



***REMEDIAL ACTION WORK PLAN***

**CPB – Property  
Block 15950, Lot 29  
Far Rockaway, New York  
BCP # 241158**

Prepared For:

Corporation of the Presiding Bishop (CPB) of The  
Church of Jesus Christ of Latter-day Saints, a Utah Corporation Sole  
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*TRC Job Number: 174788*

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## **1.0 Introduction**

TRC has prepared this Remedial Action Work Plan (RAWP) for CPB Site (Brownfields Cleanup Program (BCP) # C241158), located in Far Rockaway Queens (Figure 1). This RAWP provides the New York State Department of Environmental Conservation (NYSDEC) with the proposed remedial alternatives screened for the site and is based on the BCP Remedial Investigation (RI). The results of the RI have been provided in the RI Report (RIR) and were submitted to the NYSDEC on August 10, 2015. A brief summary of the findings is provided below for your reference. As described below, TRC believes that the proposed, straightforward remedial actions are adequate to address the limited, residual on-site impacts.

A comprehensive, active remediation program that included excavation and off-site disposal of contaminated soil and in-situ thermal treatment (ISTT) of contaminated groundwater has already been completed. These measures substantially reduced the environmental impacts at the site. The proposed remedial actions to address the limited residual impacts, consist of engineering and institutional controls and continued groundwater monitoring for Natural Attenuation (NA). Engineering controls, which consist of two asphalt caps for soil impacts and a Sub-Slab Depressurization System (SSDS) for potential vapor intrusion have been proposed and are described below. These engineering controls can be easily implemented and will be governed by the Site Management Plan (SMP). An institutional control, consisting of an Environmental Easement, has been prepared, executed and recorded as of December 17, 2015.

## **2.0 Remedial Investigation Summary**

A brief description of the RI results and the current state of each impacted media are provided below. A full discussion of the RI results can be found in the RIR (TRC 15).

### **2.1 Groundwater RI Findings**

Groundwater samples were collected from ten temporary well point samples and five shallow wells samples. Groundwater sample results indicated that environmental impacts are limited to VOCs and metals. The metals compounds are likely naturally occurring from salt water intrusion as they are largely limited to iron, manganese and sodium. The Jamaica Bay is less than 580 feet northwest of the site and the Atlantic Ocean is approximately 2,100 feet south of the site. Nickel was also found in MW-8s, at a concentration of 126 µg/L.

VOC analyses demonstrated that TCE and its breakdown products, cis-1,2 dichloroethylene (cis-1,2 DCE) and vinyl chloride (VC), remain the main contaminants of concern at the site, with locally limited exceedances of benzene and toluene. The maximum TCE, cis-1,2 DCE and VC concentrations observed on-site were 50.5, 167 and 151 micrograms per liter (µg/L), respectively. The highest concentrations were observed

near the former source area at MW-4i and SG-2. Away from the source area, the contaminant concentrations decrease to near groundwater standards. The maximum benzene and toluene concentrations were 3.6 and 32.7 µg/L, respectively. Table 1 presents the groundwater sampling results, and Figure 2 presents the exceedances of the NYSDEC Technical & Operational Guidance Series (TOGS) Class GA Groundwater Quality Standards.

## **2.2 Soil RI Findings**

Shallow soil samples were collected at nine locations across the site. The results of these samples were compared for screening purposes to NYSDEC Restricted Residential Use Soil Cleanup Objectives (RR-SCO) as depicted in Table 2. The analyses confirmed that concentrations for only three shallow samples, SS-3, SS-8 and SS-9 marginally exceeded RR-SCO for the secondary parameters of manganese, mercury and SVOCs, respectively, as depicted on Figure 3. No exceedances of Commercial Restricted Use Cleanup Objectives (CR-SCO) were observed, except for a marginal exceedance of manganese at SS-3.

## **2.3 Soil Gas RI Findings**

Soil gas samples were collected from ten on-site locations, installed near the groundwater sample (temporary well) locations. The results of the soil gas samples are presented in Table 3, and are also depicted on Figure 5. There are no standards for soil gas, and there are no current structures on-site where sub-slab soil gas samples can be collected. While the New York State Department of Health guidance document, Guidance for Evaluating Soil Vapor Intrusion, does provide matrix for describing vapor intrusion potential, only indoor air and sub-slab concentrations are referenced.

In general, high concentrations of VOCs in soil gas were limited to the area around SG-2 and SG-10. This limited area is coincident with an area of elevated dissolved VOC levels in groundwater. Concentrations of TCE and cis-1,2 DCE were found at concentrations of up to 1,800 and 92 µg/m<sup>3</sup>, respectively. Concentrations of VC were below detection limits in the SG-2 and SG-10 samples. Outside of the area of SG-2 and SG-10, TCE and cis-1,2 DCE concentrations decrease substantially, with maximum observed concentrations of 60.7 and 42 µg/m<sup>3</sup>, respectively.

## **3.0 Remedial Action Objectives**

Remedial Action Objectives (RAOs) have been developed by the NYSDEC for the Site. The RAOs are media specific, and have been developed for groundwater, soil and soil gas. The RAOs establish the minimum goals for the remedial actions in each impacted media.

The RAOs for soil address public health concerns, and are as follows:

- Prevent ingestion/direct contact with contaminated soil; and

- Prevent inhalation exposure to contaminants volatilizing from soil.

The RAOs for groundwater address both public health concerns and environmental protection, and include the following:

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards;
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater; and
- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.

The RAOs for soil gas are protective of public health, and state the following:

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

#### **4.0 Remedial Alternative Assessment and Proposed Remedial Actions**

To address the environmental impacts described above, TRC has conducted a Remedial Alternative Assessment (RAA) for the on-site soil, groundwater and soil gas. The following sections describe the RAA, the retained technologies and TRC's proposed remedial actions for each media of concern. A summary of the RAA is provided as Table 4.

##### **4.1 Groundwater RAA and Proposed Remedial Action**

Multiple remedial alternatives were screened for CPB groundwater. These alternatives included active treatments, such as pump and treat, enhanced in-situ bioremediation (EISB), in-situ chemical oxidation (ISCO) and air sparging (AS), and a passive alternative consisting of NA.

Active remediation of groundwater was conducted during the ISTT program, with over 99% removal of the chlorinated VOCs. Any further active remediation is likely to be inefficient, given the very low concentration of contaminants at the site. Additionally, most active remedial alternatives would be detrimental to ongoing NA. Enhanced in-situ bioremediation (EISB) would not disrupt the NA, however it is doubtful that an EISB program would be successful at achieving significant further reductions in groundwater concentrations since the concentrations are already very low.

Based on the post-ISTT data and recent samples obtained during the RI, substantial NA of residual groundwater impacts is occurring at the site. The pre- and post-ISTT groundwater results for source area wells MW-4s and MW-4i are presented in Table 5. The groundwater quality has continued to improve after the ISTT program, with TCE below detectable levels in the source area wells. TCE concentrations at all monitoring

wells, with the exception of MW-6s and soil gas point SG-2, are below the TOGS Class GA quality standards. The groundwater on the site is not potable; however, because the water is brackish and not suitable for potable uses.

Because the geochemical and biological samples confirm that conditions amenable for NA exist, and sample trends confirm decreasing groundwater contamination, TRC believes that NA is the best remedial alternative. TRC requests that no further groundwater monitoring be required for the site, as all monitoring wells are near or below the TOGS Class GA groundwater quality standards for the contaminants of concern.

## **4.2 Soil RAA and Proposed Remedial Action**

Multiple remedial alternatives were screened for CPB soil. These alternatives included active treatments, such as limited excavation with off-site disposal, stabilization and solidification (S&S), and containment alternatives such as a natural soil cover or a protective cap. Because there are no development plans, the compatibility of the active options with potential redevelopment cannot be assessed at this time. The S&S alternative may not be compatible if the treatment areas will be used for landscaped areas in the future. Additionally, if the impacted soils are excavated and disposed of off-site, the subsequent backfill material may be excavated in the future if the site development calls for regrading of the site.

To address these localized and marginal exceedances, TRC is proposing to install asphalt capping as an engineering control over two separate areas, as depicted on Figure 4. The caps will consist of a geotextile liner for demarcation (over the existing fill), a four-inch layer of recycled concrete aggregate (RCA) (provided by a licensed Subchapter 375 vendor, Parts 360-16.4 and 360-1.15) and a two-inch thick layer of asphalt. Cap Area 1 will cover an area of approximately 5,400 square feet and will be installed around sample location SS-3. Cap Area 2 will cover an area of approximately 9,900 square feet and will be installed around sample locations SS-8 and SS-9. The proposed capping locations and cap schematic are provided in Figure 4. The asphalt cap will constitute an engineering control.

The engineering control will be governed by an institutional control in the form of an environmental easement (EE). The SMP will state the following:

- Require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- Allow the use and development of the controlled property for restricted residential as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH; and
- Require compliance with the Department approved Site Management Plan.

### **4.3 Soil Gas RAA and Proposed Remedial Action**

Multiple remedial alternatives were screened for CPB soil gas. These alternatives included engineering controls consisting of active and passive SSDSs and a vapor barrier.

The decision document will require that any future structure built on the site include a SSDS, which can operate in an active or passive mode. The system will consist of a layer of permeable material and collection piping, connected to vertical conveyance piping. The installation of a suction fan will be predicated on soil gas samples collected after the sub-slab infrastructure is installed. Wind powered turbines may be included if the system operates in a passive mode.

If a significant period of time lapses before a building is constructed, the soil gas concentrations may be re-assessed before construction. The NA of contamination within the source area is expected to further decrease the potential for vapor intrusion over time. If sufficient attenuation occurs the need for an active venting system may be alleviated or unnecessary.

Because there are no development plans, the compatibility of the active options with potential redevelopment cannot be assessed at this time. The location of any future buildings and the timing of the building installation will affect the proposed remedial alternative for vapor intrusion.

### **5.0 Summary and Future Actions**

TRC believes that the proposed remedial actions are adequate and protective of human health and the environment at the site. While future land use has not been established, the Environmental Easement was granted to NYSDEC for the site which limits future operations to restricted residential or commercial uses. CPB may elect to utilize the site for a future Meeting House or Church, however no assessment or feasibility for use has been determined at this time. As described above, if structures are built on the site, vapor intrusion mitigation measures consisting of either active or passive SSDSs will be installed.

Additionally, the caps described above, will be installed. If the site is developed in the future, the capping plan may be altered to include different cap types (*i.e.*, asphalt may be replaced by a structure foundation, concrete slab, crushed stone, or soil cap).

A SMP has been developed which will establish the future restrictions and monitoring requirements for the site. The SMP provides provisions for modifications to the engineering controls, which will likely be required if the property is developed.

A Health and Safety Plan for the proposed cap installation has been provided as Appendix B. Appendix C provides the proposed construction quality assurance project plan (CQAPP). The CQAPP will provide the framework for the cap installation and describes the general construction requirements for the proposed asphalt cap.

## **6.0 REFERENCES**

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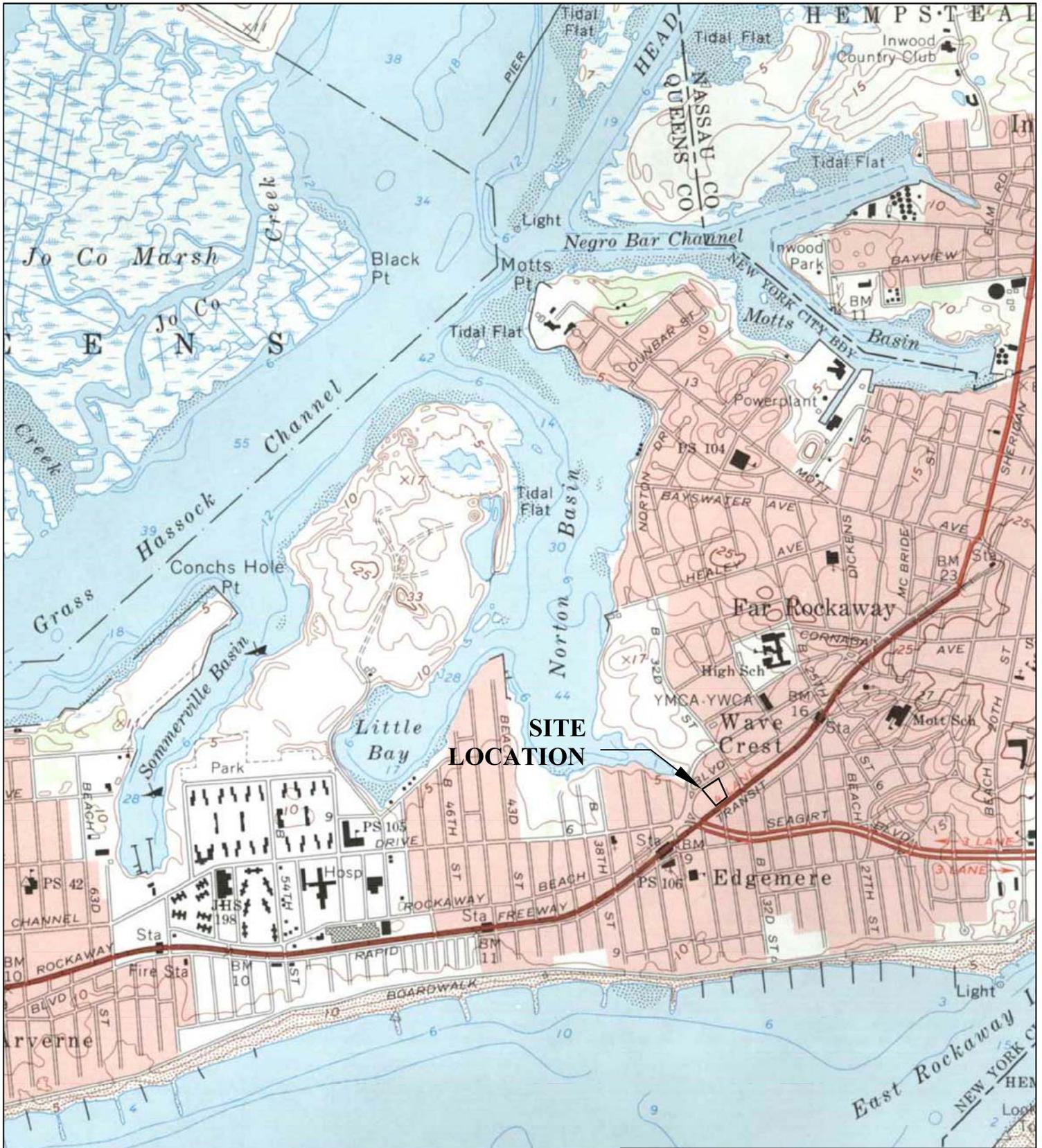
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- TRC 3, TRC Environmental, Inc. In Situ Chemical Oxidation Pilot Test Report, CPB-Property, Edgemere, New York- December 22, 2008.
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- TRC 13, TRC Environmental, Inc. Phone Call to NYSDEC: 90 Day Post Treatment Ground Water Samples – January 19, 2012.
- TRC 14, TRC Environmental Inc. In-Situ Thermal Treatment (ISTT) Remedial Action Report – August 24, 2012
- TRC 15, TRC Environmental Inc. Remedial Investigation Report (RIR) – August 2015

## FIGURES



**TRC ENVIRONMENTAL CORP.**  
 57 East Willow Street  
 Millburn, New Jersey 07041

**SITE LOCATION MAP**

CPB – EDMERE, NEW YORK

JOB NO.: 159807

HN

DATE: AUGUST 2009

FIGURE: 1

# FAR ROCKAWAY BOULEVARD

TO BAY  
P.O.B. 32ND STREET

Well ID	SG-1-GW
Date	1/23/2015
Benzene	ND
cis-1,2-Dichloroethene	ND
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	0.83
Vinyl chloride	0.76
Xylene (total)	ND

Well ID	SG-2-GW
Date	1/29/2015
Benzene	ND
cis-1,2-Dichloroethene	14.8
trans-1,2-Dichloroethene	0.52
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	50.5
Vinyl chloride	1.4
Xylene (total)	ND

BLOCK 15950  
LOT 24

Well ID	SG-10-OFF SET-GW
Date	1/30/2015
Benzene	0.68
cis-1,2-Dichloroethene	1.5
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	0.58
Trichloroethene	4.8
Vinyl chloride	1.9
Xylene (total)	ND

Well ID	SG-10-GW	
Date	1/29/2015	1/29/2015 (dup)
Benzene	1.4	1.3
cis-1,2-Dichloroethene	0.58	0.56
trans-1,2-Dichloroethene	ND	ND
Ethylbenzene	ND	ND
Tetrachloroethene	ND	ND
Toluene	0.83	0.85
Trichloroethene	1.1	0.93
Vinyl chloride	3.8	4.1
Xylene (total)	ND	ND

Well ID	MW-4i	
Date	1/5/2015	1/5/2015 (dup)
Benzene	3.6	3.5
cis-1,2-Dichloroethene	162	167
trans-1,2-Dichloroethene	5.4	5.5
Ethylbenzene	0.46	0.47
Tetrachloroethene	ND	ND
Toluene	0.72	0.69
Trichloroethene	ND	ND
Vinyl chloride	147	151
Xylene (total)	0.78	0.75

Well ID	SG-3-GW
Date	1/29/2015
Benzene	ND
cis-1,2-Dichloroethene	1.3
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	0.48
Vinyl chloride	1
Xylene (total)	ND

Well ID	MW-6s
Date	1/5/2015
Benzene	0.78
cis-1,2-Dichloroethene	2.3
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	6.5
Vinyl chloride	0.81
Xylene (total)	ND

Well ID	MW-9s
Date	1/5/2015
Benzene	1.7
cis-1,2-Dichloroethene	5.4
trans-1,2-Dichloroethene	0.94
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	0.31
Trichloroethene	3.7
Vinyl chloride	ND
Xylene (total)	ND

Well ID	MW-4s
Date	1/6/2015
Benzene	ND
cis-1,2-Dichloroethene	ND
trans-1,2-Dichloroethene	0.65
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	ND
Vinyl chloride	ND
Xylene (total)	ND

Well ID	MW-8s
Date	1/5/2015
Benzene	ND
cis-1,2-Dichloroethene	1
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	1.7
Vinyl chloride	0.86
Xylene (total)	ND

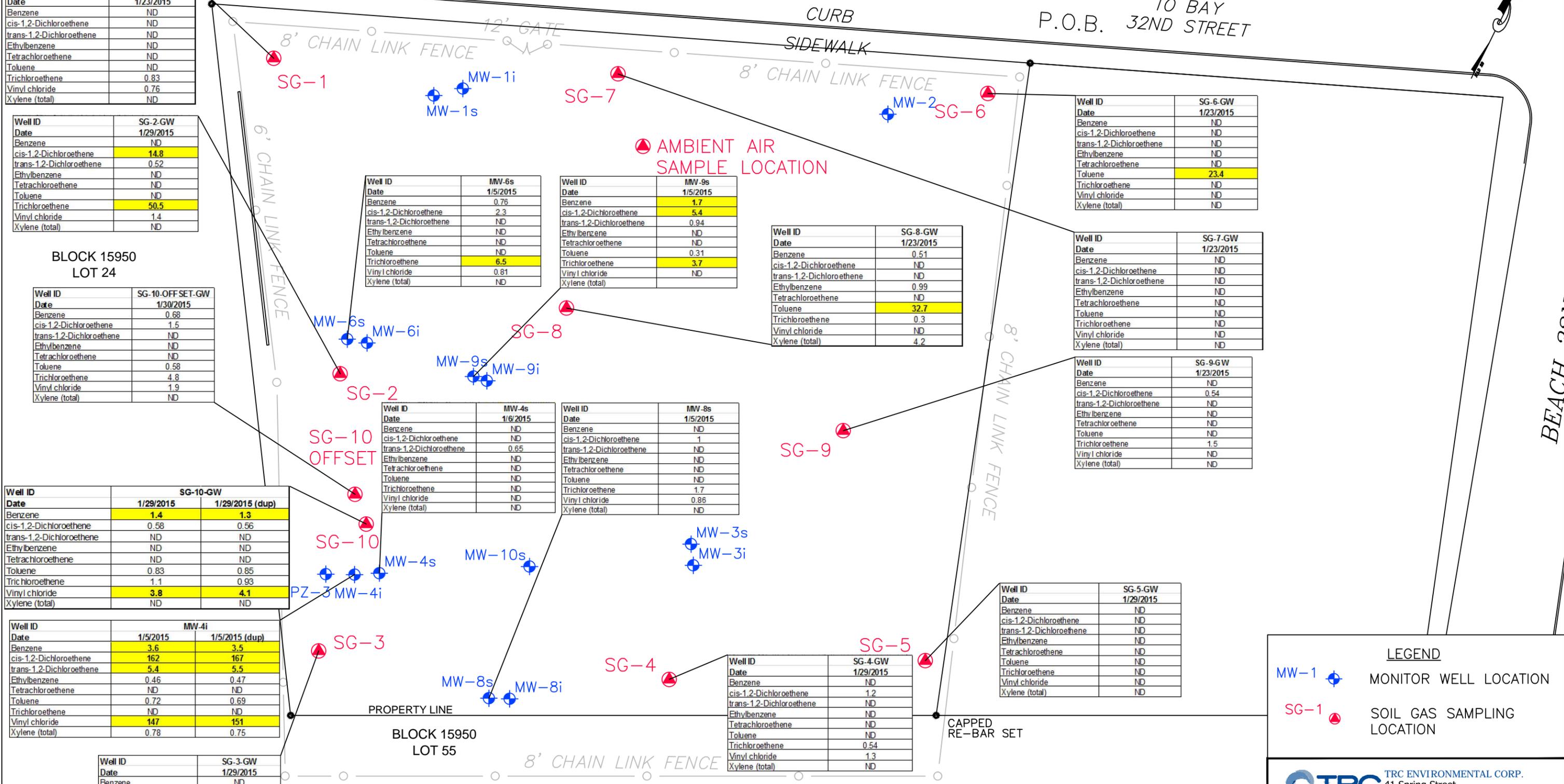
Well ID	SG-4-GW
Date	1/29/2015
Benzene	ND
cis-1,2-Dichloroethene	1.2
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	0.54
Vinyl chloride	1.3
Xylene (total)	ND

