Barium	1000	μg/L	166	167	212	153	221	157	180	141
Beryllium	3	μg/L	0.8 U							
Cadmium	5	μg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Calcium		μg/L	226000	236000	289000	311000	297000	308000	268000	275000
Chromium, Hexavalent	50	μg/L	10 U	NA						
Chromium, Total	50	μg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Cobalt		μg/L	1.6 J	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Copper	200	μg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Cyanide	200	μg/L	820	NA	21	NA	21.5	NA	24.3 J	NA
Iron	300	μg/L	531	291	8070	120 U	7650	120 U	4870	120 U
Lead	25	μg/L	0.7 J	1.2 U	10.9	1.2 U	8.4	1.2 U	2.1	1.2 U
Magnesium		μg/L	62300	63200	83800	82600	81700	82600	79100	78100
Manganese	300	μg/L	271	266	777	747	761	729	1240	1150
Mercury	0.7	μg/L	0.2 U							
Nickel	100	μg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Potassium		μg/L	67300	66900	52600	51700	50100	51900	44100	43500
Selenium	10	μg/L	10 U							
Silver		μg/L	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Sodium		μg/L	554000	515000	588000	589000	607000	577000	427000	407000
Thallium		μg/L	0.8 U							
Vanadium		μg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
Zinc		μg/L	16 U							



Table 11. Summary of Polychlorinated Biphenyls in Groundwater, HPS Parcel G, Queens, New York

	Sample Desig	nation:	RMW-G1	RMW-G2	RMW-G2	RMW-G3
	Sample	e Date:	05/08/2019	05/08/2019	05/08/2019	05/08/2019
	Normal or Field Duplicate:		N	N	FD	N
	NYSDEC Ambient					
	Water-Quality					
	Standards and					
Parameter	Guidance Values	Units				
PCB-1016 (Aroclor 1016)		μg/L	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1221 (Aroclor 1221)		μg/L	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1232 (Aroclor 1232)		μg/L	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1242 (Aroclor 1242)		μg/L	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1248 (Aroclor 1248)		μg/L	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1254 (Aroclor 1254)		μg/L	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1260 (Aroclor 1260)		μg/L	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1262 (Aroclor 1262)		μg/L	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1268 (Aroclor 1268)		μg/L	0.4 U	0.4 U	0.4 U	0.4 U
Polychlorinated Biphenyl (PCBs)	0.09	μg/L	0.4 U	0.4 U	0.4 U	0.4 U



Table 12. Summary of Pesticides and Herbicides in Groundwater, HPS Parcel G, Queens, New York

	Sample Desig	nation:	RMW-G1	RMW-G2	RMW-G2	RMW-G3
	Sample	e Date:	05/08/2019	05/08/2019	05/08/2019	05/08/2019
	Normal or Field Du	plicate:	N	N	FD	N
	NYSDEC Ambient					
	Water-Quality					
	Standards and					
Parameter	Guidance Values	Units				
2,4-D (Dichlorophenoxyacetic Acid)	50	μg/L	1.2 U	1.2 U	1.2 U	1.2 U
Acetic acid, (2,4,5-trichlorophenoxy)-		μg/L	1.2 U	1.2 U	1.2 U	1.2 U
Aldrin	0	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Alpha Bhc (Alpha Hexachlorocyclohexane)		μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Alpha Endosulfan		μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Beta Bhc (Beta Hexachlorocyclohexane)		μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Beta Endosulfan		μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Chlordane	0.05	μg/L	0.5 U	0.5 U	0.5 U	0.5 U
Delta BHC (Delta Hexachlorocyclohexane)		μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Dieldrin	0.004	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan Sulfate		μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Endrin	0	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Endrin Aldehyde	5	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Endrin Ketone		μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Gamma Bhc (Lindane)		μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Heptachlor	0.04	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Heptachlor Epoxide	0.03	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Methoxychlor	35	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
P,P'-DDD	0.3	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
P,P'-DDE	0.2	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
P,P'-DDT	0.2	μg/L	0.02 U	0.02 U	0.02 U	0.02 U
Silvex (2,4,5-TP)	0.26	μg/L	1.2 U	1.2 U	1.2 U	1.2 U
Toxaphene	0.06	μg/L	0.5 U	0.5 U	0.5 U	0.5 U



Table 13. Summary of Perfluorinated Alkyl Acids in Groundwater, HPS Parcel G, Queens, New York

Sample Design	nation:	RMW-G2	RMW-G2	RMW-G3
	e Date:	05/24/2019	05/24/2019	05/08/2019
Normal or Field Du	Normal or Field Duplicate:			
Parameter	Units			
2-(N-methyl perfluorooctanesulfonamido) acetic acid	ng/L	7.02 U	7.06 U	6.81 U
N-Ethyl-N-((heptadecafluorooctyl)sulphonyl) glycine	ng/L	6.2 U	6.23 U	6.01 U
Perfluorobutanesulfonic acid (PFBS)	ng/L	11.7	12.7	22.1 J
Perfluorobutanoic Acid	ng/L	43	46.1	52.5
Perfluorodecane Sulfonic Acid	ng/L	3.72 U	3.74 U	3.6 U
Perfluorodecanoic acid (PFDA)	ng/L	3.18 U	3.2 U	3.08 U
Perfluorododecanoic acid (PFDoA)	ng/L	2.44 U	2.45 U	2.36 U
Perfluoroheptane Sulfonate (PFHPS)	ng/L	3.92 U	3.95 U	3.8 U
Perfluoroheptanoic acid (PFHpA)	ng/L	21.7	22.6	25.4 J
Perfluorohexanesulfonic acid (PFHxS)	ng/L	33.9	34	19.8
Perfluorohexanoic acid (PFHxA)	ng/L	24.6	29.2	28.9 J
Perfluorononanoic acid (PFNA)	ng/L	2.32 J	2.37 J	1.08 U
Perfluorooctane Sulfonamide (FOSA)	ng/L	2.64 U	2.66 U	2.56 U
Perfluorooctanesulfonic acid (PFOS)	ng/L	15	17.3	19.4
Perfluorooctanoic acid (PFOA)	ng/L	125	119	120
Perfluoropentanoic Acid (PFPeA)	ng/L	16.6 J	30 J	13.7 J
Perfluorotetradecanoic acid (PFTA)	ng/L	3.8 U	3.82 U	3.68 U
Perfluorotridecanoic Acid (PFTriA)	ng/L	2.48 U	2.49 U	2.4 U
Perfluoroundecanoic Acid (PFUnA)	ng/L	2.19 U	2.2 U	2.12 U
Sodium 1H,1H,2H,2H-Perfluorodecane Sulfonate (8:2)	ng/L	12 U	12.1 U	11.6 U
Sodium 1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2)	ng/L	19 U	19.1 U	18.4 U



Table 14. Summary of Volatile Organic Compounds in Soil Vapor, HPS Parcel G, Queens, New York

Sample Des	ignation:	RSV-G1	RSV-G2	RSV-G3	RSV-G4	RSV-G4
	ole Date:		05/08/2019	05/08/2019	05/08/2019	05/08/2019
Normal or Field D		N	N	N	N	FD
Parameter	Units					
1,1,1-Trichloroethane (TCA)	UG/M3	21	8.7 U	1.4 J	4.4 U	3.3 U
1,1,2,2-Tetrachloroethane	UG/M3	1.4 U	11 U	1.3 J	5.5 U	4.1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	UG/M3	1.5 U	12 U	3.1 U	6.1 U	4.6 U
1,1,2-Trichloroethane	UG/M3	1.1 U	8.7 U	2.2 U	4.4 U	2 J
1,1-Dichloroethane	UG/M3	0.68 J	6.5 U	1.6 U	3.2 U	2.4 U
1,1-Dichloroethene	UG/M3	0.14 U	1.1 U	0.28 U	0.56 U	0.42 U
1,2,4-Trichlorobenzene	UG/M3	3.7 U	30 U	7.4 U	15 U	11 U
1,2,4-Trimethylbenzene	UG/M3	0.53 J	7.9 U	2 U	3.9 U	2.9 U
1,2-Dibromoethane (Ethylene Dibromide)	UG/M3	1.5 U	12 U	3.1 U	6.1 U	4.6 U
1,2-Dichlorobenzene	UG/M3	1.2 U	9.6 U	2.4 U	4.8 U	3.6 U
1,2-Dichloroethane	UG/M3	0.81 U	6.5 U	1.6 U	3.2 U	2.4 U
1,2-Dichloropropane	UG/M3	0.92 U	7.4 U	1.8 U	3.7 U	2.8 U
1,2-Dichlorotetrafluoroethane	UG/M3	0.9 J	11 U	2.8 U	5.6 U	4.2 U
1,3,5-Trimethylbenzene (Mesitylene)	UG/M3	0.98 U	7.9 U	2 U	3.9 U	2.9 U
1,3-Butadiene	UG/M3	4.3	8	1.9	1.8 U	1.2 J
1,3-Dichlorobenzene	UG/M3	1.2 U	9.6 U	2.4 U	4.8 U	3.6 U
1,4-Dichlorobenzene	UG/M3	1.2 U	9.6 U	2.4 U	4.8 U	3.6 U
1,4-Dioxane (P-Dioxane)	UG/M3	18 U	140 U	36 U	72 U	54 U
2,2,4-Trimethylpentane	UG/M3	1.6	6.2 J	1.9 U	13	11
2-Chlorotoluene	UG/M3	1 U	8.3 U	2.1 U	4.1 U	3.1 U
2-Hexanone	UG/M3	85	270	130	40	110
4-Ethyltoluene	UG/M3	0.98 U	7.9 U	2 U	3.9 U	2.9 U
Acetone	UG/M3	480 D	2300 D	1100 D	810 D	960 D
Allyl Chloride (3-Chloropropene)	UG/M3	1.6 U	13 U	3.1 U	6.3 U	4.7 U
Benzene	UG/M3	5.6	7.1	1.4	7.9	9.2
Benzyl Chloride	UG/M3	1 U	8.3 U	2.1 U	4.1 U	3.1 U
Bromodichloromethane	UG/M3	1.3 U	11 U	2.7 U	5.4 U	4 U
Bromoform	UG/M3	2.1 U	17 U	4.1 U	8.3 U	6.2 U
Bromomethane	UG/M3	0.78 U	6.2 U	1.6 U	3.1 U	2.3 U
Butane	UG/M3	78	280	38	220	230
Carbon Disulfide	UG/M3	18	16	17	67	76
Carbon Tetrachloride	UG/M3	0.22 U	1.8 U	9.4	0.88 U	0.66 U
Chlorobenzene	UG/M3	0.92 U	7.4 U	1.8 U	3.7 U	2.8 U
Chlorodifluoromethane	UG/M3	1.8 U	14 U	3.5 U	8.6	8.8
Chloroethane	UG/M3	1.3 U	11 U	2.6 U	5.3 U	4 U
Chloroform	UG/M3	0.76 J	7.8 U	8.4	3.9 U	2.9 U



Table 14. Summary of Volatile Organic Compounds in Soil Vapor, HPS Parcel G, Queens, New York

Sample Des	ignation:	RSV-G1	RSV-G2	RSV-G3	RSV-G4	RSV-G4
Sam	ole Date:	05/08/2019	05/08/2019	05/08/2019	05/08/2019	05/08/2019
Normal or Field D	uplicate:	N	N	N	N	FD
Parameter	Units					
Chloromethane	UG/M3	38	160	2.1 U	4.1 U	3.1 U
Cis-1,2-Dichloroethylene	UG/M3	0.2 U	1.6 U	0.4 U	0.8 U	0.6 U
Cis-1,3-Dichloropropene	UG/M3	0.91 U	7.3 U	1.8 U	3.6 U	2.7 U
Cyclohexane	UG/M3	9.2	72	1.1 J	23	26
Cymene	UG/M3	1.1 U	8.8 U	2.2 U	4.4 U	3.3 U
Dibromochloromethane	UG/M3	1.7 U	14 U	3.4 U	6.8 U	5.1 U
Dichlorodifluoromethane	UG/M3	22	9.2 J	5.2	37	36
Ethylbenzene	UG/M3	1	6.9 U	0.77 J	3.5 U	1.4 J
Hexachlorobutadiene	UG/M3	2.1 U	17 U	4.3 U	8.5 U	6.4 U
Isopropanol	UG/M3	20	110	51	38 J	41
Isopropylbenzene (Cumene)	UG/M3	0.98 U	7.9 U	2 U	3.9 U	2.9 U
m,p-Xylene	UG/M3	2.9	3.5 J	2.7 J	1.8 J	4.1 J
Methyl Ethyl Ketone (2-Butanone)	UG/M3	350 D	1500 D	630 D	420 B	550 D
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	UG/M3	2 U	16 U	4.1 U	8.2 U	6.1 U
Methyl Methacrylate	UG/M3	2 U	16 U	4.1 U	8.2 U	6.1 U
Methylene Chloride	UG/M3	1.7 U	14 U	2.8 J	6.9 U	5.2 U
Naphthalene	UG/M3	2.6 U	21 U	5.2 U	10 U	7.9 U
N-Butylbenzene	UG/M3	1.1 U	8.8 U	2.2 U	4.4 U	3.3 U
N-Heptane	UG/M3	11	79	9.8	27	36
N-Hexane	UG/M3	17	120	10	50	54
N-Propylbenzene	UG/M3	0.98 U	7.9 U	2 U	3.9 U	2.9 U
O-Xylene (1,2-Dimethylbenzene)	UG/M3	1.2	6.9 U	1.2 J	3.5 U	2.1 J
Styrene	UG/M3	0.85 U	6.8 U	1.7 U	3.4 U	2.6 U
Tert-Butyl Alcohol	UG/M3	46	150	75	52 J	58
Tert-Butyl Methyl Ether	UG/M3	0.72 U	5.8 U	1.4 U	2.9 U	2.2 U
Tetrachloroethylene (PCE)	UG/M3	2.9	5.1 J	11	3 J	7.7
Tetrahydrofuran	UG/M3	15 U	120 U	29 U	59 U	44 U
Toluene	UG/M3	110	75	130	41 B	72 B
Trans-1,2-Dichloroethene	UG/M3	0.79 U	6.3 U	1.6 U	3.2 U	2.4 U
Trans-1,3-Dichloropropene	UG/M3	0.91 U	7.3 U	1.8 U	3.6 U	2.7 U
Trichloroethylene (TCE)	UG/M3	0.27	1.5 U	0.45	0.85	1.1
Trichlorofluoromethane	UG/M3	4.1	9 U	13	6.8	6.5
Vinyl Bromide	UG/M3	0.87 U	7 U	1.7 U	3.5 U	2.6 U
Vinyl Chloride	UG/M3	0.2 U	1.6 U	0.4 U	0.8 U	0.6 U

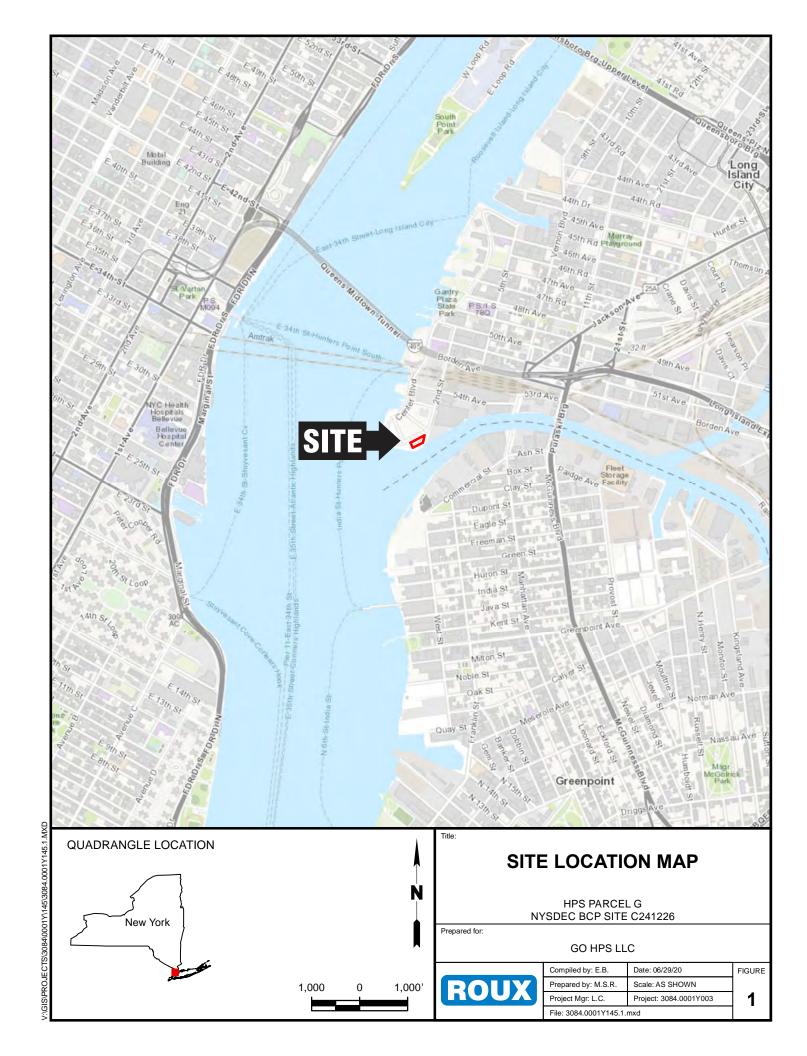


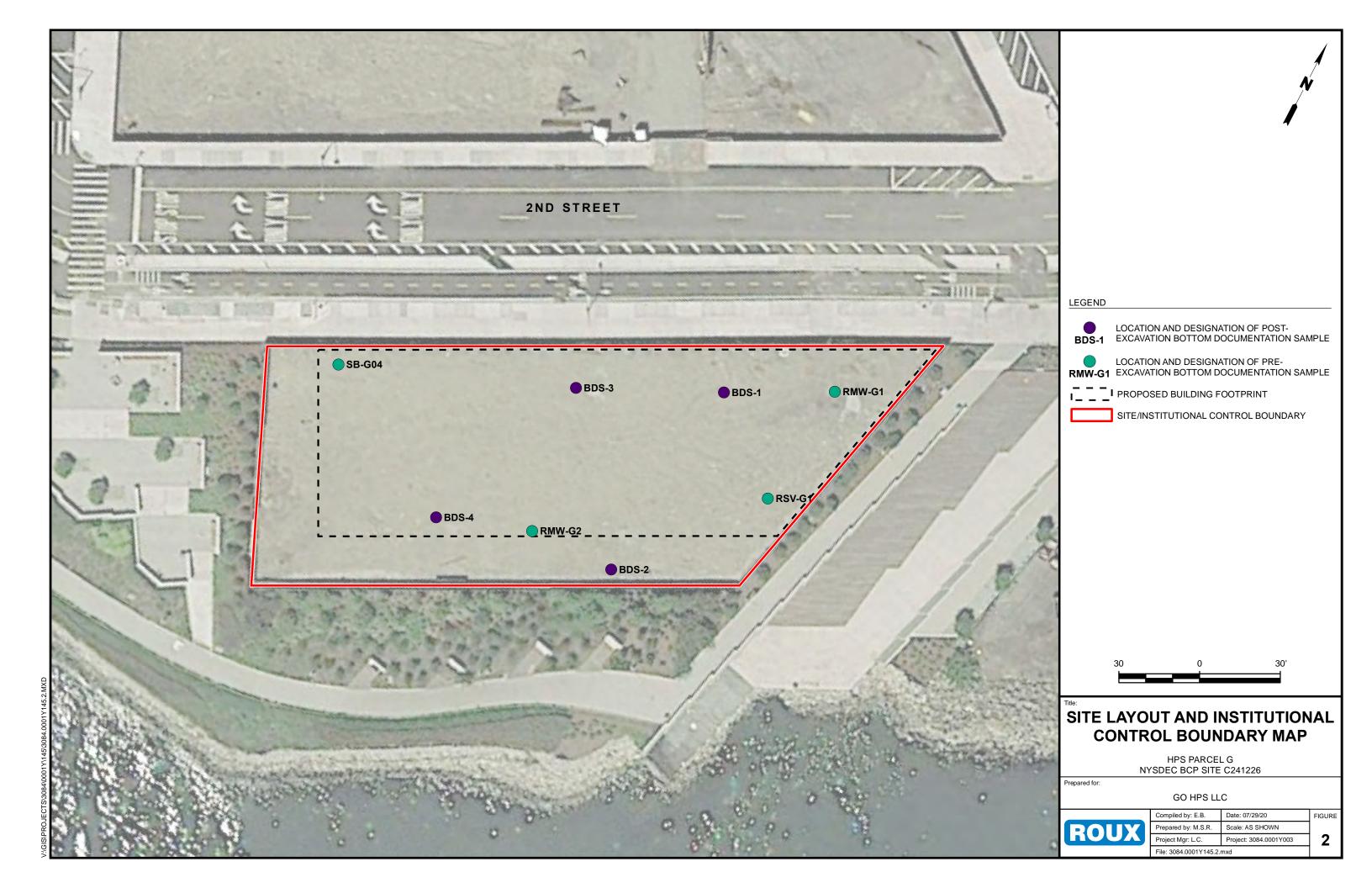
Site Management Plan HPS Parcel G – 57-28 2nd Street, Long Island City, New York BCP Site #C241226

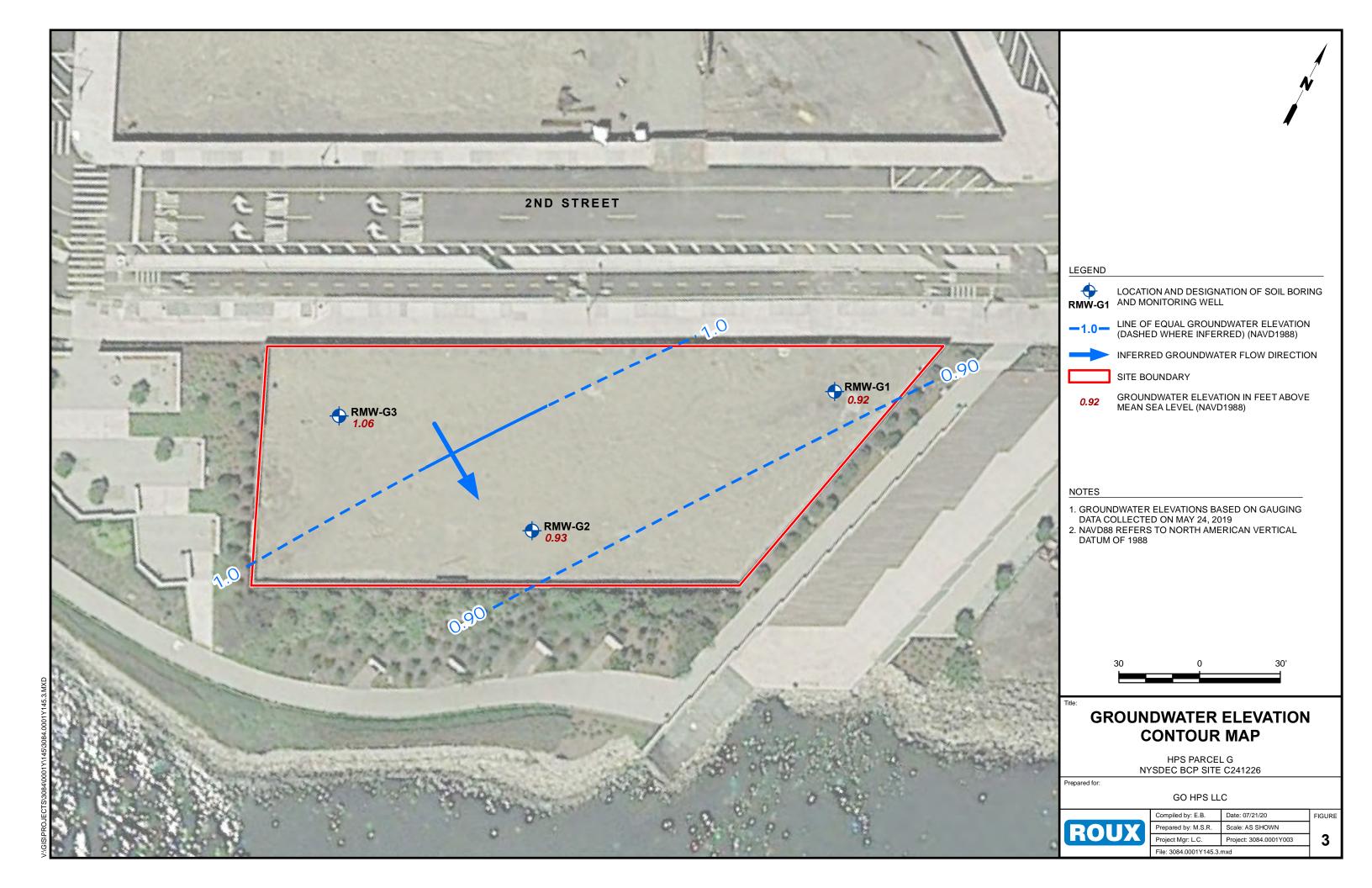
FIGURES

- 1. Site Location Map
- 2. Site Layout and Institutional Control Boundary Map
- 3. Groundwater Contour Map
- 4. Remaining Soil Sample Exceedances
- 5. Summary of Groundwater Exceedances
- 6. Summary of Soil Vapor Detections
- 7. Engineering Control Locations

3084.0001Y145/CVRS ROUX

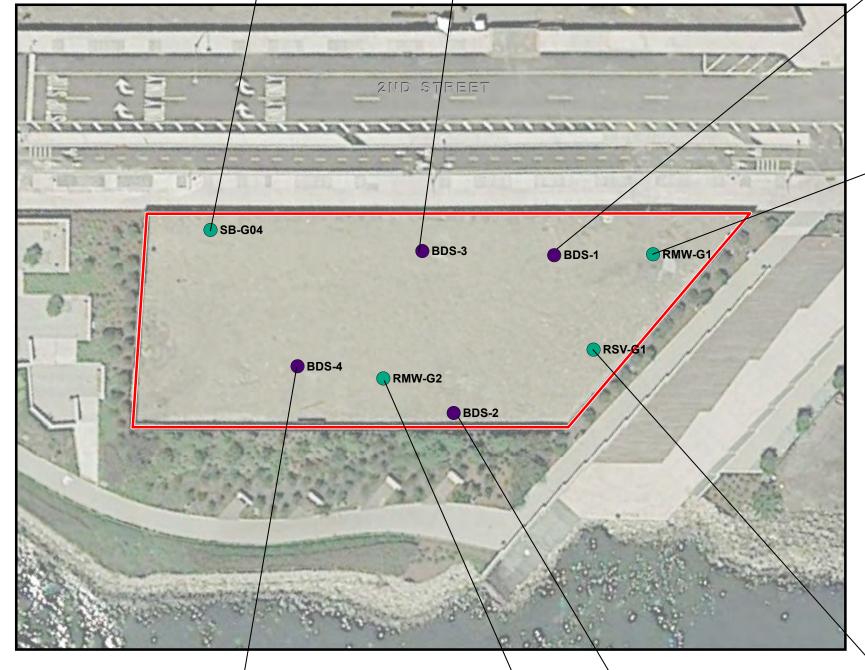






5/21/20	5/21/20 DUP
15-17	15-17
3.4	9.4
3.5	8.6
4.5	10
2	5.2
2.7	7.8
0.31	0.66
1.3	3
24.4	12.1
48.7	18.1
48.7	18.1 B
126	71
377	917
0.71	1.6
39.8	19.8
371	318
0.2	0.29
0.0060 J	0.0081 U
0.0085	0.0075 J
0.019	0.0081 U
	15-17 3.4 3.5 4.5 2 2.7 0.31 1.3 24.4 48.7 48.7 126 377 0.71 39.8 371 0.2 0.0060 J 0.0085

BDS-1	4/28/20
Depth (ft bls)	10.5-12.5
VOCs	
Acetone	0.056
SVOCs	
Benzo[a]anthracene	3.1
Benzo[a]pyrene	3.8
Benzo[b]fluoranthene	4.5
Benzo[k]fluoranthene	1.3
Chrysene	3
Dibenzo[a,h]anthracene	0.53
Indeno[1,2,3-cd]pyrene	2
Metals	
Arsenic	13.4
Copper	82.6
Lead	242
Mercury	0.82
Zinc	226
PCBs, Total	0.18
Pesticides	
4,4'-DDT	0.011P



RMW-G1	4/29/19	4/29/19
Pepth (ft bls)	0 - 2	10 - 12
/OCs		
cetone	ND	0.086
SVOCs		
Benzo[a]anthracene	2.1	1.2
Benzo[a]pyrene	2.2	1.1
Benzo[b]fluoranthene	3.1 T	1.7 T
Benzo[k]fluoranthene	1.1	NE
Chrysene	2.2	1.2
ndeno[1,2,3-cd]pyrene	1.5	0.85
/letals		
Copper	91.9	66
.ead	219	246
Mercury	0.53	1.2
inc	187	214
CBs, Total	0.23	NE
Pesticides		
-,4'-DDD	0.0059 J	ND
,4'-DDE	0.0096 P	NE
,4'-DDT	0.025	0.0046 JP

BDS-4	5/20/20
Depth (ft bls)	15-17
SVOCs	
Benzo[a]anthracene	20
Benzo[a]pyrene	32
Benzo[b]fluoranthene	35
Benzo[k]fluoranthene	13 T
Chrysene	18
Dibenzo[a,h]anthracene	3.5 T
Indeno[1,2,3-cd]pyrene	13 T
Metals	
Arsenic	43.7
Barium	488
Copper	178
Lead	152
Mercury	0.29 T
Nickel	35.3 T
Zinc	217 T

RMW-G2	4/29/19
Depth (ft bls)	16 - 18
SVOCs	
Benzo[b]fluoranthene	1.2 T
Metals	
Arsenic	20.3 T
Barium	779
Copper	71.7
Lead	1440
Mercury	0.23 T
Zinc	133
Pesticides	
4,4'-DDD	0.0085
4,4'-DDT	0.0052 J

BDS-2	5/21/20
Depth (ft bls)	0-2
SVOCs	
Benzo[a]anthracene	2.3
Benzo[a]pyrene	2.2
Benzo[b]fluoranthene	3.1
Benzo[k]fluoranthene	1.2
Chrysene	2
Indeno[1,2,3-cd]pyrene	0.83
Metals	
Arsenic	23.9
Barium	488
Chromium, Trivalent	33
Chromium	33
Copper	202
Lead	425
Mercury	0.95
Nickel	37.5
Zinc	1090
PCBs, Total	0.25
Pesticides	
4,4'-DDE	0.0046 JP
4,4'-DDT	0.011P

RSV-G1	4/30/19
Depth (ft bls)	0 - 2
SVOCs	
Benzo[a]anthracene	1.9
Benzo[a]pyrene	1.8
Benzo[b]fluoranthene	2.4
Benzo[k]fluoranthene	0.88
Chrysene	1.8
ndeno[1,2,3-cd]pyrene	0.87
Vletals	
Copper	105
_ead	287
Mercury	0.38
Zinc	384
PCBs, Total	0.29
Pesticides	
4,4'-DDT	0.017

LEGEND

LOCATION AND DESIGNATION OF PRE-RMW-G1 EXCAVATION BOTTOM DOCUMENTATION SAMPLE



LOCATION AND DESIGNATION OF POST-BDS-1 EXCAVATION BOTTOM DOCUMENTATION SAMPLE



SITE/INSTITUTIONAL CONTROL BOUNDARY

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential Use SCO
VOCs		
Acetone	0.05	100
SVOCs		
Benzo[a]anthracene	1	1
Benzo[a]pyrene	1	1
Benzo[b]fluoranthene	1	1
Benzo[k]fluoranthene	0.8	3.9
Chrysene	1	3.9
Dibenzo[a,h]anthracene	0.33	0.33
Indeno[1,2,3-cd]pyrene	0.5	0.5
Metals		
Arsenic	13	16
Barium	350	400
Chromium, Trivalent	30	180
Chromium	30	180
Copper	50	270
Lead	63	400
Mercury	0.18	0.81
Nickel	30	310
Zinc	109	10000
PCBs, Total	0.1	1
Pesticides		
4,4'-DDD	0.0033	13
4,4'-DDE	0.0033	8.9
4,4'-DDT	0.0033	7.9

1. CONCENTRATIONS IN MILIGRAMS PER KILOGRAM (mg/kg)
2. BOLD DATA INDICATES AN EXCEEDANCE OF NYSDEC PART 375
UNRESTRICTED USE SCO
3. SHADED DATA INDICATES AN EXCEEDANCE OF NYSDEC PART 375
RESTRICTED RESIDENTIAL USE SCO

NYSDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DUP - DUPLICATE SAMPLE
FT BLS - FEET BELOW LAND SURFACE
SCOS - SOIL CLEANUP OBJECTIVES

J - ESTIMATED VALUE

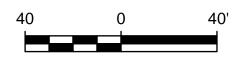
P - THE RELATIVE PERCENT DIFFERENCE BETWEEN THE RESULTS FOR ND - NO DETECTION

NE - NO EXCEEDANCE

T - THE TWO COLUMNS EXCEEDS THE METHOD-SPECIFIED CRITERIA INDICATES THAT A QUALITY CONTROL PARAMETER HAS EXCEEDED

PCBS - LABORATORY LIMITS SVOCS - POLYCHLORINATED BIPHENYLS

VOCS - SEMIVOLATILE ORGANIC COMPOUNDS VOLATILE ORGANIC COMPOUNDS



SUMMARY OF EXCEEDANCES IN SOIL

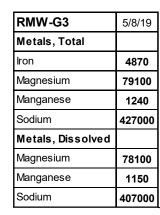
HPS PARCEL G NYSDEC BCP SITE C241226

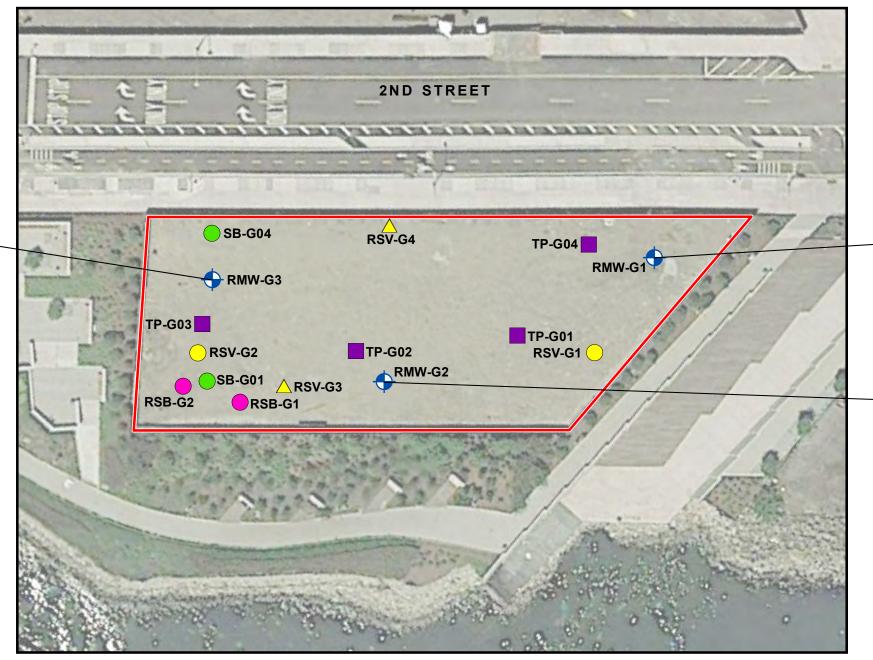
Prepared for:

GO HPS LLC



Compiled by: E.B.	Date: 09/18/20	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	4
Project Mgr: L.C.	Project: 3084.0001Y003	4
File: 3084.0001Y145.3.	mxd	





RMW-G1	5/8/19
Metals, Total	
Cyanide	820
Iron	531
Magnesium	62300
Sodium	554000
Metals, Dissolved	
Magnesium	63200
Sodium	515000

RMW-G2	5/8/19	5/8/19 DU
Metals, Total		
Iron	8070	7650
Magnesium	83800	81700
Manganese	777	761
Sodium	588000	607000
Metals, Dissolved		
Magnesium	82600	82600
Manganese	747	729
Sodium	589000	577000