Well ID	SG-6-GW
Date	1/23/2015
Benzene	ND
cis-1,2-Dichloroethene	ND
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	23.4
Trichloroethene	ND
Vinyl chloride	ND
Xylene (total)	ND

Well ID	SG-7-GW
Date	1/23/2015
Benzene	ND
cis-1,2-Dichloroethene	ND
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	ND
Vinyl chloride	ND
Xylene (total)	ND

Well ID	SG-9-GW
Date	1/23/2015
Benzene	ND
cis-1,2-Dichloroethene	0.54
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	1.5
Vinyl chloride	ND
Xylene (total)	ND

Well ID	SG-5-GW
Date	1/29/2015
Benzene	ND
cis-1,2-Dichloroethene	ND
trans-1,2-Dichloroethene	ND
Ethylbenzene	ND
Tetrachloroethene	ND
Toluene	ND
Trichloroethene	ND
Vinyl chloride	ND
Xylene (total)	ND



**LEGEND**

MW-1 MONITOR WELL LOCATION

SG-1 SOIL GAS SAMPLING LOCATION

**TRC** TRC ENVIRONMENTAL CORP.  
41 Spring Street  
New Providence, New Jersey 07974

ON-SITE  
GROUNDWATER SAMPLING RESULTS

CPB - FAR ROCKAWAY, NEW YORK

JOB NO.: 174788

DL/GB DATE: MARCH 2015 FIGURE: 2



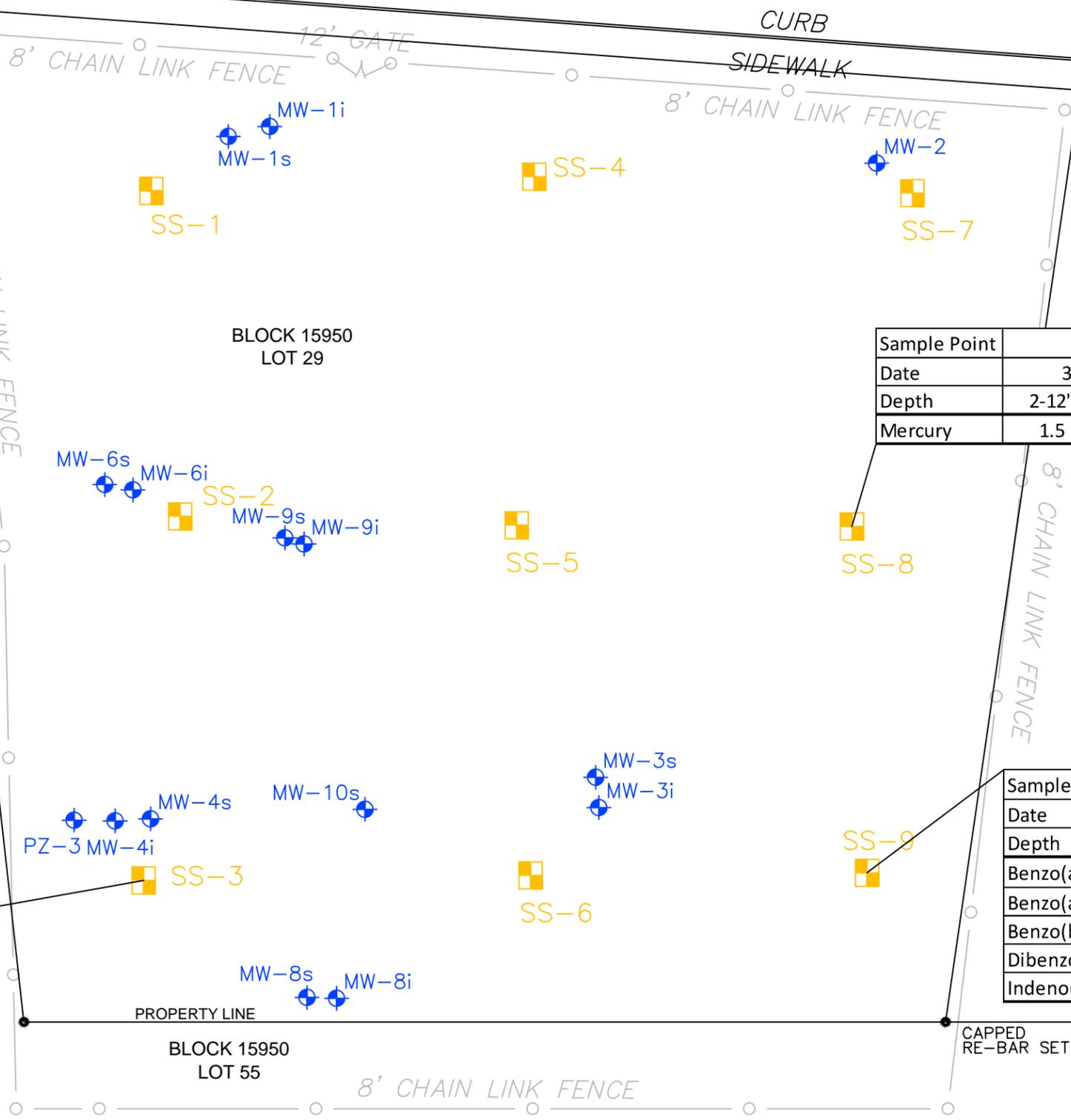
FAR ROCKAWAY BOULEVARD

TO BAY  
P.O.B. 32ND STREET

BLOCK 15950  
LOT 24

BLOCK 15950  
LOT 29

BLOCK 15950  
LOT 55



Sample Point	SS-8	
Date	3/27/2015	
Depth	2-12"	12-24"
Mercury	1.5	1.9

Sample Point	SS-9
Date	3/27/2015
Depth	12-24"
Benzo(a)anthracene	1.95
Benzo(a)pyrene	1.99
Benzo(b)fluoranthene	2.19
Dibenzo(a,h)anthracene	0.51
Indeno(1,2,3-cd)pyrene	1.64

Sample Point	SS-3
Date	3/27/2015
Depth	2-12"
Manganese	2,250

Applicable Criteria (RR-RSCO)	mg/kg
Benzo(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Dibenzo(a,h)anthracene	0.33
Indeno(1,2,3-cd)pyrene	0.5
Manganese	2000
Mercury	0.81

RR-RSCO = Restricted Residential-  
Restricted Use Soil Cleanup Objectives

CAPPED  
RE-BAR SET

ROCKAWAY FREEWAY



LEGEND	
MW-1	MONITOR WELL LOCATION
SS-1	SURFACE SOIL SAMPLING LOCATION

**TRC** TRC ENVIRONMENTAL CORP.  
41 Spring Street  
New Providence, New Jersey 07974

SOIL SAMPLING RESULTS  
RESTRICTED RESIDENTIAL USE EXCEEDANCES

CPB - FAR ROCKAWAY, NEW YORK

JOB NO.: 174788

PB/GB DATE: AUGUST 2015 FIGURE: 3

FAR ROCKAWAY BOULEVARD

TO BAY  
P.O.B. 32ND STREET

BLOCK 15950  
LOT 24

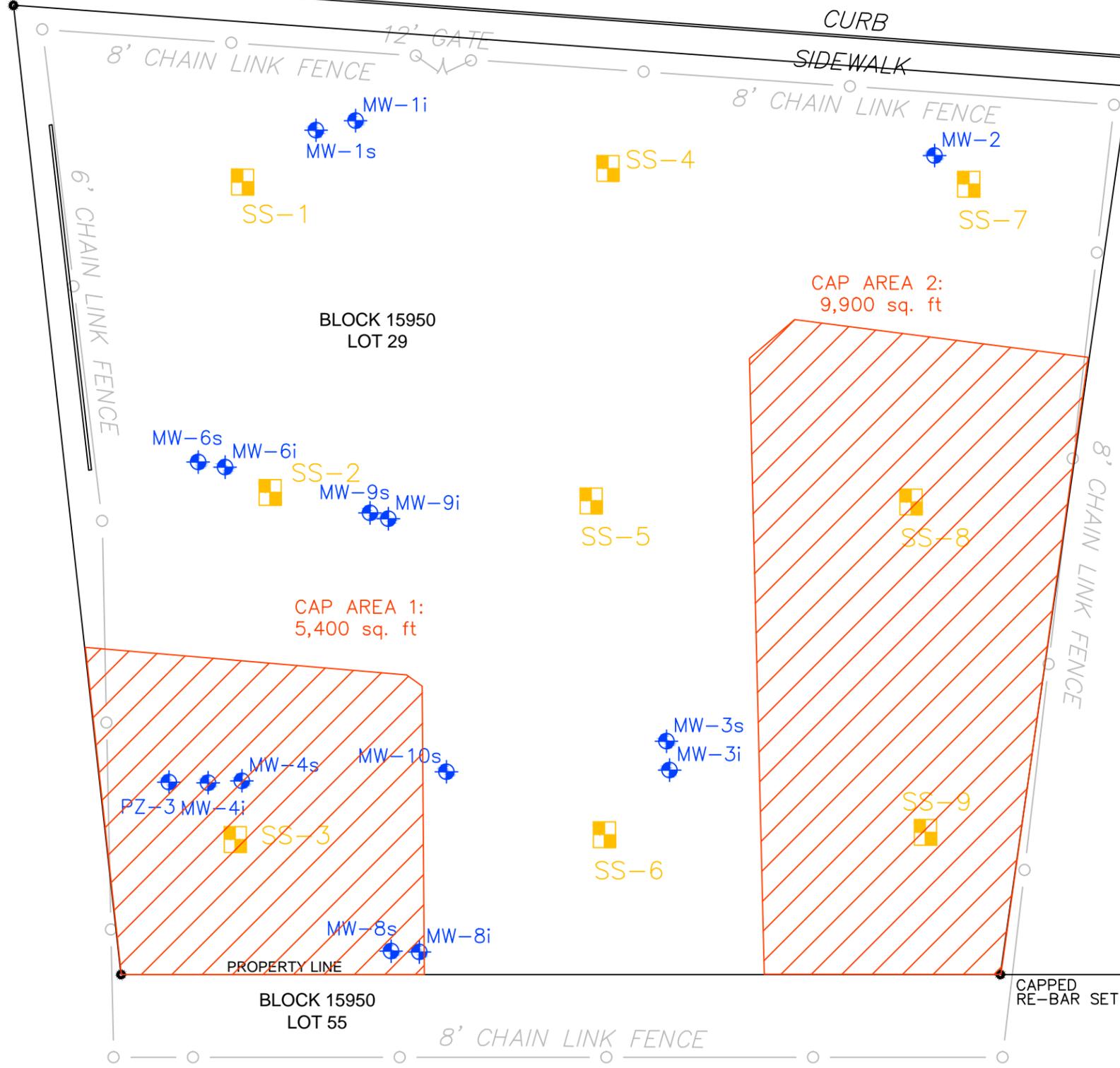
BLOCK 15950  
LOT 29

CAP AREA 1:  
5,400 sq. ft

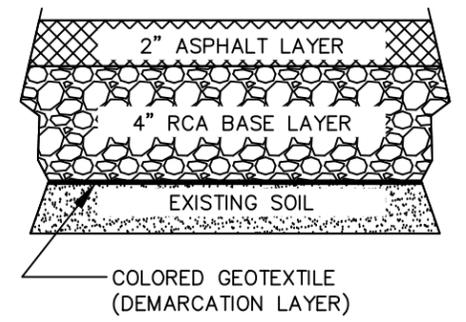
CAP AREA 2:  
9,900 sq. ft

BLOCK 15950  
LOT 55

ROCKAWAY FREEWAY



ASPHALT CAP DETAIL



LEGEND

- MW-1 MONITOR WELL LOCATION
- SS-1 SURFACE SOIL SAMPLING LOCATION

**TRC** TRC ENVIRONMENTAL CORP.  
41 Spring Street  
New Providence, New Jersey 07974

ENGINEERING CONTROL LOCATIONS  
AND ASPHALT CAP DETAILS

CPB - FAR ROCKAWAY, NEW YORK

JOB NO.: 174788

DL/GB	DATE: MARCH 2015	FIGURE: 4
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# FAR ROCKAWAY BOULEVARD

TO BAY  
P.O.B. 32ND STREET

Sample Point	SG-1-AIR
Date	1/23/2015
Benzene	1.5
trans-1,2-Dichloroethylene	ND
cis-1,2-Dichloroethylene	ND
Ethylbenzene	ND
Tetrachloroethylene	5.6
Toluene	3.7
Trichloroethylene	13
Vinyl chloride	ND
Xylenes (total)	ND

Sample Point	SG-6-AIR
Date	1/23/2015
Benzene	ND
trans-1,2-Dichloroethylene	ND
cis-1,2-Dichloroethylene	ND
Ethylbenzene	ND
Tetrachloroethylene	ND
Toluene	8.7
Trichloroethylene	ND
Vinyl chloride	ND
Xylenes (total)	ND

Sample Point	SG-7-AIR
Date	1/23/2015
Benzene	2.9
trans-1,2-Dichloroethylene	ND
cis-1,2-Dichloroethylene	ND
Ethylbenzene	ND
Tetrachloroethylene	2.3
Toluene	2.9
Trichloroethylene	1.2
Vinyl chloride	ND
Xylenes (total)	1.7

Sample Point	AMBIENT
Date	1/29/2015
Benzene	0.73
trans-1,2-Dichloroethylene	ND
cis-1,2-Dichloroethylene	ND
Ethylbenzene	ND
Tetrachloroethylene	0.26
Toluene	0.83
Trichloroethylene	ND
Vinyl chloride	ND
Xylenes (total)	ND

Sample Point	SG-8-AIR
Date	1/23/2015
Benzene	68.4
trans-1,2-Dichloroethylene	ND
cis-1,2-Dichloroethylene	ND
Ethylbenzene	13
Tetrachloroethylene	ND
Toluene	119
Trichloroethylene	11
Vinyl chloride	ND
Xylenes (total)	39

Sample Point	SG-9-AIR
Date	1/23/2015
Benzene	2
trans-1,2-Dichloroethylene	ND
cis-1,2-Dichloroethylene	3.6
Ethylbenzene	ND
Tetrachloroethylene	ND
Toluene	5.3
Trichloroethylene	24
Vinyl chloride	ND
Xylenes (total)	ND

Sample Point	SG-5-AIR
Date	1/23/2015
Benzene	6.1
trans-1,2-Dichloroethylene	ND
cis-1,2-Dichloroethylene	ND
Ethylbenzene	ND
Tetrachloroethylene	ND
Toluene	3.7
Trichloroethylene	0.81
Vinyl chloride	ND
Xylenes (total)	ND

Sample Point	SG-4-AIR
Date	1/29/2015
Benzene	1.8
trans-1,2-Dichloroethylene	ND
cis-1,2-Dichloroethylene	ND
Ethylbenzene	ND
Tetrachloroethylene	ND
Toluene	2.3
Trichloroethylene	60.7
Vinyl chloride	ND
Xylenes (total)	ND

BLOCK 15950  
LOT 24

Sample Point	SG-2-AIR
Date	1/29/2015
Benzene	1.2
trans-1,2-Dichloroethylene	3.9
cis-1,2-Dichloroethylene	92.4
Ethylbenzene	ND
Tetrachloroethylene	18
Toluene	2.4
Trichloroethylene	1.820
Vinyl chloride	ND
Xylenes (total)	ND

Sample Point	SG-10-AIR	
Date	1/29/2015	1/29/2015 (dup)
Benzene	3.8	4.2
trans-1,2-Dichloroethylene	ND	ND
cis-1,2-Dichloroethylene	20	21
Ethylbenzene	ND	ND
Tetrachloroethylene	4	4.3
Toluene	2.2	2.7
Trichloroethylene	168	178
Vinyl chloride	ND	ND
Xylenes (total)	ND	ND

Sample Point	SG-3-AIR
Date	1/29/2015
Benzene	3.2
trans-1,2-Dichloroethylene	ND
cis-1,2-Dichloroethylene	42
Ethylbenzene	ND
Tetrachloroethylene	ND
Toluene	ND
Trichloroethylene	24
Vinyl chloride	1.6
Xylenes (total)	ND

NOTE:  
RESULTS IN  $\mu\text{g}/\text{m}^3$   
ND = NOT DETECTED

**LEGEND**

MW-1 MONITOR WELL LOCATION

SG-1 SOIL GAS SAMPLING LOCATION

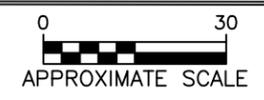
**TRC ENVIRONMENTAL CORP.**  
41 Spring Street  
New Providence, New Jersey 07974

ON-SITE  
SOIL GAS SAMPLING RESULTS

CPB - FAR ROCKAWAY, NEW YORK

JOB NO.: 174788

DL/GB      DATE: MARCH 2015      FIGURE: 5



# ROCKAWAY FREEWAY

## TABLES



**Table 2**  
**Volatile Organic Compounds in Soil (Restricted Use)**  
**CPB Site**  
**Far Rockaway, NY**

TRC Sample No.:	SS-1 (0'-2")	SS-1 (2'-12")	SS-1 (12'-24")	SS-2 (0'-2")	SS-2 (12'-24")	SS-2 (2'-12")	SS-3 (0'-2")	SS-3 (12'-24")	SS-3 (2'-12")	SS-4 (0'-2")	SS-4 (12'-24")	SS-4 (2'-12")	SS-5 (0'-2")	SS-5 (12'-24")	SS-5 (2'-12")					
Date Sampled:	1/19/2015	1/19/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	1/23/2015	1/23/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015					
Lab Sample ID:	JB86729-1	JB86729-2	JB87101-6	JB91085-2	JB91085-4	JB91085-3	JB91085-8	JB91085-10	JB91085-9	JB87101-7	JB87101-9	JB87101-8	JB91085-5	JB91085-7	JB91085-6					
Laboratory:	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest					
VOCs by GCMS (mg/kg)	RR-RSCO																			
Acetone	100	ND	ND	ND	ND	ND	ND	ND	0.0193	ND	ND	ND	ND	ND	ND					
Benzene	4.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Bromochloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Bromodichloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Bromoform	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Bromomethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
2-Butanone (MEK)	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
n-Butylbenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
sec-Butylbenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
tert-Butylbenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Carbon disulfide	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Carbon tetrachloride	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Chlorobenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Chloroethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Chloroform	49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Chloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Cyclohexane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,2-Dibromo-3-chloropropane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Dibromochloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,2-Dibromoethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,2-Dichlorobenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,3-Dichlorobenzene	49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,4-Dichlorobenzene	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Dichlorodifluoromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,1-Dichloroethane	26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,2-Dichloroethane	3.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,1-Dichloroethene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
cis-1,2-Dichloroethene	100	ND	ND	ND	ND	ND	ND	ND	0.00094	ND	ND	ND	ND	ND	ND					
trans-1,2-Dichloroethene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,2-Dichloropropane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
cis-1,3-Dichloropropene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
trans-1,3-Dichloropropene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Ethylbenzene	41	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Freon 113	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
2-Hexanone	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Isopropylbenzene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
p-Isopropyltoluene	-	NA	NA	ND	ND	ND														
Methyl Acetate	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Methylcyclohexane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Methyl Tert Butyl Ether	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
4-Methyl-2-pentanone(MIBK)	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Methylene chloride	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017	J	0.0019	J				
n-Propylbenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Styrene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,1,2,2-Tetrachloroethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Tetrachloroethene	19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Toluene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,2,3-Trichlorobenzene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,2,4-Trichlorobenzene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,1,1-Trichloroethane	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
1,1,2-Trichloroethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND					
Trichloroethene	21	ND	0.00058	J	0.0024	J	0.00065	J	0.0062	0.0022	0.0013	0.0018	0.0098	ND	0.00022	J	ND	ND	ND	ND
Trichlorofluoromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	0.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene (total)	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	-	0	0.00058	0.0024	0.00065	0.0062	0.0022	0.0013	0.0018	0.03004	0	0.00022	0	0.0017	0	0.0019				
Total VOC TICs	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
Total VOCs	-	0	0.00058	0.0024	0.00065	0.0062	0.0022	0.0013	0.0018	0.03004	0	0.00022	0	0.0017	0	0.0019				

Notes:  
 ND = not detected.  
 NA = not analyzed.  
 J = estimated concentration detected below the Method Detection Limit.  
 RR-RSCO = Restricted Residential Restricted Use Soil Cleanup Objectives  
 Bold & Highlighted indicates concentration above RR-RSCO.

**Table 2**  
**Volatile Organic Compounds in Soil (Restricted Use)**  
**CPB Site**  
**Far Rockaway, NY**

TRC Sample No.:	SS-6 (0"-2")	SS-6 (12"-24")	SS-6 (2"-12")	SS-7 (0-2")	SS-7 (0-2")(A)	SS-7 (12-24")	SS-7 (2-12")	SS-7 (2-12")(A)	SS-8 (0"-2")	SS-8 (12"-24")	SS-8 (2"-12")	SS-9 (0"-2")	SS-9 (12"-24")	SS-9 (2"-12")
Date Sampled:	3/27/2015	3/27/2015	3/27/2015	1/23/2015	1/23/2015	1/23/2015	1/23/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015
Lab Sample ID:	JB91085-11	JB91085-13	JB91085-12	JB87101-10	JB87101-11	JB87101-14	JB87101-12	JB87101-13	JB91085-17	JB91085-19	JB91085-18	JB91085-14	JB91085-16	JB91085-15
Laboratory:	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest
VOCs by GCMS (mg/kg)	RR-RSCO													
Acetone	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	4.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromochloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Butylbenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butylbenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	26	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	41	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Freon 113	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Isopropyltoluene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Acetate	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylcyclohexane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Tert Butyl Ether	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone(MIBK)	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	100	ND	0.00055 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichlorobenzene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	21	ND	0.003	0.00063 J	ND	ND	ND	ND	ND	ND	ND	ND	0.0027	0.00042 J
Trichlorofluoromethane	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	0.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
m,p-Xylene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene (total)	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	-	0	0.00355	0.00063	0	0	0	0	0	0	0	0	0.0027	0.00042
Total VOC TICs	-	0	0	0	0	0	0	0	0	0	0	0	0	0
Total VOCs	-	0	0.00355	0.00063	0	0	0	0	0	0	0	0	0.0027	0.00042

Notes:  
 ND = not detected.  
 NA = not analyzed.  
 J = estimated concentration detected below the M  
 RR-RSCO = Restricted Residential Restricted Us  
 Bold & Highlighted indicates concentration above

**Table 2**  
**Semi-Volatile Organic Compounds in Soil (Restricted Use)**  
**CPB Site**  
**Far Rockaway, NY**

SVOCs by GCMS (mg/kg)	TRC Sample No.:		SS-1 (0'-2")	SS-1 (2'-12")	SS-1 (12'-24")	SS-2 (0'-2")	SS-2 (12'-24")	SS-2 (2'-12")	SS-3 (0'-2")	SS-3 (12'-24")	SS-3 (2'-12")	SS-4 (0'-2")	SS-4 (12'-24")	SS-4 (2'-12")	SS-5 (0'-2")	SS-5 (12'-24")	SS-5 (2'-12")															
	RR-RSCO	C-RSCO	1/19/2015 JB86729-1 Accutest	1/19/2015 JB86729-2 Accutest	1/23/2015 JB87101-6 Accutest	3/27/2015 JB91085-2 Accutest	3/27/2015 JB91085-4 Accutest	3/27/2015 JB91085-3 Accutest	3/27/2015 JB91085-8 Accutest	3/27/2015 JB91085-10 Accutest	3/27/2015 JB91085-9 Accutest	1/23/2015 JB87101-7 Accutest	1/23/2015 JB87101-9 Accutest	1/23/2015 JB87101-8 Accutest	3/27/2015 JB91085-5 Accutest	3/27/2015 JB91085-7 Accutest	3/27/2015 JB91085-6 Accutest															
2-Chlorophenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
4-Chloro-3-methyl phenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
2,4-Dichlorophenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
2,4-Dimethylphenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
2,4-Dinitrophenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
4,6-Dinitro-o-cresol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
2-Methylphenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
3&4-Methylphenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
2-Nitrophenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
4-Nitrophenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
Pentachlorophenol	6.7	-	ND	ND	ND	ND	ND	ND	ND	ND																						
Phenol	100	-	ND	ND	ND	ND	ND	ND	ND	ND																						
2,3,4,6-Tetrachlorophenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
2,4,5-Trichlorophenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
2,4,6-Trichlorophenol	-	-	ND	ND	ND	ND	ND	ND	ND	ND																						
Acenaphthene	100	-	ND	ND	0.0216	J	ND	0.0142	J	0.0488	0.0194	J	ND	ND	0.0151	J	ND	ND	0.0235	J	ND	0.0161	J									
Acenaphthylene	100	-	ND	ND	0.0224	J	0.0233	J	0.0332	J	0.0476	0.0634	0.0459	0.061	0.0531	0.0216	J	0.0468	0.0714	0.0541	0.0556											
Acetophenone	-	-	ND	ND	ND	ND	ND	0.0301	J	ND	ND	ND	ND	ND	ND	ND																
Anthracene	100	-	0.015	J	ND	0.0363	0.0323	J	0.0652	0.167	0.13	0.0597	0.0796	0.0684	0.0297	J	0.0513	0.124	0.0794	0.0916												
Atrazine	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																
Benzo(a)anthracene	1	-	0.0857	0.0629	0.146	0.154	0.212	0.392	0.448	0.225	0.325	0.295	0.16	0.238	0.33	0.19	0.284															
Benzo(a)pyrene	1	-	0.101	0.069	0.165	0.181	0.268	0.421	0.522	0.293	0.412	0.347	0.187	0.308	0.4	0.209	0.313															
Benzo(b)fluoranthene	1	-	0.12	0.0957	0.202	0.22	0.316	0.488	0.614	0.345	0.477	0.422	0.239	0.365	0.449	0.246	0.383															
Benzo(g,h,i)perylene	100	-	0.0714	0.0611	0.133	0.151	0.215	0.299	0.401	0.286	0.334	0.302	0.16	0.283	0.324	0.156	0.228															
Benzo(k)fluoranthene	3.9	-	0.0468	0.029	J	0.0684	0.0709	0.0955	0.185	0.212	0.125	0.177	0.17	0.077	0.148	0.178	0.0761	0.118														
4-Bromophenyl phenyl ether	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																	
Butyl benzyl phthalate	-	-	ND	0.0407	J	ND	ND	ND	ND	0.223	ND	ND	0.128	ND	0.0777	ND	ND	ND	ND	ND	ND	ND	ND									
1,1'-Biphenyl	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																
Benzaldehyde	-	-	ND	ND	ND	ND	ND	0.0191	J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND									
2-Chloronaphthalene	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																
4-Chloroaniline	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																
Carbazole	-	-	ND	ND	0.0217	J	ND	0.0246	J	0.0477	J	0.0299	J	ND	0.0178	J	0.0296	J	ND	0.0221	J	0.0333	J	ND	0.0297	J						
Caprolactam	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Chrysene	3.9	-	0.096	0.0726	0.165	0.157	0.228	0.407	0.459	0.232	0.343	0.347	0.19	0.284	0.355	0.193	0.295															
bis(2-Chloroethoxy)methane	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
bis(2-Chloroethyl)ether	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
bis(2-Chloroisopropyl)ether	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
4-Chlorophenyl phenyl ether	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
2,4-Dinitrotoluene	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
2,6-Dinitrotoluene	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
3,3'-Dichlorobenzidine	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
1,4-Dioxane	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Dibenzo(a,h)anthracene	0.33	-	0.0176	J	0.0145	J	0.031	J	0.0383	0.0531	0.0793	0.0943	0.0614	0.0778	0.0685	0.0386	0.0639	0.0796	0.0439	0.062												
Dibenzofuran	-	-	ND	ND	0.0202	J	ND	ND	0.0327	J	ND	ND	ND	ND	ND	ND	ND	ND	ND													
Di-n-butyl phthalate	-	-	ND	ND	0.0493	J	ND	ND	ND	ND	ND	ND	0.0494	J	ND	0.047	J	ND	ND	ND	ND	ND	ND	ND	ND							
Di-n-octyl phthalate	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Diethyl phthalate	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Dimethyl phthalate	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
bis(2-Ethylhexyl)phthalate	-	-	ND	0.0817	1.62	0.0678	J	0.0867	0.0625	J	0.174	0.117	ND	0.306	ND	0.176	0.0783	0.187	0.114													
Fluoranthene	100	-	0.128	0.0931	0.305	0.233	0.376	0.795	0.747	0.255	0.402	0.523	0.251	0.387	0.58	0.303	0.506															
Fluorene	100	-	ND	ND	0.0207	J	ND	ND	0.0485	0.0229	J	ND	ND	0.0177	J	ND	ND	0.0201	J	ND	0.0175	J	ND	0.0175	J							
Hexachlorobenzene	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Hexachlorobutadiene	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Hexachlorocyclopentadiene	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Hexachloroethane	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Indeno(1,2,3-cd)pyrene	0.5	-	0.071	0.0557	0.123	0.137	0.215	0.304	0.384	0.244	0.315	0.275	0.153	0.259	0.305	0.144	0.229															
Isophorone	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
2-Methylnaphthalene	-	-	ND	ND	0.0572	J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND							
2-Nitroaniline	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
3-Nitroaniline	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
4-Nitroaniline	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Naphthalene	100	-	ND	ND	0.0297	J	ND	ND	0.0197	J	ND	ND	ND	ND	ND	ND	ND	ND	ND													
Nitrobenzene	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
N-Nitroso-di-n-propylamine	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
N-Nitrosodiphenylamine	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Phenanthrene	100	-	0.0553	0.0302	J	0.248	0.0946	0.183	0.553	0.338	0.0668	0.112	0.215	0.109	0.163	0.258	0.119	0.213														
Pyrene	100	-	0.149	0.106	0.284	0.232	0.346	0.676	0.688	0.277	0.399	0.492	0.249	0.39	0.57	0.309	0.467															
1,2,4,5-Tetrachlorobenzene	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
Total	-	-	0.9568	0.8122	3.7695	1.7922	2.7315	5.1185	5.5699	2.6328	3.5322	4.1539	1.8649	3.3098	4.1792	2.3095	3.4225															
Total SVOC TICs	-	-	1.47	J	1.17	J	1.54	J	0.55	J	1.13	J	3.71	J	2.19	J	1.91	J	1.29	J	5.57	J	1.18	J	3.52	J	3.73	J	1.24	J	1.19	J
Total SVOCs	-	-	2.43	1.98	5.31	2.34	3.86	8.83	7.76	4.54	4.82	9.72	3.04	6.83	7.91	3.55	4.61															

Notes:  
 ND = not detected.  
 J = estimated concentration detected below the Method Detection Limit.  
 RR-RSCO = Restricted Residential Restricted Use Soil Cleanup Objectives  
 C-RSCO

**Table 2**  
**Semi-Volatile Organic Compounds in Soil (Restricted Use)**  
**CPB Site**  
**Far Rockaway, NY**

SVOCs by GCMS (mg/kg)	TRC Date Lab	SS-6 (0"-2")	SS-6 (12"-24")	SS-6 (2"-12")	SS-7 (0"-2")	SS-7 (0"-2")(A)	SS-7 (12"-24")	SS-7 (2"-12")	SS-7 (2"-12")(A)	SS-8 (0"-2")	SS-8 (12"-24")	SS-8 (2"-12")	SS-9 (0"-2")	SS-9 (12"-24")	SS-9 (2"-12")								
		3/27/2015 JB91085-11 Accutest	3/27/2015 JB91085-13 Accutest	3/27/2015 JB91085-12 Accutest	1/23/2015 JB87101-10 Accutest	1/23/2015 JB87101-11 Accutest	1/23/2015 JB87101-14 Accutest	1/23/2015 JB87101-12 Accutest	1/23/2015 JB87101-13 Accutest	3/27/2015 JB91085-17 Accutest	3/27/2015 JB91085-19 Accutest	3/27/2015 JB91085-18 Accutest	3/27/2015 JB91085-14 Accutest	3/27/2015 JB91085-16 Accutest	3/27/2015 JB91085-15 Accutest								
RR-RSCO																							
2-Chlorophenol	-	ND																					
4-Chloro-3-methyl phenol	-	ND																					
2,4-Dichlorophenol	-	ND																					
2,4-Dimethylphenol	-	ND																					
2,4-Dinitrophenol	-	ND																					
4,6-Dinitro-o-cresol	-	ND																					
2-Methylphenol	-	ND																					
3&4-Methylphenol	-	ND																					
2-Nitrophenol	-	ND																					
4-Nitrophenol	-	ND																					
Pentachlorophenol	6.7	ND																					
Phenol	100	ND																					
2,3,4,6-Tetrachlorophenol	-	ND																					
2,4,5-Trichlorophenol	-	ND																					
2,4,6-Trichlorophenol	-	ND																					
Acenaphthene	100	0.0152	J	ND	0.0188	J	ND	0.0091	J	ND	0.151	ND	ND	0.0196	J	ND	0.0297	J	ND				
Acenaphthylene	100	0.0455	J	0.041	0.0355	J	0.0197	J	0.0218	J	ND	ND	0.021	J	0.0237	J	0.0377	J	ND	0.386	0.026	J	
Acetophenone	-	ND	ND	ND	ND	ND	ND	ND	ND														
Anthracene	100	0.0779	J	0.0737	0.0847	J	0.0259	J	0.0333	J	ND	0.24	ND	0.0257	J	0.0292	J	0.0723	J	0.0155	J	0.672	0.055
Atrazine	-	ND	ND	ND	ND	ND	ND	ND	ND	ND													
Benzo(a)anthracene	1	0.28	0.233	0.287	0.126	0.149	ND	0.5	0.0542	0.137	0.139	0.284	0.057	1.95	0.119								
Benzo(a)pyrene	1	0.318	0.246	0.286	0.156	0.193	ND	0.396	0.0646	0.161	0.163	0.295	0.0586	1.99	0.117								
Benzo(b)fluoranthene	1	0.372	0.301	0.343	0.197	0.229	ND	0.494	0.0846	0.205	0.215	0.378	0.0701	2.19	0.136								
Benzo(g,h,i)perylene	100	0.264	0.199	0.216	0.138	0.173	ND	0.199	0.0559	0.128	0.134	0.21	0.0468	1.86	0.074								
Benzo(k)fluoranthene	3.9	0.135	0.0856	0.116	0.0653	0.0833	ND	0.173	0.0321	J	0.067	0.0634	0.13	0.0234	J	0.795	0.0517						
4-Bromophenyl phenyl ether	-	ND	ND	ND	ND	ND	ND	ND	ND														
Butyl benzyl phthalate	-	ND	ND	ND	ND	ND	ND	ND	ND														
1,1'-Biphenyl	-	ND	ND	ND	ND	ND	ND	ND	ND														
Benzaldehyde	-	ND	ND	ND	ND	ND	ND	ND	ND														
2-Chloronaphthalene	-	ND	ND	ND	ND	ND	ND	ND	ND														
4-Chloroaniline	-	ND	ND	ND	ND	ND	ND	ND	ND														
Carbazole	-	0.0281	J	0.0224	J	0.0332	J	ND	0.0159	J	ND	0.157	ND	ND	0.0352	J	ND	0.062	J	ND	ND	ND	
Caprolactam	-	ND	ND	ND	ND	ND	ND	ND	ND														
Chrysene	3.9	0.308	0.246	0.297	0.136	0.169	ND	0.541	0.0662	0.154	0.159	0.312	0.0634	2.25	0.128								
bis(2-Chloroethoxy)methane	-	ND	ND	ND	ND	ND	ND	ND	ND														
bis(2-Chloroethyl)ether	-	ND	ND	ND	ND	ND	ND	ND	ND														
bis(2-Chloroisopropyl)ether	-	ND	ND	ND	ND	ND	ND	ND	ND														
4-Chlorophenyl phenyl ether	-	ND	ND	ND	ND	ND	ND	ND	ND														
2,4-Dinitrotoluene	-	ND	ND	ND	ND	ND	ND	ND	ND														
2,6-Dinitrotoluene	-	ND	ND	ND	ND	ND	ND	ND	ND														
3,3'-Dichlorobenzidine	-	ND	ND	ND	ND	ND	ND	ND	ND														
1,4-Dioxane	-	ND	ND	ND	ND	ND	ND	ND	ND														
Dibenzo(a,h)anthracene	0.33	0.0557	0.0465	0.0565	0.0358	0.0465	ND	0.0663	0.0143	J	0.0335	J	0.0308	J	0.0595	ND	0.507	0.0171	J				
Dibenzofuran	-	ND	0.0879	ND	ND	ND	0.0191	J	ND	0.021	J	ND	0.28	0.0494	J								
Di-n-butyl phthalate	-	0.0918	0.0709	J	21.7	ND	ND	ND	ND	ND	ND	ND	ND										
Di-n-octyl phthalate	-	ND	ND	ND	ND	ND	ND	ND	ND														
Diethyl phthalate	-	ND	ND	ND	ND	ND	ND	ND	ND														
Dimethyl phthalate	-	ND	ND	ND	ND	ND	ND	ND	ND														
bis(2-Ethylhexyl)phthalate	-	0.473	0.636	0.802	0.0911	0.0885	ND	ND	0.14	0.0823	0.0902	0.0854	0.761	0.274									
Fluoranthene	100	0.502	0.391	0.496	0.211	0.256	ND	1.18	0.0896	0.257	0.261	0.578	0.092	1.78	0.216								
Fluorene	100	0.0153	J	ND	0.0178	J	ND	ND	0.15	ND	ND	0.0262	J	ND	0.0617	0.016	J						
Hexachlorobenzene	-	ND	ND	ND	ND	ND	ND	ND	ND														
Hexachlorobutadiene	-	ND	ND	ND	ND	ND	ND	ND	ND														
Hexachlorocyclopentadiene	-	ND	ND	ND	ND	ND	ND	ND	ND														
Hexachloroethane	-	ND	ND	ND	ND	ND	ND	ND	ND														
Indeno(1,2,3-cd)pyrene	0.5	0.234	0.174	0.206	0.133	0.164	ND	0.227	0.056	0.123	0.122	0.21	0.0458	1.64	0.0714								
Isophorone	-	ND	ND	ND	ND	ND	ND	ND	ND														
2-Methylnaphthalene	-	0.0245	J	0.0295	J	0.0277	J	ND	0.0375	J	ND	ND	ND	0.0216	J	ND							
2-Nitroaniline	-	ND	ND	ND	ND	ND	ND	ND	ND														
3-Nitroaniline	-	ND	ND	ND	ND	ND	ND	ND	ND														
4-Nitroaniline	-	ND	ND	ND	ND	ND	ND	ND	ND														
Naphthalene	100	0.0384	0.0224	J	0.0219	J	ND	ND	0.023	J	ND	ND	0.0224	J	ND	0.032	J	ND					
Nitrobenzene	-	ND	ND	ND	ND	ND	ND	ND	ND														
N-Nitroso-di-n-propylamine	-	ND	ND	ND	ND	ND	ND	ND	ND														
N-Nitrosodiphenylamine	-	ND	ND	ND	ND	ND	ND	ND	ND														
Phenanthrene	100	0.218	0.185	0.274	0.0889	0.115	ND	1.42	0.0373	0.0919	0.0931	0.29	0.045	0.708	0.122								
Pyrene	100	0.491	0.409	0.476	0.211	0.248	ND	1.06	0.0877	0.222	0.229	0.494	0.0989	3.13	0.194								
1,2,4,5-Tetrachlorobenzene	-	ND	ND	ND	ND	ND	ND	ND	ND														
Total	-	3.9874	3.412	25.7951	1.6347	1.9944	0	7.1027	0.6425	1.7661	1.7445	3.5632	0.7019	21.127	1.6666								
Total SVOC TICs	-	3.09	J	1.31	J	1.97	J	2.46	J	3.1</													

**Table 2  
Pesticide Compounds in Soil (Restricted Use)  
CPB Site  
Far Rockaway, NY**

TRC Sample No.:	SS-1 (0-2")	SS-1 (2-12")	SS-1 (12-24")	SS-2 (0"-2")	SS-2 (12"-24")	SS-2 (2"-12")	SS-3 (0"-2")	SS-3 (12"-24")	SS-3 (2"-12")	SS-4 (0-2")	SS-4 (12-24")	SS-4 (2-12")	SS-5 (0"-2")	SS-5 (12"-24")	SS-5 (2"-12")														
Date Sampled:	1/19/2015	1/19/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	1/23/2015	1/23/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015														
Lab Sample ID:	JB86729-1	JB86729-2	JB87101-6	JB91085-2	JB91085-4	JB91085-3	JB91085-8	JB91085-10	JB91085-9	JB87101-7	JB87101-9	JB87101-8	JB91085-5	JB91085-7	JB91085-6														
Laboratory:	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest														
Pesticides by GC (mg/kg)	RR-RSCO																												
Aldrin	0.097	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
alpha-BHC	0.48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
beta-BHC	0.36	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
delta-BHC	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
gamma-BHC (Lindane)	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND														
alpha-Chlordane	4.2	ND	ND	ND	0.0052	a	0.005	a	0.0125	a	0.0113	a	0.007	a	0.0112	a	0.0036	a	ND	0.002	a	0.003	a	0.0082	0.0124	a			
gamma-Chlordane	-	ND	ND	ND	0.0048		0.0052		0.0095		0.0109		0.007		0.0108		0.0018	a	ND	0.0011		0.0021		0.0076	0.0118				
Dieldrin	0.2	ND	ND	ND	0.0025		ND		ND		0.0199		0.0125		0.0198		ND		ND		ND		ND		0.0202				
4,4'-DDD	13	ND	ND	ND	ND		ND		ND		ND		0.00072		0.00089		ND		ND		ND		ND		ND				
4,4'-DDE	8.9	ND	0.0022	0.0276	ND		ND		ND		0.0011	a	0.0013	a	0.0013	a	0.0027	a	ND		0.0075		ND		ND	0.0013	a		
4,4'-DDT	7.9	0.0037	a	0.0046	0.0501		0.0094		0.0098		0.0069		0.0023		0.0055		0.0146		0.0036		0.0267		ND		ND	0.0061			
Endrin	11	ND	ND	ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND				
Endosulfan sulfate	24	ND	ND	ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND				
Endrin aldehyde	-	ND	ND	ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND				
Endosulfan-I	24	ND	ND	ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND				
Endosulfan-II	24	ND	ND	ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND				
Heptachlor	2.1	ND	ND	ND	ND		ND		ND		0.0011		ND		0.0012		ND		ND		ND		ND		ND	0.0013			
Heptachlor epoxide	-	ND	ND	ND	0.00084		ND		ND		0.0013		0.00069		0.0012		0.0008		ND		ND		ND		ND	0.0014			
Methoxychlor	-	ND	ND	ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND				
Endrin ketone	-	ND	ND	ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND				
Toxaphene	-	ND	ND	ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND				
<b>Total</b>	-	0.0037		0.0068	0.0777		0.02274		0.0102		0.0318		0.0525		0.03151		0.05189		0.0235		0.0036		0.0373		0.0051		0.0158		0.0545

Notes:  
 ND = not detected.  
 a = more than 40% RPD for detected concentrations between the two GC columns.  
 RR-RSCO = Restricted Residential Restricted Use Soil Cleanup Objectives  
 Bold & Highlighted indicates concentration above RR-RSCO.