LEGEND



LOCATION AND DESIGNATION OF SOIL BORING AND MONITORING WELL COMPLETED IN 2019



LOCATION AND DESIGNATION OF SOIL BORING AND SOIL VAPOR SAMPLING POINT COMPLETED IN 2019



LOCATION AND DESIGNATION OF SOIL BORING RSB-G1 COMPLETED IN 2019



LOCATION AND DESIGNATION OF SOIL VAPOR RSV-G4 SAMPLING POINT COMPLETED IN 2019



LOCATION AND DESIGNATION SOIL BORING SB-G04 COMPLETED IN 2018



LOCATION AND DESIGNATION OF TEST PIT TP-G01 COMPLETED IN 2018



SITE BOUNDARY

NYSDEC

AWQSGVS

200

300

35000

300

20000

Parameter

Metals

Cyanide

Magnesium

Manganese

Sodium

Iron

1. CONCENTRATIONS IN MICROGRAMS PER LITER (µg/L)

NYSDEC - NEW YORK STATE DEPARTMENT OF **ENVIRONMENTAL PROTECTION**

AWQSGVS - AMBIENT WATER QUALITY STANDARDS & GUIDANCE VALUES

DUP - FIELD DUPLICATE



SUMMARY OF EXCEEDANCES IN GROUNDWATER

HPS PARCEL G NYSDEC BCP SITE C241226

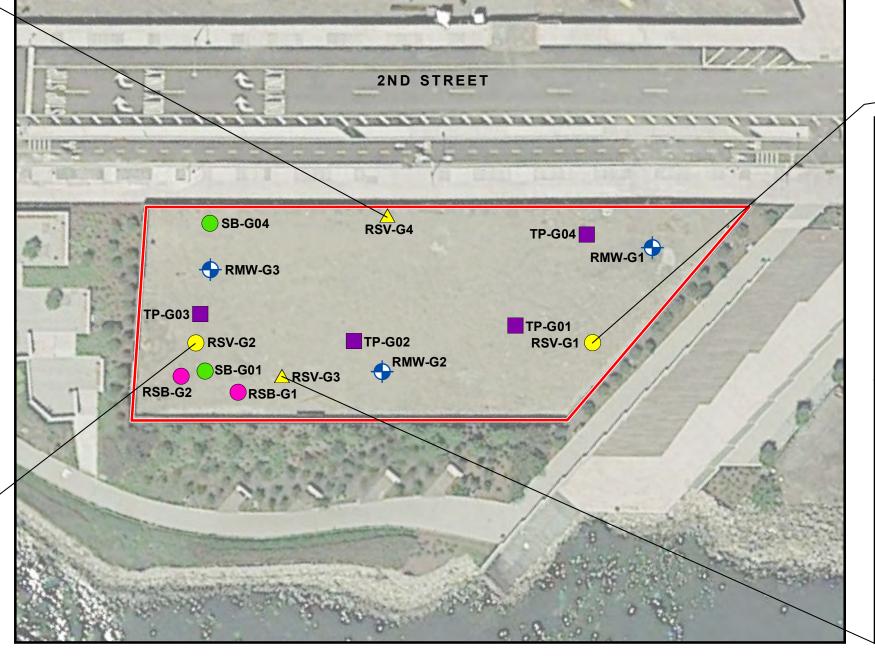
Prepared for:

GO HPS LLC

FIGURE



RSV-G2	5/8/19
VOCs	
1,3-Butadiene	8
2-Butanone (MEK)	1500 D
2-Hexanone	270
Acetone	2300 D
Benzene	7.1
Butane	280
Carbon disulfide	16
Chloromethane	160
Cyclohexane	72
Dichlorodifluoromethane	9.2 J
Isooctane	6.2 J
Isopropanol	110
m+p-Xylene	3.5 J
N-Heptane	79
n-Hexane	120
t-Butyl Alcohol	150
Tetrachloroethene	5.1 J
Toluene	75



RSV-G3 5/8/19 VOCs 1,1,1-Trichloroethane 1.4 J 1,1,2,2-Tetrachloroethane 1.3 J 1.3-Butadiene 1.9 2-Butanone (MEK) 630 D 130 2-Hexanone Acetone 1100 D Benzene 1.4 Butane 38 17 Carbon disulfide Carbon tetrachloride 9.4 8.4 Chloroform Cyclohexane 1.1 J 5.2 Dichlorodifluoromethane Ethylbenzene 0.77 J 51 Isopropanol 2.7 J m+p-Xylene Methylene chloride 2.8 J 9.8 N-Heptane n-Hexane 10 o-Xylene 1.2 J t-Butyl Alcohol 75 Tetrachloroethene 11 Toluene 130 Trichloroethene 0.45 Trichlorofluoromethane 13

RSV-G1	5/8/19
VOCs	
1,1,1-Trichloroethane	21
1,1-Dichloroethane	0.68 J
1,2,4-Trimethylbenzene	0.53 J
1,3-Butadiene	4.3
2-Butanone (MEK)	350 D
2-Hexanone	85
Acetone	480 D
Benzene	5.6
Butane	78
Carbon disulfide	18
Chloroform	0.76 J
Chloromethane	38
Cyclohexane	9.2
Dichlorodifluoromethane	22
Ethylbenzene	1
Freon 114	0.90 J
Isooctane	1.6
Isopropanol	20
m+p-Xylene	2.9
N-Heptane	11
n-Hexane	17
o-Xylene	1.2
t-Butyl Alcohol	46
Tetrachloroethene	2.9
Toluene	110
Trichloroethene	0.27
Trichlorofluoromethane	4.1

LEGEND



LOCATION AND DESIGNATION OF SOIL BORING RMW-G1 AND MONITORING WELL COMPLETED IN 2019



LOCATION AND DESIGNATION OF SOIL BORING AND SOIL VAPOR SAMPLING POINT COMPLETED IN 2019



LOCATION AND DESIGNATION OF SOIL BORING COMPLETED IN 2019



LOCATION AND DESIGNATION OF SOIL VAPOR RSV-G4 SAMPLING POINT COMPLETED IN 2019



LOCATION AND DESIGNATION SOIL BORING SB-G04 COMPLETED IN 2018



LOCATION AND DESIGNATION OF TEST PIT COMPLETED IN 2018

SITE BOUNDARY

1. CONCENTRATIONS IN MICROGRAMS PER CUBIC METER (µg/m³) 2. BOLD DATA INDICATES A DETECTION

DUP - FIELD DUPLICATE

- ND NO DETECTION
- B THE ANALYTE WAS FOUND IN AN ASSOCIATED BLANK AS WELL AS IN THE SAMPLE
- D A SECONDARY ANALYSIS AFTER DILUTION DUE TO EXCEEDANCE OF THE CALIBRATION RANGE IN THE ORIGINAL SAMPLE
- J ESTIMATED VALUE

VOCS - VOLATILE ORGANIC COMPOUNDS



SUMMARY OF DETECTIONS IN SOIL VAPOR

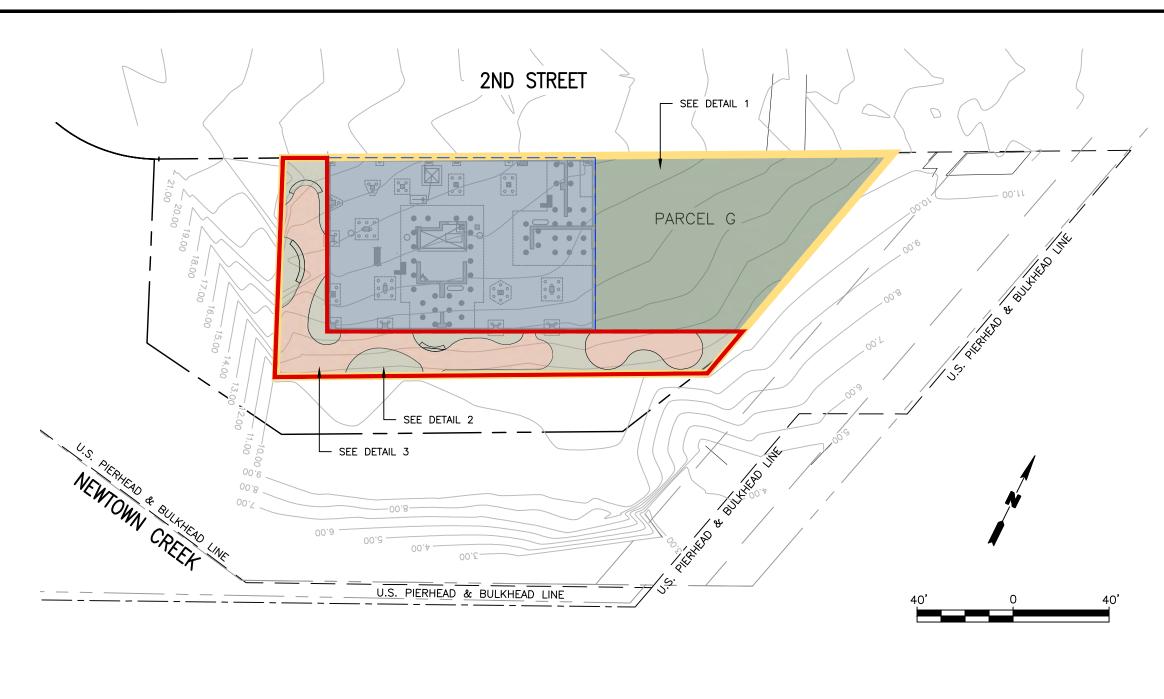
HPS PARCEL G NYSDEC BCP SITE C241226

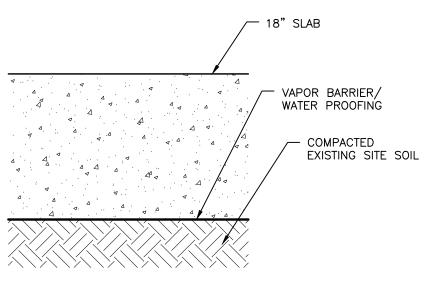
Prepared for:

GO HPS LLC

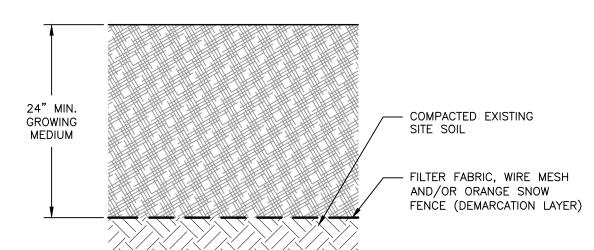
Compiled by: E.B. Date: 06/27/19 Prepared by: M.S.R. Scale: AS SHOWN Project Mgr: L.C. File: 3084.0001Y117.6.mxd

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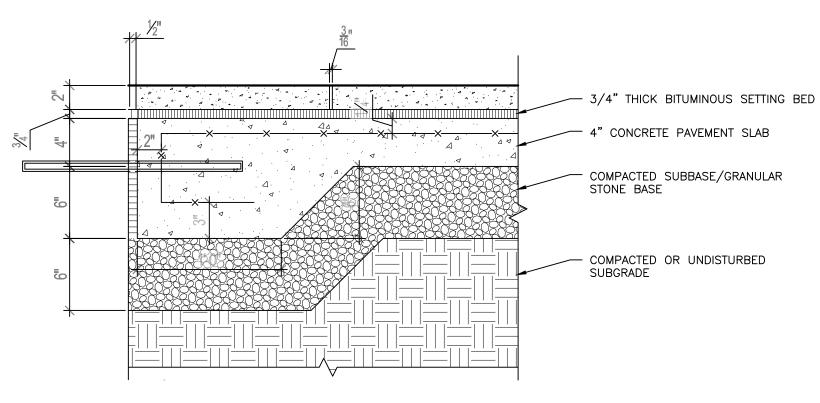




SITE COVER CONCRETE **BUILDING FOUNDATION** NOT TO SCALE



2 FINAL SITE COVER SYSTEM LANDSCAPED AREAS NOT TO SCALE



FINAL SITE COVER CONCRETE PAVER WALKWAYS NOT TO SCALE

<u>LEGEND</u>

SITE/INSTITUTIONAL CONTROL BOUNDARY

EXTENT OF BUILDING FOOTPRINT

LIMITS OF SITE COVER SYSTEM COMPRISED OF CONCRETE BUILDING FOUNDATIONS WITH A

DEMARCATION LAYER OF 20 MIL THICK VAPOR BARRIER/WATERPROOFING SYSTEM (TRACK 4; SEE DETAIL 1 AND NOTE 2)

LIMITS OF CELLAR EXCAVATION TO A MINIMUM DEPTH OF 15 FT BLS (TRACK 2)

PROPOSED LIMITS OF FINAL SITE COVER SYSTEM COMPRISED OF A MINIMUM OF 2 FEET OF SOIL MEETING UUSCOs PLACED OVER A DEMARCATION LAYER WITH THE UPPER 6 INCHES OF SUFFICIENT QUALITY TO MAINTAIN A VEGETATIVE LAYER (SEE DETAIL 2 AND NOTE 2)

PROPOSED LIMITS OF FINAL SITE COVER SYSTEM COMPRISED OF CONCRETE PAVERS AND A CONCRETE SLAB WITH A DEMARCATION LAYER OF THE UNDERSIDE OF THE CONCRETE SLAB (SEE DETAIL 3 AND NOTE 2)

PROPOSED LIMITS OF TEMPORARY SITE COVER SYSTEM IN LANDSCAPED AREAS COMPRISED OF A MINIMUM 4" CONCRETE SLAB (SEE DETAIL 4 AND NOTE 2)

1. REFER TO DETAILS FOR PROPOSED SITE COVER SYSTEM TYPES.

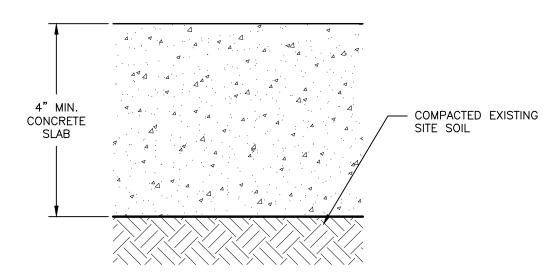
2. BACKFILL FOR THE SITE WILL MEET THE LOWER OF PART 375 RRSCOs OR PGWSCOs (WITH THE EXCEPTION OF GRANULAR FILL MATERIALS WITH LESS THAN 10 PERCENT PASSING THE NUMBER 80 SIEVE). FILL MATERIALS WITH LESS THAN 10 PERCENT PASSING THE NUMBER 80 SIEVE (I.E., STONE, GRAVEL, ETC.) DO NOT REQUIRE

FT BLS - FEET BELOW LAND SURFACE

RRSCOs - PART 375 RESTRICTED RESIDENTIAL SOIL CLEANUP OBJECTIVES

PGWSCOs - PART 375 PROTECTION OF GROUNDWATER SOIL CLEANUP OBJECTIVES

RCA - RECYCLED CONCRETE AGGREGATE



(4) PROPOSED TEMPORARY SITE COVER SYSTEM LANDSCAPED AREAS

NOT TO SCALE

SOURCE

PRELIMINARY ARCHITECTURAL SURVEY, TRUE NORTH SURVEYORS, P.C., DATED

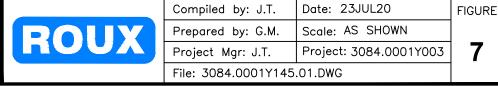
Title:

ENGINEERING CONTROL LOCATIONS

HPS PARCEL G NYSDEC BCP SITE C241226

Prepared For:

GO HPS LLC



Site Management Plan HPS Parcel G – 57-28 2nd Street, Long Island City, New York BCP Site #C241226

APPENDICES

- A. Environmental Easement
- B. List of Site Contacts
- C. Monitoring Well Boring and Construction Logs
- D. Excavation Work Plan
- E. Health and Safety Plan
- F. Site Management Forms

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Site Management Plan HPS Parcel G – 57-28 2nd Street, Long Island City, New York BCP Site #C241226

APPENDIX A

Environmental Easement

3084.0001Y145/CVRS ROUX

Containing 19,744.14 square feet or 0.45 acre of land more or less.

the preceding course, 253.68 feet to the point and place of Beginning. Northeasterly with an interior angle of 92 degrees 46 minutes 00 seconds with

the preceding course, 91.42 feet to a point, thence Northwesterly with an interior angle of 87 degrees 11 minutes 54 seconds with

with the preceding course, 176.10 feet to a point, thence Southwesterly with an interior angle of 142 degrees 53 minutes 31 seconds

the preceding course, 11.64 feet to a point, thence Southerly with an interior angle of 167 degrees 57 minutes 41 seconds with

preceding course, 111.23 feet to a point, thence Southerly with an exterior angle of 130 degrees 49 minutes 6 seconds with the

sideline prolongation of 2nd Street, running thence; centerline prolongation of 56th Avenue (60 feet wide) with the southeasterly therein distant 95.21 feet southwesterly from the intersection formed by the Beginning at a point on the southeasterly sideline of 2nd Street (75 feet wide),

and County of Queens, City and State of New York, bounded and described as follows All that certain plot, piece of land situate, lying and being in the Borough

- EMBOSSED SEVT SHVIT BE CONSIDERED LO BE AVID' LEGE COLIES L) ONTA COLIES OF THIS MAP BEARING THE LICENSED LAND SURVEYOR'S
- 1509' SUBDIVISION 2' OF THE NEW YORK STATE EDUCATION LAW LICENSED LAND SURVEYOR'S EMBOSSED SEAL IS A VIOLATION OF SECTION 6) UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A
 - MATER COURSES VISIBLE ON THE PREMISES SHOWN HEREON. 2) THIS IS TO CERTIFY THAT THERE ARE NO STREAMS OR NATURAL
 - 4) THERE ARE NO ENCROACHMENTS AFFECTING PROPERTY.
 - 3) THE PROPERTY DESCRIPTION CLOSES MATHEMATICALLY.
- TAX MAPS AND INFORMATION SUPPLIED BY CLIENT.
 - SLVLES SLVNDVED OF MEASUREMENT. 1) WIT DIWENSIONS SHOWN HEREON ARE IN THE UNITED
 - NOLES:

CLF-CHAIN LINK FENCE

RAPHALT PAVEMENT

CONC-CONCRETE PAVEMENT

CONCRETE PAVEMENT

CONC-CONCRETE PAVEMENT

CONCRETE PAVEMENT

CONCRE

FECEND:

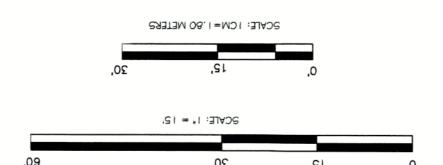
57-28 2nd Street, Long Island City, New York COMP FILE: 7-1-20 BLOCK 6 LOT 20 CHKD BJ: MA 2CALE: 1:20 SLVLE OF NEW YORK AUTH. DATE FIELD DATE: 1-7-2 AND THE THE COMPANY CONCENTRATION OF THE THE COMPANY CONCENTRATION OF THE CHANGE WITH THE WITH THE CHANGE WITH THE WITH THE CHANGE WITH THE WI LHE BOKONCH OF QUEENS SITUATED IN ENAIRONMENTAL EASEMENT SURVEY UNAUTHORIZED ALTERATION OR ADDITION TO THIS SURVEY IS A VIOLATION OF ADDITION THE SURVEY WAS EUGACHOU LAW.

AND ORIGINAL SIGNATURE SHALL NOT BE CONSIDERED TO BE A VALID TRUE COPY.

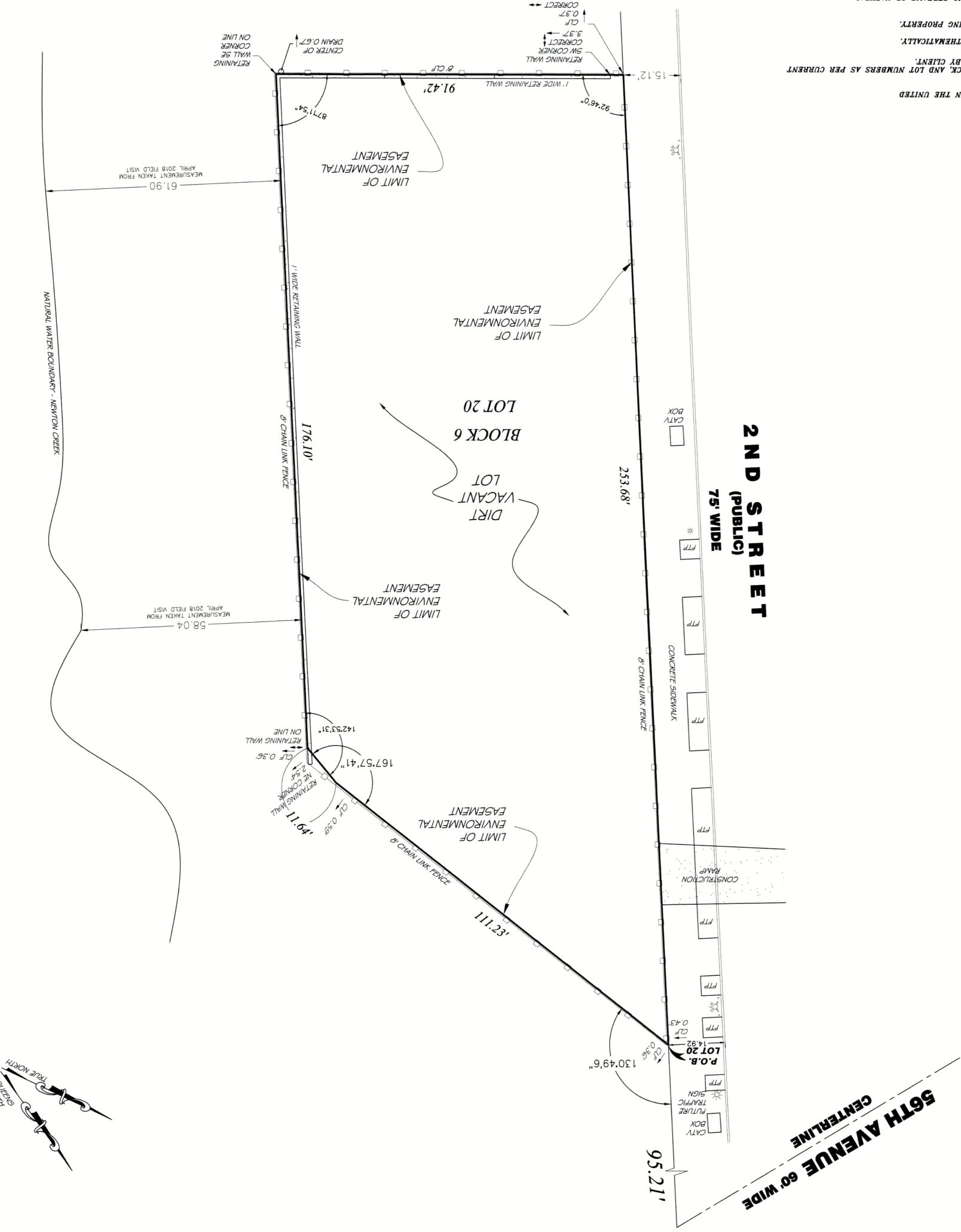
John J. Vide M.P. 8. Lic. No. 050298

111 Kosciuszko Roda Whitehouse Station, NJ 08889

True North Surveyors, P.C.



Site Control Section, 625 Broadway, Albany, NY 12233 or at "derweb@dec.ny.gov." NYS Department of Environmental Conservation, Division of Environmental Remediation, obtained by any party with an interest in the property. The SMP can be obtained from Easement are set forth in the Site Management Plan (SMP). A copy of the SMP must be York Environmental Conservation Law. The engineering and institutional controls for this Department of Environmental Conservation pursuant to Title 36 of Article 71 of the New This property is subject to an environmental easement held by the New York State



Site Management Plan HPS Parcel G – 57-28 2nd Street, Long Island City, New York BCP Site #C241226

APPENDIX B

List of Site Contacts

3084.0001Y145/CVRS ROUX

APPENDIX B – LIST OF SITE CONTACTS

This Appendix should include a listing of all site contacts. The below table should be edited as necessary to include all site contacts necessary for implementation of the SMP.

Name South Point Housing Development Fund Corporation GO HPS LLC Jessica L. Taylor, P.G. Roux Environmental Engineering and Geology, D.P.C.	Phone/Email Address [phone] [email address] [phone] [email address] (631) 232-2600 jtaylor@rouxinc.com
Christopher Allan Project Manager, NYSDEC Division of Environmental Remediation, Superfund and Brownfield Cleanup Section	(718) 482-4065 christopher.allan@dec.ny.gov
Jane O'Connell Chief, NYSDEC Division of Environmental Remediation, Superfund and Brownfield Cleanup Section	(718) 482-4599 jane.oconnell@dec.ny.gov
Kelly Lewandowski Chief, NYSDEC Division of Environmental Remediation, Site Control Section	(518) 402-9569 kelly.lewandowski@dec.ny.gov
Tenants - TBD Adam Stolorow Sive, Paget & Reisel, P.C.	(646) 378-7256 astolorow@sprlaw.com

Site Management Plan HPS Parcel G – 57-28 2nd Street, Long Island City, New York BCP Site #C241226

APPENDIX C

Monitoring Well Boring and Construction Logs

3084.0001Y145/CVRS ROUX



Page 1 of 1 WELL CONSTRUCTION LOG

WELL NO.		NORTHING		ISTRUCTION LOG EASTING			
	MW-G1	-50405.6		12155.88			
	NO./NAME 01Y003 / Hunter	r's Point South		LOCATION			
APPROVE		LOGGED BY		Parcel G			
J. Taylo	r	E. Butler		Long Island City, New York			
DRILLING ADT / D.	CONTRACTOR/DRII	LLER		GEOGRAPHIC AREA Parcel G			
	DIAMETER/TYPE	BOREHOLE DIAME	TER	DRILLING EQUIPMENT/METHOD	SAMPLING ME	ETHOD	START-FINISH DATE
6-in. / Sc		6-inches		XL Max / Rotosonic	Sonic Core	9	4/29/19-4/29/19
CASING M		SCREEN:		001140 010	10.00	0 ! !-	0.000
<u>SCH 40</u> ELEVATIO	PVC / 2-inch	TYPE Slotte OUND SURFACE	TOP OF WEL	T. SCH 40 PVC TOTAL LENGTH 1 LL CASING TOP & BOTTOM SCF		2-inch	SLOT SIZE 20-Slot PACK SIZES
(Feet)	13.	.25		3.3 / -6.8		Morie #	
	Stick-up \	J-plug			Blow	PID	
epth, feet	VE	7	Graphic Log	Visual Description	Counts	Values	REMARKS
					per 6"	(ppm)	
Cer	ment/_	500	7 7 7	rown, fine to coarse SAND, some Brick nd Concrete (FILL); moist.		8.5	
	1553	Soil Cuttings					
* **	1664	Soil Cullings					Collect soil sample RMW-G1
	7669		111			(0-2) for RI list of analyses.
	1889		000				
			444				
	-	2-inch,					
		Schedule 40, PVC Riser					
5	\$ 9 07		$\Delta \Delta \Delta$		l ∐	.	
	ŘSSŽ	198°,				6.1	
		B					
		 Betonite Seal 					
			$\Delta \Delta \Delta$				
			000				
10		4					
			444			6.8	
		=					Collect soil sample RMW-G1
		∄ X3-8				(10-12) for RI list of analyses.
		2-inch, Schedule 40,				v	Vater observed at 13 ft bls.
		20-slot PVC	444				
		∃ XX.	0.0.0				
15			A A A A		H		
		- Sand WG #2	444				
		∃	000				
			Δ Δ Δ				
			000				
		3					
		= 1.3.7	444				
		∃	000				End of haring at 20 ft Li-
20		I ta Na	444				End of boring at 20 ft bls.



Page 1 of 1 WELL CONSTRUCTION LOG

Page 1 WELL NO.	of 1	NORTHING	LLL CO	NSTRUCTION LOG			
RI	MW-G2	-50528.56		12134.19			
	NO./NAME	r'o Doint Couth		LOCATION			
<u>3084.000</u> APPROVEI	01Y003 / Hunte i D BY	LOGGED BY		Parcel G			
J. Taylor	r	E. Butler		Long Island City, New York			
DRILLÍNG (CONTRACTOR/DRII	LLER		GEOGRAPHIC AREA Parcel G			
ADT / D.	Moon DIAMETER/TYPE	BOREHOLE DIAM	CTCD	DRILLING EQUIPMENT/METHOD	SAMPLING M	IETHOD	START-FINISH DATE
6-in. / Sc		6-inches	LILIX	XL Max / Rotosonic	Sonic Cor	e	4/29/19-4/29/19
CASING MA	AT./DIA.	SCREEN:		•	1		
SCH 40 I ELEVATION	PVC / 2-inch	TYPE Slotte OUND SURFACE		AT. SCH 40 PVC TOTAL LENGTH 'ELL CASING TOP & BOTTOM SCI		2-inch	SLOT SIZE 20-Slot
ELEVATION (Feet)	N OF: GR		TOP OF W	3.6 / -6.4	KEEN	Morie i	PACK SIZES
(i cct)	Stick-up \	J-plug		0.07 0.4		•	· -
Depth,	\ <u></u>	=	Graphic	Visual Description	Blow Counts	PID Values	REMARKS
feet			Log	vioual Bessiiption	per 6"	(ppm)	TEM II II II
Cem	nent/_		444	Brown, fine to coarse SAND and WOOD,		360.2	
	(66)			some Brick and Concrete (FILL); moist.			
		Soil Cuttings					
			444				
			7 0				
			444				
			000				
	- 123	2-inch,	444				
	<i>3</i> 23	Schedule 40, PVC Riser					
5	\$992 F					Į į	
				Brown, fine to coarse SAND, some Brick and Concrete, little wood (FILL); moist.		57.5	
			444	,			
		Bentonite Sea					
			444				
			111				Collect soil sample RMW-G2
			000				(8-10) (in triplicate for
10		<u> </u>	444		 	2050	MS/MSD) for RI list of analyses.
						3258	High PID reading likely due to organics (wood) found in
							organics (wood) found in sample.
			444				
		1 000	000				
	<u> </u>						
		2-inch,					
		Schedule 40, 20-slot PVC					Water observed at 13 ft bls.
		ZU-SIOT PVC	444				
15		=	Δ Δ Δ				
		∃ 2008				Ī	
		- Sand WG #2	444				
			7 0 0				
			444				
			000				
			444				
		∃					
		The second secon	1771			_	



Page 1 of 1 WELL CONSTRUCTION LOG

WELL NO.	/IW-G3	NORTHING -50563.99		EASTING 12057.58			
ROJECT N		-50505.33		LOCATION			
084.000	1Y003 / Hunte	r's Point South		Parcel G			
PPROVED		LOGGED BY		Long Island City, New York			
. Taylor RILLING C	CONTRACTOR/DR	E. Butler		GEOGRAPHIC AREA			
DT / D.	Moon			Parcel G			
	DIAMETER/TYPE	BOREHOLE DIAM	ETER	DRILLING EQUIPMENT/METHOD	SAMPLING Sonic Co	METHOD	START-FINISH DATE
S <mark>-in. / So</mark> SASING MA		6-inches SCREEN:		XL Max / Rotosonic	Soliic Co	n C	4/29/19-4/29/19
	PVC / 2-inch	TYPE Slotte	e d M	AT. SCH 40 PVC TOTAL LENGTH 1	10.0ft DIA	A. 2-inch	SLOT SIZE 20-Slot
LEVATION		ROUND SURFACE	TOP OF W	TOP & BOTTOM SCI	REEN		L PACK SIZES
Feet)	Stick-up \	'.87		3.9 / -6.1		Morie	#2
epth,			Graphic	Visual Description	Blow Counts	PID Values	REMARKS
eet			Log	visual Description	per 6"	(ppm)	S REWARKS
Ceme	ent		444	Brown, fine to coarse SAND, some Brick		1.7	
		Soil Cuttings	000	and Concrete (FILL); moist.			
		Con Cuttings	444				
			\(\delta \) \(\d				
			444				
5			A A A A			Ц	
						18.0	
	. 1993 -	2-inch,	444				
	1992 1992	Schedule 40,	000				
	155A						
	1553						
	1553						
	7 55 7		444				
	7667		000				
0			444			Ц	
						16.4	
		 Bentonite Se 					
			444				
			000				
							Collect soil sample RMW-G3
							(12-14) for RI list of analyses. Collect soil sample
			444				DUP042919 for RI list of
5_			000			$H_{\alpha \alpha}$	analyses.
	<u> </u>	= 1				2.9	
		∃	A A A A				
		2-inch, Schedule 40,					Water observed at 17 ft bls.
		20-slot PVC	000				
			444				
^			2 2 2				
0		- Sand WG #2				2.9	
			000			2.8	
			444				
		=	000				
			111				
	, i i ja 🚍	■ 11.11	444				End of boring at 24 ft bls.



Page 1 of 1 SOIL BORING LOG WELL NO. | NORTHING EASTING

WELL NO.	-G1	NORTHING -50583.71	EASTING 12106.84			
PROJECT NO./	/NAME		LOCATION			
3084.0001Y APPROVED BY	<u>003 / Hunter'</u> /	S Point South LOGGED BY	Parcel G			
J. Taylor	ITRACTOR/DRILI	E. Butler	Long Island City, New York	<u> </u>		
ADT / D. MC DRILL BIT DIAN	on	BOREHOLE DIAMETER	Parcel G DRILLING EQUIPMENT/METHOD	SAMPLING N	METHOD	START-FINISH DATE
6-in. / Sonic		6-inches	XL Max / Rotosonic	Sonic Co	re	4/29/19-4/29/19
LAND SURFAC 12.81(FT.)	E ELEVATION	DEPTH TO WATER Not Measured	BACKFILL Soil Cuttings			
12.01(11.)		NOT MEASURED	3011 Cuttings			
epth, feet	Graphic Log	Vis	ual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
	1111	Brown, fine to coarse SANI	D, some Brick and Concrete (FILL); moist.		2.8	
	444					
	000					
		1				
	000					
	7 7 7					
	444	-				
	000	+				
	444	-				
	000	-				
		1				
5	444					
	000				3.4	
		1				
	000	1				
	000					
	444	-				
	000	+				
]				
		-				
		1				
	444	1				
	000	-				
10		+				
10	000				0.6	
	7 7 7				0.6	
	444	-				
	0 0 0 0 0 0	+				Collect soil sample RSB-G1 (10-12) for mercury analysis
	222]				(10 12) for moroury analysis
	<u> </u>	Brown fine to coarse SANI	D, some Silt and Gravel, little clay; moist.			
		Bown, fine to coarse SAINI	5, 30mb ont and Oraver, little day, moist.		0.7	
		Dark brown, fine to coarse	SAND, some Gravel and Wood; wet.		1.0	
						End of boring at 15 ft bls.
15	P	3				



Page 1 of 1 SOIL BORING LOG

Page 1 WELL NO.	of 1	NORTHING	EASTING LOG			
RSB.		-50586.63	12080.17			
PROJECT NO./	/NAME '003 / Hunter's	Point South	LOCATION			
APPROVED BY		LOGGED BY	Parcel G	_		
J. Taylor	TD 1 0 T 0 D / D D 1	E. Butler	Long Island City, New Yo	rk		
ADT / D. Mo	TRACTOR/DRILL	ER	GEOGRAPHIC AREA Parcel G			
DRILL BIT DIAN	METER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING I	METHOD	START-FINISH DATE
6-in. / Sonic		6-inches	XL Max / Rotosonic	Sonic Co	re	4/29/19-4/29/19
LAND SURFAC 15.59(FT.)		DEPTH TO WATER Not Measured	BACKFILL Soil Cuttings			
10.00(1.1.)	1		oon outungo			
epth, feet	Graphic Log	Vist	ual Description	Blow Counts	PID Values	REMARKS
	444	Brown, fine to coarse SAND	, some Brick and Gravel (FILL); moist.	per 6"	(ppm) 142.0	
	000					
	7 7 7					
	444					
-						
5					H	
	444				38.7	
	000					
	444					
	444					
10	000				H	
					22.1	
	444					
	000					
	7 7 7					Collect soil sample RSB-G2 11-13) for mercury analysis
						TI-10, TOT THE TOUTY AHAIYSIS
	000					
						End of horizon at 45 ft Li-
15		1			 	End of boring at 15 ft bls.



Page 1 of 1

SOIL BORING LOG EASTING

	of 1		IL BURING LUG				
WELL NO. RSV-(G1	NORTHING -50448.74	EASTING 12174.45				
PROJECT NO./N	IAME	•	LOCATION				_
3084.0001Y0 APPROVED BY		s Point South LOGGED BY	Parcel G				
J. Taylor		E. Butler	Long Island City, New York	k			
DRILLING CONT	TRACTOR/DRILL	LER	GEOGRAPHIC AREA Parcel G				
ADT / D. Mod ORILL BIT DIAMI	on FTFR/TYPF	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING	METHOD	START-FINISH DATE	_
in. / Sonic		6-inches	XL Max / Rotosonic	Sonic Co	re	4/30/19-4/30/19	
AND SURFACE	ELEVATION	DEPTH TO WATER	BACKFILL Soil Cuttings				
11.97(FT.)		Not Measured	Son Cullings				_
epth,	Graphic	V: - v		Blow	PID	DEMARKO	
eet	Log		al Description	Counts per 6"	Values (ppm)	REMARKS	_
		brown, line to coarse SAND,	, some Brick and Concrete (FILL), moist.		4.9		
	444						
	ΔΔΔ						
	444						
1	000					Collect coil DOV C	
	A A A					Collect soil sample RSV-G1 (0-2) for RI list of analyses.	
	444						
	0.00	+					
2	211						
	0.00	CONCRETE.					
	00000	1					
	0.10.00						
	0000						
3	0 1 0 1						
	0.0.0.0						
	0.0.0						
	0000						
	0000						
4	0.0.0						
1	0000						
	0000						
	0000						
	0.000						
5	0.0.0.0						
<u> </u>	444	Brown, fine to coarse SAND,	, some Brick and Concrete (FILL); moist.		П		
	000						
		1					
	000						
ŝ	7 7 7						
<u>6</u>	444						
		+					
	444	1					
-	000	1					
7		1					
	000	1					
	2 2 2						
	444	.]			I I	Set soil vapor pin at 8 ft bls.	
	7 7 7						



Page **1** of **1**

SOIL BORING LOG

WELL NO. RSV	/-G2	NORTHING -50586.63	EASTING 12080.17			
PROJECT NO.	./NAME		LOCATION			
3084.0001\	<u>/003 / Hunter'</u> : ~	s Point South	Parcel G			
APPROVED B' J. Taylor	Υ	LOGGED BY E. Butler	Long Island City, New York	(
	NTRACTOR/DRILL		GEOGRAPHIC AREA	-		
ADT / D. Me	oon		Parcel G			
DRILL BIT DIA	METER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING N	METHOD	START-FINISH DATE
S-in. / Soni	C ELEVATION	6-inches	XL Max / Rotosonic	Sonic Co	re	4/30/19-4/30/19
_AND SURFAC 15.59(FT.)	CE ELEVATION	DEPTH TO WATER Not Measured	BACKFILL Soil Cuttings			
<u>10.00(1 1.)</u>		THE INCUSURED	John Outlings			
epth,	Graphic		1.5	Blow	PID	
feet	Log		al Description	Counts per 6"	Values (ppm)	REMARKS
	444		some Brick and Concrete (FILL); moist.		32.7	
	444					
1	000					
2	000					
	444					
	10.00					
3	444					
4	000					
4						
	7 7 7					
5						
	0000	CONCRETE.			40.0	
	0000				49.6	
	0000					
§	0.1.0.1	-				
	0000					
	0.0.0					
	0 0 0 0	?				
.	0.000					
	0000					
	0 0 0 0					
	0.0.0					
3	0000					
	0000					
9	0000					
7	0.7.0.7.					
	0000					
	0000					
0	0000					
_	444	Brown, fine to coarse SAND,	some Brick and Concrete (FILL); moist.			Set soil vapor pin at 10 ft bls.
	000					
11						
		· -				Collect soil sample RSV-G2
						(10-12) for RI list of analyses.
		1				End of boring at 12 ft bls.
12	1.12.12.12	1				



Page 1 of 1 SOIL BORING LOG

PROJECT NO.		s Point South	LOCATION			
APPROVED B		LOGGED BY	Parcel G			
J. Taylor	NTRACTOR/DRILL	E. Butler	Long Island City, New York GEOGRAPHIC AREA Parcel G	k		
DRILL BIT DIA	METER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING	METHOD	START-FINISH DATE
6-in. / Soni	CE ELEVATION	6-inches DEPTH TO WATER	XL Max / Rotosonic BACKFILL	Sonic Co	ore	4/30/19-4/30/19
16.39(FT.)		Not Measured	Soil Cuttings			
epth, feet	Graphic Log	Vis	ual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
	1 1 1 1 A A A A A A A A A A A A A A A A	Brown, fine to coarse SAND), some Brick and Concrete (FILL); moist.		7.2	
	444					
	000					
1						
1	444					
	0 0 0 0 0 0					
	000					
	444					
2	000					
	000					
		-				
	000					
	000					
3						
	000					
4						
4	000					
	444	1				
5		1				
	000				56.6	
	444					
6		-				
	0 0 0 0 0 0	-				
7						
7						
		-				
						Set vapor pin at 8 ft bls.
		1		1		End of boring at 8 ft bls.