**Table 2  
Pesticide Compounds in Soil (Restricted Use)  
CPB Site  
Far Rockaway, NY**

TRC Sample No.:	SS-6 (0"-2")	SS-6 (12"-24")	SS-6 (2"-12")	SS-7 (0-2")	SS-7 (0-2")(A)	SS-7 (12-24")	SS-7 (2-12")	SS-7 (2-12")(A)	SS-8 (0"-2")	SS-8 (12"-24")	SS-8 (2"-12")	SS-9 (0"-2")	SS-9 (12"-24")	SS-9 (2"-12")
Date Sampled:	3/27/2015	3/27/2015	3/27/2015	1/23/2015	1/23/2015	1/23/2015	1/23/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015
Lab Sample ID:	JB91085-11	JB91085-13	JB91085-12	JB87101-10	JB87101-11	JB87101-14	JB87101-12	JB87101-13	JB91085-17	JB91085-19	JB91085-18	JB91085-14	JB91085-16	JB91085-15
Laboratory:	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest
Pesticides by GC (mg/kg)	RR-RSCO													
Aldrin	0.097	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
alpha-BHC	0.48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
beta-BHC	0.36	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
delta-BHC	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
gamma-BHC (Lindane)	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
alpha-Chlordane	4.2	0.003	a	0.004	a	0.0052	a	ND	ND	ND	ND	0.0036	0.0013	ND
gamma-Chlordane	-	0.0027		0.0041		0.0051		ND	ND	ND	ND	0.0037	0.0013	ND
Dieldrin	0.2	0.0012	a	0.0019	a	0.0029	a	ND	ND	ND	ND	0.0012	ND	ND
4,4'-DDD	13	ND		0.0019		0.0013	a	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	8.9	0.002	a	0.0031	a	0.0015	a	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	7.9	0.0142		0.0129		0.0143		0.0023	0.0014	ND	ND	0.003	0.0032	0.0016
Endrin	11	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
Endosulfan sulfate	24	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
Endrin aldehyde	-	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
Endosulfan-I	24	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
Endosulfan-II	24	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
Heptachlor	2.1	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	-	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
Methoxychlor	-	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
Endrin ketone	-	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
Toxaphene	-	ND		ND		ND		ND	ND	ND	ND	ND	ND	ND
<b>Total</b>	-	0.0231		0.0279		0.0303		0.0023	0.0014	0	0	0	0.003	0.0117

Notes:  
 ND = not detected.  
 a = more than 40% RPD for detected concentra  
 RR-RSCO = Restricted Residential Restricted l  
 Bold & Highlighted indicates concentration abo

**Table 2  
PCB Compounds in Soil (Restricted Use)  
CPB Site  
Far Rockaway, NY**

TRC Sample No.:	SS-1 (0-2")	SS-1 (2-12")	SS-1 (12-24")	SS-2 (0"-2")	SS-2 (12"- 3/27/2015	SS-2 (2"-12")	SS-3 (0"-2")	SS-3 (12"- 3/27/2015	SS-3 (2"-12")	SS-4 (0-2")	SS-4 (2-12")	SS-4 (12-24")	SS-5 (0"-2")	SS-5 (12"- 3/27/2015	SS-5 (2"-12")	
Date Sampled:	1/19/2015	1/19/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	1/23/2015	1/23/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015	
Lab Sample ID:	JB86729-1	JB86729-2	JB87101-6	JB91085-2	JB91085-4	JB91085-3	JB91085-8	JB91085-10	JB91085-9	JB87101-7	JB87101-8	JB87101-9	JB91085-5	JB91085-7	JB91085-6	
Laboratory:	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	
PCBs by GC (mg/kg)	RSCO															
Aroclor 1016	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1221	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1232	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1242	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1254	-	ND	ND	ND	ND	0.0647	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1268	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1262	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	1	0	0	0	0	0.0647	0	0	0	0	0	0	0	0	0	0

Notes:  
 ND = not detected.  
 RR-RSCO = Restricted Residential Restricted Use Soil Cleanup Objectives

**Table 2  
PCB Compounds in Soil (Restricted Use)  
CPB Site  
Far Rockaway, NY**

TRC Sample No.:		SS-6 (0"-2")	SS-6 (12"-	SS-6 (2"-12")	SS-7 (0-2")	SS-7 (0-2")(A)	SS-7 (2-12")	SS-7 (2-12")(A)	SS-7 (12-24")	SS-8 (0"-2")	SS-8 (12"-	SS-8 (2"-12")	SS-9 (0"-2")	SS-9 (12"-	SS-9 (2"-12")	
Date Sampled:		3/27/2015	3/27/2015	3/27/2015	1/23/2015	1/23/2015	1/23/2015	1/23/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	
Lab Sample ID:		JB91085-11	JB91085-13	JB91085-12	JB87101-10	JB87101-11	JB87101-12	JB87101-13	JB87101-14	JB91085-17	JB91085-19	JB91085-18	JB91085-14	JB91085-16	JB91085-15	
Laboratory:		Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	
PCBs by GC (mg/kg)	RSCO															
Aroclor 1016	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1221	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1232	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1242	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1254	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1268	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1262	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

ND = not detected.

RR-RSCO = Restricted Residential Restricted l

**Table 2  
Metal Compounds in Soil (Restricted Use)  
CPB Site  
Far Rockaway, NY**

	TRC Sample No.:		SS-1 (0-2")	SS-1 (2-12")	SS-1 (12-24")	SS-2 (0"-2")	SS-2 (12"-24")	SS-2 (2"-12")	SS-3 (0"-2")	SS-3 (12"-24")	SS-3 (2"-12")	SS-4 (0-2")	SS-4 (2-12")	SS-4 (12-24")	SS-5 (0"-2")	SS-5 (12"-24")	SS-5 (2"-12")
	Date Sampled:	Lab Sample ID:	1/19/2015	1/19/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	3/27/2015	1/23/2015	1/23/2015	1/23/2015	3/27/2015	3/27/2015	3/27/2015
	Laboratory:		Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest	Accutest
Metals (mg/kg)	RR-RSCO	C-RSCO															
Aluminum	-	-	1,870	2,920	2,950	3,020	3,600	4,080	4,670	4,560	6,410	2,560	2,340	2,500	4,400	3,890	4,920
Antimony	-	-	ND	2.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	16	16	ND	11.8	4.1	2.4	3.5	2.6	3	3.2	11.1	4.2	3.3	3.8	4	3.2	4.6
Barium	400	400	23.7	56.9	40.7	39.4	37	42.2	59.1	53.8	107	61.5	56.4	74.2	52.9	32.7	40.9
Beryllium	72	590	ND	ND	ND	ND	ND	ND	0.24	ND	0.61	ND	ND	ND	0.22	ND	ND
Cadmium	4.3	9.3	ND	0.52	0.91	ND	ND	ND	ND	ND	ND	0.7	0.59	0.59	ND	ND	ND
Calcium	-	-	1,110	1,250	7,220	6,530	9,200	9,340	16,900	20,400	26,700	56,000	4,580	1,950	26,700	14,100	23,700
Chromium	110	400	6	21.5	9.8	11.4	10.9	14.6	16.9	15.3	17.9	9.5	10.5	9.5	19.1	8.3	12.5
Cobalt	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	270	270	10	25.3	18.8	16.7	20.7	18.5	22.7	19.2	57.3	24.8	24.8	28.8	28.5	17.9	30.6
Iron	-	-	3,560	13,400	4,880	5,270	6,800	6,930	8,770	8,950	15,300	6,220	5,660	9,170	10,600	6,720	8,630
Lead	400	1000	77	149	123	79.1	108	102	108	80.4	88	185	183	210	98.8	67.1	85.8
Magnesium	-	-	786	560	982	1,630	3,410	2,390	2,940	4,360	4,680	3,610	897	641	8,490	1,960	6,340
Manganese	2000	10000	58.3	75.7	62.4	78.4	70.5	83.4	122	153	<b>2,250</b>	112	70.1	69.8	117	90.6	94.9
Mercury	0.81	2.8	0.2	0.14	0.39	0.14	0.097	0.16	0.17	0.12	0.13	0.21	0.2	0.11	0.17	0.19	0.21
Nickel	310	310	ND	6.3	8.1	8.6	8.4	11	34.6	22.6	32.2	11.3	11.5	7.7	29	9.1	29.1
Potassium	-	-	ND	ND	ND	ND	ND	ND	ND	ND	1040	ND	ND	ND	ND	ND	ND
Selenium	180	1500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	180	1500	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND
Sodium	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	-	-	ND	ND	ND	ND	ND	ND	ND	ND	<3.0	b	ND	ND	ND	ND	ND
Vanadium	-	-	7.1	30.8	9.7	10.6	15.4	16.1	21.7	16.3	22.5	11.3	10	10	21	16.1	18.3
Zinc	10000	10000	75.7	124	93	74.3	122	83.1	98.7	77.3	679	156	136	154	111	73.9	95
General Chemistry (%)																	
Solids, Percent			88.1	94.5	92	87	92.1	90.4	87.6	90.5	96.4	96.8	88.6	92.5	86.7	90.8	87.5

Notes:  
 ND = not detected.  
 RR-RSCO = Restricted Residential Restricted Use Soil Cleanup Objectives  
 C-RSCO = Commercial Restricted Use Soil Cleanup Objectives  
 Bold & Highlighted indicates concentration above RR-RSCO.  
 b - Elevated detection limit due to dilution required for high interfering element.

**Table 2  
Metal Compounds in Soil (Restricted Use)  
CPB Site  
Far Rockaway, NY**

Metals (mg/kg)	TRC Sample No.:		SS-6 (0"-2")	SS-6 (12"-24")	SS-6 (2"-12")	SS-7 (0-2")	SS-7 (0-2")(A)	SS-7 (2-12")	SS-7 (2-12")(A)	SS-7 (12-24")	SS-8 (0"-2")	SS-8 (12"-24")	SS-8 (2"-12")	SS-9 (0"-2")	SS-9 (12"-24")	SS-9 (2"-12")
	RR-RSCO	C-RSCO	Date Sampled:	Date Sampled:	Date Sampled:	Date Sampled:	Date Sampled:	Date Sampled:	Date Sampled:	Date Sampled:						
			Lab Sample ID:	Lab Sample ID:	Lab Sample ID:	Lab Sample ID:	Lab Sample ID:	Lab Sample ID:	Lab Sample ID:	Lab Sample ID:						
			Laboratory:	Laboratory:	Laboratory:	Laboratory:	Laboratory:	Laboratory:	Laboratory:	Laboratory:						
Aluminum	-	-	4,570	4,050	3,970	2,300	2,340	1,800	1,730	1,160	3,450	4,920	3,760	3,820	3,140	3,540
Antimony	-	-	ND	ND	ND	ND	ND	ND	ND	ND						
Arsenic	16	16	4	4.8	5	2.5	2.5	ND	ND	ND	3.2	4.1	2.9	2.7	4.3	2.8
Barium	400	400	107	130	82.4	33.2	ND	23.1	24.9	ND	54.6	93.4	65.1	42.2	80.6	41.2
Beryllium	72	590	0.59	0.24	0.47	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	4.3	9.3	ND	ND	ND	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	-	-	10,400	9,780	14,000	1,140	1,000	ND	611	ND	2,560	8,310	5,760	1,660	28,700	1,470
Chromium	110	400	53.3	71.9	57.3	15.6	7.9	6.1	5.1	3.6	13.6	21.9	12	7.8	51.4	18.9
Cobalt	-	-	ND	ND	5.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	270	270	132	137	190	28.1	20.7	11.6	8.8	ND	46.2	53.3	44.5	24.2	130	42.4
Iron	-	-	10,100	9,770	14,700	7,080	5,450	3,920	2,980	2,000	7,520	9,680	6,190	10,100	12,700	6,400
Lead	400	1000	216	267	296	134	153	52.3	49.8	4.4	142	218	155	123	243	158
Magnesium	-	-	2,410	1,470	1,770	730	675	ND	ND	ND	1,110	2,640	1,290	1,290	8,800	743
Manganese	2000	10000	119	89.6	130	55.5	49	34.5	32.0	21.7	69.6	83.8	63	126	88.1	106
Mercury	0.81	2.8	0.34	0.53	0.65	0.17	0.22	0.24	0.074	ND	0.51	<b>1.9</b>	<b>1.5</b>	0.18	0.44	0.29
Nickel	310	310	202	291	244	8.4	7.8	ND	ND	ND	26.2	123	38.6	7.6	107	94.4
Potassium	-	-	ND	ND	ND	ND	ND	ND	ND	ND						
Selenium	180	1500	ND	ND	ND	ND	ND	ND	ND	ND						
Silver	180	1500	ND	ND	0.62	1.2	1.2	<0.54	0.59	<0.54						
Sodium	-	-	ND	ND	ND	ND	ND	ND	ND	ND						
Thallium	-	-	ND	ND	ND	ND	ND	ND	ND	ND						
Vanadium	-	-	19.9	29.7	23.1	17	9	6.4	6	ND	11.6	17.5	17.7	10.9	11.4	11
Zinc	10000	10000	583	297	564	102	99.1	47.2	49.7	17	200	293	195	97.6	313	138
General Chemistry (%)																
Solids, Percent			93.9	84.4	90.5	96.1	94.9	95.4	95.6	97.8	84.5	88	87.3	90.2	84.3	89.2

Notes:  
 ND = not detected.  
 RR-RSCO = Restricted Residential Restricted Use Soil Clea  
 C-RSCO = Commercial Restricted Use Soil Cleanup Objectiv  
 Bold & Highlighted indicates concentration above RR-RSCC  
 b - Elevated detection limit due to dilution required for high in

Table 3  
Soil Gas Sampling Results  
CPB Site  
Far Rockaway, NY

VOCs by GCMS	TRC Sample No.: Date Sampled: Lab Sample ID: Laboratory: Units:	SG-1-AIR 1/23/2015 JB87099-1 Accutest		SG-2-AIR 1/29/2015 JB87367-1 Accutest		SG-3-AIR 1/29/2015 JB87367-5 Accutest		SG-4-AIR 1/29/2015 JB87367-6 Accutest		SG-5-AIR 1/29/2015 JB87367-7 Accutest		SG-6-AIR 1/23/2015 JB87099-3 Accutest		SG-7-AIR 1/23/2015 JB87099-2 Accutest		SG-8-AIR 1/23/2015 JB87099-5 Accutest		SG-9-AIR 1/23/2015 JB87099-4 Accutest		SG-10-AIR 1/29/2015 JB87367-2 Accutest		SG-10-AIR(A) 1/29/2015 JB87367-3 Accutest												
		ppbv	µg/m3	ppbv	µg/m3	ppbv	µg/m3	ppbv	µg/m3																									
		CAS No.	MW																															
Acetone	67-64-1	58.078	29.3	69.6	23.4	55.6	7.6	18	ND	ND	29.7	70.6	8.9	21	ND	ND	ND	ND	12.7	30.2	20.1	47.7	22.4	53.2										
1,3-Butadiene	106-99-0	54.09	0.78	1.7	J	ND	ND	4	8.8	0.48	1.1	J	3.7	8.2	ND	ND	11.1	24.6	19.5	43.1	4	8.8	2.6	5.8	3	6.6								
Benzene	71-43-2	78.108	0.46	1.5	J	0.38	1.2	J	1	3.2	0.55	1.8	J	1.9	6.1	ND	ND	0.92	2.9	21.4	68.4	0.63	2	J	1.2	3.8	1.3	4.2						
Bromodichloromethane	75-27-4	163.83	ND	ND	3.7	25	ND	ND	0.63	4.2	J	ND	ND	ND	ND	ND																		
Bromofom	75-25-2	252.75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Bromomethane	74-83-9	94.94	h	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																				
Bromoethene	593-60-2	106.96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Benzyl Chloride	100-44-7	126	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Carbon disulfide	75-15-0	76.14	1.6	5	ND	ND	2.5	7.8	0.82	2.6	1.1	3.4	ND	ND	3.3	10	5.7	18	1.3	4	2.3	7.2	2.4	7.5										
Chlorobenzene	108-90-7	112.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Chloroethane	75-00-3	64.52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Chloroform	67-66-3	119.38	0.39	1.9	J	0.51	2.5	J	2	9.8	0.39	1.9	J	ND	ND	ND	ND	ND	ND	8	39	ND	ND	ND	ND	ND	ND	ND						
Chloromethane	74-87-3	50.49	ND	ND	ND	0.68	1.4	J	0.39	0.81	J	ND	ND	ND	ND	ND																		
3-Chloropropene	107-05-1	76.53	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
2-Chlorotoluene	95-49-8	126.59	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Carbon tetrachloride	56-23-5	153.81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Cyclohexane	110-82-7	84.16	ND	ND	ND	ND	ND	ND	0.78	2.7	J	ND	ND	ND	ND	ND	7.3	25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND						
1,1-Dichloroethane	75-34-3	98.96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,1-Dichloroethylene	75-35-4	96.94	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,2-Dibromoethane	106-93-4	187.87	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,2-Dichloroethane	107-06-2	98.96	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,2-Dichloropropane	78-87-5	112.99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,4-Dioxane	123-91-1	88.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Dichlorodifluoromethane	75-71-8	120.91	0.59	2.9	J	0.56	2.8	J	0.58	2.9	J	2.7	13	0.55	2.7	J	0.51	2.5	J	0.74	3.7	J	0.52	2.6	J	0.49	2.4	J	0.49	2.4	J	0.55	2.7	J
Dibromochloromethane	124-48-1	208.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																					
trans-1,2-Dichloroethylene	156-60-5	96.94	ND	ND	0.98	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																		
cis-1,2-Dichloroethylene	156-59-2	96.94	ND	ND	23.3	92.4	10.6	42	ND	ND	0.9	3.6	5	20	5.3	21																		
cis-1,3-Dichloropropene	10061-01-5	110.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
m-Dichlorobenzene	541-73-1	147	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
o-Dichlorobenzene	95-50-1	147	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
p-Dichlorobenzene	106-46-7	147	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
trans-1,3-Dichloropropene	10061-02-6	110.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Ethanol	64-17-5	46.07	7	13	4.4	8.3	2	3.8	2.7	5.1	7	13	4.2	7.9	4.9	9.2	4.6	8.7	3.3	6.2	5.1	9.6	6.7	13										
Ethylbenzene	100-41-4	106.17	ND	ND	3	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																		
Ethyl Acetate	141-78-6	88	0.65	2.3	J	ND	ND	ND	ND	0.4	1.4	J	ND	ND	ND	ND	0.49	1.8	J	ND	ND	ND	ND	0.86	3.1	3.3	12							
4-Ethyltoluene	622-96-8	120.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Freon 113	76-13-1	187.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Freon 114	76-14-2	170.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Heptane	142-82-5	100.21	ND	ND	ND	ND	ND	ND	ND	ND	0.76	3.1	J	ND	ND	0.75	3.1	J	21	86.1	0.46	1.9	J	ND	ND	ND	ND	ND						
Hexachlorobutadiene	87-68-3	260.76	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Hexane	110-54-3	86.172	0.67	2.4	J	0.46	1.6	J	0.52	1.8	J	1.1	3.9	2.2	7.8	0.59	2.1	J	3.4	12	34.8	123	1.8	6.3	0.63	2.2	J	1.6	5.6					
2-Hexanone	591-78-6	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Isopropyl Alcohol	67-63-0	60.1	3.8	9.3	1.2	2.9	ND	ND	ND	ND	3.3	8.1	1.3	3.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	3.4								
Methylene chloride	75-09-2	84.93	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Methyl ethyl ketone	78-93-3	72.11	5.8	17	1.5	4.4	0.66	1.9	J	0.53	1.6	J	3	8.8	1.4	4.1	6	18	4.4	13	1.3	3.8	2.7	8	2.9	8.6								
Methyl Isobutyl Ketone	108-10-1	100.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Methyl Tert Butyl Ether	1634-04-4	88.15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Methylmethacrylate	80-62-6	100.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
Propylene	115-07-1	42	5.5	9.4	2	3.4	42.8	73.5	ND	ND	39.5	67.9	3.7	6.4	171	294	162	278	59.5	102	14.6	25.1	16.9	29										
Styrene	100-42-5	104.15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,1,1-Trichloroethane	71-55-6	133.41	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,1,2,2-Tetrachloroethane	79-34-5	167.85	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,1,2-Trichloroethane	79-00-5	133.41	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,2,4-Trichlorobenzene	120-82-1	181.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,2,4-Trimethylbenzene	95-63-6	120.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
1,3,5-Trimethylbenzene	108-67-8	120.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND																						
2,2,4-Trimethylpentane	540-84-1	114.23	ND	ND	0.62	2.9	J	31.4	147	ND	ND	ND	ND	ND																				

**TABLE 4**  
**SCREENING OF POTENTIAL REMEDIAL ACTIONS**  
**The CPB Site - BCP # 241158**  
**Far Rockaway, Queens, New York**

REMEDIAL ACTION AND PERFORMANCE/EFFECTIVENESS <sup>(1)</sup>	RETAINED <sup>(2)</sup>
<b>I. Groundwater</b>	
<b>A. ACTIVE TREATMENT</b>	
<b>PUMP-AND-TREAT</b>	
<ul style="list-style-type: none"> <li>+ Installation of recovery and "pump-and-treat" is protective of potential receptors and is a proven technology.</li> <li>+ Site groundwater will be intercepted. Dissolved phase impacts will be treated ex-situ.</li> <li>- Unnecessary due to limited environmental impacts to on-site groundwater</li> <li>- Downgradient/Off-Site groundwater is clean, so hydraulic control is not needed.</li> <li>- A number of wells, and potentially high pumping rate, may be needed for effective capture of free product and groundwater.</li> <li>- Potentially high pumping rates near surface water.</li> <li>- Pumping can adversely affect natural biodegradation process.</li> <li>- Considerably higher O&amp;M due to recovery system maintenance requirements and operation of ex-situ groundwater treatment system.</li> <li>- Treatment to take place over a longer period of time.</li> <li>- May cause migration of contaminated groundwater through previously uncontaminated areas.</li> <li>- Will not be efficient at remediating low levels of contaminants.</li> </ul>	<p><b>NO</b>  <b>Not cost effective or efficient at removal of low level contaminants.</b>  <b>Extended operating period.</b></p>
<b>Enhanced In-Situ Bioremediation</b>	
<ul style="list-style-type: none"> <li>+ Would stimulate natural degradation of contaminants of concern.</li> <li>+ Minimum on-going costs, one to two applications of amendment would likely be sufficient.</li> <li>- Unnecessary due to limited environmental impacts to on-site groundwater</li> <li>- Downgradient/Off-Site groundwater is clean, contaminant migration is not a concern.</li> <li>- Existing microbial population is robust and contains the requisite bacteria to complete the remediation.</li> <li>- Existing geochemical conditions are already in an optimal range for biodegradation</li> <li>- Will not be efficient at remediating low levels of contaminants.</li> </ul>	<p><b>NO</b>  <b>Biodegradation is ongoing at the site, and enhancements are not needed.</b></p>
<b>In-Situ Chemical Oxidation (ISCO)</b>	
<ul style="list-style-type: none"> <li>+ Chemical oxidation can address the contaminants of concern.</li> <li>+ The site is undeveloped, so injection point spacing would be un-obstructed.</li> <li>- Pilot test on site showed limited effectiveness at treating source zone.</li> <li>- High natural oxidant demand of the clay zones will limit the effectiveness of ISCO, and will require multiple applications.</li> <li>- Oxidation of natural organics will diminish the adsorptive capacity of the natural soil to retard contamination.</li> <li>- Will alter the existing geochemical conditions, leaving them unfavorable to biodegradation.</li> <li>- Will not be efficient at remediating low levels of contaminants.</li> </ul>	<p><b>NO</b>  <b>ISCO will not be an efficient treatment</b></p>
<b>Air Sparging (AS)</b>	
<ul style="list-style-type: none"> <li>+ Contaminants of concern are volatile, and would be removed through AS</li> <li>+ Technology is well understood and mature.</li> <li>- Would require a soil vapor extraction system (SVE) to accompany the AS and recover the injected air.</li> <li>- Presence of clay layers in the saturated zone could impede the upward migration of sparged air, requiring a wider SVE coverage area.</li> <li>- Potential for fugitive vapors is high because of saturated zone clay layers.</li> <li>- Will require ongoing O&amp;M.</li> <li>- Will negatively affect future biodegradation by increasing dissolved oxygen and increasing the oxidation/reduction potential (ORP).</li> </ul>	<p><b>NO</b>  <b>AS will not be an effective treatment</b></p>
<b>B. NATURAL ATTENUATION</b>	
<b>MONITORING OF GROUNDWATER</b>	
<ul style="list-style-type: none"> <li>+ Natural attenuation is a proven technology; favorable geochemical conditions and microbial community documented.</li> <li>+ Strong evidence of on-going bioremediation (including the presence of dissolved ethane in groundwater near former source area).</li> <li>+ Less intrusive than pump &amp; treat.</li> <li>+ No impact to off-site groundwater in the downgradient direction has been identified.</li> <li>+ Decreased exposure of humans to contaminated groundwater.</li> <li>- Long-term monitoring associated costs.</li> </ul>	<p><b>YES</b></p>
<b>C. HYDRAULIC CONTAINMENT</b>	
<b>BARRIER WALL</b>	
<ul style="list-style-type: none"> <li>+ Proven technology for impeding groundwater flow, and thereby containing subsurface movement of contaminants.</li> <li>+ Minimal future OM&amp;M requirements.</li> <li>- Off-Site groundwater in the downgradient direction is not impacted.</li> <li>- High capital cost.</li> <li>- Does not address on-site groundwater.</li> <li>- May cause local groundwater mounding, requiring groundwater management.</li> <li>- May alter groundwater geochemistry, and may impact natural biodegradation.</li> </ul>	<p><b>NO</b>  <b>Off-Site groundwater downgradient of the site is not impacted.</b></p>

**TABLE 4**  
**SCREENING OF POTENTIAL REMEDIAL ACTIONS**  
**The CPB Site - BCP # 241158**  
**Far Rockaway, Queens, New York**

REMEDIAL ACTION AND PERFORMANCE/EFFECTIVENESS <sup>(1)</sup>	RETAINED <sup>(2)</sup>
<b>I. SOIL</b>	
<b>A. ACTIVE REMEDIATION</b>	
<b>LIMITED EXCAVATION WITH OFF-SITE DISPOSAL</b>	<b>YES</b> To be considered for future activities, should the site be developed.
<ul style="list-style-type: none"> <li>+ Will effectively remove soil contamination.</li> <li>+ Will eliminate the potential for soil contamination to impact future on-site receptors.</li> <li>- Will not address contaminants in the groundwater.</li> <li>- Future development may require more soil removal, including the clean backfill.</li> </ul>	
<b>STABILIZATION AND SOLIDIFICATION</b>	<b>NO</b> Overly intrusive method that may not be conducive to redevelopment activities.
<ul style="list-style-type: none"> <li>+ Physically encapsulates contaminants within the soil matrix, minimizing or eliminating potential migration.</li> <li>+ Effective at treating inorganic contaminants.</li> <li>- May not be effective at trapping semi-volatile contaminants.</li> <li>- Contains and encapsulates contaminants, without removal or destruction.</li> <li>- May not be consistent with future site uses.</li> <li>- Limited volume for stabilization will increase unit costs.</li> </ul>	
<b>B . CONTAINMENT</b>	
<b>EXISTING SOIL COVER AND ENVIRONMENTAL EASEMENT</b>	<b>NO</b> Not effective in present condition
<ul style="list-style-type: none"> <li>+ Proven technology and readily implementable.</li> <li>+ Minimal future O&amp;M requirements.</li> <li>- Contaminants found in shallow soil samples in 3 locations, indicating existing cover is not adequate at all locations.</li> <li>- All contaminated material remains on-site.</li> <li>- No immediate treatment for soils. This treatment option to be combined with Institutional Controls (Deed Notice) for soils.</li> </ul>	
<b>CAPPING SYSTEM AND ENVIRONMENTAL EASEMENT</b>	<b>YES</b> Asphalt cover in areas with shallow soil exceedances.
<ul style="list-style-type: none"> <li>+ Proven technology and readily implementable.</li> <li>+ Would work in conjunction with proposed site development activities.</li> <li>+ Minimal future O&amp;M requirements.</li> <li>- All contaminated material contained on-site.</li> <li>- No immediate treatment for soils. This treatment option to be combined with Institutional Controls (Deed Notice) for soils.</li> </ul>	
<b>III. SOIL GAS</b>	
<b>A. ENGINEERING CONTROLS</b>	
<b>ACTIVE SUB-SLAB DEPRESSURIZATION (SSDS)</b>	<b>YES</b> Decision to operate in an active or passive system to be made after construction
<ul style="list-style-type: none"> <li>+ Proven technology for vapor intrusion pathway in areas with habitable structures.</li> <li>+ Reduces human exposures.</li> <li>+ Can be incorporated with the redevelopment activities.</li> <li>+ Moderate capital costs when installed with building construction.</li> <li>- Active venting will require continuous energy use and frequent inspections.</li> <li>- May become unnecessary as biodegradation of remaining contamination continues.</li> </ul>	
<b>PASSIVE SSDS</b>	<b>YES</b> Decision to operate in an active or passive system to be made after construction
<ul style="list-style-type: none"> <li>+ Proven technology.</li> <li>+ Reduces human exposures.</li> <li>+ Can be incorporated with site redevelopment activities.</li> <li>+ Can be readily incorporated and adapted into active system (Adaptive Active/Passive system).</li> <li>+ Minimal long term OM&amp;M costs.</li> <li>- Less protective than active system if vapor intrusion potential is high after construction.</li> </ul>	
<b>VAPOR BARRIERS</b>	<b>No</b> May be considered in future when MNA further reduces contaminant concentrations
<ul style="list-style-type: none"> <li>+ Proven technology to mitigate vapor intrusion.</li> <li>+ Easily incorporated into building design.</li> <li>+ Limited to no future O&amp;M requirements.</li> <li>- Least protective alternative for vapor intrusion, many not be sufficient if contaminant concentrations in soil gas are high.</li> <li>- Cannot be retro-fitted to operate as a venting system.</li> </ul>	

**Notes:**

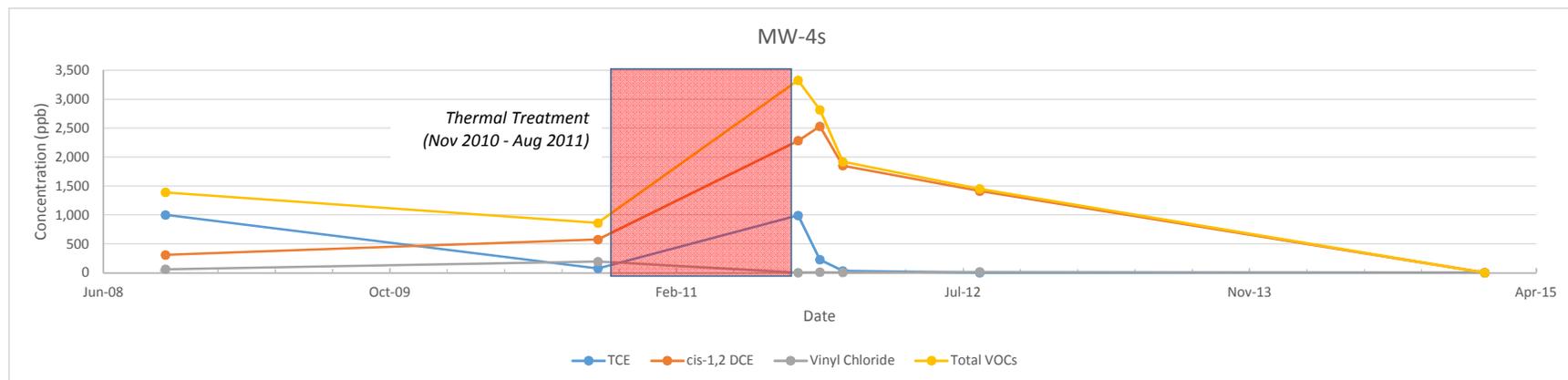
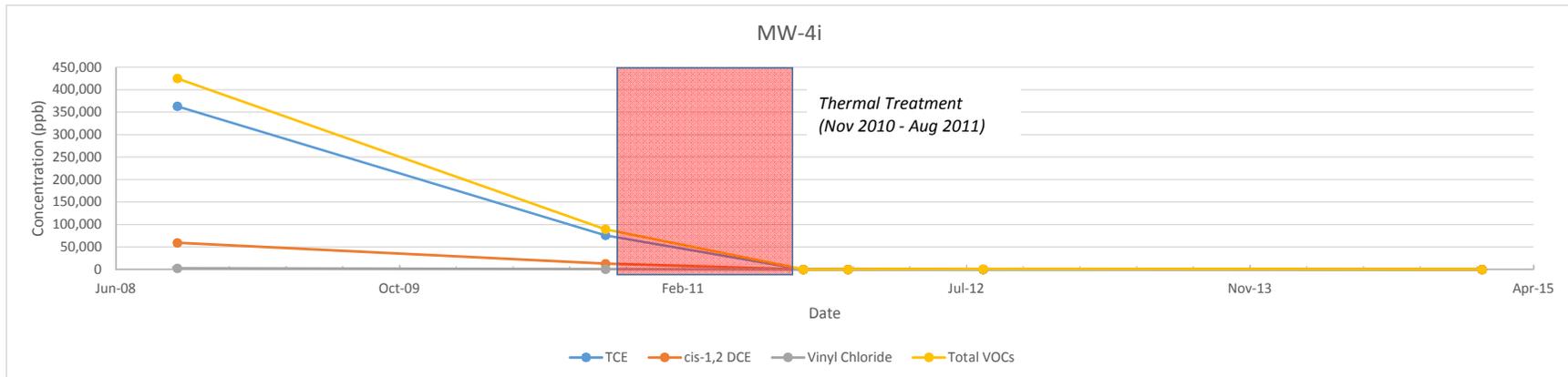
(1) Performance/effectiveness primarily based on potential ability to reduce contaminants of concern.

(2) Indicates if the technology has the potential to achieve the remedial objective.

- + Positive/potential technology benefit.
- Negative/potential technology limitation.

**Table 5**  
**Groundwater Remediation Progress**  
**CPB Site**  
**Far Rockaway, Queens, NY**

Well	MW-4i						MW-4s							
	Date	9/17/2008	10/12/2010	9/26/2011	12/14/2011	8/8/2012	1/5/2015	9/17/2008	10/12/2010	9/26/2011	11/3/2011	12/13/2011	8/8/2012	1/6/2015
Reference	Post ISCO PT	Pre-ISTT	Post-ISTT	Post-ISTT	Lot 24 RI	2015 RI	Post ISCO PT	Pre-ISTT	Post-ISTT	Post-ISTT	Post-ISTT	Lot 24 RI	2015 RI	
Benzene	ND	ND	82.4	25.1	24.7	3.6	0.51	0.28	13.2	10.6	7.2	6	ND	
cis-1,2-DCE	59,400	12,800	37.2	311	929	167	307	574	2,280	2,530	1,850	1,410	ND	
trans-1,2-DCE	ND	82.10	ND	ND	8.40	5.5	3.7	10.4	4.7	5.6	ND	1.5	0.65	
PCE	ND	83.3	ND	ND	ND	ND	2.8	ND	ND	ND	ND	ND	ND	
TCE	363,000	76,200	135	28.4	1.3	ND	1,000	74.4	988.8	224	32.3	ND	ND	
Vinyl chloride	2,610	569	4.7	ND	8	151	59.6	193	ND	8.2	4.4	14	ND	
Total VOCs	425,010	89,734.4	272.2	387.6	998.34	329	1,388.34	858.68	3,324.6	2,815.8	1,916.7	1,448.2	0.65	



## APPENDICES

APPENDIX A  
SITE HEALTH AND SAFETY PLAN



**HEALTH AND SAFETY PLAN**

**Remedial Action  
CPB - Far Rockaway Project  
Far Rockaway, New York**

TRC Job No.  
174788.0000.0000

Prepared by:

TRC Environmental Corporation  
41 Spring Street, Suite 102  
New Providence, New Jersey 07974

April 2016

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## 1. Client/Personnel Contact, Emergency Contacts and Utility Clearance Information

### 1.1 Client/Personnel Contact Information

Table 1 - Site Name/Location, Project Number, Client and Contractor Contact Information		
Site Name: <u>CPB Site – Queens, NY</u>		TRC Project Number: <u>174788</u>
Site Address: <u>Block 15950, Lot 29 Far Rockaway</u> <u>By the Corner of Far Rockaway</u> <u>Freeway and Beach Channel Drive</u>		
Client Contact/Title	Office Phone Number	Cellular Phone Number
Grant Cooper, PhD, PE	(801) 240-4074	(801) 718-0427
Contractor <sup>1</sup> Contact/Title	Office Phone Number	Cellular Phone Number
To Be Determined		

**Notes:**

<sup>1</sup> Contractors are required to develop and implement their own Health and Safety Plan.

Table 2 - TRC Personnel and Project Role		
Name / Project Role	Office Phone Number	Cellular Phone Number
Gail Bradbury / TRC Field Lead	908-988-1651	(856) 285-6018
Gail Bradbury / TRC OHSO*	908-988-1651	(856) 285-6018
Anthony Brown / TRC Field Staff	908-988-1618	(609) 226-2169
Phil Bosco / TRC Field Staff	908-988-1708	(551) 486-6452
Heath Potter / TRC Project Manager	(908)-988-1655	(908) 548-3655
Stacey Felts-Bock / Office Safety Coordinator (OSC)	908-988-1719	(973) 289-8213
David Sullivan / RMD Safety Manager	(978) 656-3565	(978) 758-2809
Mike Glenn / TRC Health & Safety Director	(949) 727-7347	(949) 697-7418
<b>Notes:</b> *OHSO – On-Site Health & Safety Officer. The OHSO is 40-hour OSHA certified, is current on refresher training, and has OSHA 8-hour supervisor training. The OHSO can be Field Lead or a member of the Field Staff as suits the work at hand and/or the availability of qualified personnel.		

### 1.2 Emergency Medical Assistance

Table 3 - Emergency Telephone Numbers		
Service	Emergency Telephone Numbers	Direct Telephone Numbers
<b>Police:</b> Far Rockaway Police Department (NYPD)	<b>Emergency:</b> 911	(718)-318-1294

Table 3 - Emergency Telephone Numbers		
Service	Emergency Telephone Numbers	Direct Telephone Numbers
Fire: NYFD	Emergency: 911	
Ambulance: St. John's Episcopal Hospital		(718) 868-7000
Poison Control: (use applicable local number)	800 222-1222	
CHEMTREC:		800-424-9300
WorkCare (Early Incident Intervention)	888 449-7787	

### 1.3 Medical Facility Identification and Directions

Hospitals or clinics identified for emergency medical care should be contacted, to verify that emergency care is provided at that location. Verify the exact location of the medical facility during this call.

Drive the emergency route as defined below before the fieldwork begins to verify that the planned route is feasible.

**Nearest Hospital:** St. John's Episcopal Hospital

**Hospital Address:** 327 Beach 19th St, Far Rockaway, NY 11691

**Hospital Telephone Number:** (718) 868-7000

**Directions to Hospital (see attached Map):**

Exit site, turn left and proceed west down Far Rockaway Boulevard. And make left hand turn from Far Rockaway Blvd onto Sea Girt Boulevard. Continue approximately ¾ of a mile and make left hand turn onto Beach 19<sup>th</sup> Street. Continue straight on Beach 19<sup>th</sup> Street. Hospital is one block up on left.

**Map to Hospital:**

A map to St. John's Episcopal Hospital from the site is provided as an insert to this HASP on the following page.

### 1.4 Utility Clearance Information

The utility clearance will be conducted prior to the commencement of subsurface drilling. Both one-call clearance and a private utility mark-out will be conducted. The clearance number will be provided by the subcontracted driller prior to work. The responding utility companies will be checked against the list below to ensure sufficient clearance.

Table 4 – Utility Clearance Information		
Clearance Organization, Number and Utilities Covered	Clearance Numbers (or Other Documentation) and Date Obtained	Expiration Dates/Other Notes
Consolidated Edison (Gas)	TO BE PROVIDED AS THE WORK DATE APPROACHES	
NYC DEP (Potable water and sewer)		
Verizon (Phone and fiber optics)		
LIPA or Consolidated Edison (Electric)		
<b>Notes:</b>		
Use Drilling/Borehole/Excavation Checklist in Appendix A before conducting intrusive or overhead work with the potential to encounter utilities.		

## 2. Site Information

This Health and Safety Plan covers the activities associated with TRC’s conduct of environmental monitoring at CPB Site, located at Block 15950, Lot 29 (Far Rockaway Blvd.) in Edgemere, New York. CPB is a vacant lot with brush and shrubby growth. A detailed summary of previous site investigations and remedial actions, including implementation of the ISTT groundwater remedy, is contained in the ISTT Remedial Action Report (RAR) submitted to NYSDEC, dated August, 2012. As described in the RAR, a thermal treatment program was implemented at the Site from November 1, 2010 to August 25, 2011. The ISTT remedy successfully achieved and surpassed all required site-specific NYSDEC remedial goals.

### Site History

Excavations to remove petroleum impacted soils were enacted following UST removal and the observation of free product on the site. During these excavations, impacts to soil and groundwater from chlorinated solvents was discovered. Soil and ground water investigations at the site have revealed the presence of soil and ground water impacts above NYDEC’s soil cleanup criteria and Ground Water Quality Standards for PCE, cis 1,1 DCE and VC. Additional investigations also detected the presence of residual petroleum impacts at the site. An ISTT work plan was developed by TRC and approved by the New York state department of Environmental conservation (NYSDEC). The ISTT system operated on site from November 15, 2010 and operated for 283 days. The ISTT program was successful at removing contaminant mass, with a maximum post treatment PCE concentration of 23 ug/L observed at MW-4i.

Table 5 – Contaminant Concentrations	
Compound	Highest Concentration (December 2011) - µg/L
Tetrachloroethene (PCE)	23.1
Trichloroethene (TCE)	267
Cis-1,2 Dichloroethene	1,850
Vinyl Chloride	311
Xylenes	404
Toluene	189

### 3. Work Scope Summary

The work to be conducted at and around the site will consist of Remedial Action activities. Soil borings, temporary well point and soil gas sampling points will be installed both on-site, and along the sidewalks and streets around the site. Additional surface soil samples will be collected on site, to a depth of 2 feet below grade. Drilling locations will be pre-cleared with a private utility markout, in addition to the Dig Safe One Call. See the Remedial Action Work Plan for additional details regarding the Scope of Work.

Remedial Action activities will consist of the installation of 2 asphalt caps over areas of impacted soil. See the Remedial Action Work Plan and the Construction Quality Assurance Project Plan (CQAPP) for additional details regarding the Remedial Action Scope of Work.

### 4. Roles/Responsibilities

Per the TRC RMD HASP Template Development Memorandum (2013), Roles and responsibilities descriptions are required in all cases where a specific safety-related plan or permit is required such as permit-required confined space entry and Lock Out/Tag Out. The OSC or Project Manager may also require role and responsibility at their discretion. As noted below, per TRC policy all employees are empowered to stop work if they feel it is unsafe to continue. Safety issues must be brought to the attention of the Project Manager.