Environmental Consulting & Management

Page 1 WELL NO.	of 1	NORTHING	OIL BORING LOG EASTING			
RSV		-50490.09	12081.29			
ROJECT NO.		s Point South	LOCATION			
APPROVED BY		LOGGED BY	Parcel G			
I. Taylor		E. Butler	Long Island City, New York	k		
	NTRACTOR/DRILL	_ER	GEOGRAPHIC AREA Parcel G			
ADT / D. MO DRILL BIT DIAI	oon Meter/type	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING	METHOD	START-FINISH DATE
6-in. / Soni	С	6-inches	XL Max / Rotosonic	Sonic Co		4/30/19-4/30/19
	CE ELEVATION	DEPTH TO WATER	BACKFILL			
16.76(FT.)		Not Measured	Soil Cuttings			
epth,	Graphic	Vi	sual Description	Blow Counts	PID Values	REMARKS
eet	Log		ND, some Brick and Concrete (FILL); moist.	per 6"	(ppm)	
	7 7 7	,	()		84.8	
	444	1				
1		-				
1		1				
		1				
	7 0 0					
2	444	1				
	000	-				
		1				
	000					
3						
	111	1				
	000	1				
		+				
4	000	+				
		1				
	111	1				
	000	1				
5		+				
		+			24.8	
6	000					
	444	-				
		-				
		1				
7	444					
	7 7 7					
	444	-				
_	000	1				
3		1				
		1				
^						
9	000					
		1				
	000	+				
		1				
10		1				
	7 7 7					
	444	1				Set soil vapor pin at 11 ft bls
		-				
1	7.7.7.	1		1	. mi	End of boring at 11 ft bls.

Site Management Plan HPS Parcel G – 57-28 2nd Street, Long Island City, New York BCP Site #C241226

APPENDIX D

Excavation Work Plan

3084.0001Y145/CVRS ROUX

APPENDIX D – EXCAVATION WORK PLAN (EWP)

D-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table 1.1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

Table 1.1: Notifications*

Christopher Allan Project Manager, NYSDEC Division of Environmental Remediation, Superfund and Brownfield Cleanup Section	(718) 482-4065 christopher.allan@dec.ny.gov
Jane O'Connell Chief, NYSDEC Division of Environmental Remediation, Superfund and Brownfield Cleanup Section	(718) 482-4599 jane.oconnell@dec.ny.gov
Kelly Lewandowski Chief, NYSDEC Division of Environmental Remediation, Site Control Section	(518) 402-9569 kelly.lewandowski@dec.ny.gov
Christine Vooris Project Manager, NYSDOH Bureau of Environmental Exposure Investigation	(518) 402-7860 christine.vooris@health.ny.gov

^{*} Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for Site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;

- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix E of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

D-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Sections 6 and 7 of this Appendix.

D-3 SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.

D-4 MATERIALS EXCAVATION AND LOAD-OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

A truck wash will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of offsite soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

D-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

Truck transport routes are as follows:

The inbound truck route to the Site is:

From Interstate 495 (Long Island Expressway)

- Take 50th Ave to 51st Ave.
- Take the 51st Ave exit from 50th Ave

- Continue onto 51st Ave
- Turn left onto Vernon Blvd
- Continue on Borden Ave
- Take left onto 2nd St.

The outbound truck route from the Site is:

- Turn left out of the Site
- Turn right onto 57th St
- Turn right onto Central Ave
- Turn right onto Borden Ave
- Turn left onto the Long Island Expressway ramp to Eastern Long Island Riverhead

The proposed truck routes for ingress and egress to the Site are shown in Figure D-1. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting offsite queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

D-6 MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State and Federal regulations. If disposal of material from this Site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C&D debris recovery facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled consistent with 6NYCRR Parts 360, 361, 362, 363, 364 and 365. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State C&D debris recovery facility (6NYCRR Subpart 361-5 registered facility).

D-7 MATERIALS REUSE ON-SITE

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be reused on-site.

D-8 FLUIDS MANAGEMENT

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during large-scale construction activities to surface waters (i.e. a local pond, stream or river) will be performed under a SPDES permit.

D-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the RAWP and Decision Document. The existing cover system is comprised of the following combination of elements:

- concrete foundation in slab-on-grade areas of the building; and
- two feet of recycled concrete aggregate (RCA) over a demarcation layer in the outdoor areas of the Site.

The RCA is a temporary cover that will remain in place during the completion of the new building. The final outdoor cover, consisting of concrete pavers and landscaping, will be placed prior to building occupancy. Where a permeable cover is to be used (i.e., RCA or soil) it will be a minimum of two feet placed over a demarcation layer, with the upper six inches of soil of sufficient quality to maintain a vegetative layer. The demarcation layer, consisting of orange snow fencing material, white geotextile or equivalent material, etc. will be replaced to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

D-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the Site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the Site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards are restricted residential and protection of groundwater SCOs listed in 6NYCRR 375-6.8(b). Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

D-11 STORMWATER POLLUTION PREVENTION

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

D-12 EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

D-13 COMMUNITY AIR MONITORING PLAN

Air monitoring around the Site perimeter and within the community is described in the Community Air Monitoring Plan (CAMP) included in Appendix E of the SMP. The location of air sampling stations will be based on generally prevailing wind conditions. These locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and downwind monitoring station. A fixed monitoring location will also be located between the Site and the new public school being constructed to the north, during times that the school is occupied.

Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

D-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors both on- and off-site. Specific odor control methods to be used on a routine basis will include odor and dust suppressing foam if needed or requested by NYSDEC. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the

remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

D-15 DUST CONTROL PLAN

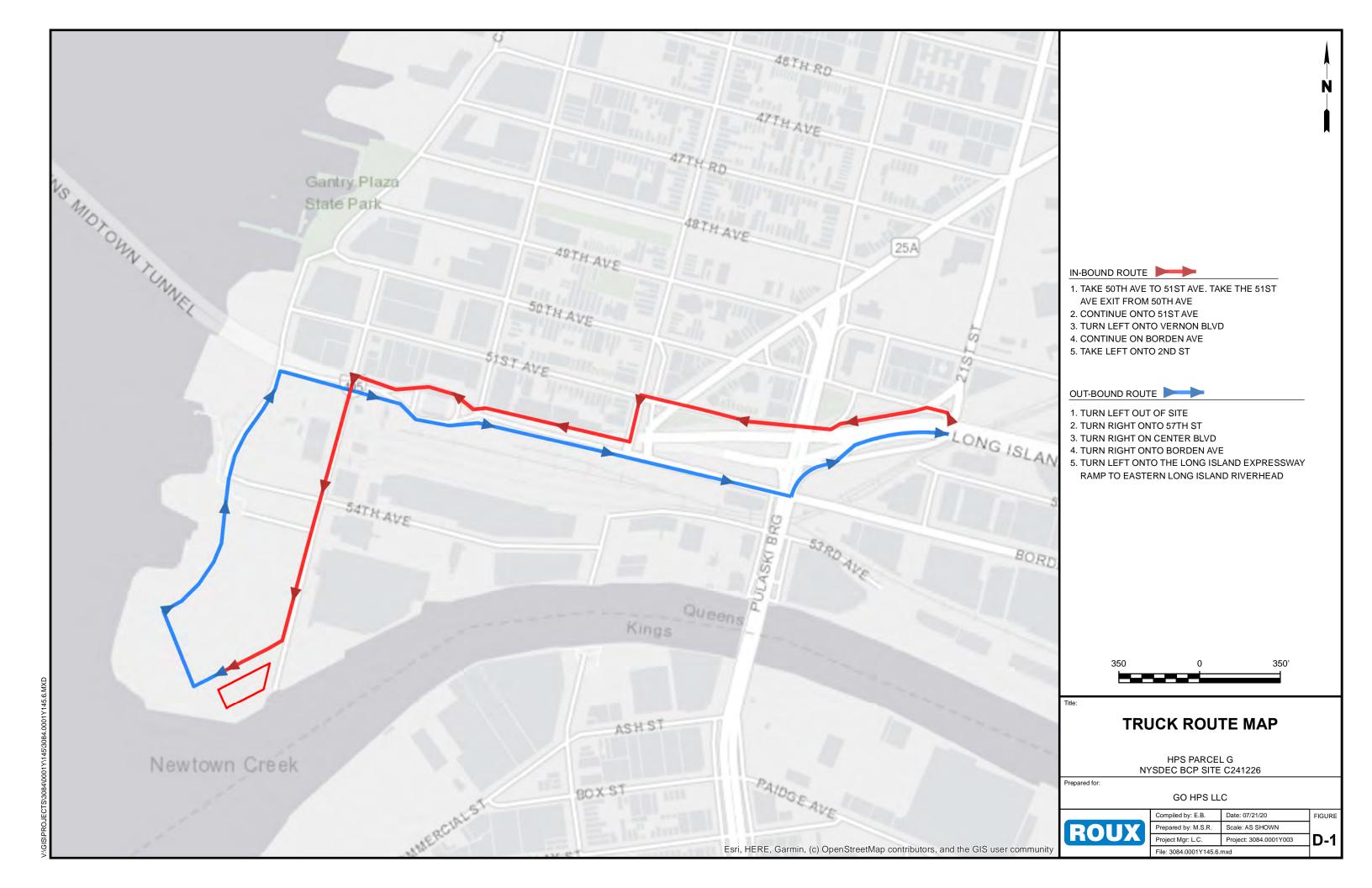
A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved though the use of a dedicated on-site water truck
 for road wetting. The truck will be equipped with a water cannon capable of spraying
 water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed,
 unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

D-16 OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor prior to and during site clearing and site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.



Site Management Plan HPS Parcel G – 57-28 2nd Street, Long Island City, New York BCP Site #C241226

APPENDIX E

Health and Safety Plan

3084.0001Y145/CVRS ROUX



Site-Specific Health and Safety Plan

Hunter's Point South Development Parcels F and G, Block 6, Lots 20 and 30, Long Island City, New York

June 19, 2019

Prepared for:

Go HPS, LLC 432 Park Avenue South, 2nd Floor New York, New York 11016

Prepared by:

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

Table of Contents

1.	Introduction	
	1.1 Roles and Responsibilities	5
2.	Background	7
	2.1 Site Description	
	2.2 Site History	
	2.3 Known and Potential Releases of Hazardous Substances at the Site	7
3	Scope of Work	8
	·	
4.	Site Control	
	4.1 Site Map	
	4.2 Site Access	
	4.3 Buddy System	
	4.4 Site Communications	9
5.	Job Hazard Evaluation	10
	5.1 Employee Notification of Hazards and Overall Site Information Program	11
6	Emergency Response Plan	12
0.	6.1 Emergency Response	
	6.2 Emergency Alerting and Evacuation	
	6.3 Emergency Medical Treatment and First Aid	
	6.4 Adverse Weather Conditions	
	6.5 Electrical Storm Guidelines	
7	Safety Procedures	
7.	7.1 Training	
	7.1 Training	
	7.3 HASP Information and Site-Specific Briefings for Workers	
	7.4 Medical Surveillance	
	7.4.1 Site Medical Surveillance Program	
	7.4.2 Medical Recordkeeping Procedures	
	7.4.3 Program Review	
	7.5 Personnel Protection	
	7.6 Monitoring	
	7.7 Tailgate Safety Meetings	
	7.8 Spill Containment	
	7.8.1 Initial Spill Notification and Response	
	7.8.2 Spill Evaluation and Response	
	7.9 Decontamination	
	7.9.1 Decontamination Procedures for Personnel and PPE	
	7.9.2 Decontamination Procedures for Equipment	
	7.9.3 Monitoring the Effectiveness of Decontamination Procedures	
	7.10 Confined Space Entry	
	7.11 Client and Site-Specific	
	7.12 Unusual or Significant Risks	21

	7.13 Activity-Specific	. 22
8.	Field Team Review	. 23
9.	Approvals	. 24

Tables

1. Toxicological Properties of Hazardous Substances Present at the Site

Figures

- 1. Site Location Map
- 2. Site Plan
- 3. Route to Hospital and Urgent Care Facility

Appendices

- A. Job Safety Analysis (JSA) Forms
- B. SDSs for Chemicals Used
- C. Incident Investigation and Reporting Management Program
- D. ACORD® Automobile Loss Notice Form
- E. Personal Protective Equipment Management Program
- F. Respiratory Protection Management Program
- G. Generic Community Air Monitoring Plan (CAMP)
- H. Health and Safety Briefing/Daily Meeting Log
- I. Heavy Equipment Exclusion Zone Program

SITE-SPECIFIC EMERGENCY INFORMATION

Emergency Phone Numbers

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

Emergency Contact Information					
Roux Site Personnel					
Title	Contact		Telephone		
Project Manager (PM)	Jessica Taylor		(631) 630-2395; (631) 766-0607		
Site Health and Safety Officer/Site Supervisor (SHSO/SS)	Emily Butler		(719) 494-6722		
SHSO/SS Alternate	TBD		TBD		
Outside Assistance					
Agency	Contact	Telephone	Address/Location		
Ambulance/EMS	FDNY	(718) 999-2000	10-40 47 th Ave., Long Island City, NY 11101		
Police	NYPD (108 th Pct)	(718) 784-5411	547 50 th Ave., Long Island City 11101		
Fire	FDNY (Engine 258)	(718) 999-2000	10-40 47 th Ave., Long Island City, NY 11101		

Emergency Medical Facility

Mount Sinai Queens 25-10 30th Road Long Island City, New York, 11102

Hospital Phone#: 718-932-1000

- Head north on 2nd St. toward 54th Ave
- Turn right onto 54th Ave
- Turn left onto Vernon Blvd.
- Vernon Blvd turns right and becomes 53rd St
- Turn left onto 11th St
- Turn right onto Borden Ave
- Take the I-495 ramp
- Take immediate exit onto 21st St on right
- Continue on 21st St 2.3 miles
- Turn right onto 30th Ave
- Turn right onto Crescent Street

Emergency Room entrance will be on your left at corner of 30th Rd.

Urgent Care Facility

City MD (Greenpoint) 795 Manhattan Ave Brooklyn, New York 11222

Urgent Care Phone#: 718-489-3549

- Head north on 2nd St and turn left onto 54th Ave
- Turn right onto 49th Ave
- Turn right onto Pulaski Bridge
- Turn right onto Meserole Avenue
- Turn right at the 3rd cross street onto Manhattan Ave

Destination will be on the left.

1. Introduction

On behalf of GO HPS LLC, this site-specific Health and Safety Plan (HASP) has been prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux) for use by personnel from Roux (and any of Roux subcontractors) during the Remedial Investigation, Remedial Activities, and any onsite work thereafter that will be performed at Hunter's Point South Project Area to the west of 2nd Street, in the Hunter's Point South neighborhood of Queens. (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 investigative sampling, drilling, and construction oversight 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.

Implementation of this HASP is the joint responsibilities of the project manager, the site health and safety officer, and all field staff, with assistance from the project principal and the office health and safety manager. The project manager for this project is Jessica Taylor, based on the scope of work, the field oversight personnel will act as both the Site Health and Safety Officer (SHSO) as well as Site Supervisor. If necessary, an alternate SS/SHSO will be identified during the project as needed.

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 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:

- coordinating the site work plan;
- providing site supervisor(s) with work assignments and overseeing their performance; Coordinating safety and health efforts with the SHSO;
- ensuring effective emergency response through coordination with the Emergency Response Coordinator (ERC);
- serving as primary site liaison with public agencies and officials and site contractors; and
- Exercise "stop work authority" when an imminent hazard or potentially dangerous work practice is identified or discovered.

Site Health and Safety Officer (SHSO) / Site Supervisor (SS)

The SHSO/SS has full responsibility and authority to develop and implement this HASP and to verify compliance. The SHSO/SS reports to the PM. The SHSO/SS 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;
- executing the work plan and schedule as detailed by the PM;
- serving as the site's point of contact for safety and health matters;
- ensuring site monitoring, worker training, and effective selection and use of Personal Protective Equipment (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;
- exercise "stop work authority" when an imminent hazard or potentially dangerous work practice is identified or discovered;
- · coordinating with the others as necessary for safety and health efforts; and
- act on the recommendations of the Corporate Health & Safety Manager.

Site Workers (Subcontractors)

Site workers are responsible for complying with this HASP, using the proper PPE, reporting unsafe acts and conditions, and following the work, safety, and health instructions of the PM and SHSO/SS.

2. Background

The Site and surrounding area historically operated as a sugar refinery and newspaper printing press, among other industrial and commercial uses, and has the potential of causing an adverse impact to subsurface conditions due to operation of the facility and its subsequent demolition. 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 consists of two parcels, F and G, within the Hunters Point South Project Area (HPSPA) which span a total of approximately 61,187 square feet encompassing a peninsula-like land formation at the end of 2nd Street. Parcel F is approximately 32,484 square feet and corresponds to Tax Lot 30, which is bound by 56th Avenue to the north, Center Boulevard to the west, 2nd Street to the east, and 57th Avenue to the south. Parcel G is approximately 28,703 square feet and corresponds to Tax Lot 20, which is bounded by 2nd street to the west and Newtown creek to the east. The planned redevelopment for Parcels F and G is mixed-use developments containing commercial and residential spaces along with a full and partial cellar, respectively.

Development in the surrounding area is zoned for mixed-use (residential, commercial, and community-oriented uses) development. The majority of the Site is surrounded by water and one dead-end street bordering the east perimeter of the Site, vehicular and pedestrian traffic is not expected to be a hazard while performing tasks on-Site. However, additional hazards may include trespassing by the public and other public hazards such as dogs and insect bites.

2.2 Site History

Former usage of the HPSPA has included rail yards at the northernmost end, lumber yards and a concrete manufacturer in the central area, and a sugar refinery and newspaper plant at the southernmost end. Site records should that this area has been used for storage and a commercial use as well at times. Due to the various manufacturing plants, historic Sanborn Maps indicate the presence of petroleum storage tanks in the HPSPA. Previous Environmental Site Assessments (ESAs) for HPSPA have revealed that the immediate surrounding area has a history of past industrial usage and petroleum storage tanks. Since the Site occupies a lower elevation than most of its surroundings and is generally downgradient of adjacent properties, past industrial usage of the surrounding area has the potential of causing an adverse impact to subsurface conditions at the Site due to on-Site migration of contamination from off-Site sources, including the active petroleum spill (Spill No. 9313234) from the Long Island Rail Road (LIRR) Passenger Yard immediately to the east.

2.3 Known and Potential Releases of Hazardous Substances at the Site

Historic Sanborn Maps and building department records referenced in previous ESAs indicate the presence of historic petroleum tanks at the Site. An aboveground solvent tank, an 850,000-gallon No. 6 oil tank, two gasoline tanks, and a 5,500-gallon No. 2 fuel oil tank were present at the Site with no available records of closure or removal. Previous investigations found that the subsurface soils were impacted with polyaromatic hydrocarbons (PAHs) associated with historic fill. Groundwater and soil vapor results also exceeded standards for metals and volatile organic compounds (VOCs), respectively. During the April 2019 *in situ* soil waste characterization activities at Parcel F, Roux identified lead in soil that exceeded United States Environmental Protection Agency (USEPA) Regulatory Levels for hazardous substances at the depth interval 11-15 feet below land surface. Further delineation will take place as part of the Parcel F Remedial Action Work Plan (RAWP).

3. Scope of Work

Based on information gathered as a result of previous ESAs and at the request of the GO HPS LLC, the purpose of the Remedial Investigation Work Plan (RIWP) is to investigate current site conditions, in preparation for redevelopment and associated remedial activities. The proposed RIWP scope of work includes the following:

- · ground penetrating radar survey
- installation of soil borings via hollow stem auger and direct push geoprobe drill rigs
- installation and sampling of monitoring wells
- installation and sampling of soil vapor sampling points.

Additional work at the Site will occur as per the and RAWP for the Site. The majority of work during these scopes will occur during the proposed development at the Site (mixed-use buildings with cellars) and the associated subsurface work. Once development activities commence, Roux will provide support services to assist with environmental items related to the excavation and construction for the building foundations. The proposed RAWP scopes of work include the following:

- Delineation of hazardous lead in soil hotspot;
- Oversight of support or excavation (SOE) installation;
- Oversight of excavations and backfilling;
- Oversight of soil disposal via live-loading into trucks;
- · Community Air Monitoring Program implementation; and
- · Collection of post-excavation samples.

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 the Site, showing site boundaries, designated work zones, and points of entry and exit is provided in Figure 2.

4.2 Site Access

Access to the Site is restricted to reduce the potential for exposure to its safety and health hazards. During hours of site operation, site entry and exit is authorized only at the points identified in Figure 2. Access for all equipment will be through designated Site entries and exits yet to be established. Roux will maintain Site access throughout the work day and lock all entrances and exits at the end of the day.

4.3 Buddy System

When multiple people are onsite and while working in the Exclusion Zone, if any is established, site workers use the buddy system. The buddy system means that personnel work in pairs and stay in close visual contact to be able to observe one another and summon rapid assistance in case of an emergency. The responsibilities of workers using the buddy system include:

- Remaining in close visual contact with partner,
- Providing partner with assistance as needed or requested,
- Observing partner for signs of heat stress 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: visual hand signals will be used during use of the drill rig, and workers will have cell phones on-Site. Should multiple operations be occurring at the Site concurrently radios shall be issued for communication if determined to be necessary.

A current list of emergency contact numbers shall be posted at the worksite and provided to site workers as appropriate.

5. Job Hazard Evaluation

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

Caught/Crushed – the potential to become caught in, under, between, or by an object or parts of an object, such as equipment with parts that open and close or move up and down ("pinch points") or equipment that rotates, and the accompanying potential to have body parts cut, mangled, or crushed thereby.

Contact – the potential to be struck by or against moving or stationary objects that can cause physical injury, such as heavy machinery, overhead piping, moving vehicles, falling objects, and equipment (including tools and hand-held equipment) or infrastructure with the ability to cut or impale.

Energy Sources – the potential for bodily harm associated with energy sources, most notably electricity, but also including latent energy sources such as compressed air and equipment under tension (which when released could cause injurious contact or a fall).

Ergonomics – the potential for musculoskeletal injury associated with lifting/carrying, pushing/pulling, bending, reaching, and other physical activity attributable to poor body position/mechanics, repetitive motion, and/or vibration.

Exposure – the potential for injury/illness due to physical, chemical, or biological exposures in the work environment, including but not limited to temperature extremes, solar radiation, and noise (physical), chemical splashes and hazardous atmospheres (chemical), and animal/insect bites and poisonous plants (biological).

Falls - the potential to slip or trip and thus fall or drop a load, resulting in bodily injury to oneself or others

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

5.1 Employee Notification of Hazards 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. Safety data sheets (SDS) will be maintained by the SHSO/SS for chemicals brought onsite. Copies of SDSs can be found in Appendix B.

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 Emergency Muster Area Map (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 site. If any worker cannot be accounted for, notification is given to 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 procedures outlined below. All work-place injury and illness situations require the Roux 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, is initiated. The Injury/Illness Notification Flowchart is provided below and within Roux's Incident Investigation and Reporting program included as Appendix C.

If onsite personnel require any medical treatment, the following steps will be taken:

- a. Notify Roux Project and Corporate Management Team for any work-related injury and/or illness occurrence and communicate with the contracted Occupational Health Care Management Provider, AllOne Health, 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. A Hospital Route and Urgent Care Facility map with directions to Mount Sinai Queens Hospital and City MD, respectively, is included as Figure 3.
- c. Decontaminate to the extent possible prior to administration of first aid or movement to medical or emergency facilities.
- d. First aid medical support will be provided by onsite personnel trained and certified in First Aid, Cardio Pulmonary Resuscitation (CPR), Automatic External Defibrillation (AED), and Blood-Borne Pathogens (BBP) Awareness, until relieved by emergency medical services (EMS).
- e. The SHSO and PM will perform a Loss Investigation (LI) and the Project Team will complete the final Loss Report. If a Roux employee is involved in a vehicular incident, the employee must also complete the ACORD® Automobile Loss Notice (included as Appendix D of this HASP).



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.
- 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 outdoors, all outdoor 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 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 on site 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/Corporate Health and Safety Manager (CHSM) or Human Resources Department. Subcontractors on-Site will be required to maintain and provide training records to Roux. These records shall be maintained with the SHSO onsite.

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 that employees are familiar with this HASP and the information and requirements it contains as well as relevant JSAs. Additional briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during ongoing site characterization and analysis. 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).

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 A of this HASP and in compliance with the requirements of 29 CFR 1910.120(f)(2). Based on site information and use of direct reading instruments, limited use of respirators (less than 30 days per year), and the absence of an employee-staffed HAZMAT team, a limited medical surveillance program is required and implemented at this site. The medical surveillance program provides that:

- 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. NY 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)
- Exposure monitoring results

7.4.3 Program Review

The medical program is reviewed to ensure its effectiveness. The CHSM 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,
- Review of emergency treatment procedures and emergency contacts list to ensure they were sitespecific, 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 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. PPE to be used at the Site will meet the appropriate American National Standards Institute (ANSI) standards and the following OSHA (General Industry) standards for minimum PPE requirements. This program can be found in Appendix E.

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)
- 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 or longer hair should be tied back.

Site specific PPE ensembles and materials are identified within task specific JSAs located within Appendix A. Levels of protection will be upgraded or downgraded in response to site conditions. Upgrades to PPE can include use of hearing protection whenever noise levels exceed 85dBA, nitrile gloves worn whenever skin hazards exist or when handling samples, and whenever total organic vapors exceed levels specified elsewhere in this plan, respiratory protection is necessary. Although not expected, Level C would involve an APR Cartridge classified as Organic Vapors and P-100 cartridge. Any upgrades or downgrades of the level of protection (i.e., not specified in the JSA) must be immediately communicated to all Roux personnel and subcontractors as applicable. PPE is used in accordance with manufacturer's recommendations. Additional information can be found within Roux's Personal Protective Equipment Corporate Management Program and Respiratory Protection Corporate Management Program found in Appendix E and Appendix F respectively.

Intrusive activities (e.g., drilling, excavation activities, etc.) include any Site activity which will, or potentially will, result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the permissible exposure limit (PEL), or to flammable or oxygen deficient atmospheres. Prior to commencing with any field activity, the potential for such conditions should be evaluated to determine air monitoring requirements. General procedures for air monitoring are described below. During intrusive activities, continuous monitoring may be performed using various meters outlined in Section 7.6 Monitoring.

7.6 Monitoring

An air monitoring program is important to the safety of on- and off-Site personnel. 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 and approximate temperature during all invasive site activities. This survey will be conducted with the appropriate air monitoring instrument(s) as warranted by the field activity. Once this survey has been complete, any change in the type of PPE will be determined.

Air monitoring will be performed to verify that the proper level of equipment is used and to determine if increased PPE or work stoppage is required. The following equipment may 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.
- In accordance with the DER-10 Technical Guidance for Site Investigation and Remediation dated May 2010 (DER-10) issued by the New York State Department of Environmental Conservation (NYSDEC), a community air monitoring plan (CAMP) will be implemented during intrusive Site activities. The Generic CAMP as provided in DER-10, Appendix 1A, is included in Appendix G of this HASP and includes action levels.

Monitoring equipment will be calibrated in accordance with applicable regulatory requirements and manufacturer specifications.

Below are monitoring action levels for Site-specific chemicals of concern. In the event that 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.).

PID Action Levels

Site Action Levels									
PID Reading in Breathing Zone (ppm) Action									
<5	No Action								
≥5 - <25	Level C								
≥25	Cease Field Operations								

If PID measurements exceed 25 ppm-v above background for five minutes in the breathing zone, work activities will cease until airborne vapor levels can be reduced to less than 25 ppm-v and are quantified or the SHSO determines alternate methods to be followed in order to proceed.

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. The Safety Meeting Log is provided in Appendix H of this HASP.

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 SHSO/SS. 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

In coordination with the SHSO/SS, the PM (Jessica Taylor) 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 contamination reduction zone at this site.

7.9.1 Decontamination Procedures for Personnel and PPE

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

- Decontamination is required for all workers exiting a contaminated area. Personnel may re-enter the Support Zone 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 Exclusion Zone or CRZ are decontaminated in the CRZ prior to removal to the Support Zone. 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 that may apply:

- 1. Decontamination is required for all equipment exiting a contaminated area. Equipment may re-enter the Support Zone only after undergoing the equipment decontamination procedures.
- Vehicles that travel regularly between the contaminated and clean areas of the site are carefully decontaminated each time they exit the Exclusion Zone 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

For the purpose of this project, all confined spaces are considered permit required and will not be performed by Roux personnel or any personnel within Roux's oversight. Confined space means a space with the following characteristics:

- large enough and so configured that an employee can barely enter and perform assigned work;
- limited or restricted means of entry and exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits); and
- not designed for continuous employee occupancy.

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 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, etc.

7.13 Activity-Specific

In addition to the general hazards discussed above, there are activity-specific hazards associated with each work activity planned for the Site. An activity-specific JSA has been completed for each of the activities planned for the Site. JSAs are provided in Appendix A. In the event that new work activities or tasks are planned, JSAs will be developed and implemented prior to performing the new activities. In the absence of a JSA, the personnel performing work must prepare a field JSA and receive clearance from a designated competent safety official prior to performing any task with significant risk. In emergency situations where time is critical SPSAs will be utilized to identify the task, associated hazards and mitigative actions to take. For lower risk activities (as deemed by the discretion of a Competent Person) where a JSA is determined to not be needed, the individual(s) conducting the activities must perform SPSAs prior to and during the work.

As the proposed site development commences and construction oversight tasks begin, Roux personnel will likely to be exposed to heavy equipment while onsite. Roux personnel should always establish a minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). There should be no personnel or equipment entering the established Exclusion Zones while heavy equipment is in operating to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment. Additional information about Exclusion Zones is included Roux's Heavy Equipment Exclusion Zone Management Program in Appendix I.

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: Hunter's Point South Development, Parcels F & G

Name Printed	Signature	Date
	_	
-		

9. Approvals

By their signature, the undersigned certify that this HASP is approved	and will be utilized at the Site.
Lena Lai – Site Health and Safety Officer	Date
Brian Hobbs – Senior Health and Safety Manager	Date
Jessica Taylor – Project Manager	Date
Joseph D. Duminuco – Project Principal	Date

TABLE

1. Toxicological Properties of Hazardous Substances Present at the Site

3084.0001Y.101/CVRS ROUX

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Hunter's Point South Project Area, Queens, New York

Compound	CAS#	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Acenaphthene	83-32-9	None established	None established	None established	None established	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system	Eyes, skin, respiratory system	Brown solid
Acenaphthylene	208-96-8	None Established	None established	None established	None established		Irritation eyes, skin, respiratory system	Eyes, skin, respiratory system	Yellow Solid FI. Pt.=251°F
Arsenic (inorganic)	7440-38-2 (metal)	TWA 0.01 mg/m3	Ca C 0.002 mg/m3 [15-min]	TWA 0.010 mg/m3	Ca [5 mg/m3 (as As)]	Inhalation; ingestion; skin absorption; skin	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]	Liver, kidneys, skin, lungs, lymphatic sys	Metal: sliver-gray or tin-white, brittle, odorless sol BP: sublimes
Barium	7440-39-3	TWA 0.5 mg/m3	None established	TWA 0.5 mg/m3	None established	Inhalation, ingestion, skin contact	Irritation skin, respiratory system, digestive system	Skin, eyes, respiratory system	Yellow white powder BP: 1640 C
Benzene	71-43-2	TWA 0.5 ppm STEL 2.5 ppm	Ca TWA 0.1 ppm STEL 1 ppm	TWA 1 ppm ST 5 ppm	Ca [500 ppm]	inhalation, skin absorption, ingestion skin and/or eye contact	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	Colorless to light yellow liquid with an aromatic odor [Note: Solid below 42 °F] BP: 176°F FI.Pt. = 12°F LEL: 1.2% UEL: 7.8% Class B Flammable liquid
Benzo[a]anthracene	56-55-3	None established [skin cancer]	None established	None established	None established	Inhalation; ingestion; skin absorption; skin and/or eye contact	Irritation eyes, skin, respiratory system, CNS; skin cancer	Skin	Pale Yellow crystal, solid BP: 438 C
Benzo[a]pyrene	50-32-8	None established [cancer]	TWA 0.1 mg/m3	TWA 0.2 mg/m3	None established	skin absorption; skin	POISON. This material is an experimental carcinogen, mutagen, tumorigen, neoplastigen and teratogen. It is a probable carcinogen in humans and a known human mutagen. IARC Group 2A carcinogen. It is believed to cause bladder, skin and lung cancer. Exposure to it may damage the developing fetus. May cause reproductive damage. Skin, respiratory and eye irritant or burns.	Skin, eye, bladder, lung, reproductive	Yellow crystals or powder [found in cigarette smoke, coal tar, fuel exhaust gas and in many other sources] BP: 495 C
Benzo[b]fluoranthene	205-99-2	None established [cancer]	TWA 0.1 mg/m3	TWA 0.2 mg/m3	None established	Inhalation; ingestion; skin and/or eye contact	No data were identified on the toxicity of benzo[b]fluoranthene to humans Based on results of studies in animals, IARC concluded that benzo[b]fluoranthene is possibly carcinogenic to humans	. Respiratory system, skin, bladder, kidneys	Off-white to tan powder
Benzo[k]fluoranthene	207-08-9	None established	None established	None established	None established	inhalation, skin absorption, ingestion skin and/or eye contact	Irritation eyes, skin, respiratory tract, gastrointestinal; fatal if swallowed, inhaled, absorbed through the skin; vomiting, nausea, diarrhea	Lungs, respiratory system	Yellow crystals BP: 480 C
Benzo(g,h,i)perylene	191-24-2	None established	None established	California permisible exposure limits for chemical contaminants (Title 8, Article 107) PEL 0.2 mg/m3	None established	inhalation, skin absorption, ingestion skin and/or eye contact	Irritation eyes, skin, respiratory tract, very toxic to aquatic life with long , lasting effects	Eyes, skin, respiratory system	Pale Yellow -Green Crystals BP: 550°C
Beryllium	7440-41-7 (metal)	TWA 0.00005 mg/m ³	Ca C 0.0005 mg/m ³	TWA 0.002 mg/m ³ C 0.005 mg/m ³ (30 minutes) with a maximum peak of 0.025 mg/m ³			Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen	system	Metal: A hard, brittle, gray-white solid. BP: 4532°F
Cadmium	7440-43-9 (metal)	TWA 0.01 mg/m ³	Ca	TWA 0.005 mg/m ³	Ca [9 mg/m ³ (as Cd)]	inhalation, ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscl aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen	e prostate, blood	Metal: Silver-white, blue-tinged lustrous, odorless solid. BP: 1409°F
Carbon Tetrachloride	56-23-5	TWA 5 ppm STEL 10 ppm	Ca ST 2 ppm (12.6 mg/m3) [60 minute]	TWA 10 ppm C 25 ppm 200 ppm (5-minute maximum peak in any 4 hours)	Ca [200 ppm]	inhalation, skin absorbtion, ingestion skin and/or eye contact	irritation eyes, skin; central nervous system depression; nausea, vomiting, liver, kidney injury; drowsiness, dizziness, incoordination; [potential occupational carcinogen]	g; central nervous system, eyes, lungs, liver, kidneys, skin	Colorless liquid with a characteristic ether-like odor. BP: 170°F
Carbon Monoxide	630-08-0	TWA 25 ppm	TWA 35 ppm	TWA 50 ppm	1,200 ppm	inhalation	Carboxyhemogloemia	Blood	Colorless, odorless gas
Chromium	7440-47-3	TWA 0.5 mg/m³ (metal and Cr III compounds) TWA 0.05 mg/m³ (water-soluble Cr VI compounds) TWA 0.01 mg/m³ (insoluble Cr IV compounds)	C 200 ppm TWA 0.5 mg/m ³	TWA 1 mg/m ³	250 mg/m ³ (as Cr)	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; lung fibrosis (histologic)	Eyes, skin, respiratory system	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid. BP: 4788°F
Chrysene; Phenanthrene; Pyrene; Coal tar pitch volatiles	65996-93-2	TWA 0.2 mg/m3	Ca TWA 0.1 mg/m³ (cyclohexane-extractable fraction)	TWA 0.2 mg/m³ (benzene- soluble fraction)	Ca [80 mg/m ³]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue. Combustible Solids