#### 4.1 Stop Work Authority

**All TRC employees and subcontractor employees have the authority and obligation to stop any project if they observe a condition that could put people or equipment at risk.** TRC's Stop Work Authority policy is summarized below.

**What is Stop Work Authority?:** Stop Work Authority is the ability to stop work if there is a potential safety issue. Employees will not be reprimanded for issuing a stop work and all project employees will adhere to the stop work condition and no work will continue until the issues have been resolved. The Stop Work Process includes appropriate training, stopping the work, notifying Project Manager of the stop work condition, correcting the condition and resuming operation once the condition has been corrected.

**Policy Understanding and Management Responsibility:** Employees are required to read and understand the Stop Work Authority policy in order to recognize conditions that could warrant a stop work injunction. Project Managers will encourage employees to initiate stop work authority when necessary and notify other employees and the client of the stop work condition. The Project manager will conduct an investigation into the conditions that led to the stop work order and verify that the unsafe condition has been corrected before work can recommence. Work can only continue when it is safe to do so.

**Stop Work Related Reporting:** A written report will be prepared by the Project Manager that documents the reason for the stop work, the corrective measures taken and the lessons learned from the incident. These reports will be reviewed by the TRC Safety Department and Senior Management and also shared with the client. Once work has resumed after the stop work condition has been closed the Project Manager or designee will conduct a follow-up inspection to verify that the safety concerns have been addressed and corrective measures implemented.

## **4.2 Project Manager**

The TRC Project Manager is responsible for controlling the technical work in an environmentally safe manner, assuring that operational hazards are minimized and that appropriate precautionary actions are implemented this during project work. Specific responsibilities include but are not limited to:

- Implementing and confirming that all subcontractors to TRC are prequalified to conduct the work included in their Contract, including health and safety pre-qualifications.
- Verifying that all TRC personnel involved with this project have the required training and medical clearance for the work and environment they will be assigned.
- Verifying that all personnel involved with this project have read and understand this HASP and have signed the HASP.
- Assuring that all personnel involved with this project have attended a briefing or a tailgate safety meeting regarding the contents of the HASP and site-specific hazards prior to performing work.
- Determining that sufficient personal protective equipment (PPE), air monitoring equipment and other equipment, as required by this HASP, are available and that the personnel are training in the proper use of PPE as well as other administrative and/or engineered controls.
- Assuring that all subcontractor personnel submit documentation of employee participation in a medical, training and drug & alcohol programs (when applicable).
- Promoting and maintaining a high level of health and safety consciousness among the field personnel.

### **4.3 On-Site Health & Safety Officer**

The On-Site Health & Site Safety Officer (OHSO) is responsible for ensuring the Health & Safety guidelines are followed, in addition to monitoring for airborne contaminants when necessary and evaluating new hazards and operation changes. The OHSO has the authority to correct all noncompliance situations immediately and to stop work in cases of immediate danger. Specific responsibilities include but are not limited to:

- Performing daily safety meetings prior to commencement of work, commencement of a new task and whenever new personnel arrive.
- Obtaining the air monitoring instrumentation required and conducting or directing the necessary air monitoring.
- Verifying that all PPE and other health and safety equipment are in proper working condition.
- Advising the Project Manager and field personnel on matters relating to health and safety.
- Recommending appropriate PPE and air monitoring instrumentation to protect personnel from site hazards and coordinating the upgrading and downgrading of PPE as specified in the HASP.
- Establishing and maintaining the work zones per the HASP.
- Conducting field observations to monitor the effectiveness of the HASP and to assure compliance with the HASP.
- Performing personal exposure monitoring where required and to determine the adequacy of protective measures and PPE specified by this HASP. Working with the Project Manager to ensure that sufficient PPE is available onsite.
- Conducting briefing meetings and apprising personnel of the contents of the HASP and site hazards.
- Supervising and monitoring the safety performance of all field personnel to ensure required safety and health procedures are followed and correct any deficiencies.
- Initiating emergency response procedures, as well as incident reporting and near miss reporting.
- Notifying the Project Manager and Office Safety Coordinator of all noncompliance and dangerous situations.
- Reporting all accidents/incidents/near misses to the Office Safety Coordinators and/or Project Manager.

#### **4.4 Office Safety Coordinators and Line Managers**

The OSCs and Line Managers are responsible for the following:

- Providing managerial and executive level support for all matters regarding project health and safety.
- Assisting the Project Manager in developing the HASP and identifying task-specific Job Safety Analyses (JSAs) to incorporate in the plan.
- Safety Observations.
- Near miss/incident investigations.
- Accident/incident investigations.

#### **4.5 Field Lead**

The TRC Field Lead is responsible for the field operations needed to complete the project. The Field Lead may also be the OHSO. Specific responsibilities include but are not limited to:

- Leading by example.
- Ensuring all equipment needed for the project is available and properly maintained.
- Ensuring field personnel have received the necessary training and Health & Safety briefings before work begins.
- Correcting any deficiencies regarding health, safety or operating procedures.
- Communicating newly identified hazards or noncompliance issues with the OHSO, OSC(s), and TRC Management
- Reporting any injuries and illnesses to the Project Manager, OSHO, and OSCs.

#### **4.6 Field Personnel/Staff**

All field personnel are responsible for following the health and safety procedures specified in this HASP and work practices specified in applicable operating procedures. Some specific responsibilities include but are not limited to:

- Maintaining an awareness of their training status and demonstrating that they have the required training and medical clearance for the work and environment they will be assigned.
- Reporting all accidents, incidents, injuries, illnesses, or near misses to the Field Lead.
- Complying with the requests of the OHSO and Field Lead.
- Immediately communicating newly identified hazards or noncompliance issues to the OHSO and Field Lead.

## 5. Hazard Assessment

This HASP assumes that an ongoing hazard assessment process with Project Management and TRC Office Safety Coordinators (OSCs) will take place regularly (via meetings/teleconferences), supplemented by ad hoc communication on project safety needs, to ensure the project work is conducted at a high level of technical excellence both safely and efficiently. Where the on-going hazard assessment indicates the presence of hazards, tasks, or other activities that are not adequately covered by the HASP and supporting documentation and/or staff training levels, supplemental planning will be conducted and documented in a revised or higher level HASP document and appropriately trained personnel assigned.

### 5.1 Chemical Hazards

Based on previous experience at the site from prior RI and RA activities, TRC anticipates the presence of the following contaminants at the site:

- Petroleum hydrocarbons (e.g., benzene, mineral oil dielectric fluid)
- Chlorinated VOCs (Trichloroethene and breakdown products: cis-1,2 dichloroethene, vinyl chloride)

TRC also anticipates the presence of the following chemicals in laboratory bottles used as sample preservatives: nitric acid, sulfuric acid, and hydrochloric acid. Material Safety Data Sheets (MSDS) for preservatives and decontamination products are provided in Appendix B. Sample bottles containing hazardous preservatives will be handled with care. Sample bottles will be checked for leaks and lids tightened. Cut resistant and chemical resistant gloves and safety glasses will be worn at all times when handling sample bottles.

Isobutylene will be used during a short time period at the beginning of each work day to calibrate the PID. 100 ppm isobutylene will be primarily contained in a tedlar bag. Any gas that is released to the air will quickly disperse and will not pose a threat to on-site workers. No further monitoring is required for isobutylene.

The following is a list of the accepted exposure limits in parts per million (ppm) of the contaminants of concern.

Contaminant of Concern	PEL-TWA	PEL-STEL	TLV-TWA	TLV-STEL	A1	A2	Skin	Ceiling Concentration
Trichloroethene	100	NA	50	25	No	Yes	Yes	200
Tetrachloroethene	100	NA	10	25	No	Yes	Yes	200
Cis-1,2-Dichloroethene	200	NA	200	NA	No	No	No	NA
Vinyl Chloride	1	NA	1	NA	No	No	Yes	5
Petroleum Hydrocarbons (Naphtha)	500	NA	350	NA	No	No	Yes	1800

PEL-TWA, OSHA = Permissible Exposure Limit-Time Weighted Average

PEL-STEL, OSHA = Permissible Exposure Limit-Short Term Exposure Limit

TLV-TWA, ACGIH = Threshold Limit Value-Time Weighted Average

TLV-STEL, ACGIH = Threshold Limit Value-Short Term Exposure Limit

A1, ACGIH = Known Human Carcinogen

A2 = Suspected Human Carcinogen

Skin = Potential overall exposure through skin absorption, including mucous membranes and eye, either airborne or through direct contact with the substance

Ceiling, ACGIH = Concentration that should not be exceeded during any part of the working exposure

Note: Concentrations are in ppmv

## 5.2 Key Physical Hazards

Key physical hazards are outlined below. If a Job Safety Analysis (JSA; see Section 10 and supporting appendix) has been included, this is signified below in first column.

Table 6 - Key Physical Hazards Matrix			
JSA	APPL.	KEY PHYSICAL HAZARDS	GENERAL CONTROL MEASURE
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Edges/material handling	Cut resistant gloves are required to be worn at all times while performing all tasks. A glove selection guideline is presented in Appendix C.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Weather	Heat and cold stress are a potential concern for on-site workers. Please refer to Appendix D for the signs, symptoms and precautions for cold and heat stress, and required breaks. Work will also occur during a time of year when thunderstorms are possible/likely. If thunder or lightning is noted by onsite personnel, work will cease until the storm passes (thunder and/or lightning ceases and is not observed over at least a 15-minute period). Personnel will seek shelter in buildings or vehicles
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Energized Sources (electrical equipment or hookups, lines, etc.)	Personnel engaged in electrical activities, and any facility equipment with moving parts must follow proper lock-out/tag-out procedures, and only properly trained employees will perform the work. Heed any caution signs or labels.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Slips, Trips, Falls	Be aware of uneven ground, and buried debris (metal, plastic, etc.), to avoid potential slip/trip/fall hazards, and use caution near open excavations. Maintain good housekeeping practices to eliminate physical hazards. Use proper lifting techniques to avoid injury and obtain help when lifting greater than 50 lbs. Be aware of uneven ground to avoid potential slip/trip/fall hazards and also of buried debris (metal, plastic, etc.). Sites with unprotected edges >6' require barricades and/or fall protection equipment. A fall protection plan will be required if there is leading edge work including excavations >6' deep.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Heavy Equipment	Use caution around construction equipment and emergency response vehicles. Ensure the operator of the construction/emergency equipment is aware of the location of onsite personnel at all times to avoid potential injury to onsite workers (e.g., maintain eye contact with the equipment operator). If full visibility is not possible during movement of equipment a spotter should be used to direct the movement of heavy equipment. A swing zone should be established with cones behind any excavators to prevent injury during movement of equipment. Exercise caution and wear protective equipment as noted herein (e.g., safety toe boots, hard hat, Class 3 reflective safety vest, ear plugs, etc.) around the heavy equipment to prevent crushing and pinching hazards.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Underground or Overhead Utilities	Existing underground utilities are present at the project site. Prior to conducting active excavation, the Site will be visually observed for potential overhead hazards (e.g., tree branches and wires), and drilling/excavation locations will be selected that are located at safe distances from the hazard. Use caution when heavy equipment may come in contact with utilities. Maintain a minimum distance of 10 feet from overhead utilities at all times. Proceed cautiously and with due diligence to minimize the possibility of contacting underground or overhead utilities. Use TRC utility clearance checklist prior to starting any subsurface work.

<b>Table 6 - Key Physical Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>KEY PHYSICAL HAZARDS</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Driving/Traffic Hazards	Driving to and from the Site each day is considered a physical hazard. Directions and travel time to the Site should be determined in advance (a.k.a. Journey Management Planning) and adequate time should be allocated to drive safely. The use of cellular phones is prohibited, and distracted driving should be avoided. Seatbelts must be worn at all times while the vehicle is moving. Use caution around traffic flow. Ensure proper traffic control (e.g., signs, traffic cones, jersey barriers, etc., or where jurisdictionally required, police details) are in place prior to and throughout the work day where work takes place in or near traffic. Work personnel must wear ANSI-rated class 3 reflective traffic vests at all times. A site-specific traffic management plan describing procedures to be employed, including barriers, signage, and police detail, will be used for tasks taking place in areas of vehicular traffic.
<b>Notes:</b> APPL. – Abbreviation for “Applicable.” JSA – Job Safety Analysis			

### 5.3 Other Common Physical Hazards Potentially Present

Other common physical hazards that might be encountered during the course of the work are outlined below. If a JSA (see Section 10 and supporting appendix) has been included, this is signified below in the first column.

<b>Table 7 - Other Common Physical Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>PHYSICAL HAZARD</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input type="checkbox"/>	Aboveground Storage Tanks (AST)	Be aware of any above ground storage tanks and the type of material being stored in them. Be aware of the potential of spills, sources of ignition, fires, explosions, etc., while working near the tanks. Stay clear of tanks whenever possible, and be aware of any equipment operators near the tank(s).
<input type="checkbox"/>	<input type="checkbox"/>	Arcing, welding, open flame work	TRC personnel will clear the area when work of this kind is undertaken by the client/subcontractor unless properly trained and equipped with PPE.
<input type="checkbox"/>	<input type="checkbox"/>	Blasting/Explosives	TRC personnel shall not handle any explosive devices or materials. TRC personnel should understand the blasting procedures being used by the subcontractor, and all of the associated health and safety precautions. The subcontractor shall handle, store, and use the explosives in accordance with 29 CFR 1926.900, Subpart H and U.
<input type="checkbox"/>	<input type="checkbox"/>	Business Traffic	Be aware of traffic patterns associated with local businesses near the work site. Allow traffic to enter and exit the businesses in such a manner to avoid creating traffic hazards, back-ups, delays, or potential accident situations. Review directions before all business travel.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Cement Dust</b>	Stay clear of mixing operations and avoid contact with, or breathing of the dust.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Chain Saws/Power Saws</b>	Stay clear of any chain saw/power saw operations. Subcontractor is responsible for the safe use of chain saws/power saws on site.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Cleaning Agents</b>	Use caution of applying cleaning agent to equipment. Use gloves, safety glasses, splash shields, and protective clothing as needed.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Client Activities</b>	Be aware of client activities at or adjacent to the site. Work activities should be coordinated with other site activities to avoid conflicts.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Compressed Air/Gas, Pressurized Liquids Hoses, Lines &amp; Fittings</b>	Compressed air or gas, or pressurized liquid lines or hoses should be inspected at least daily, or in the event a leak develops, or if a line or hose is run over or crimped.
<input type="checkbox"/>	<input type="checkbox"/>	Concrete/Masonry/ Foundations	No construction loads shall be placed on a concrete structure or portion of a concrete structure unless a person who is qualified in structural design has determined that the structure or portion of the structure is capable of supporting the loads. All protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement. No employee shall be permitted to work under concrete buckets while buckets are being elevated or lowered into position. To the extent practical, elevated concrete buckets shall be routed so that no employee, or the fewest number of employees, are exposed to the hazards associated with falling concrete buckets. A limited access zone shall be established whenever a masonry wall is being constructed. All masonry walls over eight feet in height shall be adequately braced to prevent overturning and to prevent collapse unless the wall is adequately supported so that it will not overturn or collapse. The bracing shall remain in place until permanent supporting elements of the structure are in place.

<b>Table 7 - Other Common Physical Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>PHYSICAL HAZARD</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input type="checkbox"/>	Confined Spaces (tanks, vaults, vessels, trenches, manholes, some excavations, etc.)	The scope of this project does not entail entry into confined spaces. Confined spaces will not be entered unless a confined space entry permit or other planning has been completed, signed, and approved, and all participating personnel are trained in confined space entry procedures, including safety, and rescue procedures. Real and potential hazards of confined space are not addressed by this hazard assessment, and health and safety plan.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Cutting Tools</b>	Stay clear of contractors' cutting tools, especially saws and torches. Be aware that cutting operations could create other hazards, such as falling objects, or shifting materials, etc. All cutting tools must be inspected and saw blade type reviewed prior to starting work. Appropriate hand protection and safety glasses should be worn while using cutting tools. Spark-proof tools should be used when working in areas of potential explosive or flammable conditions.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Demolition Activities/Debris</b>	Stay clear of walls, ceilings, roofs, etc., as they are being demolished. Demolition material should only be handled by appropriate equipment because of sharp points, edges, etc. Demolition material may also pose a trip hazard, fall, or puncture hazard, so avoid walking or climbing on debris piles, etc.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Dim Lighting</b>	If electrical power has been disrupted causing dim/low lighting conditions and or work is required to be performed through the evening hours. Use a suitable flashlight and/or portable lighting in low lighting areas.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Drilling Operations	Drilling operations involve boring, augering or directionally pushing into soil or other surfaces. Various types of mechanical equipment may be used to provide the force of drilling. Drilling may be on a small scale, such as during the installation of monitoring wells, or a large scale project such as oil or gas well drilling. Drilling operations present physical and mechanical hazards as well. The equipment used in drilling can cause injury if not operated properly. Combustion engines are often used as a power source, and these also present hazards in terms of flammability, and as sources of vapors. Typical injuries that could result include eye injuries, burns, scrapes, and cuts from mechanical equipment. Chemical hazards could also be present in the water or soil resulting from drill cuttings.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Downed electrical wires</b>	Downed wires can energize other objects, including fences, water pipes, bushes and trees, buildings, telephone/CATV/fiber optic cables and other electric utilities. Even manhole castings and reinforcement bars (re/bar) in pavement can become energized by downed wires. During storms, wind-blown objects such as canopies, aluminum roofs, siding, sheds, etc., can also be energized by downed wires.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Drums</b>	If drums are used on-site, they should be clearly labeled with the name of the contents. Drums should only be handled with the appropriate equipment. Drums discovered during excavations, etc., shall not be opened or moved until appropriate identification can be performed. <b><i>At a minimum, Level B protection is required for sampling any unlabeled drums discovered during remediation procedures. This HASP does not contemplate and upgrade to Level B. Coordinate in advance with your OSC, RMD Safety Manager, or TRC Health and Safety direct before conducting Level B work of any kind.</i></b>

<b>Table 7 - Other Common Physical Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>PHYSICAL HAZARD</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Dust/Particulates</b>	For general dust, work should be performed up-wind if possible. If conditions warrant it, monitoring should be done with PM-10 monitor as described herein. For hazardous dusts, a detailed air monitoring plan and a respiratory protection plan should be developed in consultation with a Certified Industrial Hygienist (CIH) for the site activities before proceeding.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Ground Fault Circuit Interrupters (GFCI) and Electrical Cords</b>	GFCIs will be used on all 120 volt, single phase, 15 and 20-ampere receptacle outlets when electrical equipment is used on-site. Electrical cords will be inspected for cracks, tears, or general wear to the outer protective casing. If the wiring of the cord is exposed, the cord will be repaired, if possible, or discarded. All extension cords will contain a grounding prong. If the grounding prong is missing, or if the cord was designed to contain only two prongs, the cord will not be allowed for use. These cords are dangerous and cannot be grounded through the use of a GFCI.
<input type="checkbox"/>	<input type="checkbox"/>	Elevated Work	For any construction work activities elevated 6 feet or more, or other non-construction activities elevated 4 feet or more, fall protection must be provided. Caution should be taken on catwalks and ladders because of potential slippery conditions, or the potential for footwear to catch on the surfaces.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Equipment Exhaust</b>	Equipment exhaust should be ventilated away from the work area while drilling inside structures. Industrial fans can be used to move exhaust out of the area.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Ergonomic Issues</b>	Ergonomic hazards will be addressed on a site-specific basis once mobilization to the field has occurred.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Evening Work</b>	If work is performed during the evening hours, work shall be limited by the availability and the quality of artificial lighting. Care should also be taken to avoid slip, trip, and fall hazards that are not as easy to identify during low light conditions.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Excavations</b>	Stay clear of excavation walls. TRC personnel will not enter an excavation, in accordance with 1926 Sub Part P. Subcontractor must provide a competent person on site, if one is required by the planned activities. Side cuts should conform to 1926 Subpart P requirements, or shoring should be used. All open excavations should be secured using traffic cones, barrier tape, or barricade signs stating "Do Not Enter Excavations", especially if left open overnight
<input type="checkbox"/>	<input type="checkbox"/>	Explosives	Be aware of potential explosive materials and how to identify them. No smoking is allowed on-site or near where potential explosive materials may be present.
<input type="checkbox"/>	<input type="checkbox"/>	Facility Conveyors (product or waste lines)	Stay clear of facility conveyors, product process lines, and waste disposal lines. Be aware of any client specific health and safety requirements to work in these areas.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Facility Equipment/Machinery</b>	Be aware of active and moving client equipment on site.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Facility Piping (Above Ground)</b>	Stay clear of above ground pipes. Unless other arrangements have been made, the Client and/or Facility owner is responsible to identify all applicable aboveground facility pipes prior to any work activities in the area on their facility. Pipes can be overhead hazards, or trip hazards. Pipes can be hazardous because of the material flowing through them, such as steam, natural gas, toxic chemicals, etc. Some pipes are also coated with hazardous material such as asbestos.