1 of 4

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Hunter's Point South Project Area, Queens, New York

Compound	CAS#	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Coal Tar Pitch Volatiles; Chrysene Phenanthrene; Pyrene	e; 65996-93-2	TWA 0.2 mg/m ³	Ca TWA 0.1 mg/m³ (cyclohexane-extractable fraction)	TWA 0.2 mg/m³ (benzene-soluble fraction)	Ca [80 mg/m³]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue. Combustible Solids
1,1-Dichloroethane	75-34-3	TWA 100 ppm	TWA 100 ppm (400 mg/m³)	TWA 100 ppm (400 mg/m³)	3000 ppm	inhalation, ingestion, skin and/or eye contact	Irritation skin; central nervous system depression; liver, kidney, lung damage	Skin, liver, kidneys, lungs, central nervous system	Colorless, oily liquid with a chloroform-like odor. BP: 135°F FI.P: 2°F UEL: 11.4% LEL: 5.4%
1,2-Dichloroethane (Ethylene Dichloride)	107-06-2	TWA 10 ppm	Ca TWA 1 ppm (4 mg/m³) STEL 2 ppm (8 mg/m³)	TWA 50 ppm C 100 ppm 200 ppm [5-minute maximum peak in any 3 hours]	Ca [50 ppm]	skin absorption, skin	Irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	Eyes, skin, kidneys, liver, central nervous system, cardiovascular system	Colorless liquid with a pleasant, chloroform-like odor. [Note: Decomposes slowly, becomes acidic & darkens in color.] BP: 182°F FI.P: 56°F UEL: 16% LEL: 6.2% Class IB Flammable Liquid
1,2-Dichloroethene (total)	540-59-0	TWA 200 ppm	TWA 200 ppm (790 mg/m ³)	TWA 200 ppm (790 mg/m ³)	1000 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; central nervous system depression	Eyes, respiratory system, central nervous system	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor BP: 118-140°F FI.P: 36-39°F UEL: 12.8% LEL: 5.6% Class IB Flammable Liquid
cis-1,2-Dichloroethene	156-59-2	TWA 200 ppm	TWA 200 ppm	TWA 200 ppm	None established	inhalation, skin absorption, ingestion	Harmful if swallowed, inhaled, or absorbed through skin. Irritant. Narcotic. Suspected carcinogen	Skin	Colorless liquid BP: 60 C FI.P: 4 C UEL: 12.8% LEL: 9.7 %
trans-1,2-Dichloroethene	156-60-5	TWA 200 ppm	None established	TWA 200 ppm STEL 250 ppm (skin)	None established	inhalation, skin absorption, ingestion skin and/or eye contact	Narcotic. Irritation eyes, skin, respiratory tract, mucous membrane; CNS, depression.	Respiratory tract, mucous membrane, eyes, skin, CNS	Colorless liquid with a fruity pleasant odor BP: 48°C FI.P 6C UEL: 12.8% LEL: 9.7%
Dibenzo[a,h]anthracene	53-70-3	None established	None established	None established	None established	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin	Eyes, skin; skin photosensitization.	Colorless crystalline powder BP: 524°C
Dibenzofuran	132-64-9								
Diesel Fuel #2	68476-34-6	TWA 100 mg/m ³ ; Skin notation	None established	Designated as an OSHA Select Carcinogen	None established	ingestion, skin and/or eye contact	Kidney damage; potential lung damage; suspected carcinogen; irritation of eyes, skin, respiratory tract; dizziness, headache, nausea; chemical pneumonitis (from aspiration of liquid); dry, red skin; irritant contact dermatitis; eye redness, pain.	Eyes, skin, kidneys	Clear yellow brown combustible liquid; floats on water; distinct diesel petroleum hydrocarbon odor BP: 356-716°F FI.P: 154.4-165.2°F LEL: 0.6% UEL: 7.0%
Ethylbenzene	100-41-4	TWA 20 ppm	TWA 100 ppm (435 mg/m ³) STEL 125 ppm (545 mg/m ³)	TWA 100 ppm (435 mg/m ³)	800 ppm [10%LEL]		Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with an aromatic odor. BP: 277°F FI.P: 55°F UEL: 6.7% LEL: 0.8% Class IB Flammable Liquid
Fluoranthene	206-44-0	None established	None established	None established	None established	inhalation, skin absorption, ingestion skin and/or eye contact	Irritation eyes, skin; possible burns; heart and liver injury, pulmonary, edema, respiratory arrest, gastrointestinal disturbances.	Heart, liver, lungs.	Yellow needles.
Fuel Oil #2	68476-30-2	TWA 100 mg/m3; Skin notation	None established	None established	None established	inhalation, skin absorption, ingestion	Irritation eyes, skin; CNS effects; nausea, vomiting, headache, cramping, dizziness, weakness, loss of coordination,, drowsiness; kidney, liver damage	Eyes, skin, CNS	Clear or yellow to red oily liquid, kerosene-like odd BP: 347 - 689 °F UEL:5-6% LEL: 0.7-1.0%
Gasoline	8006-61-9	TWA 300 ppm STEL 500 ppm	Carcinogen	None established	Ca [IDLH value has not been determined		Eyes and skin irritation, mucous membrane; dermatitis; headache; listlessness, blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis; possible liver, kidney damage [Potential occupational carcinogen]	Eyes, skin, respiratory system, CNS, Liver, Kidneys	Clear liquid with a characteristic odor, aromatic : FI.Pt. = -45°F LEL = 1.4% UEL = 7.6% Class 1B Flammable Liquid



2 of 4

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Hunter's Point South Project Area, Queens, New York

Compound	CAS#	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Hydrogen Sulfide	7783-06-4	TWA 1 ppm STEL 5 ppm	C 10 ppm (15 mg/m³) [10-minute]	C 20 ppm 50 ppm [10-minute maximum peak]	100 ppm	inhalation, skin and/or eye contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, lassitude (weakness, exhaustion), irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, central nervous system	Colorless gas with a strong odor of rotten eggs. BP: -77°F UEL: 44.0% LEL: 4.0% Flammable Gas
Indeno[1,2,3-cd]pyrene	193-39-5	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; possible human carcinogen (skin); weakness; affect , liver, lung tissue, renal tissue; impairment of blood forming tissue	Skin	Fluorescent green-yellow crystalline solid BP: 536 C
Lead (inorganic)	7439-92-1	TWA 0.05 mg/m ³	TWA (8-hour) 0.050 mg/m ³	TWA 0.050 mg/m ³	100 mg/m³ (as Pb)	inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. BP: 3164°F Noncombustible Solid in bulk form
Mercury (organo) alkyl compounds (as Hg)	7439-97-6	TWA 0.01 mg/m ³ STEL 0.03 mg/m ³ [skin]	TWA 0.01 mg/m ³ STEL 0.03 mg/m ³ [skin]	TWA 0.01 mg/m ³ C 0.04 mg/m ³	2 mg/m³ (as Hg)	inhalation, skin absorption, ingestion, skin and/or eye contact	Paresthesia; ataxia, dysarthria; vision, hearing disturbance; spasticity, jerking limbs; dizziness; salivation; lacrimation (discharge of tears); nausea, vomiting, diarrhea, constipation; skin burns; emotional disturbance; kidney injury; possible teratogenic effects	• •	Appearance and odor vary depending upon the specific (organo) alkyl mercury compound
Mercury compounds [except (organo) alkyls] (as Hg) Mercury	7439-97-6	TWA 0.025 mg/m ³ (elemental and inorganic forms)	Hg Vapor: TWA 0.05 mg/m ³ [skin] Other: C 0.1 mg/m3 [skin]	TWA 0.1 mg/m ³	10 mg/m ³ (as Hg)	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eyes, skin, respiratory system, central nervous system, kidneys	Metal: Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & any Hg compounds except (organo) alkyls.] BP: 674°F
Methylene Chloride (Dichloromethane)	75-09-2	TWA 50 ppm, A3 - suspected human carcinogen	Ca	TWA 25 ppm STEL 125 ppm	Ca [2300 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numbness, tingle limbs; nausea; [potential occupational carcinogen]	Eyes, skin, cardiovascular system, central nervous system	Colorless liquid with a chloroform-like odor BP: 104°F UEL: 23% LEL: 13%
Naphtha (Rubber Solvent)	8030-30-6	None established	TWA 100 ppm (400 mg/m³)	TWA 100 ppm (400 mg/m ³)	1000 ppm [10%LEL] inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; dizziness, drowsiness; dermatitis; in animals: liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Reddish-brown, mobile liquid with an aromatic odor BP: 320-428°F FI.P: 100-109°F Class II Combustible Liquid
Naphthalene	91-20-3	TWA 10 ppm [skin]	TWA 10 ppm (50 mg/m³) STEL 15 ppm (75 mg/m³)	TWA 10 ppm (50 mg/m³)	250 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling, of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	Colorless to brown solid with an odor of mothballs BP: 424°F FI.P: 174°F UEL: 5.9% LEL: 0.9%
Petroleum hydrocarbons(Petroleun distillates)	n 8002-05-9	None established	TWA 350 mg/m ³ C 1800 mg/m ³ [15 min]	TWA 500 ppm (2000 mg/m ³)	1,100 [10% LEL]	Inhalation; ingestion; skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, drowsiness, headache, nausea; dried/cracked skin; chemical pneumonitis	CNS, eyes, respiratory system, skin	Colorless liquid with a gasoline or kerosene-like odor BP: 86-460°F FI. Pt = -40 to -86°F UEL: 5.9% LEL: 1.1% Flammable liquid
Polychlorinated Biphenyls (PCBs) (Chlorodiphenyl (42% Chlorine))	53469-21-9	TWA 1 mg/m ³	Ca TWA 0.001 mg/m ³	0.5 mg/m ³	5 ppm		Irritation eyes; chloracne; liver damage; reproductive effects; [potential r occupational carcinogen]	Eyes, skin, liver, respiratory system	Colorless to light-colored, viscous liquid, hydrocarbon odor, BP: 617 - 734°F, non-flammable, LEL: NA, UEL: NA
Selenium	7782-49-2	TWA 0.2 mg/m ³	TWA 0.2 mg/m ³	TWA 0.2 mg/m ³	1 mg/m³ (as Se)	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eyes, skin, respiratory system, liver, kidneys, blood spleen	Amorphous or crystalline, red to gray solid. [Note I, Occurs as an impurity in most sulfide ores.] BP: 1265°F
Silver	7440-22-4 (metal)	TWA 0.1 mg/m³ (metal, dust, fume) TWA 0.01 mg/m³ (Soluble compounds, as Ag)	TWA 0.01 mg/m ³	TWA 0.01 mg/m ³	10 mg/m ³ (as Ag)	inhalation, ingestion, skin and/or eye contact	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Nasal septum, skin, eyes	Metal: White, lustrous solid BP: 3632°F
Tetrachloroethene	127-18-4	TWA 25 ppm STEL 100 ppm listed as A3, animal carcinogen	Ca Minimize workplace exposure concentrations	TWA 100 ppm C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm	Ca [150 ppm]	inhalation, skin	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless liquid with a mild, chloroform-like odor. BP: 250°F Noncombustible Liquid
Toluene	108-88-3	TWA 20 ppm	TWA 100 ppm (375 mg/m ³) STEL 150 ppm (560 mg/m ³)	TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)	500 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a sweet, pungent, benzene- like odor. BP: 232°F FI.P: 40°F UEL: 7.1% LEL: 1.1% Class IB Flammable Liquid



3 of 4

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Hunter's Point South Project Area, Queens, New York

Compound	CAS#	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	e Toxic Properties	Target Organs	Physical/Chemical Properties
1,1,1-Trichloroethane (Methyl Chloroform)	71-55-6	TWA 350 ppm STEL 450 ppm	C 350 ppm (1900 mg/m³) [15-minute]	TWA 350 ppm (1900 mg/m³)	700 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	Eyes, skin, central nervous system, cardiovascular system, liver	Colorless liquid with a mild, chloroform-like odor. BP: 165°F UEL: 12.5% LEL: 7.5%
Trichloroethene	79-01-6	TWA 10 ppm STEL 25 ppm	Са	TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)	Ca [1000 ppm]	inhalation, skin absorption, ingestion skin and/or eye contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eyes, skin, respiratory system, heart, liver, kidneys central nervous system	Colorless liquid (unless dyed blue) with a , chloroform-like odor. BP: 189°F UEL(77°F): 10.5% LEL(77°F): 8%
Vinyl Chloride	75-01-4	TWA 1 ppm	Carcinogen	TWA 1 ppm C 5 ppm [15-minute]	Ca [IDLH value has not been determined]		Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Liver, central nervous system, blood, respiratory system, lymphatic system	Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. BP: 7°F UEL: 33.0% LEL: 3.6% Flammable Gas
Xylene (m, o & p isomers)	108-38-3, 95-47-6, 106-42-3	TWA 100 ppm STEL 150 ppm	TWA 100 ppm (435 mg/m³)	TWA 100 ppm (435 mg/m³)	900 ppm	Skin absorption, inhalation, ingestion, skin, and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys	Colorless liquid with an aromatic odor BP: 282°F, 292°F, 281°F FI. Pt. 82°F, 90°F, 81°F LEL: 1.1%, 0.9%, 1.1% UEL: 7.0%, 6.7%, 7.0% Class C Flammable Liquid
Zinc Oxide	1314-13-2	TWA 2 mg/m3 STEL 10 mg/m ³	None established	TWA 10 mg/m3 (for zinc oxide fume)	None established	skin and/or eye contact, inhalation, ingestion	Irritation eyes, skin, respiratory tract; gastrointestinal disturbances	Eyes, skin, respiratory system,	Bluish gray solid BP: 1664.6°F Flammable

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Proctor, N.H., J.P. Hughes and M.L. Fischman, 1989. Chemical Hazards of the Workplace. Van Nostrand Reinhold. New York.

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2017 TLVs® and BEIs®, American Conference of Industrial Hygienists

Abbreviations:

ACGIH – American Conference of Governmental Industrial Hygienists.

BP – boiling point at 1 atmosphere, °F

C – Ceiling, is a concentration that should not be exceeded during and part of the working exposure.

CAS# - Chemical Abstracts Service registry number which is unique for each chemical. Ft Pt. - Flash point

IDLH - Immediately Dangerous to Life and Health concentrations represent the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.

LEL – Lower explosive (flammable) limit in air, % by volume (at room temperature)

mg/m³ – Milligrams of substance per cubic meter of air

NIOSH - National Institute for Occupational Safety and Health.

OSHA – Occupational Safety and Health Administration

PEL - OSHA Permissible Exposure Limit (usually) a time weighted average concentration that must not be exceeded during any 8 hour work shift of a 40 hr work week.

ppm - parts per million

REL - NIOSH Recommended Limit indicated a time weighted average concentration that must not be exceeded during any 10 hour work shift of a 40 hr work week

SG - Specific Gravity

STEL – Short-term exposure limit (ST)

TLV - ACGIH Threshold Limit Values (usually 8 hour time weighted average concentrations).

TWA - 8-hour, time-weighted average

UEL – Upper explosive (flammable) limit in air, % by volume (at room temperature)

VP - Vapor Pressure



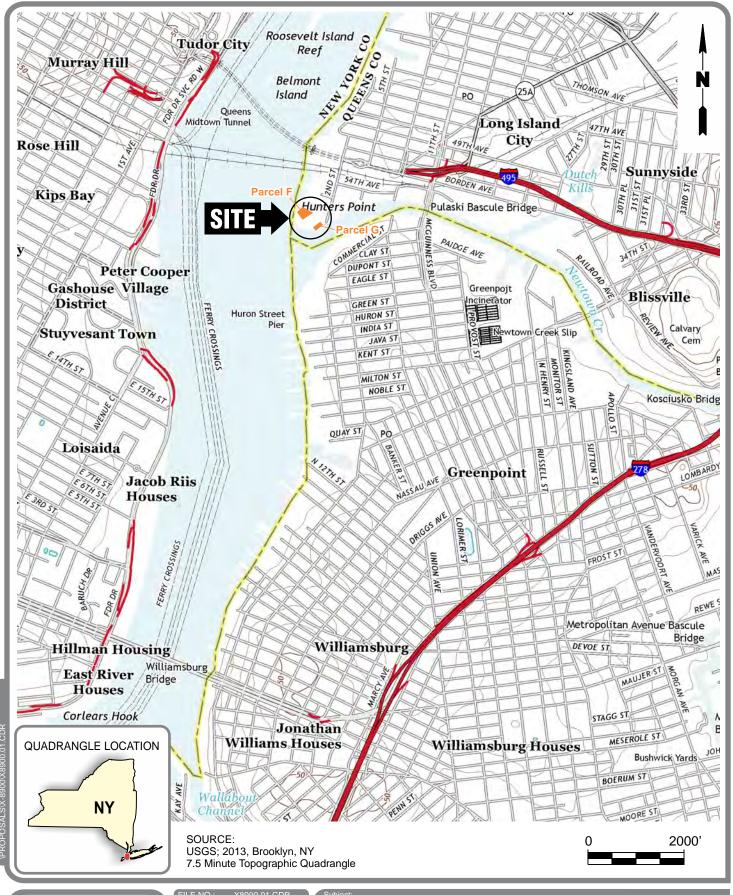
4 of 4 3084.0001Y.101/T1

Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

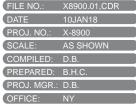
FIGURES

- 1. Site Location Map
- 2. Site Plan
- 3. Route to Hospital and Urgent Care Facility

3084.0001Y.101/CVRS ROUX







SITE LOCATION MAP

HUNTER'S POINT SOUTH DEVELOPMENT PARCELS F & G QUEENS, NEW YORK

Prepared for:

GO HPS LLC

FIG.



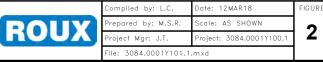
EMERGENCY MUSTER AREA

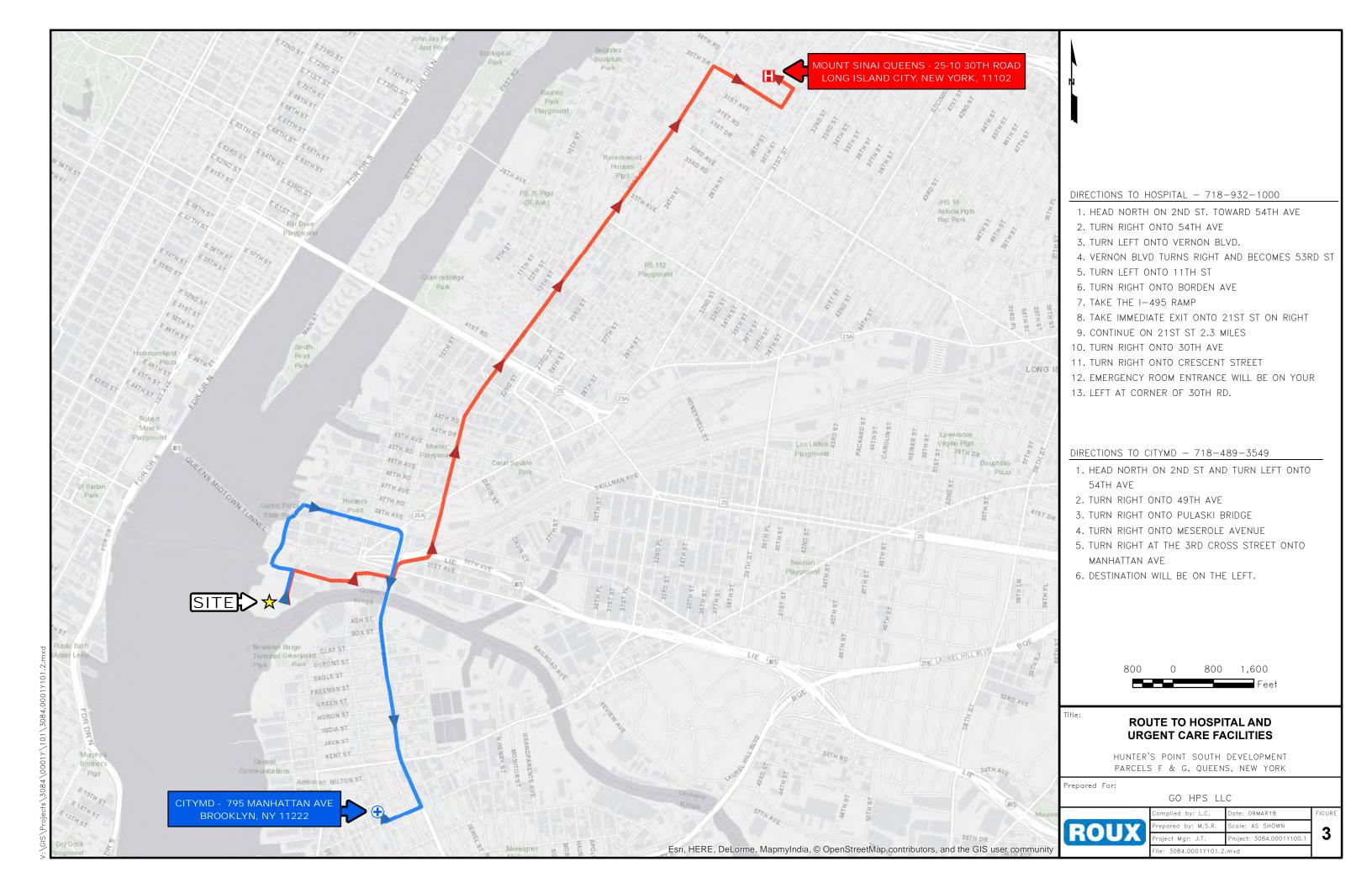
SITE BOUNDARY

SITE PLAN AND EMERGENCY MUSTER AREA

HUNTER'S POINT SOUTH DEVELOPMENT PARCELS F & G, QUEENS, NEW YORK

GO HPS LLC





APPENDICES

- A. Job Safety Analysis (JSA) Forms
- B. SDSs for Chemicals Used
- C. Incident Investigation and Reporting Management Program
- D. ACORD® Automobile Loss Notice Form
- E. Personal Protective Equipment Management Program
- F. Respiratory Protection Management Program
- G. Generic Community Air Monitoring Plan (CAMP)
- H. Health and Safety Briefing/Daily Meeting Log
- I. Heavy Equipment Exclusion Zone Program

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Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

APPENDIX A

Job Safety Analysis (JSA) Forms

3084.0001Y.101/CVRS ROUX

			⊠ NEW					
JOB SAFETY ANALYSIS	Cntrl. No.	DATE:		REVISED	PAGE 1 of 2			
JSA TYPE CATEGORY GENERIC	WORK TYPE		WORK ACTIVITY ((Description)				
DEVELOPMENT TEAM	POSITION / TITL	E	REVIEWE	D BY:	POSITION / TITLE			
F	L REQUIRED AND / OR RECOM	MENDED PERSO	I NAL PROTECTIVE E	OUIPMENT				
☐ LIFE VEST	□ GOGGLES	III LINDED I LINGO	☐ AIR PURIF	/ING	☐ GLOVES:			
☐ HARD HAT☐ LIFELINE / BODY HARNESS	FACE SHIELD	ION	RESPIRATO	OR RESPIRATOR	OTHER			
☐ LIFELINE / BODY HARNESS ☐ SAFETY GLASSES	☐ HEARING PROTECT☐ SAFETY SHOES	ION	SUPPLIED PPE CLOTH					
		/ OR RECOMMEN	IDED EQUIPMENT					
Required Equipment:								
Commitment to LPS – All person	nel onsite will actively p	articipate in SF	PSA performance	e by verbalizing SF	PSAs throughout the day.			
EXCLUSION ZONE: A _ foot exclus		ed around (indi	cate equipment).					
Assess	Analyze	1000		Act	FIGNIO			
1JOB STEPS	POTENTIAL HAZA		4.0	3CRITICAL ACT	TIONS			
1. [INSERT JOB STEP]	1a. CONTACT: [INSER	I HAZARDJ	1a.					
	1b. CAUGHT: [INSERT	HAZARDI	1b.					
	ib. OAGGIII. [INGLIKI	TIAZARDJ	TD.					
	1c. FALL: [INSERT HA	ZARD]	1c.					
	•	•						
	1d. EXPOSURE: [INSE	RT HAZARD]	1d.					
	1e. EXERTION: [INSER	T HAZARDI	1e.					
	ie. EXERTION: [INOEK	TINZARD	10.					
	1f. ENERGY SOURCE:	[INSERT	1f.					
	HAZARD]							
o INOEDT IOS OTES:	UNICEDT IOD CTEDI		2a.					
2. [INSERT JOB STEP]	P] 2a. CONTACT : [INSERT HAZARD]							
	2b. CAUGHT: [INSERT	HAZARD1	2b.					
	[52	,						

¹ Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

A hazard is a potential danger. Break hazards into five 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.
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."

P <u>L-2204</u>		
	2c. FALL: [INSERT HAZARD]	2c.
	2d. EXPOSURE: [INSERT HAZARD]	2d.
	2e. EXERTION: [INSERT HAZARD]	2e.
	2f. ENERGY SOURCE : [INSERT HAZARD]	2f.

¹ Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

A hazard is a potential danger. Break hazards into five 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.

Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating

procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

JOB SAFETY ANALYSIS	Ctrl. No. GEN-006	DATE 1/4	/2018	☐ NEW ⊠ REVISED	PAGE 1 of 2				
JSA TYPE CATEGORY:	WORK TYPE:			TY (Description):					
Generic	Drilling				Well Installation				
DEVELOPMENT TEAM	POSITION / TITL		REVIEW		POSITION / TITLE				
Timothy Zei	Project Hydrogeologis	st	Raymond Ols		Staff Assistant Geologist				
			Christine Piet	rzyk	Office Health & Safety Manager				
			Brian Hobbs		Senior Health & Safety Manager				
			Joe Gentile		Corporate Health & Safety Manager				
RE	QUIRED AND / OR RECO	MMENDED P	ERSONAL PRO	TECTIVE EQUIPME	5				
☐ LIFE VEST ☑ HARD HAT ☐ LIFELINE / BODY HARNESS ☑ SAFETY GLASSES	GOGGLES FACE SHIELD HEARING PROTECTI (as needed) SAFETY SHOES: Co steel toe boots		SUPPLIED PPE CLOTH reflective ve	YING RESPIRATOR RESPIRATOR HING: <u>Fluorescent</u> est or high visibility ng Sleeve Shirt	 ☑ GLOVES: <u>Leather, Nitrile and cut resistant</u> ☑ OTHER: <u>Insect Repellant.</u> <u>sunscreen (as needed)</u> 				
			MMENDED EQU						
Opening Tool, 20 lb. Type ABC Fire	Extinguisher, 42" Cones &	ß Flags, "Work	nization Detector, Multi-Gas Meter (or equivalent), Macrocore liners, Liner Vork Area" Signs, Water						
COMMITMENT TO SAFETY- All pe	ersonnel onsite will actively	participate in	hazard recognition	on and mitigation thro	oughout the day by verbalizing SPSAs				
EXCLUSION ZONE (EZ) - All non-	essential personnel will ma	aintain a distar	nce of 10 feet fron	n drilling equipment v	vhile equipment is moving/engaged				
	"5	SHOW ME Y	ME YOUR HANDS"						
Driller a	nd helper should shov			n controls and me	oving parts				
Assess	Analyze			Act					
¹ JOB STEPS	² POTENTIAL HAZAR			³CRITICAL A					
Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed)	Equipment/proper	1a. 1a. 1a. 1a.	 The drill rig's tower/derrick will be lowered and secured prior to mobilization. A spotter should be utilized while moving the drill rig. If personnel mo 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. Set-up the work area and position equipment in a manner that elimin or reduces the need for backing of support trucks and trailers. When backing up truck rig with an attached trailer use a second spot there is tight clearance simultaneously on multiple sides of the equipment if turning angles limit driver visibility. Inspect the driving path for uneven terrain. Level or avoid if needed. Drill rig should have a minimum exclusion zone of 10 feet for nonessential personnel (i.e., driller helper, geologist) when the rig is movin operation. 						
	1b. FALL: Slip/trip/fall hazard 1c. CONTACT: Crushing from rol	ds. 1b.	 1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Practice housekeeping. 1b. Use established pathways and walk on stable, secure ground. 						

- Pinch Points/Amputation 2b. Lower outriggers to ensure stability prior to raising rig tower/derrick. Points when raising the 2b. If the rig needs to be mounted, be sure to use three points of contact. rig and instability of rig
 - 3a. CONTACT:
- equipment and well installation Flying debris as eye, ear, and hand protection. 3b. EXPOSURE: 3b. Wet borehole area with sprayer to minimize dust.
 - Noise and dust. Stand upwind and keep body away from rig. Dust mask should be worn if conditions warrant.
 - 3b. Wear hearing protection when the drill rig is in operation.

Prior to raising the tower/derrick, the area above the drilling rig will be

2b. Inspect the equipment prior to use and avoid pinch/amputation points.

3a. Be aware of and avoid potential lines of fire and wear required PPE such

in contact with the rig's tower and/or drilling rods or tools. Maintain a safe distance of 10' from overhead structures.

inspected for wires, tree limbs, piping, or other structures, that could come

Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

2a. CONTACT:

2b. CONTACT:

Overhead hazards.

- A hazard is a potential danger. Break hazards into five 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.
- 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".

2. Raising tower/derrick of drill rig

3. Advancement of drilling

Assess 1JOB STEPS	2P(Analyze DTENTIAL HAZARDS	Act ³CRITICAL ACTIONS
Advancement of drilling equipment and well installation (Continued)		CONTACT: Flying debris	Contain drill cuttings and drilling water to prevent fall hazards from developing in work area. See 1b.
(Continued)		EXPOSURE: Noise and dust. FALL: Slip/trip/fall hazards.	 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.	CAUGHT: Limb/extremity pinching; abrasion/crushing.	 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 10 feet while in operation.
	3e.	CONTACT: Equipment imbalance during advancement of drill equipment.	 3e. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 3e. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred. 3e. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (minimum exclusion zone of 10 feet).
		EXPOSURE: Inhalation of contamination/vapors. EXERTION: Potential for muscle strain/injury while lifting and installing well casings, lifting sand bags, and/or lifting rods.	 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.	4a Utilize team lifting for objects over 50lbs. 4a. Use hydraulic liner extruder if available.
	4b.	CONTACT: Pinch points and cuts	 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.
		EXPOSURE: Inhalation and/or dermal contact with contaminants.	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).	 5a. Wear chemical-resistant disposable gloves and safety glasses. 5a. Contain decontamination water so that it does not spill. 5a. Use an absorbent pad to clean spills, if necessary. 5a. Spray equipment from side angle, not straight on, to avoid backsplash. 5a. See 3b.
	5b.	EXPOSURE: To chemicals in cleaning solution including ammonia.	5b. See 4a. Review SDS to ensure appropriate precautions are taken and understood.

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JOI	B SAFETY ANALYSIS	Ctrl. No. GEN-009 DATE: 1/4/2018								PAGE 1 of 1		
_	A TYPE CATEGORY	WORK TYPE O&M			WORK ACTIVITY (Description) Movement of 55-Gallon Drums/Drum Handling							
Gei	neric				with Mobile Carrier							
	DEVELOPMENT TEAM		POSITION / TITL	E	REVIEWED BY:					POSITION / TITLE		
Mic	hael Sarni	Tech	nnician		Bria	ın Hobbs			Ma	nior Health & Safety anager		
						Gentile				rporate Health & fety Manager		
_		EQUIRED AND / OR RECOMMENDED PERSO			NAL P					01.07/20.0 1		
	LIFE VEST HARD HAT LIFELINE / BODY HARNESS SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☑ 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		
			REQUIRED AND	/ OR RECOMMEN	DED E		nooti	o carety voot.	l			
	oile Drum Carrier, safety cones, and			attata ara ta basasa	.1			and an observation		and a character line and ODOA		
	MMITMENT TO SAFETY- All person CLUSION ZONE (EZ): A 10-foot of								out tr	ne day by verbalizing SPSAs		
	Assess 1JOB STEPS		Analyze ² POTENTIAL HAZA	ABD8				Act 3CRITICAL AC	CTIO	NG		
1.		1a.	FALL:	a co	1a	Clear area	n of l			d debris. Inspect 55-gal		
••	Inspection of Drum	ıu.	Tripping/falling du surface. Loose		ıu.	drums for	prop	per condition,	labe	eling, check drum ring mobile drum carrier.		
			debris/garbage ir	work area.	1a.	Do a Test the drum.	Test Lift to get a general sense of the weight of um.					
					1a.	Inspect and use established pathways to avoid uneven terrain, weather-related hazards (i.e., debris, puddles, ice, etc.), and other obstructions.						
					Secure work area and coordinate and communicate the planned work activities with other personnel working in the area.							
					1a.	Delineate	wor	k area with 42	2" sa	afety cones.		
		1b. CONTACT/EXPOSURE: Drums could potentially be damaged or contain hazardous material. Mobile			1b.	drum is no drum trans	t pr spor	operly labeled t activities. In	d, do mme	ut-resistant gloves. If o not open and cease all ediately contact project drum situation.		
			drum carrier coul	g condition	 Do not continue drum transport activities until furth actions are determined by the project manager. 							
			causing malfunct operation.	ioning during	1b.					but leaking, improperly ce drum in an over-pack		
					1b. Inspect mobile drum carrier to ensure its integrity. Look for rust marks or potential v where the drum carrier could malfunction. wheels to ensure that they easily turn and impeding their movement.			potential weak points alfunction. Inspect the				
		1c.	EXERTION/CAU Potential pinching hazards while set tightening bolts	g/exertion	1c.					slightly bent while olt. Wear cut-resistant		
2.	Position drum clamp tightly in between drum ribs, securing drum clamp to drum with chain	2a.	CAUGHT: Pinching fingers I drum clamp and		2a.	not place h chain is tig	hano ghte	ds between d ned; wear cu	rum t res	and tighten until snug. Do clamp and drum as the istant gloves. Keep face in case of escaping		

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Assess ¹ JOB STEPS		Analyze ² POTENTIAL HAZARDS		Act 3CRITICAL ACTIONS		
3.	Disengage safety latches on handle, pull handle down until drum is lifted off ground and safety latches are reengaged; slightly suspending drum off the ground	3a.	EXERTION/ CONTACT: Potential muscle strain associated with lifting/engaging drum/handle. Drum could shift/slip downward and crush toes.	3a.	Ascertain whether the drum is overweight; if it is, then two people are needed to lower handle while drum is secured with clamp so that safety latches can be engaged. Keep body out of the line of fire of the handle (do not position head above handle) as it is being pushed down. Do not allow feet/toes to be positioned under the drum as it is being lifted; wear steel/composite toe boots.	
		3b.	CAUGHT: Fingers could be pinched while engaging/disengaging safety latches on handle	3b. 3b.	Wear cut-resistant gloves while disengaging/reengaging safety latches. Avoid placing hands in pinch points.	
4.	Transport drums to designated location and disengage drum clamp (repeat Step 3 in reverse order)	4a.	FALL: Tripping/ falling due to obstructions and uneven terrain. Potential for drum to fall during transport.	4a.	Ensure transport path is free of potential obstructions that may cause the drum/carrier to become unstable. Position drum clamp between the ribs on the drum to prevent possible slipping.	

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JOB SAFETY				☐ NEW	
ANALYSIS	Cntrl. No. GEN-009	DATE: 2/11/2	2015	☑ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY	WORK TYPE		WORK ACTIVITY (Description)		,
GENERIC	Hand Tools		Pre-Clearing activities, including Air		
				l Soil Vacuum	_
DEVELOPMENT TEAM	POSITION / TITLE		REVIEWED BY: POSITION / TITLE		
Alyssa Lau	Staff Engineer		Daniel Abberton		SHSM
			Mike Ritorto		Senior Hydrogeologist
	DECUMEN AND LOD DECOM		Laura Jensen		Staff Hydrogeologist
☐ LIFE VEST	REQUIRED AND / OR RECOMI	WENDED PERS	AIR PURIF		GLOVES: Nitrile and cut
☐ HARD HAT	FACE SHIELD (while air k	knifing)	RESPIRATO		resistant
☐ LIFELINE / BODY HARNESS	HEARING PROTECTION needed)	(as	☐ SUPPLIED ☐ PPE CLOTH	RESPIRATOR	OTHER: Dust mask (as
☐ SAFETY GLASSES	SAFETY SHOES: Steel of	<u>or</u>	_	reflective vest	needed)
	composite toed	/ OD DECOMM	or high visib		
Required Equipment: Air Kni	fe, Vactor Truck (Vac Truck), (Hand Tools Circu		Photoionization Detector
Multi-Gas Meter, Traffic Cones,	Rigid Barrier, Caution Tape, 20) lb. Fire Extin	guisher, "Work A	rea" and/or "Exclusion	n Zone" Signs
Commitment to LPS – All perso					
EXCLUSION ZONE: A 10 foot		tained around	air knife and/oi		itions.
Assess 1JOB STEPS	Analyze ² POTENTIAL HAZARI	os		Act 3CRITICAL AC	TIONS
Verify pre-clearance	1a. CONTACT :		1a. Confirm tha		ies were contacted prior to
protocol.	Underground utility dam	J ,	drilling.	, ,	·
	property damage; perso	nal injury.			narkings and review maps
	See Site Walk Inspection JS/	A for			for critical actions). rm and sub-surface clearance
	potential hazards.				cates that clearance must be
					rtical feet below ground
			surface or 8 zone using	•	round surface in the critical
Mobilize/demobilize and	2a. See Mobilization / Den	obilization			ion JSA for critical actions.
establish work area.	JSA for potential haza		Zu. Gee mobili	eution / Demobilizat	ion don for orthographics.
Pre-clear with air knife, water lance, and soil vacuum, and/or clearance with hand tools	3a. CONTACT: Flying debris striking fac		operator an zone while a including (a	d designated helper air knife/vac truck is	ne. Only (air knife/vac truck) shall remain within exclusion active. Use the required PPE, sistant gloves, safety glasses ed shirt
			3a. Wear a face using air kn3a. Aim air knife fire hazards	e shield to protect factife. The tip away from self and the self and t	e from flying debris when and others, so to avoid line-of-
	3b. EXPOSURE/ENERGY	SOURCE:	3b. Monitor bre		essor hoses. alibrated PID and multi-gas · 5 ppm, the Roux field
	Inhalation/exposure to h vapors; inhalation/exposelectrocution.	sure to dust;	personnel n personnel to inform the F Project Mar 3b. Wear dust r 3b. Ensure no c work area. 3b. No open fla 3b. Ensure vac	nust temporarily ceaso step away from the Roux Project Manage lager will then recomnasks as needed open flames/heat sources. truck is properly gro	se work, instruct all Site area of elevated readings and of the condition. The Roux mend additional precautions.
	Damage to unknown/knoutility with air knife.	own	air stream tool. 3c. Keep the ai pressure on 3c. increase the	and using the air kni r knife tip constantly a potential utility. e distance between a	with the high pressure fe tip as a physical digging moving to reduce direct iir knife tip and soil/utility.
	3d. ERGONOMICS			remove soil slurry from abrasive effect on	om hole with vacuum, which utility casings.
	Poor body positioning w	hen	•		, 0
	handling equipment ar materials.		minimizes n		I lifting techniques that ack straight, lift with legs, keep ach with a load.

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Assess 1JOB STEPS	Analyze ² POTENTIAL HAZARDS	Act 3CRITICAL ACTIONS		
Pre-clearing with air knife and soil vacuum, and/or clearance with hand tools (continued)	ERGONOMICS: (continued) Poor body positioning when handling equipment and materials.	3d. Ensure that loads are balanced to reduce the potential for muscle strain.3d. Two people or a mechanical lifting aid are required when lifting objects over 50 lb. or when the shape makes the object difficult to lift.		
	3e. FALL: Tripping/falling due to uneven terrain, weather conditions, and materials/equipment stored at the Site.	 3e. Inspect walking path for uneven terrain, weather-related hazards (e.g., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 3e. Walk around any stored materials/equipment; do not climb over. Practice good housekeeping. 3e. Use established pathways and walk on stable, secure ground. 3e. Equipment and tools will be stored at the lowest point of potential energy and out of the walkway and immediate work area (i.e., tools should not be propped against walls or nearby equipment or vehicles). 3e. Equipment and tools that are not anticipated to be used will be returned to a storage area that is out of the immediate work area. 3e. Ensure power cords/hoses are grouped when used within the work area. Mark out cords/hoses that cross pathways with traffic cones. 3e. Ensure all Site personnel and equipment stay a minimum of 2 feet from an open hole. Mark out open holes with traffic 		
	3f. CAUGHT: Pinch points or amputation points associated with the equipment and vacuum hose.	cones/caution tape, etc. 3e. Pre-cleared location will be finished flush to grade as to prevent a slip/trip hazard. 3f. Always wear cut-resistant gloves when making connections and using hand tools. 3f. Inspect the equipment prior to use for potential pinch points. 3f. Test all emergency shutdown devices prior to using equipment. 3f. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3f. All non-essential personnel shall maintain a 10 foot exclusion zone; position body out of the line-of-fire. 3f. Drillers and helpers will understand and use the "Show Me Your Hands Policy".		
	3g. EXPOSURE : Noise from vac truck and/or air compressor.	3g. Wear hearing protection when vac truck and air compressor are in operation. Otherwise, if sound levels exceed 85 dB, don hearing protection.		
Move drum to staging area using drum cart.	4a. EXPOSURE/CONTACT: Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, soil).	 4a. Wear chemically resistant gloves (i.e., Nitrile; worn in addition to cut resistant gloves). 4a. Do not overfill drums. Ensure that the drum lids are attached securely. 4a. Stage all drums in the designated storage area (per Roux Project Manager) and ensure they are labeled. 		
	4b. ERGONOMICS : Muscle strain while maneuvering drums with drum cart/lift gate.	4b. See 3d. Do not overfill drums. Use lift gate on back of truck to load and unload drums or drum cart to transport drums.		
	4c. CAUGHT : Pinch points or amputation points associated with handling drum lid.	4c. Ensure that fingers are not placed under the lid of the drum. Wear cut-resistant gloves. Use 15/16" ratchet while sealing drum lid.		
Decontaminate equipment and tools.	5a. EXPOSURE/CONTACT: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors).	 5a. See 4a. 5a. Contain decontamination water (closed lid) so that it does not spill. 5a. Use an absorbent pad to clean spills, if necessary. 5a. Store all impacted materials/PPE in a designated storage container (per Roux Project Manager) and ensure the container is labeled. 		
	5b. EXPOSURE : To chemicals in cleaning solution.	5b. See 4a.		

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-013		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 Joe Gentile	Senior Health & Safety Manager Corporate Health & Safety		
		GOO GOTTAINE	Manager		
			· ·		
	REQUIRED AND / OR RECOMMENDED PE				
☑ LIFE VEST☑ HARD HAT	☐ GOGGLES☐ FACE SHIELD	☐ AIR PURIFYING RESPIRATOR☐ SUPPLIED RESPIRATOR	GLOVES: <u>Leather, Nitrile and cut</u> resistant		
☐ LIFELINE / BODY HARNESS	HEARING PROTECTION	□ Soft Eleb Red in Ration □ PPE CLOTHING: Fluorescent	☐ OTHER: Knee pads, Insect		
	SAFETY SHOES: Composite-toe or steel	reflective vest or high visibility	Repellant, sunscreen (as needed)		
	required and / or recoi	clothing MMENDED FOLLIPMENT			
42-inch Safety Cones, Caution T Wrench, Screw Driver, Crow Bar	ape, Interface Probe and/or Water Level Me		, Buckets. Tools as needed: Socket		
COMMITMENT TO SAFETY- All	l personnel onsite will actively participate in h	nazard recognition and mitigation throu	ghout the day by verbalizing SPSAs		
Assess 1JOB STEPS	Analyze ² POTENTIAL HAZARDS	Act ³CRITICAL A			
Mobilization to monitoring	1a. FALL: Personal injury from		ost suitable designated pathway		
well(s).	slip/trip/fall due to uneven terrain	prior to mobilization.	panear 20019 panear		
	and/or obstructions.	1a. Use established pathways, wal			
		ground and avoid steep hills or 1a. If working near open water with			
		ľ	5		
	1b. CONTACT: With traffic/third parties.	 Identify potential traffic sources inch traffic safety cones. Positi 			
	parties.	oncoming traffic. Use caution t			
		delineation of the work area if r			
		1b. Wear appropriate PPE includin	g high visibility clothing or reflective		
		vest.	at with an arming vahiolog, and		
		 Face traffic, maintain eye conta establish a safe exit route. 	ict with oncoming vehicles, and		
	1c. EXERTION: Muscle strain from	1c. Use proper lifting techniques w bend knees and keep back stra	hen handling/moving equipment;		
	lifting equipment	4c. Use mechanical assistance or t			
		equipment is 50 lbs. or heavier			
		4c. Make multiple trips to carry equ	ipment.		
	1d. EXPOSURE:	Ad the second second second second second			
	To biological hazards.	1d. Inspect work area for bees and1d. Use insect/tick repellent as nec			
2. Open/close well.	2a. EXERTION: Muscle strain.		eep back straight, lift with legs and		
	<u> </u>	bend knees when reaching to c	pen/close well.		
	2b. CAUGHT: Pinch/crush points associated with removing/replacing	2b. Wear leather gloves or cut resis	stant gloves when working with well		
	manholes and working with hand	cover and hand tools. 2b. Use proper tools (ratchet and p	ry har for well cover) and inspect		
	tools.	before use.	ry bar for well cover) and inspect		
		2b. Do not put fingers under well co	over.		
	2c. CAUGHT: Pinch points associated	2c. See 2b.	ule and a security of the second		
	with placing J-plug back onto PVC pipe.	2c. Keep fingers out of line-of-fire v	vnen securing cap.		
		2d. No open flames/heat sources.			
2d. EXPOSURE: To potential hazardous vapors.		2d. To minimize exposure to vapors, allow well to vent after opening it			
	παεαιασαό ναροίο.	and before sampling activities to	pegin.		
2	25 CONTACT: Mail:	2d. Stand up-wind, if possible, to a			
3. Gauge well.	3a. CONTACT: With contamination (e.g. contaminated groundwater).	3a. Wear chemical-resistant dispos gloves) and safety glasses who			
	(o.g. oomaninatou groundwater).	3a. Insert and remove probe slowly			
		3a. Use an absorbent pad to clean			
	3b. CONTACT:	3b. See 1b.			
	With traffic.				
	Í	<u> </u>			

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	Assess ¹JOB STEPS		Analyze POTENTIAL HAZARDS		Act 3CRITICAL ACTIONS
4.	Purge and sample well	4a.	EXPOSURE/CONTACT: To	4a.	Open and fill sample jars slowly to avoid splashing and contact with
			contamination (e.g., SPH,		preservatives.
			contaminated groundwater, vapors)	4a.	Wear cut-resistant gloves and chemical-resistant disposable gloves
			and/or sample preservatives.	<i>1</i> 2	when sampling. Fill sample containers over purge container to avoid spilling water
				-α.	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
				12	well to avoid splash hazards. When sampling or purging the water using a bailer, pour out water
				4a.	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
				40	splash hazards.
		4h	CONTACT: Personal injury from	4a.	When collecting a groundwater sample always point sampling apparatus (tubing, bailer, etc.) away from face and body.
			cuts, abrasions, or punctures by	4b.	To avoid spills or breakage, place sample ware on even surface.
			glassware or sharp objects.	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.
		40	EXERTION: Muscle strain while		VOTE Vidio) of Whom doing duting tools.
			carrying equipment.	4c.	Use proper lifting techniques when handling/moving equipment,
					bend knees and keep back straight.
				4c.	
			CONTACT	4c.	equipment is 50 lbs. or heavier. Make multiple trips to carry equipment.
		4a.	CONTACT: With traffic.		
		l _		4d.	See 1b.
		4e.	CONTACT: Pinch points with groundwater	10	Mean leather aloves when working with groundwater pumps
			pump components (i.e., wheel, line,		Wear leather gloves when working with groundwater pumps. Never place hands on or near pinch points such as the wheel,
			clamps).		clamps or other moving parts during pump operations.
				4e.	Use the correct mechanisms, such as a pump reel, to lower pump
				40	into well.
				46.	Never attempt to manually stop any moving part of equipment including hose reels and/or tubing.
		4f.	EXERTION: Muscle strain from		The same of the sa
		41.	repetitive motion of bailing and	4f.	See 4c.
			sampling a well.	4f.	Include a stretch break when repetitive motions are part of the task.
		<u> </u>			
5.	Management of purge water.	5a.	EXPOSURE/CONTACT: To contamination (e.g., SPH,	5a.	Do not overfill container and pour liquids slowly so that they do not splash.
	water.		contaminated groundwater,	5a.	Properly dispose of used materials/PPE in appropriate container in
			vapors).		designated storage area.
		5h	EXERTION:	5h	Use proper lifting techniques when lifting / carrying or moving
			Muscle strain from lifting/carrying	55.	container(s) (see 4c.).
			and moving containers.	5b.	Do not overfill container(s).
_		<u> </u>	EVECULE (COVERAGE OF		
6.	Decontaminate equipment.	6a.	EXPOSURE/CONTACT: To contamination (e.g., SPH,	6a.	Work on the upwind side, where possible, of decon area. Wear chemical-resistant disposable gloves and safety glasses.
			contaminated groundwater,	6a. 6a.	Use an absorbent pad to clean spills.
			vapors).	1	
		6h	CAUGHT: Pinch points associated	6b.	See 2b.
1		55.	with handling hand tools	6b.	Inspect hand tools for sharp edges before decontaminating.
<u> </u>		l	3 • • • • •	<u> </u>	

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-014	DATE:	1/4/2018	☐ NEW REVISED	PAGE 1 of 2		
JSA TYPE CATEGORY:	WORK TYPE:	,	WORK ACTIVITY (Description):				
Generic	Drilling		Hollow Stem Auger Soil Borings / Well Installation				
DEVELOPMENT TEAM	POSITION / TITLE		REVIEWED B	Y :	POSITION / TITLE		
Douglas Ferraiolo	Staff Geologist		Brian Hobbs Joe Gentile		Senior Health & Safety Manager Corporate Health & Safety		
			Joe Gentile		Manager		
					The state of the s		
	QUIRED AND / OR RECOMME						
LIFE VEST	GOGGLES: Spoggles		☐ AIR PURIFYING F		GLOVES: Leather, Cut-		
	if winds exceed 15 mpl FACE SHIELD	<u>1.</u>	☐ SUPPLIED RESP☑ PPE CLOTHING:		Resistant, and Nitrile. OTHER: Insect Repellant,		
SAFETY GLASSES	HEARING PROTECTION	ON:	long-sleeve shirt o	r long-sleeve	Sunscreen (as needed).		
	(as needed). SAFETY SHOES: Stee	al or	shirt and reflective	safety vest.			
	Composite Toe.	<u>;i </u>					
			MMENDED EQUIPMEN				
Truck-Mounted Drilling Rig or Track Fire Extinguisher, 42" Cones & Flag		nization l	Detector, Multi-Gas Mete	er (or equivalent)), Interface Probe, 20 lb. Type ABC		
COMMITMENT TO SAFETY- All pe		icipate in	hazard recognition and r	mitigation throug	hout the day by verbalizing SPSAs		
EXCLUSION ZONE (EZ) – All non-	* *	-	=		· · ·		
	"SHO	W ME Y	OUR HANDS"				
	nd helper should show tha	t hands	are clear from contr		ng parts		
Assess 1JOB STEPS	Analyze ² POTENTIAL HAZARDS			Act 3CRITICAL AC	TIONS		
Mobilization / demobilization	1a. See Mobilization/		1a. See Mobilization /				
and establish a work area.	Demobilization JSA GE	N-015.					
2. Raising tower / derrick of	2a. CONTACT: Overhead h	azards	2a. Prior to raising the	tower / derrick	the area above the drilling rig will		
drilling rig.	Za. CONTACT. Overneau i	azarus.			s (wires, tree limbs, piping or other		
					by the rig's tower or drilling rods.		
			unless approved b	c must not be rai	sed beneath overhead power lines		
			2a. Maintain a minimu	um of 10' from a	Il overhead structures.		
			2a. Do not move the ri				
	2b. CONTACT: Amputation	/ crush	amputation points.		and avoid any potential		
	points when raising the r		2b. Lower outriggers t	o ensure stabilit	y prior to raising rig tower derrick.		
	instability of rig.				of fire when lowering out-riggers. ven terrain. Level or avoid area if		
			needed.				
			2b. If the rig needs to contact.	be mounted, be	sure to use three points of		
3. Advancement of augers for	3a. CONTACT: Equipment			ce the borehole	with caution to avoid causing the		
soil boring installation.	imbalance during advand of drill equipment.	ement	rig to become imb		tip. used to secure the rig will be		
	or ann equipment.				sonnel regularly to see if shifting		
			has occurred.	'- the "Decorate 7			
					one" policy surrounding augers to ntact with augers while in use.		
			Workers will spray	paint a 3' semi-	circle surrounding the augers to		
			visually show that drilling activities ar		nould enter the "Purple Zone" while		
			<u> </u>	•	ent that are non-essential to the		
					be positioned away from the rig at		
			a distance that is a exclusion zone of		the boom is high (minimum		
	3b. CONTACT: Flying / spra	aying	3b. Wear all required l	PPE (especially	hand, eye, and ear protection).		
	debris.				e when rig is in operation to avoid		
	3c. CAUGHT: Limb/extremi	ity			lying materials or debris. for potential pinch points.		
	amputation, abrasion, ar	,	3c. Test all emergency	y shutdown devi	ces prior to drilling.		
	crushing.		Inspect drill head to damaged or blunt.		or missing teeth; replace if		
					r flight is damaged or bent.		
Assess	Analyze			Act			

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 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.

 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."

¹ JOB STEPS	² POTENTIAL HAZARDS	³ CRITICAL ACTIONS
3. Advancement of augers for		3c. Ensure all jewelry is removed, loose clothing is secured, and PPE is
soil boring installation (Continued).		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
	3d. FALL: Slip/trip/fall hazards.	operation. 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
	3e. EXPOSURE: Inhalation of	augers. 3e. Air monitoring using a calibrated photoionization detector (PID) to
	contamination / vapors.	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
	3f. EXPOSURE: Noise and dust.	plan. 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	Potential contact with augers during installation of well materials. Keep distance from augers and do not place any materials while
	augers.	augers are in motion.
	4b. CAUGHT: Possible pinch or crush hazard assembling PVC and sending down the borehole.	Keep all body parts out of potential pinch points while placing PVC together and sending down borehole.
	4c. FALL: Slip/trip/fall hazards with hand tools and materials.	4c. See 3d.
	4d. EXPOSURE: Potential	4d. See 3e and 3f.
	contamination, harmful vapors, dust, and / or noise. 4e. EXERTION: Lifting heavy bags	4d. Stand upwind to avoid exposure to dust generated from packing materials.
	of materials to backfill borehole.	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	5a. Follow "Show Me Your Hands" Procedure and make sure auger is out of gear before contacting auger with tool or hand.
	auger.	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:	6a. Wear chemical-resistant disposable gloves and safety glasses.
	To contamination (e.g., contaminated groundwater, vapors).	6a. Contain decontamination water so that it does not spill.6a. Use an absorbent pad to clean spills, if necessary.
	6b. EXPOSURE: To chemicals in cleaning	6b. See 3e. Wear all appropriate PPE and stand upwind of any exposed cleaning solutions.
	solution (including ammonia).	

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			1	ΠΝΕ\Δ/	1	
JOB SAFETY ANALYSIS	Ctrl. No. GEN-015	DATE: 1/4/2		□NEW ☑REVISED	PAGE 1 of 2	
JSA TYPE CATEGORY GENERIC	WORK TYPE Site Recon		WORK ACTIVITY (Description) Mobilization/Demobilization			
DEVELOPMENT TEAM			REVIEW		POSITION / TITLE	
Rebecca Lowy	POSITION / TITLE Staff Assistant Geologist		Brian Hobbs	ED BT.	Senior Health & Safety	
•					Manager	
Tally Sodre	OHSM		Joe Gentile		Corporate Health & Safety Manager	
_	EQUIRED AND / OR RECOMMEND	DED PERSON				
☐ LIFE VEST ☐ HARD HAT ☐ LIFELINE / BODY HARNESS ☐ SAFETY GLASSES	□ GOGGLES □ FACE SHIELD □ HEARING PROTECTION (as needed) □ SAFETY SHOES: Steel Toe or composite toe		PPE CLOT Fluorescent of high-visit long sleeve pants	OR RESPIRATOR HING: t reflective vest bility clothing;	□ GLOVES: Leather, nitrile, and cut resistant (as needed) □ OTHER	
Paguired Equipment: None	REQUIRED AND / OR	RECOMMEN	DED EQUIPMENT			
Required Equipment: None						
COMMITMENT TO SAFETY- All person	onnel onsite will actively particip	ate in hazar	d recognition and	mitigation througho	out the day by verbalizing SPSAs	
EXCLUSION ZONE (EZ): A 10-foot 6	exclusion zone will be maintai	ned around	equipment in u	se		
Assess 1JOB STEPS	Analyze POTENTIAL HAZARDS			Act 3CRITICAL AC	PTIONS	
1. Mobilize/demobilize and	1a. FALL: Slip/trips/falls f		1a Uso 2 poi		ure secure footing when	
establish work area	obstructions, uneven terrain, weather conditions, heavy loads, and/or poor housekeeping. 1b. CONTACT: Personal injury and/or property damage caused by being struck by Site traffic or equipment used in Site activities.		 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. 			
			 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 a special hazards. Ensure that short-service employee (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 avoid backing whenever possible. 1b. Maintain a minimum 10' exclusion zone when vehicles are in motion. 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 tap and/or other barriers. 1b. Position "Work Area" signs at Site entrances, if possib or at either side of work area. 			

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Assess 1JOB STEPS	Analyze ² POTENTIAL HAZARDS	Act 3CRITICAL ACTIONS			
JOB STEPS	POTENTIAL HAZARDS	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.	 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. Wear leather gloves when handling any tools or equipment. Wear cut-resistant gloves (Kevlar or similar) when handling sharp objects/cutting tools/glass. Keep body parts away from line-of-fire of equipment. Always carry tools by the handles and/or designated carrier. Ensure sharp-edged tools are sheathed/secure. Remove any loose jewelry. Avoid wearing loose clothing and/or ensure loose clothing is secure. Secure all items on the equipment, tighten up any items or features that have potential to shift or break during 			
	1d. OVEREXERTION: Muscle strains while lifting/carrying equipment.	 mobilization. 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.	 Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, nausea, rapid and shallow breathing). Take breaks in cool places and hydrate as needed. 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. Wear clothing appropriate for weather and temperature conditions (e.g., rain jackets, snow pants, multiple layers). If lightning is observed, wait 30 minutes in a sheltered location (car is acceptable) before resuming work. 			
	1g. EXPOSURE: Personal injury from noise hazards.	Wear hearing protection if sound levels exceed 85 dBA (if you must raise your voice for normal conversation).			

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-017	DATE 1/4/	/2018	□NEW ⊠REVISED		PAGE 1 of 2
JSA TYPE CATEGORY:	WORK TYPE:		WORK ACTIVITY (Descrip	ACTIVITY (Description):		
GENERIC	Drilling		Monitoring and R			
DEVELOPMENT TEAM	POSITION / TITLE		REVIEWED BY	:	F	POSITION / TITLE
Amy Hoffman	Staff Geologist		Brian Hobbs		Manag	
Ron Lombino	Staff Geologist		Joe Gentile		Corpor Manag	ate Health & Safety er
Courtney Lind	Staff Engineer					
	QUIRED AND / OR RECOMM	IENDED PE				
☐ LIFE VEST ☐ HARD HAT ☐ LIFELINE / BODY HARNESS ☐ SAFETY GLASSES	GOGGLES FACE SHIELD HEARING PROTECTION (aneeded) SAFETY SHOES: Compostoe or steel toe boots	as site-	☐ AIR PURIFYING RESUPPLIED RESPIRATION SUPPLIED RESPIRATION PPE CLOTHING: FIreflective vest or high clothing	ATOR uorescent n visibility	res OT	OVES: <u>Leather or cut-</u> istant and Nitrile HER: <u>Insect repellant,</u> iscreen (as needed)
			MMENDED EQUIPMEN			
Required Equipment as needed: To Submersible Pump, Surge Block/P needed: Socket and Pipe Wrench,	lunger, 20 lb. Type ABC Fire E Screw Driver, Pry Bar, Ratche	Extinguisher, t, Vault Key	, Holding Tanks and/or l	Buckets, Abso	rbent Pa	ds, 5-gas meter, Tools as
COMMITMENT TO SAFETY- All p		<u> </u>	<u> </u>	mitigation thro	ughout th	ne day by verbalizing SPSAs
EXCLUSION ZONE (EZ): Maintain		•				
"SHOW ME YOUR HANDS" Driller and helper should show that hands are clear from controls and moving parts						
Assess	Analyze 2POTENTIAL HAZARDS			Act		
1JOB STEPS 1. Mobilization /	1a. CONTACT:		1.a. The truels rig!e tour	3CRITICAL A		ed and secured prior to
Demobilization (Review Mobilization and Demobilization JSA)	Equipment/property dan 1b. FALL: Slip/trip/fall hazards.	nage.	mobilization. 1a. Set-up the work are eliminates or reduction. 1a. All non-essential particles. 1a. Beep horn twice bare to avoid if needed. 1b. Inspect walking particles, ice, puddles, equipment. 1b. Do not climb over equipment at lowe	rea / position eces the need fersonnel should be fore backing with an attach of the for uneven snow, etc.), and stored materials the potential en	equipmer or backir uld maint up. ed trailer terrain, v nd obstru als/equipu ergy.	ut in a manner that ag of trucks and trailers. cain an exclusion zone of use a spotter Level or eather-related hazards actions prior to mobilizing ment; walk around. Store
2. Open/close well.	2a. EXERTION: Muscle strain (some well large vault covers).		reach with a load. potential for muscl	Ensure that lo	oads are people a	ad close to body, and never balanced to reduce the re required when lifting akes the object difficult to
	2b. CAUGHT: Pinch points associated removing/replacing man and working with hand to	holes	2b. Wear cut-resistant and hand tools. Do2b. Use ratchet and presented and presente	not put finge	rs under	orking with well vault/cover well vault/cover. d inspect before use.
	2c. EXPOSURE: Potentially hazardous va		activities to minimi	after opening i ze exposure to set up and du	o vapors.	fore starting development Air monitoring must be well development activities.
	2d. CONTACT: Traffic.		2d. Wear required PP2d. Delineate work are Position vehicle to2d. Face traffic, maintaestablish a safe ex	ea with 42" saf protect agains ain eye contac	ety cone st oncom	ing traffic.

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to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

	Assess 1JOB STEPS	Analyze ² POTENTIAL HAZARDS	Act 3CRITICAL ACTIONS
3.	Develop well (mechanical surging).	3a. CAUGHT: Cut hazards and finger pinch points.	3a See 2b. 3a. Use required PPE including leather/cut-resistant gloves when handling development equipment. Identify finger/hand pinch points. Keep hands away from active surge equipment. 3a. All non-essential personnel should maintain an exclusion zone of 20 feet.
		3b. CONTACT/EXPOSURE: Contamination (e.g., SPH, contaminated groundwater, vapors).	3b. See 2c.3b. Wear Nitrile gloves and safety glasses. Insert and remove surge block/plunger and line/cable slowly to avoid splashing at the surface.3b. Use an absorbent pad to clean any spills.
		3c. EXERTION: Muscle strain from lifting equipment.	3c. See 2a.3c. Use mechanical device to insert and remove surge block/plunger if greater than 50lb.
		3d. CONTACT: Injury while handling wench line/cable, or with active surging equipment.	 3d. If using a drill rig, inspect all wench lines/cables for any kinks or if frayed prior to use. Replace any damaged lines/cables. Review Drill Rig checklist prior to development activities. 3d. See 3a.
4.	Purging well (pumping water to holding tanks/drums/buckets).	4a. CAUGHT: Pinch points associated with connecting hose to tank. Pinch points associated with handling pump and hoses.	 4a. See 3a. 4a. Ensure that fingers are not placed near coupling when attaching and securing hose(s). Do not place fingers under pump/hoses. Wear leather or cut-resistant gloves when handling pump/hose(s). 4a. Keep hands clear from any line of fire.
		4b. FALL: Using side mounted ladder when attaching hose to tank. Slip, trip, fall from lines/hoses	 4b. Inspect ladder steps to make sure steps are not bent/damaged and free of debris/fluid. 4b. Use three points of contact always when using ladder. 4b. Use hoist or other mechanical means to secure and move hose. 4b. Utilize anti-whip cords on all compressed hoses. Keep hoses and lines coiled and organized out of designated walking paths around
		4c. CONTACT: Contamination (e.g., SPH, contaminated groundwater).	 the work zone. 4c. Secure water hose. 4c. Do not overfill tanks, and purge/transfer liquids in such a manner that they do not splash. (See 3b). 4c. Dispose of used materials/PPE in the designated impacted PPE container.
		4d. EXERTION: Muscle strain from lifting/carrying equipment.	4d. See 2a.
		4e. FALL: Spilled purge water.	4e. Clean up any spills using absorbent pads or spill kits.
5.	Decontaminate equipment	5a. CONTACT/EXPOSURE: Contamination (e.g., SPH, contaminated groundwater, vapors).	5a. See 3b.
		5b. EXPOSURE/CONTACT: Chemicals in cleaning solution	5b. Decontaminate equipment in well-ventilated area. Wear nitrile gloves to avoid skin contact with cleaning solutions.

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JOB SAFETYANALYSIS		Ctrl. No. GEN-020	DATE:	: 1/4	1/2018]NEW ₫REVISED		PAGE 1 of 2
JSA TYPE CATEGORY:	WOR	RK TYPE:			ORK ACTIVITY (Description):				
GENERIC	Gau	iging & Sampling		Soil	Sampling				
Mary Poth Lyons	Droi	POSITION / TITLE		Drios		EWI	ED BY:		OSITION / TITLE
MaryBeth Lyons	Proje	ect Scientist		Briar	n Hobbs			Manage	Health & Safety er
			,	Joe Gentile				Corpora	ate Health and Safety
	RF	QUIRED AND / OR REC	OMMEN	NDEL	DERSONAL	PR	OTECTIVE FOLIDMENT	Manage)
☐ LIFE VEST		GOGGLES			AIR PURIFYING				OVES: Leather, Nitrile and cut
☐ HARD HAT☐ LIFELINE / BODY HARNESS	_	FACE SHIELD: HEARING PROTECTION: (<u>a</u>			SUPPLIED RES		ATOR uorescent reflective vest or		stant HER: Insect repellant,
	ļ	needed)	_		high visibility clot				screen (as needed)
		SAFETY SHOES: Composite or steel toe boots	e-toe						
ozomino <u>(do noodod)</u>		REQUIRED A	ND / OF	R RE	COMMENDED	D EQ	QUIPMENT	ļ	
Recommended Equipment: 42"	traffic	cones, caution tape, trow	rel						
COMMITMENT TO SAFETY- A	l perso	onnel onsite will actively p	articipa	ate in	hazard recogn	nitior	n and mitigation througho	ut the day b	by verbalizing SPSAs.
EXCLUSION ZONE (EZ): A 10	-foot e	exclusion zone will be m	aintain	ned a	round moving	g eq	uipment, if present.		
Assess	200	Analyze					Act	ONO	
¹ JOB STEPS 1. Secure location	1a.	OTENTIAL HAZARDS CONTACT:		12	If in an area wi	ith f	3CRITICAL ACTI oot or vehicle traffic, delir		ork area with 42" traffic
1. Secure location	ıa.	Personnel and vehicula							c and inform others of work
		traffic may enter the wo			activity.				
		area.					st and/or high visibility clo		icle to protect worker from
					traffic.	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	or arry vernoular traine. I	OSMOIT VOIT	iole to proteot worker from
				1a.	Communicate	wor	k activity with adjacent w	ork areas.	
	1b.	FALL:	1b. Inspect pathways and work area for uneven terrain, weather-related h					eather-related hazards (i.e.,	
	Tripping/falling due to		ice, puddles, snow, etc.), and obstructions. 1b. Use established pathways and walk on stable, secure ground.						
	uneven terrain or entry/e from excavations.	exit	1b.	Ose establishe Stage equipme	ea pa ent a	atnways and walk on stal and tools in a convenient	oie, secure . stable. and	ground. d orderly manner. Store	
		nom excavations.		 Stage equipment and tools in a convenient, stable, and orderly manner. Store equipment at lowest potential energy. 					
							should stay 5 feet from in- excavation be required (xcavations and trenches.
							mployed for steep embar		
					trenches.		1 . 2	, .	.,,,
	1c.	EXPOSURE:					vith an SPF 15 or greater	whenever 3	30 minutes or more of
	10.	Exposure to sun and			exposure is ex			at a unlimbt	n articularly when warm
		excessive heat, possibly	y		use a tent to s temperatures a		le the work area from dire expected.	ect sunlight	particularly when warm
		causing sunburn, heat exhaustion or heat strok		1c.	Be aware of th	ne lo	cation of all Site personn		
					Watch for heat and shallow br			amping, ex	haustion, dizziness, rapid
		Exposure to cold temperatures possibly					ess symptoms (severe sh	ivering, slo	wing of body movement,
		causing cold stress.					ing or inability to walk, co		
		Skin burn as a result of					est and water as necessal olled area (i.e., car, site tr	,	an area that is well shaded
		if applicable.		1c.	No open flames	s/he	at sources.	, ,	
		Exposure to explosive					othing must be worn when a d be disabled when spec		
		vapors due to tank farm					hing with Permethrin prior		
		operations.		1c. '	Wear long slee	evec	d shirts and tuck in (or tap		
		Exposure to airborne du due to high wind speeds			prevent ticks fr		reaching skin. lant containing DEET on	exnosed sk	in when working in
					overgrown are	eas c	of the Site.		an whom woming in
		Biological hazards - tick bees/wasps, poison ivy,					oid contact with biologica		with a star that in a life
		thorns, insects, etc.	'		Wear cut-resis within the walk		t gloves when handling but path.	anches, sh	rups, etc. that may lie
				1c. '	Wear spoggles	s if t	he average wind speeds		
							camine themselves and c	o-worker's	outer clothing for ticks
					periodically wh If skin comes i		onsite. ontact with poison ivy, wa	sh skin thor	oughly with soap and
				,	water. If rash	pers	sists after washing, imme	diately notif	y your supervisor, the OM
					and OHSM for Occupational F	•	ssible consultation with a	physician a	t an approved
				'	Occupational F	ııed	iui Ollillo.		

Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

A hazard is a potential danger. Break hazards into five 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.

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

Assess 1JOB STEPS	Analyze ² POTENTIAL HAZARDS	Act ³CRITICAL 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.
	EXERTION: Exertion due to repetitive motion and ergonomics.	Utilize a table or raised surface for soil sampling if multiple soil samples are going to be taken to minimize repetitive bending motion.
3. Decontaminate equipment	3a. EXPOSURE/CONTACT: Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated vapors and/or soil). 3b. EXPOSURE: Chemicals in cleaning solution including ammonia.	 Wear chemical-resistant (nitrile) disposable gloves and safety glasses. Use an absorbent pad to clean spills. Properly dispose of used materials/PPE in provided drums in designated drum storage area. Remain upwind of sample and avoid breathing contaminant vapors, if they are present. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. Work on the upwind side of decontamination area. Use an absorbent pad to clean spills. 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-021	DATE: 1/4/2	2018	☐ NEW ☑ REVISED	PAGE 1 of 2	
JSA TYPE CATEGORY: GENERIC	WORK TYPE Gauging and Sampling		WORK ACTIVITY (Description) Soil Vapor Sampling (Permanent Monitoring			
DEVELOPMENT TEAM	POSITION / TITLE		Points) REVIEWE	D BY:	POSITION / TITLE	
Jeff Wills Project Hydrogeologist		Brian Hobbs		Senior Health & Safety Manager		
Julie Moriarity	Project Scientist	Joe Gentile			Corporate Health and Safety Manager	
	REQUIRED AND / OR RECOM	MENDED PER	SONAL PROTECTIVE	EQUIPMENT	·	
☐ LIFE VEST ☑ HARD HAT ☐ LIFELINE / BODY HARNESS ☑ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☑ SAFETY SHOES: Steel-toe boots		SUPPLIED RI	NG RESPIRATOR ESPIRATOR NG: <u>Fluorescent</u> or high visibility	□ GLOVES: <u>Cut-resistant & Nitriles</u> □ OTHER: <u>Buq Spray, Sun Screen, Knee Pads or knee pad</u>	_
	REQUIRED AND	O / OR RECOM	MENDED EQUIPMENT		·	
9/16" Socket and Wrench, Non-Toxic Clay, Teflon-Lined Tubing, Masterflex Tubing, Air Pump with Low Flow, Dry Cal, Enclosure (Bucket with 2 holes), Helium Gas Canister, Summa Canisters and Flow Controllers, MultiRae Photo Ionization Detector (PID), Helium Detector, Tubing Cutter, 42-inch Safety Cones, Caution Tape or Retractable Cone Bars						
COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs.						
EXCLUSION ZONE (EZ): A 5-foo	EXCLUSION ZONE (EZ): A 5-foot exclusion zone will be maintained for non-essential personnel.					

Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

A hazard is a potential danger. Break hazards into five 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, tension/compression, torque.

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

	Assess	Analyze	Act
	JOB STEPS fine and secure work	² POTENTIAL HAZARDS 1a. FALL:	3 CRITICAL ACTIONS 1a. Ensure work area is secure and inform others (third party)
are		Potential tripping hazards. 1b. CONTACT:	of work activity. 1a. Remove tripping hazards and inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.
		Potential contact with moving vehicles or pedestrians.	 1b. If working alongside roads, look both ways before entering roadways, face traffic, and utilize work vehicle to protect employees. 1b. Delineate work area (including vehicles) with traffic safety cones and caution tape or retractable cone bars. 1b. Maintain a 5-foot exclusion zone.
		1c. EXERTION:	1b. Wear high visibility clothing or reflective safety vest.
		Muscle strain while lifting and carrying equipment.	 1b. Wear high visibility clothing or reflective safety vest. 1c. When carrying equipment to/from work area, keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced. Use mechanical assistance/make multiple trips to carry equipment.