<b>Table 7 - Other Common Physical Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>PHYSICAL HAZARD</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input type="checkbox"/>	<b>Facility Piping (Below Ground)</b>	Unless other arrangements have been made, the Client and/or Facility owner is responsible to identify all applicable underground facility pipe locations prior to any subsurface activities.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Fall Hazard</b>	Proper tie-off, harnesses, railings, etc. should be used when performing work on ladders, scaffolding, man-lifts, or on the roof of buildings, etc. Stay clear of the edges of pits, trenches, quarries, etc.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Falling Objects</b>	Be aware of any potential falling objects or materials on site. Stay clear of any areas identified as potential falling object areas.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Fences</b>	Be aware of fences in disrepair that may be trip hazards, or may have materials that could cause punctures or cuts. Use caution when crossing over or under fences.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Field Equipment</b>	If field equipment is heavy or awkward to carry, get assistance or use carts to help move around the site.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Field Vehicle</b>	TRC personnel shall follow all applicable state and federal traffic laws while traveling to and from the site, and while working on the site. In particular the following laws should be followed: speed limits, parking restrictions, use of wipers and lights during precipitation events, etc. The use of cellular phones is prohibited, and distracted driving should be avoided. It is the responsibility of the driver to verify that all safety equipment on the vehicle is working properly before they drive the vehicle. In particular the following items should be checked: tire pressure, tire tread, windshield wipers, windshield washer, headlights, tail lights, brake lights, spare tire, fire extinguisher, first aid kit, etc.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Fire Extinguisher Chemicals</b>	To the extent practicable, minimize exposure to potentially toxic fire extinguishing chemicals.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Fire Hazards</b>	Eliminate sources of ignition in work areas that have ignitable materials. Provide an ABC fire extinguisher in close proximity to the support zone.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Flooded Areas</b>	Do not drive through flooded areas or standing water. Do not wade into moving water, or water deeper than 2 feet without adequate assistance.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Flying Debris/ Eye Injuries</b>	Be aware of any flying debris on site and wear protective eyewear when necessary.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Fork Lifts</b>	Be aware of forklift patterns, and stay clear of those routes.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Gas Cylinders</b>	See above.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Hand Tools</b>	Use only the appropriate tool for the task at hand. Use the tool(s) as designed, described, and intended by the manufacturer. Hand tools will meet the manufacturer's safety standards. Hand tools will not be altered in any way. Makeshift tools will not be used. At a minimum, hand and eye protection will be used when working with hand tools (see glove selection guide provided herein). Wrenches, including adjustable, pipe, end and socket wrenches, will not be used when jaws are sprung to the point that slippage occurs. Impact tools such as drift pins, wedges and chisels, will be kept free of mushroom heads. Wooden handles will be free of splinters or cracks and secured tightly to the tool. At all times use appropriate hand protection when utilizing hand tools.

<b>Table 7 - Other Common Physical Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>PHYSICAL HAZARD</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Heavy Equipment.</b>	Contractor is responsible for safe operation of equipment. All mobile heavy equipment must have a functioning backup alarm, and operators must comply with equipment manufacturer's instructions. Maintain proper distance and remain in line of sight of operator and out of reach of equipment. Recognize and take precaution not to enter equipment tail swing areas. Isolate equipment swings, if possible. Make eye contact with the equipment operator before approaching the equipment. Understand and review hand signals, and wear reflective safety vest.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Heavy Lifting</b>	Use proper lifting procedures and equipment when handling heavy objects such as drums, manhole covers, tank covers, etc. If a load is greater than 50 lbs, at least two people must be used.
<input type="checkbox"/>	<input type="checkbox"/>	<b>High Pressure Gas Lines, etc.</b>	Be aware of high pressure gas lines, and follow approved safety precautions when working with or around the lines.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Highway Traffic</b>	Traffic control within the right-of-way will be in accordance with local highway department protocols. Work may be restricted within specific lanes during peak traffic times. Verify peak traffic times, and review planned activities with local highway department, so that appropriate lane closures can be coordinated.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Housekeeping</b>	All field vehicles, job trailers, and field offices will be properly cleaned and organized to prevent cluttered work and storage areas.
<input type="checkbox"/>	<input type="checkbox"/>	Hunters/Firing Range, etc.	Be aware of surrounding activities that may involve hunting, firearms, etc. that may not be in your immediate area, but could be create an unsafe work environment.
<input type="checkbox"/>	<input type="checkbox"/>	Ice (thin)	When project activities include either crossing ice or working directly on the ice, a detailed plan should be developed that will be used to continually evaluate the ice conditions, and to determine when work should be terminated due to unsafe conditions. All staff working on the ice will wear an appropriate and approved personal floatation device. Other emergency equipment such as ropes, a throwable floatation device, a means to warm a wet and cold worker, etc. must be available. A buddy system should also be used for this type of work, such that one person is always on shore or at least on previously determined safe ice.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Ladders</b>	Ladders should only be used if they are in good condition, conform to OSHA requirements, and if they will be used in an appropriate manner. Be especially cautious of slipping on ladders when the ladder or footwear is wet or dirty.
<input type="checkbox"/>	<input type="checkbox"/>	Landfill Gas (Methane, CO <sub>2</sub> , Hydrogen Sulfide)	Avoid breathing gas, especially in low oxygen areas (simple asphyxiant). Potentially flammable and explosive, so keep ignition sources away from gas. Explosive conditions of LEL >5% in a work area should be ventilated as soon as possible, or the area should be evacuated.
<input type="checkbox"/>	<input type="checkbox"/>	Leachate (Municipal Solid Waste - MSW)	MSW leachate may contain hazardous biological substances, so avoid physical contact with leachate and, if possible, stay up-wind. If contact is made with leachate, wash affected areas thoroughly with soap and water. If boots contact leachate they should be thoroughly washed with soap and water also.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Lead</b>	Wear gloves when in contact with lead contaminated soil, etc. Thoroughly wash hands and arms when daily work is completed.

<b>Table 7 - Other Common Physical Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>PHYSICAL HAZARD</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input type="checkbox"/>	<b>Lighting</b>	Lighting will be provided so that a sufficient amount of light will illuminate the work area. All electrical lighting will be protected with a Ground Fault Circuit Interrupter (GFCI). In areas where flammable or combustible vapors or dust are encountered, all lighting will be approved for use in Class 1, Division 1 hazardous locations.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Long Hours/Fatigue</b>	Long work hours can lead to fatigue, and fatigue can lead to the physical inability to perform the work in a safe manner, or travel to, or from, a work site in a safe manner. If long work hours are scheduled, or if the scheduled work takes longer than planned, field staff should determine if fatigue is, or will be, an issue. Field staff should evaluate whether they are able to complete the work in a safe manner, or whether they are able to travel in a safe manner. If fatigue is an issue, appropriate breaks should be planned or taken, including overnight stays when necessary.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Material Handling</b>	Move containers and heavy material only with the proper equipment, and secure them to prevent dropping, falling, or loss of control during transport. Stay clear of material handling operations, especially near slopes. Do not stand down the slope from equipment, supplies or materials being moved above on the slope, or being deployed onto the slope.
<input type="checkbox"/>	<input type="checkbox"/>	Material Storage	Stored material may be a falling hazard, or a crush hazard. Do not stand adjacent to materials stacked up, such as pipes, geosynthetic rolls, etc., or in the area of deployment.
<input type="checkbox"/>	<input type="checkbox"/>	Methane Gas (Landfill Gas)	Explosive conditions (5% LEL) will be ventilated, if encountered, prior to working in an area. Methane is a simple asphyxiant.
<input type="checkbox"/>	<input type="checkbox"/>	Mine or Quarry	No work shall be performed within 15 feet (or other designated client setback, whichever is greatest) of the mine or quarry walls. Be aware of the potential for falling rocks or slope failures.
<input type="checkbox"/>	<input type="checkbox"/>	Municipal Solid Waste (MSW)	MSW may contain hazardous biological substances, so avoid physical contact, and if possible stay up-wind. Wear appropriate PPE, such as gloves, safety shoes, and safety glasses. Wash hands, arms, and face after working near MSW. Reusable PPE and equipment should be thoroughly decontaminated after exposure to MSW. MSW may also contain sharp objects with the potential to puncture PPE.
<input type="checkbox"/>	<input type="checkbox"/>	Natural Gas	Natural gas is flammable and explosive. Keep ignition sources away from gas sources. Use spark proof tools when working with gas lines, etc.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Noise</b>	Hearing protection must be worn when noise levels exceed 85 dBA in the work area. If you need to raise your voice to be heard at the work site, then hearing protection should be worn. Hearing protection will be worn near drill rigs.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Overhead Hazards</b>	Pay attention to overhead equipment, piping, and structures. A hard hat must be worn at all times when overhead hazards are present on site.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Overhead Wires</b>	If contact is possible (i.e., equipment, drill rig, excavator, etc.) one or more of the following will be done: <ul style="list-style-type: none"> <li>✧ Power sources will be disconnected by the utility.</li> <li>✧ Power sources will be shielded by the utility.</li> <li>✧ Object will get no closer than 10 feet to prevent arcing, unless site specific conditions or weather conditions warrant greater separation per best professional judgment, or as directed by utility representatives.</li> <li>✧ Evaluate the need for shielding and coordinate with local utility representatives.</li> </ul>

<b>Table 7 - Other Common Physical Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>PHYSICAL HAZARD</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Pedestrian Traffic (public, client, workers)</b>	Be aware of pedestrian traffic patterns and, route traffic around the exclusion zone(s), as necessary, to avoid distractions and the potential for exposures or accidents. Use appropriate barricades and caution tape to mark work areas.
<input type="checkbox"/>	<input type="checkbox"/>	Portable Heaters	Be aware of portable heater locations and stay a safe distance from them.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Power Tools</b>	All power tools will be inspected regularly (at least on a daily basis) and used in accordance with the manufacturer's instructions and its capabilities. Electrical tools will not be used in flammable areas, unless they are approved for that purpose. Portable electric tools will be used only with a GFCI. Proper hand, eye and hearing protection will be used when working with power tools and all appropriate safety guards must be in place. Personnel will be trained in the proper use of the specific tool. Any defective power tools will be immediately tagged and removed from service. Tools will be stored properly after use.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Power Washing Equipment</b>	Stay clear of the power washing nozzles and equipment.
<input type="checkbox"/>	<input type="checkbox"/>	Propane Tanks	Be aware of propane tank locations, and any gas lines leading to or from the tanks.
<input type="checkbox"/>	<input type="checkbox"/>	Rock Blasting	Contractor is responsible for following safe blasting protocol. Heed all contractor warnings at time of blasting and stay well clear until safe to return to area, as indicated by the contractor.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Sample Preservative Chemicals</b>	Wear safety glasses, cut resistant, and nitrile gloves or equivalent when adding preservative chemicals to sample bottles or vials. Have clean wash water nearby.
<input type="checkbox"/>	<input type="checkbox"/>	Scaffolding	Stay clear of scaffolding. Be aware of the OSHA safety requirements for using constructing and scaffolding.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Severe Weather</b>	Work may be suspended if dangerous weather conditions (lightening, tornadoes, high winds, heavy rain, freezing rain, etc.) occur. Be aware of changing weather conditions, and be prepared to take shelter as necessary. Potential shelters should be identified prior to beginning work.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Sharp Objects</b>	Wear appropriate cut resistant gloves when handling sharp objects, and use appropriate equipment to move objects. See Appendix C for the Glove Selection Guideline.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Slippery Ground/Surfaces</b>	Exercise caution, especially on slopes, field trailer floors and stairs, after a precipitation event. Use slip resistant boots, or implement surface preparations to eliminate the slippery nature of the surface prior to accessing the area. Spill control measures and general housekeeping should be utilized to help prevent slipping on wet floors, wet pavement, and general work areas.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Slips, Trips, and Falls:</b>	Maintain clear walkways for work areas.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Steam Cleaning Equipment</b>	Stay clear of the steam cleaning nozzles and equipment. All personnel performing this task must wear a face shield.
<input type="checkbox"/>	<input type="checkbox"/>	Steel Erection	All materials, equipment, and tools, which are not in use while aloft, shall be secured against accidental displacement. The controlling contractor shall bar other construction processes below steel erection unless overhead protection for the employees below is provided. Employees engaged in steel erection activities on a walking/working surfaces with an unprotected side or edge more than 15 feet above a lower level shall be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.

<b>Table 7 - Other Common Physical Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>PHYSICAL HAZARD</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input type="checkbox"/>	<b>Steep Slopes or Banks</b>	Pay attention to footing and walking. Stay a safe distance from unstable or extremely steep slopes. Wear appropriate footwear. Be aware of potential slope or bank failures. Heavy equipment should not be operated on or near unstable slopes or banks.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Strong Nuisance Odors</b>	Strong odors should be ventilated before entering a work area, or a respirator shall be worn as needed.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Sunburn	For extended periods of time outdoors on sunny days, sunglasses, long-sleeved shirts and long pants should be worn to help prevent sunburn and eye problems. Wear sunscreen as appropriate for the project.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Surface Water</b>	Working next to or on, bodies of water shall be done using the buddy system. Staff shall wear USCG-approved personal floatation devices when on or adjacent to bodies of water.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Terrain</b>	Uneven or steep terrain can cause hazardous conditions for walking and transporting equipment around the site. Site personnel should use caution when working on uneven surfaces, and they should avoid working down-slope from heavy equipment, or materials being moved or stored.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Traffic (client, contractors, public, semi-trucks, forklifts, etc.)</b>	Obey all posted speed limits. Park in designated areas only. Be aware of traffic patterns on site, and during access to the site. Use orange traffic cones and barrier warning tape, as needed, or if within 25 feet of the right-of-way. TRC personnel must wear safety vests when working in or near traffic areas. For work in public roadways/highways, coordination with local officials and prepare a traffic safety plan.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Trains/Railroad Tracks</b>	Be aware of any train activities on the site, entering or leaving the site, or immediately adjacent to the site. Do not walk between the rails or on the railroad ties. All work must be at least 25 feet away from the tracks unless you have a railroad representative acting as a flagman. When driving, stop at all railroad crossings, even if they are unmarked, and look in both directions before proceeding across the tracks. Coordinate with TRC Project Manager as special permitting may be required for this work, even if not conducted on railroad property or right of way.
<input type="checkbox"/>	<input type="checkbox"/>	Transporting Hazardous Materials	TRC personnel who transport hazardous materials shall have the required DOT and/or IATA training prior to transporting materials, and will comply with all applicable DOT regulations and requirements and IATA guidance for labeling, packaging, etc. See also the Required Personnel Training section of this HASP to review/specify if DOT/IATA training is required for this project.
<input type="checkbox"/>	<input type="checkbox"/>	Tree Cutting	Stay clear of tree cutting activities.
<input type="checkbox"/>	<input type="checkbox"/>	<b>Trenching</b>	TRC personnel will not enter trenches not in accordance with 1926 Sub Part P. Be aware that some trenching conditions may result in a confined space condition.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Trip Hazards (wires, cords, hoses, debris, corn stubble, uneven surfaces, etc.)</b>	Temporary wires, cords, hoses, etc., should be properly located, marked, and protected to help prevent tripping and disruption to work activities. Trip hazards are particularly a problem early in the morning, late in the day, or under other poor lighting conditions.
<input type="checkbox"/>	<input type="checkbox"/>	Under Ground Storage Tanks (USTs) (Septic Tanks)	If any unknown UST's are encountered, drilling or excavations will be terminated in that location until a new scope of work, Risk Assessment and Health & Safety Plan can be developed.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Uneven Surfaces</b>	Be aware of uneven walking or driving surfaces and exercise caution when moving around the site.

Table 7 - Other Common Physical Hazards Matrix			
JSA	APPL.	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Utilities – Overhead	<b>Electrical, telephone, cable TV, etc.</b> – In advance of the field work, a subcontractor, the client, or TRC will locate and identify all overhead utilities. The owner or client will be responsible for identifying all applicable overhead utilities, product lines, pipes, and aboveground tanks. A minimum clearance of 10 feet must be maintained between equipment and overhead utility lines. Notification timeframes vary regionally. Coordinate with the TRC Project Manager as to specific timeframes and responsibilities.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Utilities – Underground	<b>Electric, gas, telephone, water, storm sewer, sanitary sewer, cable TV, etc.</b> - In advance of the field work, A subcontractor, the client, or TRC will call Digger’s Hotline to locate all underground utilities. The owner or client will be responsible for marking all applicable on-site underground utilities, product lines, pipes, and tanks. Coordinate with the TRC Project Manager as to specific timeframes and responsibilities.
<input type="checkbox"/>	<input type="checkbox"/>	Waterways	Exercise caution near, around, or in waterways. Harnesses should be worn when working in, or within 4 feet of, the waterway, especially when attempting to sample from shore or a boat or barge. All applicable laws and regulations will be followed when navigating a boat or barge to and from a work site.
<input type="checkbox"/>	<input type="checkbox"/>	Welding Tools	Stay clear of welding operations, and do not look directly at the welding process without appropriate eyewear and shield.
<b>Notes:</b> APPL. – Abbreviation for “Applicable.” N/A – Not applicable JSA – Job Safety Analysis			

#### 5.4 Biological Hazards

Table 8- Common Biological Hazards Matrix			
JSA	APPL.	BIOLOGICAL HAZARD	GENERAL CONTROL MEASURE
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Animals (dogs, etc.)	Be aware of any animals on site or adjacent to the site. Appropriate care should be taken if any feral (wild) animals are encountered. Dogs often are not leashed and may be unfriendly. Bites from dogs and wild animals can cause infections or transmit disease. In general, it is best to not approach dogs even if they appear to be friendly, and wild animals should never be approached. If bitten, the area should be washed with soap and water. If the bite resulted in puncturing or tearing of the skin, the wound should be covered with a sterile dressing and medical attention should be sought immediately. A description of the dog should be noted and if possible, the dog’s owner.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Blood-Borne Pathogens	Injuries received in the field may require assistance from a field team member to perform first aid. Contact with blood and certain body fluids can contain pathogens that may be transmitted by contact with an open wound by the caregiver. The following precautions should be used when giving first aid: <ul style="list-style-type: none"> <li>✧ Use nitrile gloves to avoid contact with blood/fluids. Spent bandages and gloves used to perform first aid should be placed in a plastic bag and properly disposed.</li> <li>✧ Blood/fluid should be cleaned from surfaces that may be contacted by</li> </ul>

<b>Table 8- Common Biological Hazards Matrix</b>			
JSA	APPL.	BIOLOGICAL HAZARD	GENERAL CONTROL MEASURE
			<p>other individuals.</p> <p>✧ Use an appropriate barrier if required to perform rescue breathing.</p>
<input type="checkbox"/>	<input type="checkbox"/>	Briars or Thistles	Be aware of any briars or thistles on site. Wear appropriate clothing and gloves. Avoid contact with briars or thistles whenever possible.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Cold Stress</b>	Work schedules may be modified when temperatures are below 20° F as measured by the wind chill factor. Take frequent breaks to warm up. Drink plenty of fluids. Wear appropriate clothing, and monitor for cold stress symptoms (frostbite, hypothermia, etc.). See Appendix D for additional information.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Heat Stress	The work schedule may be modified if the ambient temperature is more than 80° F. Take breaks as necessary, and drink plenty of fluids. If necessary, wear sunscreen and sunglasses on bright days. Monitor site personnel for signs of heat stress symptoms (heat rash, heat cramps, heat exhaustion, or heat stroke). See Appendix D for more information.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Insects (ticks, bees, spiders, etc.)	<p>Site workers with known allergies to insect bites should carry their own medication. In case of emergencies, inform fellow workers of any severe allergies. Use insect repellent as necessary, and as specifically allowed on site. If possible, wear long-sleeved shirts and pants. If appropriate, check for ticks at the end of each day. Have other appropriate first aid supplies handy for bites.</p> <p><b>Ticks</b> - Avoid wooded and bushy areas with high grass and lots of leaf litter. If you do go into areas like this, try to stay in the center of a cleared trail to avoid contact with overgrown grass, brush, and leaf litter. Use effective tick repellants and apply according to the label instructions. For more information on repellants see the EPA Insect Repellants: Use and Effectiveness site. Wear long sleeves, long pants, and long socks to keep ticks on the outside of clothing. Light clothing will help spot ticks. Tuck shirts into pants and pants into shoes or socks to keep ticks on the outside of clothing. If outside for an extended period of time then tape pant legs where pants and socks meet so that ticks cannot crawl under clothes. Perform daily tick checks after being outdoors in areas where ticks are present, even in one's own yard. Remove ticks from clothing, gear, and pets before going inside.</p> <p>Inspect all parts of the body carefully, especially the armpits, scalp, and groin. Shower or bathe as soon as possible to wash off any ticks that still remain on you. Tumble clothes in a dryer on high heat for an hour to kill remaining ticks.</p> <p>Attached ticks should be immediately removed with fine-tipped tweezers. To remove an attached tick, grasp it with narrow-bladed tweezers or forceps as close as possible to attachment (skin) site, and pull upward and out with a firm and steady tension. If tweezers are not available, use fingers shielded with tissue paper or rubber gloves. Do not handle with bare hands. Be careful not to squeeze, crush or puncture the body of the tick which may contain infectious fluids. After tick removal, thoroughly disinfect the bite site and wash hands. Seek medical attention if there is a concern about incomplete tick removal. It is important that a tick be properly removed as soon as it is discovered. Seek medical attention if you develop a rash or fever within several weeks of removing a tick.</p> <p><b>Mosquitos</b> - Reduce the risk of being bitten by mosquitoes. Minimize time spent outdoors around dusk and dawn when mosquitoes are most active. Wear shoes, socks, long pants, and a long-sleeved shirt when outdoors for long periods of time, or when mosquitoes are most active. Clothing should be light colored and made of tightly woven materials that keep mosquitoes away from the skin. Consider the use of an EPA-registered insect repellent. Follow the directions on the package. Be sure to use insect repellent and wear long sleeves and pants at these times or consider staying indoors during these hours.</p> <p><b>Spiders</b> - Spiders typically seek cover in dark protected areas. Common areas</p>

Table 8- Common Biological Hazards Matrix			
JSA	APPL.	BIOLOGICAL HAZARD	GENERAL CONTROL MEASURE
			<p>where spiders may be encountered are heavy vegetation and trees or infrequently used buildings and structures. Spiders also are found in basements and enclosed spaces where sampling may be performed. Spider bites may cause swelling, pain and respiratory problems. Avoid dense vegetation, and use caution when sampling in dark or poorly illuminated locations. If bitten, wash the area and use ice on the bite area to reduce swelling. If respiratory stress, significant pain or swelling is noted, or discoloration around the bite area occurs, seek immediate medical attention.</p> <p><b>Stinging Insects</b> - Like spiders, wasps and yellow jackets often nest in dense vegetation and in the ground, in long-standing protective casings on monitoring wells and shielded gate locks, or in infrequently used buildings and structures. An insect sting can cause pain, swelling, and respiratory problems that may be life-threatening to certain individuals. If stung, remove stinger if present using tweezers or similar, and wash the area and use ice on the sting area to reduce swelling. If respiratory stress, significant pain or swelling is noted, or discoloration around the sting area occurs, seek immediate medical attention.</p>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Long Hours/Fatigue	Long work hours can lead to fatigue, and fatigue can lead to the physical inability to perform the work in a safe manner, or travel to, or from, a work site in a safe manner. If long work hours are scheduled, or if the scheduled work takes longer than planned, field staff should determine if fatigue is, or will be, an issue. Field staff should evaluate whether they are able to complete the work in a safe manner, or whether they are able to travel in a safe manner. If fatigue is an issue, appropriate breaks should be planned or taken, including overnight stays when necessary.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Poisonous Plants	Be able to identify any local poisonous plants and avoid them if possible, or wear protective clothing as necessary. When removing potentially exposed clothing or PPE, the clothing or PPE should be carefully and thoroughly washed or decontaminated.
<input type="checkbox"/>	<input type="checkbox"/>	Snakes	Be aware of the potential for snakes in the area and wear snake boots, snake chaps, gaiters, or leggings as needed.
<p><b>Notes:</b>                      APPL. – Abbreviation for “Applicable.”                      JSA – Job Safety Analysis</p>			

### 5.5 Radiological Hazards

No radiological hazards are expected onsite. If any new condition is encountered during this activity, the HASP will be adjusted accordingly.