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			Act
I ~	¹JOB STEPS	² POTENTIAL HAZARDS	³ CRITICAL ACTIONS
2.	Remove well cover / close well cover.	CONTACT/CAUGHT: Pinch points and scrapes associated with hand tools and well covers.	 2a. Keep hands away from pinch points. 2a. Use hand tools with extensions to remove and replace well covers. 2a. Wear cut-resistant gloves. 2a. Use knee pads or kneeling pad when repetitive kneeling on rough ground is anticipated.
		2b. FALL: Potential tripping hazards associated with installing bolts.	Place security bolts in secure location so not to create tripping hazards. Replace security bolts so that they fit flush with monitoring well covers.
		2c. EXERTION: Physical exertion to remove bolts that were over torqued or stripped.	 2c. Replace any security bolts that show signs of stripping. Do not over tighten. 2c. Use body positioning and bending techniques that minimize muscle strain; keep back straight, bend at the knees. 2c. See 2a.
3.	Screen vapor point with PID.	3a. FALL: Potential tripping hazards associated with equipment. 3b. EXPOSURE:	 3a. Place equipment in one area close to the sampling location. 3b. Identify area where equipment is to be stored within the work area (away from main walking path). 3a. Don't leave equipment on the ground. Return equipment to storage area between uses.
		Inhalation of soil vapor	 3b. Replace brass caps immediately upon completion to avoid soil vapors migrating to the surface through sample tubing. 3b. Stand upwind of sample point during screening activities.
4.	Remove / replace brass caps at the end of the sam`ple tubing.	4a. CONTACT: Pinch points associated with hand tools and brass caps.	 4a. Use wrench to remove and replace brass caps. 4a. Wear cut-resistant gloves to protect against pinch points and scrapes.
		4b. EXPOSURE: Potential pathway for vapors to migrate to land surface.	4b. See 3b.4b. Stand up wind of sample point location.
5.	Set up soil vapor sampling equipment and calibration of meters.	5a. FALL: Potential tripping hazards associated with equipment and tubing.5b.	 5a. See 3a. 5a. Keep tubing slack to a minimum and locate the summa canister as close to the sampling location as possible. 5a. Avoid stepping over equipment and tubing.
		5b. CONTACT: Pinch points associated with handling equipment.	 5b. Do not place fingers/hands under sampling equipment. 5b. Make multiple trips when unloading equipment in work area. 5b. Wear cut-resistant gloves to protect against pinch points while handling sampling equipment.
		5c. EXPOSURE: Inhalation of calibration gas and helium.	 5c. Review SDS for each type of calibration gas used before calibrating. 5c. Calibrate meters in a well-ventilated area and keep air flow regulator away from face. 5c. Close valve on canisters after use to avoid inhalation of excess helium or calibration gas. 5c. Stand up wind of bucket during helium tracer gas test.

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Caught - victim is caught on, 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, tension/compression, torque.
3 Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs

to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

	Assess 1JOB STEPS		Analyze POTENTIAL HAZARDS		Act 3CRITICAL ACTIONS
6.	Cleaning Work Area.	6a.	FALL: Potential tripping hazards associated with equipment and tubing.	6a. 6a.	See 3a. See 3b.
		6b.	CONTACT: Storing and transport of equipment in car.	6b.	Ensure that equipment is placed securely in the vehicle. Do not stack equipment on top of each other. Secure equipment so that it will not slide while being transported. Wear cut-resistant gloves while handling/loading equipment.

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Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

APPENDIX B

SDSs for Chemicals Used

3084.0001Y.101/CVRS ROUX

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 Revision: 12.10.2015

Trade Name: Alconox

1 Identification of the substance/mixture and of the supplier

1.1 Product identifier

Trade Name: Alconox

Synonyms:

Product number: Alconox

1.2 Application of the substance / the mixture : Cleaning material/Detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer

Supplier

Alconox, Inc. 30 Glenn Street White Plains, NY 10603

Not Applicable

1-914-948-4040

Emergency telephone number:

ChemTel Inc

North America: 1-800-255-3924 International: 01-813-248-0585

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments.

Hazard-determining components of labeling:

Tetrasodium Pyrophosphate Sodium tripolyphosphate Sodium Alkylbenzene Sulfonate

2.2 Label elements:

Skin irritation, category 2. Eye irritation, category 2A.

Hazard pictograms:



Signal word: Warning

Hazard statements:

H315 Causes skin irritation.

H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P302+P352 If on skin: Wash with soap and water.

P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.

P321 Specific treatment (see supplemental first aid instructions on this label).

P332+P313 If skin irritation occurs: Get medical advice/attention.

P362 Take off contaminated clothing and wash before reuse.

P501 Dispose of contents and container as instructed in Section 13.

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 Revision: 12.10.2015

Trade Name: Alconox

Additional information: None.

Hazard description

Hazards Not Otherwise Classified (HNOC): None

Information concerning particular hazards for humans and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 Chemical characterization: None

3.2 Description: None

3.3 Hazardous components (percentages by weight)

Identification	Chemical Name	Classification	Wt. %	
CAS number: 7758-29-4	Sodium tripolyphosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	12-28	
CAS number: 68081-81-2	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2; H315 Eye Irrit. 2; H319	8-22	
CAS number: 7722-88-5	Tetrasodium Pyrophosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	2-16	

3.4 Additional Information: None.

4 First aid measures

4.1 Description of first aid measures

General information: None.

After inhalation:

Maintain an unobstructed airway.

Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:

Wash affected area with soap and water.

Seek medical attention if symptoms develop or persist.

After eye contact:

Rinse/flush exposed eye(s) gently using water for 15-20 minutes.

Remove contact lens(es) if able to do so during rinsing.

Seek medical attention if irritation persists or if concerned.

After swallowing:

Rinse mouth thoroughly.

Seek medical attention if irritation, discomfort, or vomiting persists.

Committee and the second committee and the sec

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 Revision: 12.10.2015

Trade Name: Alconox

4.2 Most important symptoms and effects, both acute and delayed

None

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents: None

5.2 Special hazards arising from the substance or mixture :

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.

Refer to Section 8.

5.4 Additional information:

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.

Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures :

Ensure adequate ventilation.

Ensure air handling systems are operational.

6.2 Environmental precautions:

Should not be released into the environment.

Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up:

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections : None

7 Handling and storage

7.1 Precautions for safe handling:

Avoid breathing mist or vapor.

Do not eat, drink, smoke or use personal products when handling chemical substances.

7.2 Conditions for safe storage, including any incompatibilities:

Store in a cool, well-ventilated area.

7.3 Specific end use(s):

No additional information.

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 Revision: 12.10.2015

Trade Name: Alconox

8 Exposure controls/personal protection





8.1 Control parameters :

7722-88-5, Tetrasodium Pyrophosphate, OSHA TWA 5 mg/m3.

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance.

Eye protection:

Safety goggles or glasses, or appropriate eye protection.

General hygienic measures:

Wash hands before breaks and at the end of work.

Avoid contact with skin, eyes and clothing.

9 Physical and chemical properties

Appearance (physical state, color):	White and cream colored flakes - powder	Explosion limit lower: Explosion limit upper:	Not determined or not available. Not determined or not available.		
Odor:	Not determined or not available. Vapor pressure at 20°C		Not determined or not available.		
Odor threshold:	Not determined or not available.	Vapor density:	Not determined or not available.		
pH-value:	9.5 (aqueous solution)	Relative density:	Not determined or not available.		
Melting/Freezing point:	Not determined or not available.	Solubilities:	Not determined or not available.		
Boiling point/Boiling range:	Not determined or not available.	Partition coefficient (n- octanol/water):	Not determined or not available.		
Flash point (closed cup):	Not determined or not available.	Auto/Self-ignition temperature:	Not determined or not available.		
Evaporation rate:	Not determined or not available.	Decomposition temperature:	Not determined or not available.		

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 Revision: 12.10.2015

Trade Name: Alconox

Flammability (solid, gaseous):

Not determined or not available.

Viscosity:

Density at 20°C:

Not determined or not available.

Viscosity:

Density at 20°C:

Not determined or not available.

10 Stability and reactivity

10.1 Reactivity: None

10.2 Chemical stability: None

10.3 Possibility hazardous reactions: None

10.4 Conditions to avoid: None

10.5 Incompatible materials: None

10.6 Hazardous decomposition products : None

11 Toxicological information

11.1 Information on toxicological effects:

Acute Toxicity:

Oral:

: LD50 > 5000 mg/kg oral rat - Product .

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Sodium Alkylbenzene Sulfonate: Causes skin irritation. .

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye irritation.

Tetrasodium Pyrophosphate: Rabbit - Risk of serious damage to eyes .

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 Revision: 12.10.2015

Trade Name: Alconox

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.

Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.4 mg/l, 48 hours.

Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.

Tetrasodium Pyrophosphate: Fish, LC50 - other fish - 1,380 mg/l - 96 h.

Tetrasodium Pyrophosphate: Aquatic invertebrates, EC50 - Daphnia magna (Water flea) - 391 mg/l - 48

h.

- 12.2 Persistence and degradability: No additional information.
- 12.3 Bioaccumulative potential: No additional information.
- 12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information. **vPvB:** No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal) Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

UN Number: ADR, ADN, DOT, IMDG, IATA		None
UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA		None
Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	Class: Label: LTD. QTY:	None None None
	ADR, ADN, DOT, IMDG, IATA UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA Transport hazard classes:	ADR, ADN, DOT, IMDG, IATA UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA Transport hazard classes: ADR, ADN, DOT, IMDG, IATA Class: Label:

US DOT

additional information.

Limited Quantity Exception: None

Bulk: Non Bulk:

RQ (if applicable): None

Proper shipping Name: None

RQ (if applicable): None

Proper shipping Name: None

Hazard Class: None Hazard Class: None Packing Group: None Packing Group: None

Marine Pollutant (if applicable): No Marine Pollutant (if applicable): No

additional information.

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according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 Revision: 12.10.2015

	Comments: None	Comments: None				
14.4	Packing group: ADR, ADN, DOT, IMDG, IATA	None				
14.5	Environmental hazards :	None				
14.6	Special precautions for user:	None				
	Danger code (Kemler):	None				
	EMS number:	None				
	Segregation groups:	None				
14.7	Transport in bulk according to Annex	II of MARPOL73/78 and the IBC Code: Not applicable.				
14.8	Transport/Additional information:					
	Transport category:	None				
		None				
	Tunnel restriction code:	None				

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture. North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.

Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed. **Rules and Orders**: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):

All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 Revision: 12.10.2015

Trade Name: Alconox

Germany MAK: Not classified.

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.

H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P302+P352 If on skin: Wash with soap and water.

P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.

P321 Specific treatment (see supplemental first aid instructions on this label).

P332+P313 If skin irritation occurs: Get medical advice/attention.

P362 Take off contaminated clothing and wash before reuse.

P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

NFPA: 1-0-0

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Safety Data Sheet according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision**: 12.10.2015

Trade Name: Alconox

HMIS: 1-0-0







Material Safety Data Sheet Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: 1-800-901-7247

International Sales: 1-281-441-4400

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS#	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammable gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4, Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:

Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:

108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:

-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:

1.1- 1.19 (Water = 1) 1.10 (20% and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl

solution) 1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available. Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:

Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:

Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the folloiwing can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:

Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (fetoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances:: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC)

R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

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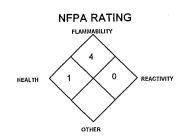
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MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART!

What is the material and what do I need to know in an emergency?

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

ISOBUTYLENE - C4H8

Document Number: Isobutylene

PRODUCT USE:

For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME:

ADDRESS:

MESA Specialty Gases & Equipment

3619 Pendleton Avenue, Suite C

Santa Ana, CA 92704

BUSINESS PHONE:

EMERGENCY PHONE:

1-714-434-7102

INFOTRAC: 1-800-535-5053

DATE OF PREPARATION:

May 10, 1999

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS#	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			
			TLV ppm	STEL ppm .	PEL ppm	STEL ppm	IDLH ppm	OTHER
Isobutylene	115-11-7	> 99.0%	There are no specific exposure limits for Isobutylene. Isobutylene is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					
Maximum Impurities < 1.0%			None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Isobutylene is a colorless, liquefied, flammable gas with an unpleasant odor similar to burning coal. The liquefied gas rapidly turns into a gas at standard atmospheric temperatures and pressures. Isobutylene is an asphyxiant and presents a significant health hazard by displacing the oxygen in the atmosphere. Rapid evaporation of liquid from the cylinder may cause frostbite. Both the liquid and gas pose a serious fire hazard when accidentally released. The gas is heavier than air and may travel to a source of ignition and flash back to a leak or open container. Flame or high temperature impinging on a localized area of a cylinder of Isobutylene can cause the cylinder to rupture without activating the cylinder's relief devices. Provide adequate fire protection during emergency response situations.

<u>SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE</u>: The most significant route of overexposure for this gas is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

<u>INHALATION</u>: High concentrations of this gas can cause an oxygen-deficient environment. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of overexposure, death may occur. Isobutylene also has some degree of anesthetic action and can be mildly irritating to the mucous membranes. The effects associated with various levels of oxygen are as follows:

CONCENTRATION SYMPTOM

12-16% Oxygen:

SYMPTOMS OF EXPOSURE
Breathing and pulse rate increased,

muscular coordination slightly disturbed.

10-14% Oxygen:

Emotional upset, abnormal fatigue,

disturbed respiration.

6-10% Oxygen:

Nausea and vomiting, collapse or loss of

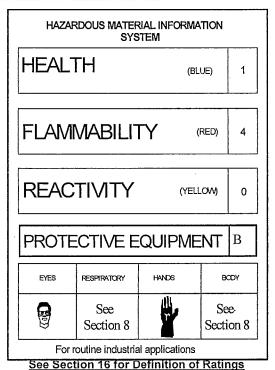
consciousness.

Below 6%:

Convulsive movements, possible respiratory

collapse, and death.

OTHER POTENTIAL HEALTH EFFECTS: Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.



<u>HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms</u>. Overexposure to Isobutylene may cause the following health effects:

ACUTE: The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, headache, dizziness, and nausea. At high concentrations, unconsciousness or death may occur. Contact with liquefied gas or rapidly expanding gases may cause frostbite.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to Isobutylene.

TARGET ORGANS: Respiratory system.

PART II What should I do if a hazardous situation occurs?

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO ISOBUTYLENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.

4. FIRST-AID MEASURES (Continued)

Remove victim(s) to fresh air as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT (Closed Cup): -10°C (< 14°F)
AUTOIGNITION TEMPERATURE: 465°C (869°F)
FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 1.8% Upper (UEL): 9.6%

<u>FIRE EXTINGUISHING MATERIALS</u>: Extinguish Isobutylene fires by shutting off the source of the gas. Use water spray or a foam agent to cool fire-exposed containers, structures, and equipment.

<u>UNUSUAL FIRE AND EXPLOSION HAZARDS</u>: When involved in a fire, this material may ignite and produce toxic gases, including carbon monoxide and carbon dioxide.

NFPA RATING
FLAMMABILITY

4

HEALTH

1

OTHER

See Section 16 for Definition of Ratings

pressure storage vessels of Isobutylene can be very dangerous. Direct flame exposure on the cylinder wall can cause an explosion either by BLEVE (Boiling Liquid Expanding Vapor Explosion), or by exothermic decomposition. This is a catastrophic failure of the vessel releasing the contents into a massive fireball and explosion. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause Isobutylene to ignite explosively if released.

<u>SPECIAL FIRE-FIGHTING PROCEDURES</u>: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the pressurized cylinder, tank car, or pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation (in enclosed areas) to prevent flammable or explosive mixture formation. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Because of the potential for a BLEVE, evacuation of non-emergency personnel is essential. If water is not available for cooling or protection of vessel exposures, evacuate the area. Refer to the North American Emergency Response Guidebook for additional information. Other information for pre-planning can be found in the American Petroleum Institute Publications 2510 and 2510A.

6. ACCIDENTAL RELEASE MEASURES

<u>SPILL AND LEAK RESPONSE</u>: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel. Adequate fire protection must be provided. Minimum Personal Protective Equipment should be Level B: fire-retardant protective clothing, gloves resistant to tears, and Self-Contained Breathing Apparatus.

Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut off with water spray. Allow the gas to dissipate. Monitor the surrounding area for combustible gas levels and oxygen. Combustible gas concentration must be below 10% of the LEL (LEL = 1.8%) prior to entry. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in place or remove it to a safe area and allow the gas to be released there.

THIS IS AN EXTREMELY FLAMMABLE GAS. Protection of all personnel and the area must be maintained.

PART III How can I prevent hazardous situations from occurring?

7. HANDLING and STORAGE

<u>WORK PRACTICES AND HYGIENE PRACTICES</u>: As with all chemicals, avoid getting Isobutylene IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Isobutylene could occur without any significant warning symptoms.

STORAGE AND HANDLING PRACTICES: Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post "No Smoking or Open Flames" signs in storage or use areas.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Isolate from oxidizers such as oxygen, chlorine, or fluorine. Use a check valve or trap in the discharge line to prevent hazardous backflow. Post "No Smoking or Open Flame" signs in storage and use areas. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand truck. Do not drag, slide, or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Isobutylene. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, Safe Handling of Compressed Gases in Containers. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

<u>VENTILATION AND ENGINEERING CONTROLS</u>: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Isobutylene dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the presence of potentially explosive air-gas mixtures and level of oxygen.

<u>RESPIRATORY PROTECTION</u>: Maintain oxygen levels above 19.5% in the workplace. Maintain level of gas below the level listed in Section 2 (Composition and Information on Ingredients). Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Isobutylene. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards.

<u>EYE PROTECTION</u>: Splash goggles or safety glasses, for protection from rapidly expanding gases and splashes of liquid Isobutylene.

<u>HAND PROTECTION</u>: Wear gloves resistant to tears when handling cylinders of Isobutylene. Use low-temperature protective gloves (e.g., Kevlar) when working with containers of liquid Isobutylene.

<u>BODY PROTECTION</u>: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product, as well as fire retardant items.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY @ 21.1°C (70°F): 2.396 kg/m³ (0.1496 lb/ft³)

SPECIFIC GRAVITY (air = 1): 1.997

SOLUBILITY IN WATER: Insoluble.

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not established.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

pH: Not applicable.

FREEZING POINT: -140°C (-220.6°F)

BOILING POINT @ 1 atm: -6.9°C (19.6°F)

EXPANSION RATIO: Not applicable

VAPOR PRESSURE (psia): 39

SPECIFIC VOLUME (ft³/lb): 6.7

<u>APPEARANCE AND COLOR</u>: Colorless gas with the unpleasant odor of burning coal. The liquid is also colorless and has the same unpleasant odor of burning coal.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

STABILITY: Stable.

<u>DECOMPOSITION PRODUCTS</u>: When ignited in the presence of oxygen, this gas will burn to produce carbon monoxide and carbon dioxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers (e.g., chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

<u>CONDITIONS TO AVOID</u>: Contact with incompatible materials and exposure to heat, sparks, and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

PART IV Is there any other useful information about this material?

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is for pure Isobutylene.

ISOBUTYLENE:

 LC_{50} (rat, inhalation) = 620 g/m³/4 hours LC_{50} (mouse, inhalation) = 415 g/m³/2 hours

SUSPECTED CANCER AGENT: Isobutylene is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, and therefore is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

<u>IRRITANCY OF PRODUCT</u>: Isobutylene may be mildly irritating to the mucous membranes. In addition, contact with rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION TO THE PRODUCT: Isobutylene is not known to cause sensitization in humans.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Isobutylene on the human reproductive system.

Mutagenicity: No mutagenic effects have been described for Isobutylene.

Embryotoxicity: No embryotoxic effects have been described for Isobutylene.

Teratogenicity: No teratogenic effects have been described for Isobutylene.

Reproductive Toxicity: No reproductive toxicity effects have been described for Isobutylene.

A <u>mutagen</u> is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An <u>embryotoxin</u> is a chemical which causes damage to a developing embryo (i.e., within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A <u>teratogen</u> is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A <u>reproductive toxin</u> is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by overexposure to Isobutylene.

11. TOXICOLOGICAL INFORMATION (Continued)

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Isobutylene.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen-deficient environments. No adverse effect is anticipated to occur to plant life, except for frost produced in the presence of rapidly expanding gases. See Section 11, Toxicological Information, for additional information on effects on animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of Isobutylene on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to MESA Specialty Gases & Equipment Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

For Isobutylene Gas:

PROPER SHIPPING NAME:

Isobutylene

HAZARD CLASS NUMBER and DESCRIPTION:

2.1 (Flammable Gas)

UN IDENTIFICATION NUMBER:

UN 1055

PACKING GROUP:

Not Applicable

DOT LABEL(S) REQUIRED:

Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 115

Alternate Description:

PROPER SHIPPING NAME:

Petroleum gases, liquefied

HAZARD CLASS NUMBER and DESCRIPTION:

2.1 (Flammable Gas)

UN IDENTIFICATION NUMBER:

UN 1075

PACKING GROUP:

Not Applicable Flammable Gas

DOT LABEL(S) REQUIRED:

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 115 MARINE POLLUTANT: Isobutylene is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101. Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Isobutylene is not subject to the reporting requirements of Sections 302, 304. and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

CANADIAN DSL/NDSL INVENTORY STATUS: Isobutylene is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Isobutylene is listed on the TSCA Inventory.

15. REGULATORY INFORMATION (Continued)

OTHER U.S. FEDERAL REGULATIONS: Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 lb. Depending on specific operations involving the use of Isobutylene, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Isobutylene is not listed in Appendix A; however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Isobutylene is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Liquefied Petroleum Gas.

California - Permissible Exposure Limits for Chemical Contaminants: Liquefied Petroleum Gas.

Florida - Substance List: Isobutylene.
Illinois - Toxic Substance List: No.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List:
Isobutylene.

Michigan - Critical Materials Register: No.

Minnesota - List of Hazardous Substances; Liquefied Petroleum Gas.

Missouri - Employer Information/Toxic Substance List: No.

New Jersey - Right to Know Hazardous Substance List: Isobutylene.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Pennsylvania - Hazardous Substance List: Isobutylene.

Rhode Island - Hazardous Substance List: Liquefied Petroleum Gas.

Texas - Hazardous Substance List: Liquefied Petroleum Gas.

West Virginia - Hazardous Substance List: Liquefied Petroleum Gas.

Wisconsin - Toxic and Hazardous Substances: Liquefied Petroleum Gas.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Isobutylene is not on the California Proposition 65 lists.

LABELING:

DANGER:

FLAMMABLE LIQUID AND GAS UNDER PRESSURE. CAN FORM EXPLOSIVE MIXTURES WITH AIR.

MAY CAUSE FROSTBITE.

Keep away from heat, flames, and sparks. Store and use with adequate ventilation.

Cylinder temperature should not exceed 52°C (125°F).

Do not get liquid in eyes, on skin, or clothing. Close valve after each use and when empty.

Use in accordance with the Material Safety Data Sheet.

FIRST AID:

IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is

difficult, give oxygen. Call a physician.

IN CASE OF FROSTBITE, obtain immediate medical attention.

DO NOT REMOVE THIS PRODUCT LABEL.

CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gas Class B1: Flammable Gas





16. OTHER INFORMATION

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. MESA Specialty Gases & Equipment assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, MESA Specialty Gases & Equipment assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. TLV - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (TWA), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (C). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration. PEL - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. The DFG - MAK is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. NIOSH is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (OSHA). NIOSH issues exposure guidelines called Recommended Exposure Levels (RELs). When no exposure guidelines are established, an entry of NE is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: 0 (normally stable), 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: <u>Health Hazard</u>: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued): Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: LD50 - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; LC50 - Lethal Concentration (gases) which kills 50% of the exposed animals; ppm concentration expressed in parts of material per million parts of air or water; mg/m³ concentration expressed in weight of substance per volume of air; mg/kg quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: IARC - the International Agency for Research on Cancer; NTP - the National Toxicology Program, RTECS - the Registry of Toxic Effects of Chemical Substances, OSHA and CAL/OSHA. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include TDLo, the lowest dose to cause a symptom and TCLo the lowest concentration to cause a symptom; TDo, LDLo, and LDo, or TC, TCo, LCLo, and LCo, the lowest dose (or concentration) to cause lethal or toxic BEI - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. EPA is the U.S. Environmental Protection Agency. WHMIS is the Canadian Workplace Hazardous Materials Information System. DOT and TC are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (SARA); the Canadian Domestic/Non-Domestic Substances List (DSL/NDSL); the U.S. Toxic Substance Control Act (TSCA); Marine Pollutant status according to the DOT; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund); and various state regulations.

INDUSTRIAL SCIENTIFIC

CORPORATION

1001 Oakdale Road Oakdale, PA 15071-1500 Phone (412) 788-4353 TOLL-FREE 800-DETECTS Fax (412) 788-8353

MATERIAL SAFETY **DATA SHEET**

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas: Oxygen, 0.0015-23.5%; Propane, 0-1.1%; n-Pentane, 0-0.75%; n-Hexane; 0-0.48%; Carbon Monoxide, 0.0005-1.0%; Hydrogen Sulfide, 0.001-0.025%

NOTE: MIXTURES COMPRISED OF AN AIR BALANCE GAS CONTAIN BETWEEN 19.5-23.5% OXYGEN.

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

EMERGENCY PHONE:

Document Number: 50016 (Replaces ISC MSDS No.1810-2187, 1810-2343, 1810-3366, 1810-3937

1810-7219, 1810-7599, 1810-6179)

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE: Calibration of Monitoring and Research Equipment

SUPPLIER/MANUFACTURER'S NAME: **CALGAZ**

ADDRESS: 821 Chesapeake Drive Cambridge, MD 21613

CHEMTREC: 1-800-424-9300

BUSINESS PHONE: 1-410-228-6400 General MSDS Information 1-713/868-0440

Fax on Demand: 1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS#	mole %			EXPOSI	JRE LIMITS I	N AIR	
			ACGIH	TLV	OS	HA	IDLH	OTHER
			TWA	STEL	TWA	STEL		
			ppm	ppm	ppm	ppm	ppm	ppm
Oxygen	7782-44-7	0.0015 - 23.5%	There are r		<u> </u>	bove 19.5%.		ls should be maintained
Propane	74-98-6	0 - 1.1%	2500	NE	1000	NE	2100	NIOSH REL: 1000 DFG MAK: 1000 ppm
n-Pentane	109-66-0	0 - 0.75%	600	750	1000 600 (Vacated 1989 PEL)	750 (Vacated 1989 PEL)	1500	NIOSH REL: TWA = 120 STEL = 610 (ceiling) 15 minutes DFG MAKs: TWA =1000 PEAK = 2•MAK, 60 min., momentary value
n-Hexane	110-54-3	0 - 0.48%	50	NE	500 50 (Vacated 1989 PEL)	NE	1100	NIOSH REL: 50 DFG MAK: 50
Hydrogen Sulfide	7783-06-4	0.001- 0.025 %	10 NIC = 5	15 NIC = 5	10 (Vacated 1989 PEL)	20 (ceiling), 50 (10 min. peak, once per shift) 15 (Vacated 1989 PEL)	100	NIOSH REL: STEL = 10 (ceiling), 10 minutes DFG MAKs: TWA = 10 PEAK = 2•MAK, 10 min., momentary value
Carbon Monoxide	630-08-0	0.0005 - 1.0%	25	NE	50 35 (Vacated 1989 PEL)	200 (ceiling) (Vacated 1989 PEL)	1200	NIOSH RELs: TWA = 35 STEL = 200 ceiling DFG MAKs: TWA = 30 PEAK = 2•MAK, 15 min., average value, 1 hr interval DFG MAK Pregnancy Risk Classification: B
Nitrogen	7727-37-9	Balance	There are n		posure limits fo en levels shou			simple asphyxiant (SA). 9.5%.

NE = Not Established.

PN 3489

NIC = Notice of Intended Change

See Section 16 for Definitions of Terms Used.

EFFECTIVE DATE: JUNE 7, 2010

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

NON-FLAMMABLE GAS MIXTURE MSDS - 50016

PAGE 1 OF 6

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This gas mixture is a colorless gas which has a rotten-egg odor (due to the presence of Hydrogen Sulfide). The odor cannot be relied on as an adequate warning of the presence of this gas mixture, because olfactory fatigue occurs after over-exposure to Hydrogen Sulfide. Hydrogen Sulfide and Carbon Monoxide (another component of this gas mixture) are toxic to humans in relatively low concentrations. Over-exposure to this gas mixture can cause skin or eye irritation, nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. The Propane, n-Pentane, and n-Hexane components can cause anesthetic or peripheral neuropathy effects. Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. A significant health hazard associated with this gas mixture is the potential of inhalation of Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this gas mixture is used in a confined space or other poorly-ventilated area. Over-exposures to Hydrogen Sulfide can cause dizziness, headache, and nausea. Exposure to this component can result in respiratory arrest, coma, or unconsciousness. Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of this gas. A summary of exposure concentrations and observed effects are as follows

CONCENTRATION OF

300-500

HYDROGEN SULFIDE OBSERVED EFFECT

Odor is obvious and unpleasant. 0.3-30 ppm

50 ppm Eye irritation. Dryness and irritation of nose, throat.

Slightly higher than 50 ppm Irritation of the respiratory system. 100-150 ppm Temporary loss of smell.

Headache, vomiting nausea. Prolonged exposure may lead to 200-250 ppm

lung damage. Exposures of 4-8 hours can be fatal. Swifter onset of symptoms. Death occurs in 1-4 hours.

Headache, excitement, staggering, and stomach ache after brief exposure. Death occurs within 0.5 - 1 hour of 500 ppm

exposure.

> 600 ppm Rapid onset of unconsciousness, coma, death.

> 1000 ppm Immediate respiratory arrest.

This gas mixture contains a maximum of 250 ppm Hydrogen

Sulfide. The higher concentration values here are presented to delineate the complete health effects which

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

PROTECTIVE EQUIPMENT

See Section 8

For Routine Industrial Use and Handling Applications

3

0

0

(BLUE)

(RED)

(YELLOW)

HEALTH HAZARD

FLAMMABILITY HAZARD

PHYSICAL HAZARD

have been observed for humans after exposure to Hydrogen Sulfide.

Inhalation over-exposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide (25 ppm), another component of this gas mixture, can result in serious health consequences. Carbon Monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs.

Since the affinity of Carbon Monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this gas mixture is released in a small, poorly ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the

following: CONCENTRATION OF

CARBON MONOXIDE **OBSERVED EFFECT**

Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red. All exposure levels: ..

200 ppm: Slight symptoms (i.e. headache) after several hours of exposure. Headache and discomfort experienced within 2-3 hours of exposure. 400 ppm:

1,000 -2000 ppm: Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger. 200-2500 ppm: Within 2 hours, there is mental confusion, headaches, and nausea. Unconsciousness within 30 minutes.

> 2500 ppm: Potential for collapse and death before warning symptoms.

Another hazard associated with this gas mixture is the potential for anesthetic and peripheral neuropathy effects after inhalation over-exposures to the Propane, n-Pentane and n-Hexane components of this gas mixture. Specific human over-exposure data are available for n-Pentane and n-Hexane, as follows:

CONCENTRATION OF n-PENTANE
Brief (10 minute) up to 5,000 ppm:
Higher than 5,000 ppm:

Long term:

OBSERVED EFFECT No symptoms.

Exhilaration, dizziness and headache can occur.

Can cause chronic neurological disorder causing damage to the nerves in the hands and feet

(peripheral neuropathy)

CONCENTRATION OF n-HEXANE

Brief (10 minute) at 1,500 ppm:

5000 ppm:

Long term at 500 ppm:

Eves and Vision:

OBSERVED EFFECT Irritation of the respiratory tract, nausea and headache.

Dizziness and drowsiness can occur.

Can affect the nerves in the arms and legs. Effects include numbing or tingling sensations in the fingers and toes, tiredness, muscle weakness, cramps and spasms in the leg, difficulty in holding objects or walking, abdominal pains, loss of appetite, weight loss. More serious exposures can cause damage to the nerves in the hands and feet (peripheral neuropathy).

Abnormal color perception and pigment changes in the eyes have been reported among industrial workers exposed to 423-1280 ppm for 5 years or more.

Blood Cells: Mild forms of anemia have also been associated with exposure to hexane. These are of

temporary nature.

Additionally, if mixtures of this gas mixture contain less than 19.5% Oxygen and are released in a small, poorly ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN

OBSERVED EFFECT

Breathing and pulse rate increased, muscular coordination slightly disturbed.

12-16% Oxygen: 10-14% Oxygen: Emotional upset, abnormal fatigue, disturbed respiration. 6-10% Oxygen: Nausea, vomiting, collapse, or loss of consciousness. Convulsive movements, possible respiratory collapse, and death.

Below 6%:

SKIN and EYE CONTACT: The Hydrogen Sulfide component of this gas mixture may be irritating to the skin. Inflammation and irritation of the eyes can occur at very low airborne concentration of Hydrogen Sulfide (less than 10 ppm). Exposure over several hours may result in "gas eyes" or "sore eyes" with symptoms of scratchiness, irritation, tearing and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing, blurring of vision, and pain when looking at light. Over-exposed individuals may see rings around bright lights. Most symptoms disappear when exposure ceases. However, in serious cases, the eye can be permanently damaged.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. However, the Hydrogen Sulfide and Carbon Monoxide components of this gas mixture are toxic to humans. Over-exposure to this gas mixture can cause nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Hydrogen Sulfide, over-exposures to this gas mixture can also irritate the skin and eyes; severe eye contamination can result in blindness. Inhalation over-exposures to Propane, n-Pentane, and n-Hexane can cause anesthetic effects and motor neuropathy (i.e. pain and tingling in feet and hands).

PN 3489 PAGE 2 OF 6

NON-FLAMMABLE GAS MIXTURE MSDS - 50016

EFFECTIVE DATE: JUNE 7, 2010

3. HAZARD IDENTIFICATION (Continued)

CHRONIC: Abnormal color perception and pigment changes in the eyes have been reported among persons exposed to 420 -1300 ppm of n-Hexane for five years. Additionally, long-term exposure to low levels of n-Hexane or n-Pentane can affect the nerves in the arms and legs. Effects include numbing or tingling sensation, tiredness, cramps, spasms in legs, difficulty holding objects or walking, loss of appetite and weight loss. Pentane isomers, such as n-Pentane, and Propane can cause sensitization of the heart to epinephrine. Refer to Section 11 (Toxicology Information) for additional information on the components of this gas mixture.

TARGET ORGANS: ACUTE: Respiratory system, blood system, central nervous system, cardiovascular system. CHRONIC: Reproductive system, cardiovascular system.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

SKIN EXPOSURE: If irritation of the skin develops after exposure to this gas mixture, immediately begin decontamination with running water.

SKIN EXPOSURE: If irritation of the skin develops after exposure to this gas mixture, <u>immediately</u> begin decontamination with running water. <u>Minimum</u> flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If irritation of the eye develops after exposure to this gas mixture, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions may be aggravated by over-exposure to this gas mixture. Carbon Monoxide, a component of this gas mixture, can aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris. Because of the presence of Hydrogen Sulfide, n-Hexane or n-Pentane in this gas mixture, central nervous system conditions, eye disorders, or skin problems may be aggravated by over-exposure to this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs. Be observant for initial signs of pulmonary edema in the event of severe inhalation over-exposures.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture contains toxic gases, Hydrogen Sulfide and Carbon Monoxide, and presents an extreme health hazard to firefighters. This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

<u>Explosion Sensitivity to Mechanical Impact</u>: Not Sensitive. <u>Explosion Sensitivity to Static Discharge</u>: Not Sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

NFPA RATING
FLAMMABILITY

0
REACTIVITY

OTHER

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic components of this gas mixture, and other safety hazards related to the remaining components of this gas mixture, than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel

For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for Hydrogen Sulfide, Carbon Monoxide, and Oxygen. Hydrogen Sulfide and Carbon Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients) and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing a gas mixture with Hydrogen Sulfide or Carbon Monoxide. If there is a malfunction or another type of operational problem, contact nearest distributor immediately. Eye wash stations/safety showers should be near areas where this gas mixture is used or stored. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All work practices should minimize releases of Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C, 70°F). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods

Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING!** Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Oxygen, Hydrogen Sulfide, and Carbon Monoxide.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if Carbon Monoxide levels exceed the exposure levels given in Section 2 (Composition and Information on Ingredients) or if oxygen levels are below 19.5%, or if either level is unknown during emergency response to a release of this gas mixture. If respiratory protection is required for emergency response to this gas mixture, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards. The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

PN 3489 PAGE 3 OF 6

NON-FLAMMABLE GAS MIXTURE MSDS - 50016

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

NIOSH/OSHA RECOMMENDATIONS FOR HYDROGEN SULFIDE CONCENTRATIONS IN AIR:

Powered air-purifying respirator with cartridge(s) to protect against hydrogen sulfide; or gas mask with canister to Up to 100 ppm:

protect against hydrogen sulfide; or SAR; or full-facepiece SCBA.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-

facepiece SAR with an auxiliary positive pressure SCBA.

Gas mask with canister to protect against hydrogen sulfide; or escape-type SCBA Escape:

NOTE The IDLH concentration for Hydrogen Sulfide is 100 ppm.

NIOSH/OSHA RECOMMENDATIONS FOR CARBON MONOXIDE CONCENTRATIONS IN AIR:

Up to 350 ppm Supplied Air Respirator (SAR)

Up to 875 ppm Supplied Air Respirator (SAR) operated in a continuous flow mode.

Gas mask with canister to protect against carbon monoxide; or full-facepiece SCBA; or full-facepiece Supplied Air Up to 1200 ppm

Respirator (SAR).

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-

facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Gas mask with canister to protect against carbon monoxide; or escape-type SCBA NOTE: End of Service Life Indicator (ESLI) required for gas masks.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: No special protection is needed under normal circumstances of use. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, the main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.072 lbs/ ft3 (1.153 kg/m3)

FREEZING/MELTING POINT @ 10 psig: -210°C (-345.8°F) **BOILING POINT**: -195.8°C (-320.4°F) SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906 pH: Not applicable. SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023 **MOLECULAR WEIGHT: 28.01**

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not applicable.

VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable. COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for the gas mixture.

APPEARANCE AND COLOR: This gas mixture is a colorless gas which has an rotten egg-like odor, due to the presence of Hydrogen Sulfide. HOW TO DETECT THIS SUBSTANCE (warning properties): Continuous inhalation of low concentrations of Hydrogen Sulfide (a component of this gas mixture) may cause olfactory fatigue, so that there are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used. Cadmium solutions will turn yellow upon contact with Hydrogen Sulfide.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Propane, n-Hexane, and n-Pentane include carbon oxides. The decomposition products of Hydrogen Sulfide include water and sulfur oxides. The other components of this gas mixture do not decompose, per se,

but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this gas mixture). Lithium reacts slowly with Nitrogen at ambient temperatures. Components of this gas mixture (Hydrogen Sulfide, Propane, n-Pentane, n-Hexane) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Hydrogen Sulfide is corrosive to most metals, because it reacts with these substances to form metal sulfides

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this gas mixture:

NITROGEN: There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the

n-PENTANE:

 LD_{50} (intravenous, mouse) = 446 mg/kg. LC_{50} (inhalation, rat) = 364 g/m³/4 hours LCLo (inhalation, mouse) = 325 g/m³/2 hours

n-HEXANE: Eye, rabbit = 10 mg/ mild

TCLo (inhalation, rat) = 10,000 ppm/7 hr.

TCLo (inhalation, rat) = 5000 ppm/20 hours; teratogenic effects

LD50 (oral, rat) = 28710 mg/kg LDLo (intraperitoneal, rat) = 9100 mg/kg LCLo (inhalation, mouse) = 120,000 mg/kg

LD50 (rat, oral): 28,710 mg/kg ACUTE INHALATION (mouse): 30,000 ppm, narcosis within 30 to 60 minutes; 35,000-40,000 ppm, convulsions and death

DERMAL (rabbit): 2 to 5 ml/kg for 4 hours resulted restlessness in and discoordination,; death occurred at 5 ml/kg.

HYDROGEN SULFIDE:

LCLo (inhalation, human) = 600 ppm/30

LDLO (inhalation, man) = 5.7 mg/kg; central nervous system, pulmonary effects

n-HEXANE (continued):

CHRONIC INHALATION (rat): ppm, 5 days/week, peripheral neuropathy in 45 days; 850 ppm for 143 days, loss of weight and degeneration of the sciatic nerve. (mouse): 250 ppm, peripheral neuropathy within 7 months; no effects at 100 ppm.

PROPANE:

No toxicity or Long-Term Inhalation: abnormalities were observed when monkeys were exposed to approximately 750 ppm for 90 days. Similar results were obtained when monkeys were exposed to an aerosol spray containing 65% propane and isobutane.

CARBON MONOXIDE:

TCLo (inhalation, mouse) = 65 ppm/24 hours (7-18 preg): rep. effects

TCLo (inhalation, mouse) = 8 pph/1 hour (female 8D post); ter, effects

HYDROGEN SULFIDE (continued):

LCLo (inhalation, human) = 800 ppm/5

 LC_{50} (inhalation, rat) = 444 ppm

CARBON MONOXIDE (continued):

EXPANSION RATIO: Not applicable. SPECIFIC VOLUME (ft³/lb): 13.8

> TCLo (inhalation, human) = 600 mg/m³/10 minutes

> LCLo (inhalation, man) = 4000 ppm/30 minutes

> TCLo (inhalation, man) = 650 ppm/45 minutes: central nervous system and blood system effects.

LCLo (inhalation, human) = 5000 ppm/5 minutes

LCLo (inhalation, dog) = 4000 ppm/46 minutes

LCLo (inhalation, rabbit) = 4000 ppm LC₅₀ (inhalation, rat) = 1811 ppm/4 hours

LC₅₀ (inhalation, guinea pig) = 2450 ppm/4 hours

 LC_{50} (inhalation, guinea pig) = 5718 ppm/4 hours

LCLo (inhalation, mammal) = 5000 ppm/5 minutes

 LD_{50} (inhalation, wild bird) = 1334 ppm

HYDROGEN SULFIDE (continued):

EFFECTIVE DATE: JUNE 7, 2010

LC₅₀ (inhalation, mouse) = 673 ppm/1 hour LCLo (inhalation, mammal) = 800 ppm/5 minutes

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies

IRRITANCY OF PRODUCT: The Hydrogen Sulfide component of this gas mixture, is irritating to the eyes, and may be irritating to the skin.

SENSITIZATION OF PRODUCT: The components of this gas mixture are not known to be skin or respiratory sensitizers. Pentane isomers (i.e. n-Pentane) and Propane can cause cardiac sensitization to epinephrine.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture on the human reproductive

Mutagenicity: No mutagenicity effects have been described for the components of this gas mixture.

Embryotoxicity: This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans due to the small cylinder size and small total amount of all components. The Carbon Monoxide component of this gas mixture which exists up to 1%, can cause teratogenic effects in humans. Severe

11. TOXICOLOGICAL INFORMATION (continued)

exposure to Carbon Monoxide during pregnancy has caused adverse effects and the death of the fetus. In general, maternal symptoms are an indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the fetus.

Reproductive Toxicity: The components of this gas mixture are not expected to cause adverse reproductive effects in humans.

A <u>mutagen</u> is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A <u>teratogen</u> is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A <u>reproductive toxin</u> is any substance which interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES (BEIs): Biological Exposure Indices (BEIs) have been determined for the components of this gas mixture, as

CHEMICAL DETERMINANT	SAMPLING TIME	BEI			
CARBON MONOXIDE Carboxyhemoglobin in blood Carbon monoxide in end-exhaled air	End of shift End of shift	• 3.5% of hemoglobin • 20 ppm			
n-HEXANE • 2,5-Hexanedione in urine • n-Hexane in end-exhaled air	• End of shift	• 5 mg/g creatinine			

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture.

OXYGEN: Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log K_{ow} = -0.65

PROPANE: Log K_{ow} = 2.38. Water Solubility = 62.4 ppm, 25°C. Propane is readily degraded by soil bacteria.

PENTANE: Log Kow = 3.39. Water Solubility = 38.5 mg/L. LOG BCF (n-pentane) = calculated, 1.90 and 2.35, respectively. Photolysis, hydrolysis, and bioconcentration are not anticipated to be important fate processes. Biodegradation and soil adsorption are anticipated to be

more important processes for this compound. **n-HEXANE:** Log $K_{ow} = 3.90$ -4.11. Water Solubility = 9.5 mg/L. Estimated Bioconcentration Factor =2.24 and 2.89. Bioconcentration in aquatic organisms is low. Hexane is volatile. Rapid volatilization from water and soil is anticipated for this compound. Hexane will float in slick on

HYDROGEN SULFIDE: Water Solubility = 1 g/242 mL at 20°C.

CARBON MONOXIDE: Water solubility = 3.3 ml/100 cc at 0 °C, 2.3 ml at 20°C.

NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C; 1.6 volumes Nitrogen/100 volumes water at 20°C. EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this gas mixture's effects on plant and animal life. The Hydrogen Sulfide and Carbon Monoxide components of this gas mixture, can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. This gas mixture may also be harmful to plant life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of this gas effects on aquatic life. The presence of more than a trace of Carbon Monoxide is a hazard to fish. The following aquatic toxicity data are available for the Hydrogen Sulfide component of this gas mixture.

21-22 °C

TLm (Asellussp) = 0.111 mg/L/96 hour TLm (Cranfgonyx sp) =1.07 mg/L/96 hour TLm (Gammarrus) = 0.84 mg/L/96 hour

TLm (Pimephlaes promelas, fathead minnow) = 0.0071-0.55 mg/L/96 hour

TLm (Lepomis macrochirus, bluegill sunfish) = 0.0448 mg/L/96 hour at

 LC_{50} (fly inhalation) = 380 mg/m³/960 minutes LC_{50} (fly inhalation) = 1500 mg/m³/7 minutes

TLm (Salvenilis foninalis, brook trout) = 0.0216-0.038 mg/L/96 hour at 8-12.5 °C

TLm (Lepomis macrochirus, bluegill sunfish) = 0.0478 mg/L/96 hour

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956 PACKING GROUP: Not Applicable

DOT LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas) NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101,

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas is considered as Dangerous Goods, per

regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956 **PACKING GROUP:** Not Applicable

HAZARD LABEL: Class 2.2 (Non-Flammable Gas) SPECIAL PROVISIONS: None

EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: 0.12 **ERAP INDEX:** None PASSENGER CARRYING SHIP INDEX: None

PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX: 75

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: This gas is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows:

COMPONENT	SARA 302 (40 CFR 355, Appendix A)	SARA 313 (40 CFR 372.65)	
n-Hexane	NO	YES	YES
Hydrogen Sulfide	YES	YES	YES

15. REGULATORY INFORMATION (Continued)

U.S. SARA THRESHOLD PLANNING QUANTITY: Section 302 EHS TPQ = Hydrogen Sulfide = 500 lbs (227 kg); U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Hexane = 5000 lb (2270 kg); Hydrogen Sulfide = 100 lbs (45.4 lb) OTHER U.S. FEDERAL REGULATIONS:

- Hydrogen Sulfide, Carbon Monoxide, Propane, n-Pentane and n-Hexane are subject to the reporting requirements of CFR 29 1910.1000.
- Hydrogen Sulfide, Propane and n-Pentane are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of these gases is 10,000 pounds and so this mixture will not be affected by the regulation.
- Depending on specific operations involving the use of this gas mixture, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lbs.
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen, Oxygen and n-Hexane are not listed Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen Sulfide is listed under this regulation in Table 1 as a Regulated Substance (Toxic Substance), in quantities of 10,000 lbs (4,553 kg) or greater. Carbon Monoxide, Propane and n-Pentane are listed under this regulation in Table 3, as Regulated Substances (Flammable), in quantities of 10,000 lbs (4,553 kg) or greater, and so this mixture will not be affected by the regulation.

Chemical Contaminants:
Nitrogen, Propane, n-P Carbon Monoxide, n-Pentane, Hydrogen Sulfide.

Florida - Substance List:

Oxygen, Monoxide, n-Pentane, n-Hexane, Hydrogen

Illinois - Toxic Substance List: Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide. Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Oxygen, Carbon Propane, n-Pentane, Monoxide, Hydrogen Sulfide.

quantities of 10,000 lbs (4,553 kg) or greater, and so this mixture will not be allected by the regulation.

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances:

Substances: Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

Minnesota - List of Hazardous Substances:

Carbon Monoxide, Propane, n-Pentane, n-Pentane, n-Hexane, Hydrogen Sulfide.

California - Permissible Exposure Limits for Hexane, Hydrogen Sulfide.

Minnesota - List of Hazardous Substances:

Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

Minnesota - List of Hazardous Substances:

Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

California - Permissible Exposure Limits for Hexane, Hydrogen Sulfide.

Minnesota - List of Hazardous Substances:

Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

Minnesota - List of Hazardous Substances:

Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

November Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

November Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

issouri - Employer Substance List t: Missouri Information/Toxic n-Pentane, n-Hexane, Propane, Hydrogen Sulfide.

ew Jersey - Right to Know Hazardous

New Jersey - Right to Know Hazardous
Substance List: Oxygen, Carbon Monoxide,
Nitrogen, Propane, n-Pentane, n-Hexane.
North Dakota - List of Hazardous Chemicals,

Reportable Quantities: Hydrogen Sulfide.

Oxygen, Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.

Texas - Hazardous Substance List: n-Pentane, n-Hexane, Propane, Hydrogen Sulfide.

West Virginia - Hazardous Substance List: n-

Pentane, n-Hexane, Propane, Hydrogen Sulfide.

Wisconsin - Toxic and Hazardous Substances:

n-Pentane, n-Hexane, Propane, Hydrogen Sulfide

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): The Carbon Monoxide component of this gas mixture is on the California Proposition 65 lists as a chemical known to the State of California to cause birth defects or other reproductive harm. ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this gas mixture are on the Canadian DSL Inventory.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances List.

CANADIAN WHMIS CLASSIFICATION: This gas mixture is categorized as a Controlled Product, Hazard Classes A and D2A, as per the Controlled Product Regulations.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900. Compressed Gas

> "Safe Handling of Compressed Gases in Containers" AV-1 "Safe Handling and Storage of Compressed Gases"

> > "Handbook of Compressed Gases"

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc. PO Box 3519, La Mesa, CA 91944-3519

619/670-0609

Fax on Demand: 1-800/231-1366



This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

EFFECTIVE DATE: JUNE 7, 2010

PN 3489 PAGE 6 OF 6

Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

APPENDIX C

Incident Investigation and Reporting Management Program

3084.0001Y.101/CVRS ROUX



INCIDENT INVESTIGATION AND REPORTING MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER : Brian Hobbs, CIH, CSP

EFFECTIVE DATE : 01/19

REVISION NUMBER : 4



TABLE OF CONTENTS

1.	PURPOSE	1
2.	SCOPE AND APPLICABILITY	,
J.	RESPONSIBILITIES	1
	3.3 Office Health and Safety Manager (OHSM)	1
	3.5 Site Health and Safety Officer (SHSO) 3.6 All Personnel	2
4		
•	PROCEDURE	2
	pendix A – Accident Report and Investigation Form	
	pendix B – Near Loss Form	
	pendix C – Injury Illness Reporting Flow Chart	

APPENDICES

Appendix A – Accident Report and Investigation Form

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 <u>immediately</u> 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	: AD	MINISTRATI	VE INF	ORMA	ATION	l					
Project #: Project Name: Project Location (stree	t address/city/state	e):	-	Immediate Verb	al Notifica	tions Gi	ven	☐ Initial	7 STATUS (24 hr)	` ☐ Fina	e): al (5-10 day	/s)	
				Composite Health	0 0-4-4.	□Yes		Date:	4 Damant D	Date:			
Client Corporate Name	/ Contact / Addr	ess / Phone #	<u>:</u>	Corporate Health	Accident Report Delivered To:								
			_		Office Health & Safety Yes No				Corporate Health & Safety ☐Yes ☐No Office Health & Safety ☐Yes ☐No				
			_	Office Manager		□Yes				ty		□No	
			_	Project Principal		□Yes		Office Ma	0			□No	
				Project Manager		□Yes		Project Pr	•			□No	
			_	Client Contact		□Yes		Project Ma			□Yes	∐No	
			_	REPORT TYPE:	☐ Los	ss	☐ Nea	r Loss	Estimated	d Costs:	\$		
				Corporate Health	2 Cofoty	Confirm	od Final	Assident	Donort				
OSHA CASE # Assigne Applicable:	d by Corporate He	ealth & Safety	if	Corporate Health ☐Yes	□No	Commin	eu rinai	Accident	Report				
DATE OF INCIDENT: TIME INCIDENT OCCURRED				INCIDENT LOCA	TION - City	/, State, ar	nd Country	/ (If outside l	U.S.A.)				
INCIDENT TYPES: (Se	lect most appropri	ate if Loss occ	curred.)	'									
From lists below, please				ne incident. When s	electing an	injury or	illness, a	lso indicat	e the sever	rity level.			
□INJURY	□ILLNESS			OTHER INCIDENT	TYPES								
Seve	rity Level			☐Spill / Release	□Mis	lisdirected Waste ☐Consent Order ☐NOV							
□Fatality	☐First Aid	□Medical		Material involved:			_	roperty Damage					
☐Restricted Work	Lost Time	Treatment		Quantity (U.S. Gallo	· —		_	lotor Vehicle ☐Fine / Penalty					
ACTIVITY TYPE (Check n				INJURY TYPE (Che					FECTED (
☐CAMP ☐G: ☐Construction ☐O:	auging	☐Subsurface Clearance		☐ Abrasion ☐ Amputation	☐Occupati ☐Punctur		∐Res □Nec	piratory	☐Shoulde ☐Arm]Face]Leg		
	aıvı ther Soil Work	☐Trucking		∏Burn	□ Punctur □ Rash	е	☐ Che		□Wrist		⊒Leg]Knee		
	e.g. Compaction)	☐Waste Mgm	nt.	☐Cold/Heat Stress	Repetiti	ve Motion			☐Hand/Fir	· ·	Ankle		
☐ Excavation ☐ Sa	ampling	☐Work Area I	Prep.	☐Inflammation	☐Sprain/S	Strain	□Gro	n	□Eye	Ī	Foot/Toes		
	te Walk/Inspection	Other		Laceration	☐Other_		□Bac		Head		Other		
I. PERSON(S) DIRECTL							essary/a	oplicable.)		1			
	Designate:		As appli		As applicable					As applica			
	Roux/Remedial Empl Roux/Remedial Subd			Occupation; urrent Occupation;	Employer Na Address; an					Phone #:	r Name; and		
	Client Employee			Position; and	Phone #:	u .				T HOHE #.			
	Client Contractor			urrent Position:									
	Third Party												
1)													
2)													





II. PERSONS INJURED IN INCIDENT (Attach additional information as necessary/applicable.)											
Name/Phone # of Each Person Injured in Incident:	Designate Roux/Ren	e: nedial Employee nedial Subcontractor ployee ntractor	As applica Current C Yrs in Cur Current P	s applicable, urrent Occupation; sin Current Occupation; and urrent Position: As applicable, Employer Nam Address; and Phone #:				As applicat Supervisor Phone #:	ole, Name; and	Description of Injury:	
1)											
2)											
III. PROPERTY DAMAGE	D IN INC										
Property Damaged:		Property Location:	(Owner Name, Addre	ess & Phone #:	D	Description of Damage:			stimated Cost:	
1)											
2)							\$				
IV. WITNESSES TO INCII	DENT (ΔΗ	tach additional informati	on as nec	ressan/annlicable)							
Witness Name:	JEITT (AU	acii additional informati		Address:				Phone	e #:		
1)											
2)											
		PART 2: WH	AT H	APPENED A	ND INCID	ENT	DETAIL	_S			
I. AUTHORITIES/GOVE	RNMENT	AL AGENCIES NOTIF	IED (Attac	ch additional informa	ation as necessa	ary/appli	cable.)				
Authority/Agency Notified:		Name/Phone #/Fax # (Notified:	of Person	Address of Pers	on Notified:	Date &	Time of Notif	fication: Exact Information Reported/Provided:			
		11001100.									
II. PUBLIC RESPONSE	S TO INC	IDENT (if applicable)									
Response/Inquiry By (check one) Newspaper	:	Entity Name:		Name/Phone # Inquirer:	of Respondent/	Addres	s of Entity/Pe	rson:	Date & Time	of Response/Inquiry:	
☐Television ☐Community Group ☐Neighbors ☐Other											
Describe Response/Inquiry:											
Roux/Remedial Response:											
(Check all that apply.) (At ATTACHED INFORMAT			p illustrate Sketches		cle Acord Form		☐Police Report ☐Other				
Name(s) of person(s) w Report:	ho prepa	red Initial and Final	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.

	et. If Factors 1-7		apply to the incident, write "External					
	DESC	RIPTI	ON OF UNDESIRABLE BEHA	VIOF	R/CONDIT	ION		
1.								
2.								
Selection of factors			OLUTION(S): HOW TO REDUCE POSSIBIL alysis of investigation team and is not meant t solution.					Root Cause and/or
CAUSAL FACTOR/ BEHAVIOR/ CONDITION	ROOT CAUSE	[SOLUTION(S) Must Match Root Cause(s)]		ERSON PONSIBLE		EED DUE ATE	ACTUAL COMPLETION DATE
INVESTIGATION	TEAM: INT NAME		JOB POSITION		DATE		Q.	IGNATURE
FR	INT NAME		JOB POSITION		DATE		IGNATURE	
						<u> </u>		
	W Correct root caus	se(s) ident	fied? Do root cause(s) and solution(s) match	? Are so	olution(s) feasib	ole / mai	ntainable?	
Name:	T. 4. D. 11. O. 1		Job Title:	11 (1	Maria Oal	4*	cc	(* -0)
		utions	were Implemented & Valida Verifier / Validator Name and Job Title					
Date	Solution		Verifier / Validator Name and Job Title		De	talis (or	I & V perfo	irmea)



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)

(Check applicable co	ompany name)								
PART 1: ADMINISTI	RATIVE INFORMATION								
Office: ☐ New York ☐ Massachusetts ☐ New Je									
Project Manager: P	roject Principal:								
Project Name: P	roject Location:								
PART 2: NEAR LOS	SS INCIDENT DETAILS								
Date\Time Occurred (MM/DD/YYYY HH:MM):	ate\Time Submitted (MM/DD/YYYY HH:MM):								
NEAR LOSS INCIDENT TYPE - What could have happened	I? - Select all that apply (1-7)								
1. ☐ Fire / 3. ☐ Security (e.g., Explosion theft, trespassing, vandalism) 2. ☐ Injury / vandalism) 3. ☐ Security (e.g., exceedance, etc.) 4. ☐ Environmental (Spill, permit exceedance, etc.) 5. ☐ Transportation of personnel (vehicle accident) 6. ☐ Property/Equipment Damage 7. ☐ Business Interruption accident)									
Event Leading to Potential Injury/Illness:									
Job Task*:	quipment 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:									
, ,	AL 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 resterm and/or life altering complications.	sulting in significant physical body damage with probable long								
INCIDENT INVOLVED:									
Roux Employee: 🗌 Yes 🔲 No Subcontractor Co	mpany Name:								
INVESTIG	ATION TEAM								
NAME JOB TITLE N	AME JOB TITLE								



PART 3: INCIDENT INVESTIGATION FINDINGS AND REPORT QUALITY REVIEW

			,	407121111							
Date Invest	igation Sta	rted (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 R maintainable		rect root cause(s) identified? Do root cause(s) and	solution(s) match?	Are solution(s) fea	sible /						
Name:		Job Title:									
PAR	PART 4: Date Solutions were Implemented & Validated (Were Solutions Effective?)										

Date	Solution	Verifier / Validator Name and Job Title	Details (of I & V performed)					

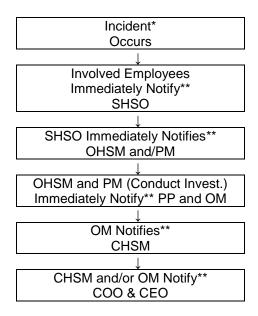
*JOB TASK - Select the most appropriate one (primary job associated with incident-related work activity, avoid "Other" if possible) 1. CAMP 7. O&M 12. Trucking 2. Construction 8. Other Soil Work (e.g. 13. Waste Management 3. Drilling4. Driving Compaction) 14. Work Area Preparation 9. Sampling 15. Other 5. Excavation/Trenching 10. Site Walk/ Inspection 11. Subsurface Clearance 6. Gauging





Appendix C - Injury Illness Reporting Flow Chart

Health & Safety Near/Loss – Loss (Incident)*
Notification Flow Chart



^{*} 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")

Initial Incident Report (written) to SHSO, OHSM, OM and CHSM within 24 hours Follow-up Report within one week.

^{**} Verbal Notification

Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

APPENDIX D

ACORD® Automobile Loss Notice Form

3084.0001Y.101/CVRS ROUX

ACC	ORI) ®			4	AUTON	ЮВ	ILE	Los	S NC	TI	CE				DATE	(MM/DD/	YYYY)
AGENCY	PHO (A/O	NE , No, Ext):	:				COMPA	ANY	NAIC CO	DE:			MISCEL	MISCELLANEOUS INFO (Site & location code))
FAX (A/C, No):							POLICY	YNUMBER		POLICY TY	/PE	PE REFERENCE NUM			IBER			CAT#
(A/C, No): E-MAIL ADDRESS:							 					DATE	05.4001051	IT AND TH			PREVIOUSLY	
CODE:				SUB CODE	:			ECTIVE DAT	E E	PIRATION D	JAIE	DATE	OF ACCIDE	PF ACCIDENT AND TIME			REPO	RTED
AGENCY CUSTOME	R ID:															PM	YES	NO
NAME AND									CONTA	CT D ADDRESS		CON	NTACT INSUF	RED				
NAME AND	ADDICEC	•		SOCS	EC#OR	FEIN:			NAME AN	DADDREGO	Wi	HEN TO CO	ONTACT:			WHE	RE TO C	ONTACT
RESIDENCE PHONE (A/C, No):									RESIDENC	CE PHONE (A	A/C, No):						
BUSINESS	BUSINESS PHONE (A/C, No, Ext):								BUSINESS	S PHONE (A/	C, No, E	Ext):						
CELL PHO	NE (A/C, N	lo):							CELL PHO	NE (A/C, No):							
E-MAIL AD	DRESS:								E-MAIL A	DDRESS:								
LOSS LOCATION	OF									AUTHOR	ITY				VIOLATIO	ONS/CIT/	ATIONS	
ACCIDENT (Include cit										REPORT								
POLICY BODILY	INJURY	В	ODILY II	ŊJUŖY	PROPI	ERTY DAMAGE	SINGL	E LIMIT	MEDICAI	PAYMENT		TC DEDUC	TIBLE O	THER CO	VERAGE &	DEDUC	TIBLES	
(Per P	erson)		(Per Acc	ident)									((JM, no-fau	lt, towing,	etc.)		
LOSS PAYI	ΞE	'									(COLLISION	I DED					
UMBRELLA EXCESS	V L	MBRELLA		EXCESS	CARRII	ER:			LIMITS:		·	AGGR			PER CLAIM/O	СС		SIR/ DED
INSURE		ICLE						BODY										
VEH#	YEAR	MAKE:						TYPE:							PLAT	E NUMB	ER	STATE
		MODEL:						V.I.N.:				RES	IDENCE PHO	NE (A/C, I	No):			
OWNER'S NAME & ADDRESS												BUS	SINESS PHON	IE (A/C, No	o, Ext):			
DRIVER'S												RES	IDENCE PHO	NE (A/C, I	No):			
NAME & ADDRESS (Che	ck if)										BUS	SINESS PHON	IE (A/C, No	o, Ext):			
RELATION (Employee,	TO INSUI	ED		DATE OF E	BIRTH	DRIVER'S LICEN	SE NUMBE	R			STATE	PURPOSE OF USE	E			US PEI	YES	N?
DESCRIBE			ERE CAI	N VEHICLE	BE SEE!	N?	WHEN C	:AN VEH BE S	SEEN?	OTHER INS	SURANG	CE ON VEH	HICLE					

PROPERTY DAMAGED	VEHICLE?	,	YES	NO	YR:		AKE:	M	ODE	<u>L:</u>			PLATE	Ε#:		
DESCRIBE PROPERTY (Other Than Vehicle)							/EH/PROP INS	AGENCY NAM	E :							
						YES	S NO	POLICY #:		RESI	DENC	E PHONE	(A/C, No):			
OWNER'S NAME &										BUSINESS PHONE (A/C, No, Ext):						
ADDRESS																
OTHER DRIVER'S										RESIDENCE PHONE (A/C, No):						
NAME & ADDRESS (Check if		BUSINESS PHONE (A/C, No, E						A/C, No, Ext):								
(Check if same as owner) DESCRIBE DAMAGE																
ESTIMATE AMOUNT	: AMOUNT WHERE CAN DAMAGE BE SEEN?															
ESTIMATE AMOUNT																
NJURED																
	NAME & ADDRE	ESS					PHONE	(A/C, No)	PED	INS VEH	OTH VEH	AGE	Е	XTENT OF INJUR	ξΥ	
											Ш					
WITNESSES OR PASSEN	IGERS												I			
	NAME & ADDRE	ESS					PHONE (A/C, No)			OTH VEH			OTHER	(Specify)		
							T			L	L					
REPORTED BY		REPORTED TO														
SIGNATURE OF INSURED DATE (MM/DD/YY						D/YYYY)	Y) SIGNATURE OF PRODUCER						DATE (MM/	DD/YYYY)		
REMARKS (Include Adjus	ster Assigne	<u>d)</u>														

Applicable in Arizona

For your protection, Arizona law requires the following statement to appear on this form. Any person who knowingly presents a false or fraudulent claim for payment of a loss is subject to criminal and civil penalties.

Applicable in Arkansas, Delaware, District of Columbia, Kentucky, Louisiana, Maine, Michigan, New Jersey, New Mexico, North Dakota, Pennsylvania, South Dakota, Tennessee, Texas, Virginia, Washington and West Virginia

Any person who knowingly and with intent to defraud any insurance company or another person, files a statement of claim containing any materially false information, or conceals for the purpose of misleading, information concerning any fact, material thereto, commits a fraudulent insurance act, which is a crime, subject to criminal prosecution and civil penalties. In DC, LA, ME, TN, VA and WA, insurance benefits may also be denied.

Applicable in California

For your protection, California law requires the following to appear on this form: Any person who knowingly presents a false or fraudulent claim for payment of a loss is guilty of a crime and may be subject to fines and confinement in state prison.

Applicable in Colorado

It is unlawful to knowingly provide false, incomplete, or misleading facts or information to an insurance company for the purpose of defrauding or attempting to defraud the company. Penalties may include imprisonment, fines, denial of insurance, and civil damages. Any insurance company or agent of an insurance company who knowingly provides false, incomplete, or misleading facts or information to a policy holder or claimant for the purpose of defrauding or attempting to defraud the policy holder or claimant with regard to a settlement or award payable from insurance proceeds shall be reported to the Colorado Division of Insurance within the Department of Regulatory Agencies.

Applicable in Florida and Idaho

Any person who knowingly and with the intent to injure, defraud, or deceive any insurance company files a statement of claim containing any false, incomplete or misleading information is guilty of a felony.*

* In Florida - Third Degree Felony

Applicable in Hawaii

For your protection, Hawaii law requires you to be informed that presenting a fraudulent claim for payment of a loss or benefit is a crime punishable by fines or imprisonment, or both.

Applicable in Indiana

A person who knowingly and with intent to defraud an insurer files a statement of claim containing any false, incomplete, or misleading information commits a felony.

Applicable in Minnesota

A person who files a claim with intent to defraud or helps commit a fraud against an insurer is guilty of a crime.

Applicable in Nevada

Pursuant to NRS 686A.291, any person who knowingly and willfully files a statement of claim that contains any false, incomplete or misleading information concerning a material fact is guilty of a felony.

Applicable in New Hampshire

Any person who, with purpose to injure, defraud or deceive any insurance company, files a statement of claim containing any false, incomplete or misleading information is subject to prosecution and punishment for insurance fraud, as provided in RSA 638:20.

Applicable in New York

Any person who knowingly and with intent to defraud any insurance company or other person files an application for commercial insurance or a statement of claim for any commercial or personal insurance benefits containing any materially false information, or conceals for the purpose of misleading, information concerning any fact material thereto, and any person who in connection with such application or claim knowingly makes or knowingly assists, abets, solicits or conspires with another to make a false report of the theft, destruction, damage or conversion of any motor vehicle to a law enforcement agency, the Department of Motor Vehicles or an insurance company, commits a fraudulent insurance act, which is a crime, and shall also be subject to a civil penalty not to exceed five thousand dollars and the value of the subject motor vehicle or stated claim for each violation.

Applicable in Ohio

Any person who, with intent to defraud or knowing that he/she is facilitating a fraud against an insurer, submits an application or files a claim containing a false or deceptive statement is guilty of insurance fraud.

Applicable in Oklahoma

WARNING: Any person who knowingly and with intent to injure, defraud or deceive any insurer, makes any claim for the proceeds of an insurance policy containing any false, incomplete or misleading information is guilty of a felony.

Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

APPENDIX E

Personal Protective Equipment Management Program

3084.0001Y.101/CVRS ROUX



PERSONAL PROTECTIVE EQUIPMENT MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER : Brian Hobbs, CIH, CSP

EFFECTIVE DATE : 01/19

REVISION NUMBER : 4



TABLE OF CONTENTS

1.	PURPOSE
	SCOPE AND APPLICABILITY
3.	PROCEDURES
	3.1 Introduction
	3.2 Types of PPE
	3.3 Protective Clothing Selection Criteria
	3.3.1 Chemicals Present
	3.3.2 Concentration of the Chemical(s)
	3.3.3 Physical State
	3.3.4 Length of Exposure
	3.3.5 Abrasion
	3.3.6 Dexterity
	3.3.7 Ability to Decontaminate
	3.3.8 Climactic Conditions
	3.3.9 Work Load4
	3.4 Types of Protective Materials
	3.5 Protection Levels
	3.5.1 Level A Protection
	3.5.2 Level B Protection
	3.5.3 Level C Protection6
	3.5.4 Level D Protection6
	3.5.5 Level E Protection6
	3.5.6 Additional Considerations



1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following program 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.



- 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 °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:
 - o overalls and long-sleeved jacket; or
 - o 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-bycase basis. Escape masks could be strategically located at the site in areas that have higher possibilities of vapors, gases or particulates.

Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

APPENDIX F

Respiratory Protection Management Program

3084.0001Y.101/CVRS ROUX



RESPIRATORY PROTECTION MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER : Brian Hobbs, CIH, CSP

EFFECTIVE DATE : 01/2019

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TABLE OF CONTENTS

1.	PURPOSE	. 1
2.	SCOPE AND APPLICABILITY	. 1
3.	MEDICAL EXAMINATION/CLEARANCE	. 2
4.	APPROVED EQUIPMENT & RESPIRATOR SELECTION	. 3
5.	INSPECTION AND MAINTENANCE 5.1 Inspection: 5.2 Maintenance: 5.3 Reporting Respirator Problems:	. 4
6.	CLEANING AND DISINFECTING	. 5
7.	STORAGE	. 5
8.	TRAINING	. 5
9.	RECORDS	. 6
10	. PROGRAM EVALUATION	. 6

APPENDICES

- Appendix A Capabilities and Limitations of Respirators
- Appendix B Respirator Fitting
- Appendix C Fit Test Protocols and Procedures OSHA 1910.134
- Appendix D OSHA 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard
- Appendix E Fit Factor vs. Protection Factor
- Appendix F Special Problems



1. PURPOSE

The health and safety philosophy of Roux is to use effective engineering controls and administrative controls to eliminate or reduce exposure to respiratory hazards to the point where respirators are not required. The practices and procedures described herein constitute the program under which respiratory protection devices (RPDs) will be effectively utilized during activities that have the potential to result in personnel exposures to airborne hazardous materials. The primary objective of the respiratory protection management program (RPMP) is to prevent harmful exposures to air contaminants that cannot be controlled using accepted engineering control measures (e.g., general and local exhaust ventilation, enclosure or isolation, and substitution of less hazardous processes or materials) or administrative controls (e.g., procedures that minimize exposure to air contaminants). No Roux Associate, Inc. employee is authorized to enter an immediately dangerous to life and health (IDLH) atmosphere; therefore, the program does not allow the use of supplied-air respirators (SARs) or self-contained breathing apparatus (SCBA). Roux has a limited number of employees who are potentially exposed to respiratory hazards during routine operations; the hazards include particulates and toxic chemicals.

The respiratory protective devices will be of the type approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) or acceptable to the US Department of Labor, Occupational Safety and Health Administration (OSHA) for the specific contamination to which the employee is potentially exposed. Respiratory protective devices will be appropriate for the hazardous material(s) involved and the extent and nature of the work requirements and conditions.

2. SCOPE AND APPLICABILITY

The practices and procedures described in this program constitute under which respiratory protective device will be effectively utilized during Roux activities involving personnel exposures to hazardous materials. The RPMP applies to all employees who are provided RPDs, or who may be required to wear RPDs to protect their health. The RPMP is intended, in part, to meet the written respiratory protection management program requirements stipulated by OSHA at 29 CFR 1910.134 and 1926.103. All information provided in this program is derived from the OSHA standard; however, to ensure compliance with 1910.134 and 1926.103 requirements, the OSHA standards and applicable mandatory appendices should be consulted (see Appendix C). All respirators, training and medical examinations are provided at no cost to employees. Specific work-site procedures where respirators are required are covered in site-specific Health and Safety Plans (HASPs).

An effective RPMP includes the following elements:

- A written statement of company program, including assignment of individual responsibility, accountability, and authority of required activities of the respiratory protection management program;
- Written standard operating procedures governing the selection and use of respirators;

Respirator selection (from National Institutes for Occupational Safety and Health (NIOSH) and/or Mine Safety and Health Administration (MSHA) approved and certified models) on the basis of hazards to which the worker is exposed;



- Medical examination of workers to determine whether or not they may be assigned an activity where RPDs are required;
- User training in the proper use and limitations of respirators (as well as a way to evaluate the skill and knowledge obtained by the worker through training);
- · Respirator fit testing;
- Regular cleaning and disinfecting of respirators;
- Routine inspection of respirators during cleaning;

(Note: Roux has no respirators designated for emergency use so monthly inspections and inspections after each use are not part of this program.);

- Storage or respirators in convenient, clean, and sanitary locations;
- Surveillance for work area conditions and degree of employee exposure (e.g., through air monitoring);
- Regular inspection and evaluation of the continued effectiveness of the program; and
- Recognition and resolution of special problems as they affect respiratory use (e.g., facial hair, eye glasses, etc.).

3. MEDICAL EXAMINATION/CLEARANCE

Only individuals who are medically cleared to wear respiratory protection will be issued RPDs. The use of any type of respirator imposes some physiological stress on the user; therefore, the respirator user must have a medical examination and evaluation performed by or under the supervision of a licensed physician to determine if a current or pre-existing medical condition exists that would be aggravated by respiratory protection. Employees who use respirators will be required to undergo a medical evaluation at the following frequency:

- Prior to assignment of a respirator for those employees who will be issued a negative pressure respirator.
- An employee reports medical signs or symptoms related to their ability to use a respirator.
- A physician, supervisor, or program administrator determines an employee needs to be reevaluated.
- Information from the respiratory protection management program including observations made during fit testing and program evaluation indicating a need for employee re-evaluation.
- A change occurs in the workplace conditions that may result in a substantial increase in the physiological burden placed on an employee.
- At least annual thereafter.

The employee will be asked to complete a detailed medical questionnaire. It will be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee. It is to be administered in a manner that ensures the employee understands its content. The detailed medical questionnaire will include the following data:

 Medical history (especially a history of asthma, emphysema, high blood pressure, artery disease, and any documented heart or lung problems).



- Work history (previous occupations, past exposures, etc.).
- Any other necessary medical information such as physical deformities, claustrophobia, or poor eye sight.

Medical tests typically conducted during the examination are:

- Pulmonary function
- Chest x-ray
- Blood chemistries
- Eye exam
- Hearing exam
- Electrocardiogram

A physician's statement that the employee can wear a respirator must be maintained on file for each employee required to wear a device. Medical records must be kept for the duration of employment plus 30 years. These examinations are confidential, conducted during normal working hours, and are convenient and understandable. During the examination, the employee is given a chance to discuss the results with the medical professional.

4. APPROVED EQUIPMENT & RESPIRATOR SELECTION

Approved respirators shall be used that provide adequate protection against the particular hazard for which it is designed in accordance with standards established by competent authorities, such as MSHA and NIOSH. To comply with the provisions of the OSHA Standard on Respiratory Protection, 29 CFR 1910.134 & 1926.103, all respiratory protective equipment purchased by Roux will have been tested by NIOSH and will carry a joint NIOSH/MSHA approval for that specific respirator assembly. Company owned respiratory protection equipment will either be maintained by the OHSM in a common equipment storage area or issued to individuals by their OHSM for their personal use as required on a project specific basis. Each respirator, which is individually assigned, will be identified in a way that does not interfere with its performance.

The proper selection of respiratory protection is based on the following factors:

- Actual exposure measurements taken by Health and Safety personnel or the potential for exposure.
- The contaminants' Permissible Exposure Limits (OSHA PELs) or Threshold Limit Values (ACGIH TLVs®) and their toxicology.
- The contaminants' form gas, vapor or particulate.
- Warning properties of the contaminants.
- The contaminants' concentration or potential maximum concentration.
- Any eye irritating effects of the contaminants.
- The duration of exposure.
- The potential for an Immediately Dangerous to Life or Health (IDLH) atmosphere to exist.



- The availability of NIOSH/MSHA approved respiratory protection devices.
- The approval of the Project Manager, OHSM and CHSM.

5. INSPECTION AND MAINTENANCE

Respirators are properly maintained in order to retain their original effectiveness. This is done through periodic inspection, repair, cleaning, and proper storage.

5.1 Inspection

All respirators are to be inspected routinely by the user before and after each use and during cleaning. Items to check include: the condition of the facepiece, head bands, valves and hoses; and the canister, filter or cartridge fit.

5.2 Maintenance

Respiratory protection, which does not pass inspection, is to be replaced or repaired immediately. Repair of the device by the user will be limited to changing canisters, cartridges, filters, and head straps. Substitution of parts from different brands or types of respirators invalidates NIOSH/MSHA approval of the device. All other replacements or repairs are to be performed by the supplier of the device.

No attempt will be made to replace components or make adjustments, modifications, or repairs beyond the manufacturer's recommendations.

5.3 Reporting Respirator Problems:

Occasionally, an employee may find a defect in the design or performance of a respirator. The best course to follow is to report these findings to the Program Administrator, CHSM. If the respirator carries the approval of MSHA and NIOSH, the Program Administrator will report the findings to the respirator manufacturer and NIOSH. This will be done by notifying the manufacturer of the defect in a report format and forwarding a copy of the report to NIOSH. The report will include the following:

- Roux name, address, and telephone number;
- The name of the respirator manufacturer;
- The model number of respirator;
- The name and part number (if possible) of the defective part;
- The lot number and/or serial number of the respirator and/or defective part;
- A brief description of respirator usage when the defect was discovered;
- A description of the defect; and
- A description of the defect's adverse effect on respirator performance.

This report should be addressed to:

NIOSH Division of Safety Research 1095 Willowdale Road Morgantown, WV 26505-2888



6. CLEANING AND DISINFECTING

Individually assigned RPDs are cleaned and disinfected as frequently as necessary to ensure proper protection is provided for the wearer. Respirators used in fit testing must be cleaned and disinfected after each use.

The following procedure is used for cleaning and disinfecting respirators:

- Employee leaves the work area for removal, cleaning, or discarding of his respirator. Filters, cartridges, or canisters are removed before washing the respirator and/or discarding, as necessary.
- Wash components in warm (43°C [110°F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
- Rinse components thoroughly in clean, warm (43oC [110oF] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.
- If the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:
 - Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43°C [110°F]; or
 - Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodine/100 cc 45% alcohol) to one liter of water at 43°C [110°F]; or
 - o Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.
- Components should be hand-dried with a clean, lint-free cloth or air dried.
- Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.
- Test the respirator to ensure all components work properly.

7. STORAGE

When it is not being used, the respirator should be individually sealed in a plastic bag/container to protect it against dust, sunlight, extreme temperatures, excessive moisture, or damaging chemicals. It should be stored in such a way that the facepiece and exhalation valve are not being distorted.

8. TRAINING

Training shall be conducted by the Program Administrator or authorized representative (OHSM/SHSM). Respirators will not be issued to individuals who have not received appropriate training, fit testing, and medical clearance. The extent and frequency of employee training depends primarily on the nature and extent of the hazard. As a minimum, all respirator users will be retrained annually, when new types of respirators are used or when inadequacies in the employee's knowledge or use indicate need. Every employee who may have to wear a respirator will be trained in this Program and the proper use of the respirator.



The training includes:

- A review of this Program;
- Descriptions of the respirators;
- Intended use and limitations of the devices:
- Proper wearing, adjustment and testing for fit;
- Cleaning and storage methods; and
- Inspection and maintenance procedures.

This training is repeated as necessary, and at least annually, to ensure that users remain familiar with the proper use of respiratory protection. This training may be conducted as part of the annual hazardous waste (i.e., HAZWOPER) training program.

9. RECORDS

The following record is maintained by the Office Health and Safety Manager:

The number and types of respirators in use.

The following record is to be maintained by the OHSM:

A record of employee training programs.

The following record is to be maintained by the Human Resources Manager:

 Medical certification that the employee is capable of wearing a respirator under his/her given work conditions.

Records are kept in accordance with 29 CFR 1910.1020.

10. PROGRAM EVALUATION

The Corporate Health and Safety Manager will evaluate the program's effectiveness at least annually to assess the overall effectiveness of the Respiratory Protection Management Program. Specific evaluation will include inspection, maintenance, cleaning, storage; monitoring and use procedures to ensure desired results are consistently achieved. This evaluation includes employee input on respirator fit, selection, use and maintenance and any other concerns expressed by the employee. The Program evaluation requires consultation with employees. Program adjustments will be made as necessary to reflect the evaluation results.



APPENDIX A - CAPABILITIES AND LIMITATIONS OF RESPIRATORS

Capabilities And Limitations Of Respirators

Air-Purifying Respirators

General Limitations: Air-purifying respirators do not protect against oxygen deficient atmosphere or against skin irritations by, or sorption through the skin of airborne contaminants.

The maximum contaminant concentration against which an APR will protect is determined by the design efficiency and capacity of the cartridge, canister, or filter and the face piece-to-face seal on the user. For gases and vapors the maximum concentration for which the air-purifying element is designed is specified by the manufacturer or is listed on labels of cartridges and canisters.

Non-powered air-purifying respirators will not provide the maximum design protection specified unless the respirator is carefully fitted to the wearer's face to prevent inward leakage. The time period over which protection is provided is dependent on canister, cartridge, or filter type; concentrations of contaminant; humidity levels in the ambient atmosphere; and the wearer's respiratory rate.

The proper type of canister, cartridge, or filter must be selected for the particular atmosphere and conditions. Non-powered APRs may cause discomfort due to a noticeable resistance to inhalation. This problem is minimized in powered respirators. Respirator face pieces present special problems to individuals required to wear prescription lenses. These devices do have the advantage of being small, light, and simple in operation.

Use of air-purifying respirators in atmospheres immediately dangerous to life or health is limited to specific devices under specified conditions.

Vapor and Gas Removing Respirators

Limitations: No protection is provided against particulate contaminants. A rise in canister or cartridge temperature indicates a gas or vapor is being removed from the inspired air.

An uncomfortably high temperature indicates a high concentration of gas or vapor and requires an immediate return to fresh air.

Use should be avoided in atmospheres where the contaminant(s) lacks sufficient warning properties (i.e., odor, taste, or irritation at a concentration in air at or above the permissible exposure limit or TLV®.). Vapor and gas removing respirators are not approved for contaminants that lack adequate warning properties.

Not for use in atmospheres immediately dangerous to life or health unless the device is a powered type respirator with escape provisions.

- (1) Full Facepiece Respirator
 - Provides protection against eye irritation in addition to respiratory protection.
- (2) Quarter Mask and Half Mask Facepiece Respirator
 - A fabric covering (facelet) available from some manufacturers shall *not* be used.



Particulate-Removing Respirators

Limitations: Protection against non-volatile particles only. No protection against gases and vapors.

Combination Particulate and Vapor Gas Removing Respirators

Not for use in atmospheres immediately dangerous to life or health unless the device is a powered-type respirator with escape provisions.

- (1) Full Facepiece Respirator.
 - Provides protection against eye irritation in addition to respiratory protection.
- (2) Quarter-Mask and Half-Mask Facepiece Respirator.
 - A fabric covering (facelet) available from some manufacturers shall not be used unless approved for use with respirator.

Combination Particulate and Vapor Gas Removing Respirators

The advantages and disadvantages of the component sections of the combination respirator as described above apply.



APPENDIX B - RESPIRATOR FITTING

Respirator Fitting

1. **Most important point:** the topic of Respirator Fitting <u>only</u> applies to respirators having <u>TIGHT-FITTING FACEPIECES</u>.

2. Respirator Seal Checks:

- (a) Applies to all tight-fitting respirators.
- (b) Two seal checks: positive and negative pressure.
- (c) Both seal checks must be performed before each use <u>and</u> if the wearer questions the fit during each use.
- (d) These seal checks are the wearer's way of assuring, on a daily basis, that there is an adequate seal of the facepiece to his/her face, thereby assuring the optimum performance from the respirator.
- (e) Seal Checks are <u>required</u> by the OSHA Respiratory Protection Standard, 29 CFR 1910.134(g)(1)(iii).

3. Respiratory Fit Tests:

- (a) Purpose: <u>Size Selection</u>. Fit testing enables you to select the best-fitting size and make for a certain individual within a pre-determined type of respirator, such as half-mask air-purifying.
- (b) Two types of fit tests: Qualitative and Quantitative.

i. Qualitative Fit Tests:

- 1. Rely on wearer's subjective response to irritation, odor, and/or taste.
- Advantages: fast, no complicated equipment, and easily performed in the field.
- 3. Disadvantages: since they rely on the wearer's subjective response, they are not entirely reliable.
- 4. Three types of validated qualitative fit tests: <u>Irritant Smoke (Stannic Chloride) Test; Banana Oil (Isoamyl Acetate) Test; and Taste (Saccharin Solution) Test.</u>

ii. Quantitative Fit Tests:

- 1. Two types: Aerosol Generation System and Ambient Aerosol System.
 - a. With the Aerosol Generation system (e.g., Dynatech-Frontier), facepiece leakage is <u>quantified</u> by the use of a detecting instrument and a test aerosol such as corn oil, di(2-ethylhexyl) sebacate (DEHS), polyethylene glycol 400 (PEG-400), and sodium chloride. The instrument measures the concentration of test aerosol outside the respirator and inside the respirator. From these values, a fit factor (FF) can be calculated (FF = Conc. Out/Conc. In). The higher the FF, the better fitting is the respirator.
 - b. With the Ambient Aerosol System (e.g., TSI Portacount), the concentrations of ambient particles outside and inside the respirator are measured to derive a fit factor.



- 2. Advantages of quantitative fit tests: numerical fit is derived (FF), permanent documentation is produced, and tests do not depend on subjective responses.
- 3. Disadvantages: Expensive, trained operators required, and time consuming.

4. Respirator Fitting Guidelines:

- (a) For <u>all</u> tight-fitting respirators, perform both seal checks before each use and during each use if the wearer questions the fit.
- (b) For tight-fitting respirators operated in a negative pressure mode, comply with the qualitative/quantitative fit test requirements described in the applicable substance-specific OSHA standards:
 - **Acrylonitrile**, 29CFR1910.1045(h): qualitative or quantitative fit testing required initially and every 6 months thereafter; quantitative fit testing required if more than 10 employees.
 - **Arsenic**, 29CFR1910.1018(h): qualitative or quantitative fit testing required initially and every 6 months thereafter; quantitative fit testing required if more than 20 employees.
 - **Benzene**, 29CFR1910.1028(g): qualitative or quantitative fit testing required initially and annually thereafter; cookbook qualitative and quantitative fit testing procedures are included in an appendix.
 - Chromium, Hexavalent, 29CFR1910.1026: follow requirements in 29CFR1910.134.
 - **Formaldehyde**, 29CFR1910.1048(g): qualitative or quantitative fit testing required initially and annually thereafter; cookbook qualitative and quantitative fit testing procedures are included in an appendix.
 - **Lead**, 29CFR1910.1025(f): qualitative or quantitative fit testing required initially and every 6 months thereafter; cookbook qualitative fit test procedures are included in an appendix.
- (c) If the air contaminant of interest is not covered by the preceding substance-specific OSHA standards, follow the 1910.134 requirements. Fit testing shall be performed on at least an annual basis for individuals requiring regular or periodic (more than once per year) respirator use.
- (d) Fit test materials:
 - Irritant smoke tubes and aspirator bulb; OR
 - Banana oil (isoamyl acetate);
 - 1 ml disposable pipettes;
 - 55-gallon drum liners, and
 - 1 quart wide-mouth canning jars with metric graduations, distilled (non-ozonated) water, and paper towels.



APPENDIX C - FIT TEST PROTOCOLS AND PROCEDURES OSHA 1910.134

Appendix A to § 1910.134: Fit Testing Procedures (Mandatory)

Part I. OSHA-Accepted Fit Test Protocols

A. Fit Testing Procedures—General Requirements

The employer shall conduct fit testing using the following procedures. The requirements in this appendix apply to all OSHA-accepted fit test methods, both QLFT and QNFT.

- 1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so the respirator is acceptable to, and correctly fits, the user.
- 2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.
- The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly will provide adequate protection.
- 4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.
- 5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item 6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.
- 6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:
 - (a) Position of the mask on the nose;
 - (b) Room for eye protection;
 - (c) Room to talk; and
 - (d) Position of mask on face and cheeks.
- 7. The following criteria shall be used to help determine the adequacy of the respirator fit:
 - (a) Chin properly placed;
 - (b) Adequate strap tension, not overly tightened;
 - (c) Fit across nose bridge;
 - (d) Respirator of proper size to span distance from nose to chin;
 - (e) Tendency of respirator to slip; and
 - (f) Self-observation in mirror to evaluate fit and respirator position.
- 8. The test subject shall conduct a user seal check; either the negative and positive pressure seal checks described in Appendix B-1 of this section or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in Appendix B-1. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask



- on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.
- 9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache, or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.
- 10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.
- 11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.
- 12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.
- 13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use that could interfere with respirator fit.
- 14. **Test Exercises.** (a) Employers must perform the following test exercises for all fit testing methods prescribed in this appendix, except for the CNP quantitative fit testing protocol and the CNP REDON quantitative fit testing protocol. For these two protocols, employers must ensure that the test subjects (i.e., employees) perform the exercise procedure specified in Part I.C.4(b) of this appendix for the CNP quantitative fit testing protocol, or the exercise procedure described in Part I.C.5(b) of this appendix for the CNP REDON quantitative fit-testing protocol. For the remaining fit testing methods, employers must ensure that employees perform the test exercises in the appropriate test environment in the following manner:
 - (a) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.
 - (b) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.
 - (c) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily, so the subject can inhale at each side.
 - (d) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).
 - (e) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the "Rainbow Passage," count backward from 100, or recite a memorized poem or song.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.



- (f) Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT)
- (g) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.
- (h) Normal breathing. Same as exercise (1).
- 15. Each test exercise shall be performed for one minute, except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

B. Qualitative Fit Test (QLFT) Protocols

1. General

- (a) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.
- (b) The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Isoamyl Acetate Protocol

Note: This protocol is not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator must be equipped with an organic vapor filter.

(a) Odor Threshold Screening

Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.

- (1) Three 1-liter glass jars with metal lids are required.
- (2) Odor-free water (e.g., distilled or spring water) at approximately 25°C (77°F) shall be used for the solutions.
- (3) The isoamyl acetate (IAA) (also known at isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1-liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.
- (4) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.
- (5) The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.
- (6) A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.
- (7) The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.
- (8) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell



banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

- (9) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.
- (10) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.
- (11) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(b) Isoamyl Acetate Fit Test

- (1) The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.
- (2) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.
- (3) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.
- (4) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.
- (5) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.
- (6) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.
- (7) If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.
- (8) If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (b) (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least 5 minutes before retesting. Odor sensitivity will usually have returned by this time.
- (9) If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.



(10)When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.

3. Saccharin Solution Aerosol Protocol

The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

- (a) Taste threshold screening. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.
 - (1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.
 - (2) The test enclosure shall have a 3/4-inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
 - (3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a sweet taste.
 - (4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.
 - (5) The threshold check solution is prepared by dissolving 0.83 gram of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting 1 ml of the fit test solution (see (b)(5) below) in 100 ml of distilled water.
 - (6) To produce the aerosol, the nebulizer bulb is firmly squeezed so it collapses completely, then released and allowed to fully expand.
 - (7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted. If the test subject reports tasting the sweet taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.
 - (8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.
 - (9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.
 - (10) The test conductor will take note of the number of squeezes required to solicit a taste response.



- (11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject is unable to taste saccharin and may not perform the saccharin fit test.
- (12) Note to paragraph 3. (a): If the test subject eats or drinks something sweet before the screening test, he/she may be unable to taste the weak saccharin solution.
- (13) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
- (14) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
- (15) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.
- (b) Saccharin solution aerosol fit test procedure
 - (1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.
 - (2) The fit test uses the same enclosure described in 3. (a) above.
 - (3) The test subject shall don the enclosure while wearing the respirator selected in section I. A. of this appendix. The respirator shall be properly adjusted and equipped with a particulate filter(s).
 - (4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.
 - (5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.
 - (6) As before, the test subject shall breathe through the slightly open mouth with tongue extended, and report if he/she tastes the sweet taste of saccharin.
 - (7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of saccharin fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test. A minimum of 10 squeezes is required.
 - (8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.
 - (9) Every 30 seconds the aerosol concentration shall be replenished using one half the original number of squeezes used initially (e.g., 5, 10 or 15).
 - (10)The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected. If the test subject does not report tasting the saccharin, the test is passed.
 - (11)If the taste of saccharin is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).
 - (12)Since the nebulizer has a tendency to clog during use, the test operator must make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.
- 4. BitrexTM (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test Protocol



The BitrexTM (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. BitrexTM is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Taste Threshold Screening

The BitrexTM taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of BitrexTM.

- (1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.
- (2) The test enclosure shall have a 3/4-inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
- (3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste.
- (4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the Threshold Check Solution into the enclosure. This Nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.
- (5) The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex[™] to 100 ml of 5% salt (NaCl) solution in distilled water.
- (6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.
- (7) An initial ten squeezes are repeated rapidly and then the test subject is asked whether the BitrexTM can be tasted. If the test subject reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.
- (8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the BitrexTM is tasted. If the test subject reports tasting the bitter taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.
- (9) If the second response is negative, ten more squeezes are repeated rapidly, and the test subject is again asked whether the Bitrex™ is tasted. If the test subject reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.
- (10) The test conductor will take note of the number of squeezes required to solicit a taste response.
- (11) If the Bitrex[™] is not tasted after 30 squeezes (step 10), the test subject is unable to taste Bitrex[™] and may not perform the Bitrex[™] fit test.



- (12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
- (13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.
- (14) The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Bitrex[™] Solution Aerosol Fit Test Procedure

- (1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.
- (2) The fit test uses the same enclosure as that described in 4. (a) above.
- (3) The test subject shall don the enclosure while wearing the respirator selected according to section I. A. of this appendix. The respirator shall be properly adjusted and equipped with any type particulate filter(s).
- (4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.
- (5) The fit test solution is prepared by adding 337.5 mg of Bitrex[™] to 200 ml of a 5% salt (NaCl) solution in warm water.
- (6) As before, the test subject shall breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex[™].
- (7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.
- (8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.
- (9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).
- (10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex[™] is detected. If the test subject does not report tasting the Bitrex[™], the test is passed.
- (11) If the taste of Bitrex[™] is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

5. Irritant Smoke (Stannic Chloride) Protocol

This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

- (a) General Requirements and Precautions
 - (1) The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).
 - (2) Only stannic chloride smoke tubes shall be used for this protocol.
 - (3) No form of test enclosure or hood for the test subject shall be used.



- (4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.
- (5) The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

(b) Sensitivity Screening Check

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

- (1) The test operator shall break both ends of a ventilation smoke tube containing stannic chloride and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.
- (2) The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.
- (3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

(c) Irritant Smoke Fit Test Procedure

- (1) The person being fit tested shall don the respirator without assistance and perform the required user seal check(s).
- (2) The test subject shall be instructed to keep his/her eyes closed.
- (3) The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.
- (4) If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.
- (5) The exercises identified in section I.A. 14. of this appendix shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.
- (6) If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.
- (7) Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has



- been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.
- (8) If a response is produced during this second sensitivity check, then the fit test is passed.

C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable: Quantitative fit testing using a non-hazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; Quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; Quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

1. General

- (a) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and ensure that test equipment is in proper working order.
- (b) The employer shall ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Generated Aerosol Quantitative Fit Testing Protocol

(a) Apparatus

- (1) Instrumentation: Aerosol generation, dilution, and measurement systems using particulates (corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS] or sodium chloride) as test aerosols shall be used for quantitative fit testing.
- (2) Test chamber: The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the test agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the test agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.
- (3) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high efficiency particulate air (HEPA) or P100 series filter supplied by the same manufacturer.
- (4) The sampling instrument shall be selected so that a computer record or strip chart record may be made of the test showing the rise and fall of the test agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.
- (5) The combination of substitute air-purifying elements, test agent, and test agent concentration shall be such that the test subject is not exposed in excess of an established exposure limit for the test agent at any time during the testing process, based upon the length of the exposure and the exposure limit duration.
- (6) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free-air flow is allowed into the sampling line at all times, and there is no interference with the fit or performance of the respirator. The in-mask sampling device (probe) shall be designed and used so that the air sample is drawn from the breathing zone of the test



- subject, midway between the nose and mouth and with the probe extending into the facepiece cavity at least 1/4 inch.
- (7) The test setup shall permit the person administering the test to observe the test subject inside the chamber during the test.
- (8) The equipment generating the test atmosphere shall maintain the concentration of test agent constant to within a 10 percent variation for the duration of the test.
- (9) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event and its being recorded.
- (10) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.
- (11) The exhaust flow from the test chamber shall pass through an appropriate filter (i.e., high efficiency particulate filter [or P100 series filter]) before release.
- (12) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.
- (13) The limitations of instrument detection shall be taken into account when determining the fit factor.
- (14) Test respirators shall be maintained in proper working order and be inspected regularly for deficiencies such as cracks or missing valves and gaskets.

(b) Procedural Requirements

- (1) When performing the initial user seal check using a positive or negative pressure check, the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these pressure checks.
- (2) The use of an abbreviated screening QLFT test is optional. Such a test may be utilized in order to quickly identify poor fitting respirators that passed the positive and/or negative pressure test and reduce the amount of QNFT time. The use of the CNC QNFT instrument in the count mode is another optional method to obtain a quick estimate of fit and eliminate poor fitting respirators before going on to perform a full QNFT.
- (3) A reasonably stable test agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain types of test units, the determination of the test agent's stability may be established after the test subject has entered the test environment.
- (4) Immediately after the subject enters the test chamber, the test agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full facepiece respirator.
- (5) A stable test agent concentration shall be obtained prior to the actual start of testing.
- (6) Respirator restraining straps shall not be over-tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use. The respirator shall not be adjusted once the fit test exercises begin.
- (7) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject shall be refitted and retested.



(8) Calculation of fit factors

- (i) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration measured inside the respirator for each test exercise except the grimace exercise.
- (ii) The average test chamber concentration shall be calculated as the arithmetic average of the concentration measured before and after each test (i.e., 7 exercises) or the arithmetic average of the concentration measured before and after each exercise or the true average measured continuously during the respirator sample.
- (iii) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:
 - (A) Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers that calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.
 - (B) Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.
 - (C) Integration by calculation of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.
 - (D) The calculation of the overall fit factor using individual exercise fit factors involves first converting the exercise fit factors to penetration values, determining the average, and then converting that result back to a fit factor. This procedure is described in the following equation:

$$Overall\ Fit\ Factor = \frac{Number\ of\ excercises}{1/ff_1 + 1/ff_2 + 1/ff_3 + 1/ff_4 + 1/ff_5 + 1/ff_6 + 1/ff_7 + 1/ff_8}$$

Where: ff₁, ff₂, ff₃, etc. are the fit factors for exercises 1, 2, 3, etc.

- (9) The test subject shall not be permitted to wear a half mask or quarter facepiece respirator unless a minimum fit factor of 100 is obtained, or a full facepiece respirator unless a minimum fit factor of 500 is obtained.
- (10) Filters used for quantitative fit testing shall be replaced whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.

3. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol

The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (PortacountTM) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, which allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also



provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Portacount Fit Test Requirements

- (1) Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) per manufacturer's instructions.
- (2) Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.
- (3) Check the following conditions for the adequacy of the respirator fit: Chin properly placed; Adequate strap tension, not overly tightened; Fit across nose bridge; Respirator of proper size to span distance from nose to chin; Tendency of the respirator to slip; Self-observation in a mirror to evaluate fit and respirator position.
- (4) Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.
- (5) Follow the manufacturer's instructions for operating the Portacount and proceed with the test.
- (6) The test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.
- (7) After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

(b) Portacount Test Instrument

- (1) The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.
- (2) Since the pass or fail criterion of the Portacount is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this Appendix.
- (3) A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

4. Controlled negative pressure (CNP) quantitative fit testing protocol

The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the



respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer Occupational Health Dynamics of Birmingham, Alabama also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his or her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) CNP Fit Test Requirements

- 1) The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.
- (2) The CNP system defaults selected for test pressure shall be set at -- 15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate shall be 53.8 liters per minute for performing fit tests.
 - (Note: CNP systems have built-in capability to conduct fit testing that is specific to unique work rate, mask, and gender situations that might apply in a specific workplace. Use of system default values, which were selected to represent respirator wear with medium cartridge resistance at a low-moderate work rate, will allow inter-test comparison of the respirator fit.)
- (3) The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test
- (4) The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.
- (5) The employer must train the test subject to hold his or her breath for at least 10 [20] seconds.
- (6) The test subject must don the test respirator without any assistance from the test administrator who is conducting the CNP fit test. The respirator must not be adjusted once the fit-test exercises begin. Any adjustment voids the test, and the test subject must repeat the fit test.
- (7) The QNFT protocol shall be followed according to section I. C. 1. of this appendix with an exception for the CNP test exercises.

(b) CNP Test Exercises

- (1) Normal breathing: In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his or her breath for 10 seconds during the test measurement.
- (2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing



- exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during test measurement.
- (3) Turning head side to side: Standing in place, the subject shall slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the turning head side to side exercise, the subject needs to hold head full left and hold his or her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his or her breath for 10 seconds during test measurement.
- (4) Moving head up and down: Standing in place, the subject shall slowly move his or her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his or her head full up and hold his or her breath for 10 seconds during test measurement. Next, the subject shall hold his or her head full down and hold his or her breath for 10 seconds during test measurement.
- (5) Talking: The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute. After the talking exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.
- (6) Grimace: The test subject shall grimace by smiling or frowning for 15 seconds.
- (7) Bending Over: The test subject shall bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.
- (8) Normal Breathing: The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of a respirator shall be tried.

(c) CNP Test Instrument

- (1) The test instrument must have an effective audio-warning device, or a visual-warning device in the form of a screen tracing, which indicates when the test subject fails to hold his or her breath during the test. The test must be terminated and restarted from the beginning when the test subject fails to hold his or her breath during the test. The test subject then may be refitted and retested.
- (2) A record of the test shall be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style and size of respirator used; and date tested.

5. Controlled negative pressure (CNP) REDON quantitative fit testing protocol

(a) When administering this protocol to test subjects, employers must comply with the requirements specified in paragraphs (a) and (c) of Part I.C.4 of this appendix ("Controlled negative pressure (CNP) quantitative fit testing protocol"), as well as use the test exercises described below in paragraph (b) of this protocol instead of the test exercises specified in paragraph (b) of Part I.C.4 of this appendix.



(b) Employers must ensure that each test subject being fit tested using this protocol follows the exercise and measurement procedures, including the order of administration, described below in Table A-1 of this appendix.

Table A-1. CNP REDON Quantitative Fit Testing Protocol

Exercises ⁽¹⁾	Exercise Procedure	Measurement Procedure	
Facing Forward	Stand and breathe normally, without talking, for 30 seconds.	Face forward, while holding breath for 10 seconds.	
Bending Over	Bend at the waist, as if going to touch his or her toes, for 30 seconds.	Face parallel to the floor, while holding breath for 10 seconds.	
Head Shaking	For about three seconds, shake head back and forth vigorously several times while shouting.	Face forward, while holding breath for 10 seconds.	
REDON 1	Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask.	Face forward, while holding breath for 10 seconds.	
REDON 2	Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask again.	Face forward, while holding breath for 10 seconds.	

⁽¹⁾ Exercises are listed in the order in which they are to be administered.

- (c) After completing the test exercises, the test administrator must question each test subject regarding the comfort of the respirator. When a test subject states that the respirator is unacceptable, the employer must ensure that the test administrator repeats the protocol using another respirator model.
- (d) Employers must determine the overall fit factor for each test subject by calculating the harmonic mean of the fit testing exercises as follows:

Overall Fit Factor =
$$\frac{N}{\left[1/FF_{\perp} + 1/FF_{\perp} + 1/FF_{\parallel}\right]}$$

Where:

N = The number of exercises;

 FF_1 = The fit factor for the first exercise;

 FF_2 = The fit factor for the second exercise; and

 FF_N = The fit factor for the nth exercise.

Part II. New Fit Test Protocols

- A. Any person may submit to OSHA an application for approval of a new fit test protocol. If the application meets the following criteria, OSHA will initiate a rulemaking proceeding under section 6(b)(7) of the OSH Act to determine whether to list the new protocol as an approved protocol in this Appendix A.
- B. The application must include a detailed description of the proposed new fit test protocol. This application must be supported by either:



- A test report prepared by an independent government research laboratory (e.g., Lawrence Livermore National Laboratory, Los Alamos National Laboratory, the National Institute for Standards and Technology) stating that the laboratory has tested the protocol and had found it to be accurate and reliable; or
- 2. An article that has been published in a peer-reviewed industrial hygiene journal describing the protocol and explaining how test data support the protocol's accuracy and reliability.
- C. If OSHA determines that additional information is required before the Agency commences a rulemaking proceeding under this section, OSHA will so notify the applicant and afford the applicant the opportunity to submit the supplemental information. Initiation of a rulemaking proceeding will be deferred until OSHA has received and evaluated the supplemental information.

[63 FR 20098, April 23, 1998; 69 FR 46993, August 4, 2004]

Appendix B-1 to § 1910.134: User Seal Check Procedures (Mandatory)

The individual who uses a tight-fitting respirator is to perform a user seal check to ensure that an adequate seal is achieved each time the respirator is put on. Either the positive and negative pressure checks listed in this appendix, or the respirator manufacturer's recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

I. Facepiece Positive and/or Negative Pressure Checks

A. Positive pressure check. Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

B. Negative pressure check. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

II. Manufacturer's Recommended User Seal Check Procedures

The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally effective.

[63 FR 1152, Jan. 8, 1998]



APPENDIX D - OSHA 1910.134 (MANDATORY) INFORMATION FOR EMPLOYEES USING RESPIRATORS WHEN NOT REQUIRED UNDER THE STANDARD

Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard. You should do the following:

- 1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
- Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
- 3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
- 4. Keep track of your respirator so that you do not mistakenly use someone else's respirator. [63 FR



APPENDIX E - FIT FACTOR VS. PROTECTION FACTOR

Fit Factor vs. Protection Factor

Fit Factor (FF)

FF= Measured Concentration Outside the Respirator

Measured Concentration Inside the Respirator

- Fit Factor applies <u>only</u> to quantitative fit testing conducted on a given day with a given respirator on a given individual.
- Fit Factor is a quantitative measure of the match between the respirator and the user: the higher the Fit Factor, the better the match.
- Fit Factors are to be used to select the best fitting make and size for a given individual from a predetermined type of respirator (e.g., half-mask air-purifying respirator).

Protection Factor (PF)

PF= Measured Concentration Outside the Respirator

Expected Concentration Inside the Respirator

- Protection Factors have been assigned to various types of respirators by ANSI, OSHA, and NIOSH.
- Protection Factor applies to all trained workers on all days of use for all makes of a given type of respirator.
- Protection Factor is a quantitative measure of the protection the workers can expect from a given type of respirator. The higher the Protection Factor, the better.
- Protection Factors are to be used to select an appropriate type of respirator for a specific workplace exposure.



APPENDIX F - SPECIAL PROBLEMS

The following are special problems that may be encountered in the wearing and use of respiratory protective equipment:

(1) Facial Hair

Facial hair, including beards, sideburns, moustaches, or even a few days growth of stubble, is not permitted on employees who are required to wear respirators that rely on a tight facepiece fit to achieve maximum protection. Facial hair between the wearer's skin and the sealing surfaces of the respirator will prevent a good seal. A respirator that permits negative air pressure inside the facepiece during inhalation may allow leakage and, in the case of positive pressure devices, will either reduce service time or waste breathing air. A worker should not enter a contaminated work area when conditions prevent a good seal of the respirator facepiece to the face.

(2) Eye Glasses

Ordinary eyeglasses should not be used with full facepiece respirators. Eyeglasses with temple bars or straps that pass between the sealing surface of a full facepiece respirator and the worker's face will prevent a good seal, and should not be used. Special corrective lenses can be permanently mounted inside a full facepiece respirator and are available from all manufacturers. To ensure good vision, comfort, and proper sealing of the facepiece, an individual designated by the manufacturer as qualified to install accessory items should mount these corrective lenses.

Eyeglasses or goggles may interfere with the half facepiece. When interference occurs, a full facepiece with special corrective lenses should be provided and worn.

(3) Facial Deformities

Facial deformities, such as scars, deep skin creases, prominent cheekbones, severe acne, and the lack of teeth or dentures, can prevent a respirator from sealing properly.

(4) Communications

Talking while wearing a respirator equipped with a facepiece can break the seal of the facepiece. Workers who must speak should keep jaw movement to a minimum. When communication is necessary within a contaminated area, it should be done with the help of special communicating equipment obtained from the manufacturer of the respirator.

(5) Temperature Extremes

In low temperatures, respirator lenses can become fogged. Coating the inner surface of the lens with an anti-fogging compound can reduce fogging. Satisfactory vision can be provided at temperatures down to -30° F by supplying a full facepiece respirator with a nose cup that directs the warm, moist exhaled air through the exhalation valve without touching the lens. Airline respirators should provide dry, respirable air to the worker in cold temperatures.

High or low temperatures can make wearing a respirator uncomfortable. Under temperature extremes, a supplied air respirator may be equipped with a vortex tube to either warm or cool the air supply as needed, if such a device has been approved for use with the respirator. Also, air supply systems are now available which heat or cool the air supplied to the respirator facepiece or air hood.

Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

APPENDIX G

Generic Community Air Monitoring Plan (CAMP)

3084.0001Y.101/CVRS ROUX

APPENDIX G

New York State Department of Health Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical-specific monitoring with appropriately sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

ROUX -1- 3084.0001Y.101/HASP-APG

VOC Monitoring, Response Levels, and Actions

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

- 1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- 2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- 3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.
- 4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

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

- 1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m³) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m³ above the upwind level and provided that no visible dust is migrating from the work area.
- 2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m³ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m³ of the upwind level and in preventing visible dust migration.
- 3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

ROUX -2- 3084.0001Y.101/HASP-APG

Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

APPENDIX H

Health and Safety Briefing/ Daily Meeting Log

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HEALTH AND SAFETY BRIEFING / TAILGATE MEETING FORM

Site Name / Location	
Date:	Weather Forecast:
Names of Personnel Attending Briefing	
Planned Work	
Instrument Calibration: Instrument/Time	e/Cal. Gas/Cal. Concentration/Actual Concentration
Items Discussed	
Work Permit Type and Applicable Rest	<u>rictions</u>
Signatures of Attending Personnel	



Site-Specific Health and Safety Plan Hunter's Point South Project Area, Queens, NY

APPENDIX I

Heavy Equipment Exclusion Zone Program

3084.0001Y.101/CVRS ROUX



HEAVY EQUIPMENT EXCLUSION ZONE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER : Brian Hobbs, CIH, CSP

EFFECTIVE DATE : 01/2019

REVISION NUMBER : 1



TABLE OF CONTENTS

1.	PURPOSE	. 2
2.	SCOPE AND APPLICABILITY	. 2
3.	PROCEDURES	. 2
	3.1 Exceptions	
4	TRAINING	•



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.

Site Management Plan HPS Parcel G – 57-28 2nd Street, Long Island City, New York BCP Site #C241226

APPENDIX F

Site Management Forms

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Site Inspection Checklist, HPS Parcel G, Queens, NY

Date:	
Completed By:	

	Status			
Description	Ok	Action Req.	N/A	Actions Taken / Comments
Site Cover System	OK	req.	14/11	Actions Taken / Comments
1 Inspect site cover system for cracks and leaks.				
Institutional Controls				
1 Confirm that the site usage is in compliance with the institutional				
controls.				
Site Records				
1 Inspect site records and confirm that they are on-Site and up to date				
(e.g., Site Management Plan, Site Inspection Checklists, etc.)				