Table 9 - Radiological Hazards Matrix			
JSA	APPL.	PHYSICAL HAZARD	GENERAL CONTROL MEASURE
<input type="checkbox"/>	<input type="checkbox"/>	Radiation (ionizing)	Exposure to ionizing radiation can be controlled by one of three methods. Time, distance, or shielding. Limit your time near the radioactive source. Keep your distance from the radioactive source. Shield yourself from the radioactive source with appropriate shielding material. If the radioactive source(s) are from TRC equipment, the TRC employee using the equipment needs required training to use the equipment, and must be monitored using a dosimeter badge. Update contact information for TRC subject matter expertise and regulatory authorities.

<b>Table 9 - Radiological Hazards Matrix</b>			
<b>JSA</b>	<b>APPL.</b>	<b>PHYSICAL HAZARD</b>	<b>GENERAL CONTROL MEASURE</b>
<input type="checkbox"/>	<input type="checkbox"/>	X-Ray Fluorescence Instruments (a.k.a., XRF Guns)	XRF units for field metals analysis are only to be used by trained employees with radiation safety training. Licensing requirements can vary by state. Coordinate with a TRC CIH before utilizing in the field to set up dosimetry protocols and instrument specific safety procedures.
<b>Notes:</b> APPL. – Abbreviation for “Applicable.” XRF – X-ray fluorescence JSA – Job Safety Analysis			

## 6. WORK ZONE AND COMMUNITY AIR MONITORING AND ACTION LEVELS

An air-monitoring program will be implemented to identify areas of elevated airborne contaminant concentrations and to determine the level of the concentrations relative to background. Air monitoring will be performed in the exclusion zone and downwind of where the field activities are conducted for the safety of the field personnel and the surrounding population. Upon exceeding the action levels (listed below) within the exclusion zone, the field operations should cease or be continued with upgraded PPE levels or with dust/vapor control measures. In addition, monitoring should extend out to the support zone and/or out to the perimeter if high levels persist in the exclusion zone.

Additional controls may be employed if the action levels are exceeded at the downwind work parameter. If the control measures are not effective in reducing air concentrations at the exclusion zone perimeter, work will be stopped and air monitoring will continue until the air concentrations are abated. If concentrations remain above the action levels for longer than 30 minutes at the downwind boundary, up-wind monitoring will be conducted to assess if factors beyond the scope of work are impacting the local air quality. If no other sources of air impacts are identified, the work will be stopped and the work area will be abandoned until alternate control methods can be identified.

<u>Monitoring Equipment/Model</u>	<u>Frequency of Surveillance</u>
<u>X</u> PID	<u>Continuous in the breathing zone during drilling and surface soil sampling.</u>
<u>X</u> Combustible Gas Meter	<u>Every 15 minutes above the borehole during drilling.</u>
<u>X</u> Miniram	<u>Dust monitoring while drilling soil borings or transporting equipment.</u>

Dust quality should be monitored with a Miniram or similar instrument. If readings are above the action level, dust control measures will be implemented (i.e., water spraying), or work will be suspended until dust levels drop below action levels. Dust levels will be assessed in the exclusion zone, and if exceedances are observed, monitoring downwind will be conducted. If dust levels remain elevated, an assessment of upwind quality will also be made to determine if an unrelated source could be contributing to the elevated readings.

### *ACTION LEVELS*

#### Direct Reading Instruments

A complex variety of toxic air pollutants (including organic and inorganic vapors, gases or particulates) can be produced at contaminated sites. Direct-reading field instruments will not detect or measure all of these substances. Thus negative readings should not be interpreted as the complete absence of airborne toxic substances. Verification of negative results can only be done by collecting air samples and analyzing them in a laboratory or in an off-site location using portable analyzers and should be considered and determined on a case-by-case basis.

Table 10 – Air Monitoring Action Levels		
Instrument	Action Level	Action Required
<b>Organic Vapor Monitoring</b>		
PID with 10.6eV Lamp	<i>Above 5 ppm sustained 15 min average reading in the downward perimeter of the work area or exclusion zone</i>	Stop operation until level remain < 5 ppm
PID with 10.6eV Lamp	Between 5 to 25 ppm in the downward perimeter of the work area or exclusion zone.	<i>Work must be halted, identify the source of vapors, take corrective actions to abate emissions. Then resume work activities if PID reading 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</i>
PID with 10.6eV Lamp	Above 25 ppm at the perimeter of the work area	Stop operations. Level B necessary
<b>LEL Action</b>		
MultiRAE	Above 10% LEL	Stop operations until levels remain <10%
<b>Dust Monitoring</b>		
Miniram	15 min. period downward PM-10 particulate level > 100 $\mu\text{g}/\text{m}^3$ or if airborne dust is observed leaving the work area	Dust suppression techniques must be employed. Then work may continue if downwind PM-10 particulate levels do not exceed 150 $\mu\text{g}/\text{m}^3$ above the upwind level and provided that no visible dust is migrating from the work area.
Miniram	Above 150 $\mu\text{g}/\text{m}^3$ after implementation of dust suppression techniques	Stop operations, re-evaluate suppression activities. Work can resume if dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to < 150 $\mu\text{g}/\text{m}^3$ of the upwind level and in preventing visible dust migration.

- (1) See the OSC for action levels using a 10.6eV lamp.
- (2) Conduct air monitoring periodically to determine when and if work may be continued. For work to continue above 25 ppm, cease work immediately and upgrade to Level B.
- (3) If dust is present above the action level, implement dust control measures such as water spraying

#### Dust Monitoring

The action level for the dust monitoring of 150  $\mu\text{g}/\text{m}^3$  at the Site is based upon the EPA's Air Quality Standards of PM-10 (particulate matter of 10 microns) and New York State Department of Environmental Conservation's DER-10, Technical guidance for site investigation and remediation.

#### Inorganic Gases and Vapors

The ability to detect and quantify nonspecific inorganic vapors and gases is extremely limited. If specific inorganics are known or suspected to be present, measurements should be made with appropriate measuring device.

#### Organic Gases and Vapors

Multi-gas PID will be used to monitor air quality while performing the excavation/s. The air will be monitored for the levels of total organic vapors and the lower explosive limits (LEL). As discussed above, operation/s will temporarily cease or be upgraded to the next level of PPE upon exceeding action levels, until safe levels return.

**Table 11 - Preservatives and Decontamination Products**

Chemical of Concern	On-Site Usage and Potential Exposures	Control Method/Other Notes
Hydrochloric Acid (HCl)	Less than 20 ml quantities used for sample preservation. Air phase exposure is expected to be minimal and incidental to sample containerization.	5 ppm (OSHA PEL)
Nitric Acid (HNO <sub>3</sub> )	Less than 20 ml quantities used for sample preservation. Air phase exposure is expected to be minimal and incidental to sample containerization.	5 mg/m <sup>3</sup> (OSHA PEL)
Isobutylene	100 ppm gas for use during calibration of PID instruments	<p>No specific exposure limits for isobutylene (simple asphyxiant). Maintain oxygen levels above 19.5%.</p> <p>Before attaching regulator to cylinder, verify that the regulator is off.</p> <p>Before opening regulator, make sure that tubing connecting regulator to monitoring device/tedlar bag is secure.</p> <p>To use a tedlar bag, put bag control valve in an open position and close after filling.</p> <p>Before disconnecting gas from the instrument and/or tedlar bag, verify the regulator is closed.</p> <p>Empty bag of contents after calibration in a downwind position and/or to avoid inadvertent inhalation.</p>
<p><b>Notes:</b></p> <p>ppm – parts per million            ml – milliliters            ug/m<sup>3</sup> – micrograms per cubic meter</p> <p>OSHA – Occupational Safety and Health Administration            PEL – Permissible Exposure Limit</p>		

**7. Personal Protective Equipment (Non-Respiratory)**

TRC personnel will use Level D PPE as noted/modified below:

<b>Table 12 - Level D Personal Protective Equipment</b>	
<b>Item</b>	<b>Rationale/Notes</b>
<b>Hardhat</b>	Appropriately rated hard hats will be worn by personnel for protection against overhead hazards, including electrical.
<b>Hearing protection</b>	Hearing protection will be worn by all personnel exposed to at least 85 dB of sound during the workday.
<b>Safety boots (steel toe/steel shank)</b>	Steel-toe safety boots will be worn by all personnel during project work described in this HASP and at all times on site.
<b>Eye protection (safety glasses)</b>	Eye protection will be worn when personnel are exposed to flying debris, chemical vapors or particulates. Chemical splash goggles will be worn for protection against chemical gases, vapors or particulates. Safety glasses will be worn for protection against flying objects.
<b>Safety vest</b>	Utilize in areas in or near vehicular traffic of any kind on or off property.
<b>Chemical Protective Clothing (CPC) and Gloves</b>	CPC and gloves will be inspected according to TRC's Personal Protective Equipment Program. CPC will be chosen with assistance from the OSC according to the chemical hazards present. Gloves to be changed between samples to avoid cross-contamination.
<b>Cut resistant work gloves</b>	As indicated herein, use Cut and Abrasion Resistance gloves when necessary for hand protection during field tasks. See Appendix C for a Glove Selection Guide. <b><i>Leather work gloves are expressly prohibited.</i></b>

A basic first aid kit will be readily available on-site in the event of an emergency.

Fire extinguisher should be present with the rig. All personnel working on or around the drill rig should know the location of and how to operate the fire extinguisher.

## 8. Personal Protective Equipment (Respiratory)

### 8.1 Evaluating the Need for a Respiratory Protection Upgrade

TRC's health and safety goal is to avoid using respiratory protection unless it is absolutely necessary or required. Administrative controls or engineering controls should always be considered as a means to reduce potential exposures before PPE is required or considered consistent with the hierarchy of control philosophy (elimination/substitution > engineering controls > administrative controls > personal protective equipment).

For TRC operations that require the use of a respirator, the TRC Project Manager (and Contractor equivalent) must verify that Field Personnel are medically approved to use respiratory equipment, fit tested, and trained in the proper use of respirators. Only respirators that are NIOSH/MSHA<sup>1</sup> approved are to be used.

Respiratory protection is mandatory if workers are required to complete tasks within a hazardous atmosphere. Per that Occupational Health and Safety Administration (OSHA), a hazardous atmosphere is defined as:

- Flammable gas, vapor, or mist in excess of 10-percent of the Lower Explosive Limit (LEL).
- Atmospheric oxygen is below 19.5-percent or above 23.5-percent.
- When concentration of a known contaminant is greater than the permissible exposure limit (PEL).
- Airborne combustible dust exceeds its LEL (approximated when dust obscures vision at a distance of 5 feet or less).

Other conditions may warrant a respiratory protection upgrade per the discretion of the TRC Project Manager, OSC, RMD Safety Manager, or Health & Safety Director as well as the client.

Air monitoring may be required to verify the presence or absence of a hazardous atmosphere. Conduct air monitoring whenever a situation or condition arises that could reasonably result in a hazardous atmosphere.

Any worker wearing a respiratory protective device in a potentially or known hazardous atmosphere must demonstrate a proper fit test with that device. Fit test records are maintained on file by TRC. The proper fitting of respiratory protective devices requires the use of a fit test. The fit test is needed to determine a proper match between the face piece of the respirator and the face of the user. Fit testing will be conducted after medical approval has been obtained. Qualitative fit-tests involve the use of a test atmosphere that employees can sense. If they are not responsive to the test material then other test methods must be deployed. Quantitative fit-tests provide a respirator specific protection factor. TRC usually does qualitative fit-tests.

Please see Chapter 12 (Respiratory Protection) of the 10/5/2010 TRC Health and Safety Manual for detailed guidance.

### 8.2 Air-Purifying Particulate Respirators

Field work involving construction and earthmoving operations that result in nuisance dust and particulates may use air-purifying respirators. Particulate respirators can be used in situations where nuisance dust and particulates are the only contaminants posing an inhalation hazard. Particulate respirators are not to be used in oxygen deficient atmosphere or if hazardous levels of gas/vapor contaminants are also present.

---

<sup>1</sup> NIOSH – National Institute for Occupational Safety and Health; MSHA – Mine Safety and Health Administration

High efficiency particulate air (HEPA) P100 respirators should be used in place of commercially available “dust masks.” Select cartridges that are based on the amount of oil and liquid vapors present. Magenta is the color code for HEPA cartridges.

### 8.3 Air-Purifying Gas/Vapor Respirators

TRC employees and Contractors are required to wear half-face, air-purifying respirators with the appropriate chemical cartridge under the following circumstances:

- When concentration of a known contaminant continuously exceeds permissible exposure limit (PEL) time-weighted average or the threshold limit value (TLV) time-weighted average.
- When volatile organic compound (VOC) vapors in the work area continuously exceed the threshold limit value-time-weighted average (TLV-TWA).
- When, at any time, VOC vapors in the work area exceed the threshold limit value - short-term exposure limit (TLV-STEL).

See Table 10 for site-specific or additional information on regulatory exposure limits for chemicals/exposures of concern at this site.

Air purifying respirators (APRs) with chemical cartridges can be used under the following conditions:

- If the oxygen concentration is between 19.5-percent and 23.5-percent.
- If chemical contaminants have been identified, the toxic concentrations are known and the respirator cartridges are effective in removing the contaminants.
- The respirator and cartridges are NIOSH/MSHA approved.
- The contaminants have noticeable warning qualities such as odor and visibility characteristics including color.

In the event workers are required to wear APRs with chemical cartridges, the following requirements must be met:

- The TRC Project Manager or Contractor’s SSO must verify that workers are:
  - ◇ Medically approved (within one year) to use respiratory protection,
  - ◇ Fit-tested for the specific respirator to be used, and
  - ◇ Trained in the proper care, use and limitations of the respirator to be used.
- Contractors must provide proof of the above to the TRC Project Manager, upon request.
- If an employee or contractor has not cleared by the Project Manager to use a respirator, they will not be assigned tasks that may potentially expose them to contaminants.
- Personnel with interfering facial hair are not permitted to wear respirators and shall not be permitted in areas where respiratory protection is required.
- Respirators must be sized to the employee
- Qualitative fit tests conducted by trained employees

Note that the protection factor (PF) on a ½ face APR is 10. If air concentrations/ levels are more than 10-times the TLV, the upgrade would require a full face APR (which has a PF of 50). All APR selections for a project are subject to TRC CIH review.

### 8.4 Supplied Air Respirators

Supplied-air respirators, such as a Self-Contained Breathing Apparatus (SCBA) or airline-equipped full-face respiratory protection, are not anticipated to be required at the site. This level of respiratory protection is utilized

in oxygen deficient atmospheres or atmospheres considered to be at or above immediately dangerous to life and health (IDLH) levels. These conditions will only occur in rare, if any, circumstances such as confined space entry or emergency situations. The use of air-supplied respiratory protection is not permitted without approval and guidance from the OSC and TRC CIH.

**9. Site Control/Work Zones (Optional)**

Access to the work area, specifically the immediate area surrounding the remediation activities, will be limited to authorized personnel only to the extent TRC has authorization.

Table 13 - Site Control/Work Zones Matrix		
APPL.	CONTROL ELEMENT	SPECIFY/DESCRIBE <sup>1</sup>
<input type="checkbox"/>	<b>Site Specific Controls</b>	N/A
<input type="checkbox"/>	Facility Alarms or Signals	N/A
<input type="checkbox"/>	Work Permitting	N/A
<input type="checkbox"/>	Work Area Traffic	N/A
<input type="checkbox"/>	Parking Issues/Restrictions	N/A
<input type="checkbox"/>	Railway Traffic/Activity	N/A
<input type="checkbox"/>	Other	N/A
<input checked="" type="checkbox"/>	<b>Support Facilities/Zones</b>	Noted below.
<input checked="" type="checkbox"/>	Field vehicle	TRC Fleet Vehicle Number _____, Registration Number _____
<input type="checkbox"/>	On-site office trailer	
<input type="checkbox"/>	Other	
<input checked="" type="checkbox"/>	<b>Contaminant Reduction Zone</b>	Noted below.
<input type="checkbox"/>	Field vehicle	
<input type="checkbox"/>	Facility restroom/utility room	
<input checked="" type="checkbox"/>	Other	Ingress and egress area from the exclusion zone.
<input checked="" type="checkbox"/>	<b>Exclusion Zone(s)</b>	Noted below.
<input checked="" type="checkbox"/>	Immediate vicinity of work area	Delineate per OHSO.
<input type="checkbox"/>	Other	
<input checked="" type="checkbox"/>	<b>Site Entry Procedures</b>	Noted below.

Table 13 - Site Control/Work Zones Matrix		
APPL.	CONTROL ELEMENT	SPECIFY/DESCRIBE <sup>1</sup>
<input checked="" type="checkbox"/>	Notify Site OSHO	Contact information in Section 1.
<input checked="" type="checkbox"/>	Read/sign HASP	Note tailgate briefing below.
<input type="checkbox"/>	Check in with facility contact	
<input type="checkbox"/>	Check in with security guard	
<input checked="" type="checkbox"/>	Wear PPE called for in HASP	See Sections 7 and 8.
<input checked="" type="checkbox"/>	<b>On-Site Orientation</b>	Noted below.
<input type="checkbox"/>	Attend facility orientation / tail gate safety meeting	
<input checked="" type="checkbox"/>	Daily tailgate safety briefing	Document briefing per HASP/checklist (see Section 14).
<input type="checkbox"/>	<b>Other</b> (specify)	
<input type="checkbox"/>	<b>Other</b> (specify)	
<b>Notes:</b> 1- Where applicable, summarize or reference relevant plan, procedure, etc. APPL. – Abbreviation for “Applicable.” HASP – health and safety plan N/A – Not applicable OSHO – TRC’s On-Site Health and Safety Officer PPE – Personal Protective Equipment		

## **10. Job Safety Analyses**

A Job Safety Analysis (JSA) is a safety management tool in which the risks or hazards of a specific job in the workplace are identified, and then measures to eliminate or control those hazards are determined and implemented. More specifically, a job safety analysis is a process of systematically evaluating certain jobs, tasks, processes or procedures and eliminating or reducing the risks or hazards to as low as reasonably practical (ALARP) in order to protect workers from injury or illness. The JSA process is documented and the JSA document is used in the workplace or at the job site to guide workers in safe job performance. The JSA document is also a living document that is adjusted as conditions warrant.

The JSA process begins with identification of the potential hazards or risks associated with a particular job. Once the hazards are understood, the consequences of those hazards are then identified, followed by control measures to eliminate or mitigate the hazards.

■

Please refer to Appendix E for the Job Safety Analyses prepared for the following:

- Air Monitoring for Subsurface Clearance
- Loading and Unloading of Equipment and Materials
- Oversight of Subcontractor Operations
- Site Inspection

## 11. Required Personnel Training

TRC field personnel will have the training outlined below before on-site work activities:

Table 14 - Project Training Requirements				
(* required for all sites; but minimum recommended)				
Check "A" if training required for everyone, and check "T" if training required for specific task or per notations.				
A	T	SUBJECT	REFERENCE	
			29 CFR 1910	29 CFR 1926 or Other
<input checked="" type="checkbox"/>	<input type="checkbox"/>	HAZWOPER 40 hour*	1910.120	1926.65
<input type="checkbox"/>	<input type="checkbox"/>	3-Day HAZWOPER Supervised On-site*	1910.120	1926.65
<input checked="" type="checkbox"/>	<input type="checkbox"/>	8-Hour HAZWOPER Refresher*	1910.120	1926.65
<input type="checkbox"/>	<input checked="" type="checkbox"/>	First Aid, CPR*, <sup>1</sup>	1910.151	1926.23,,50
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Hazard Communication (HAZCOM)	1910.1200	1926.59
<input type="checkbox"/>	<input type="checkbox"/>	DOT / IATA Shipping Training	1910.1201	49 CFR 172.704
<input type="checkbox"/>	<input type="checkbox"/>	Respiratory Protection Training	1910.134	G-7-1989 <sup>2</sup>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	TRC Hand Protection Policy	1910.138	TRC Policy <sup>4</sup>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Defensive Driving	N/A	White Paper <sup>5</sup> TRC Manual <sup>6</sup>
Client-specific training:		<input type="checkbox"/> Not Applicable <input type="checkbox"/> Specify		
Client-specific training:		<input type="checkbox"/> Not Applicable <input type="checkbox"/> Specify		
Client-specific training:		<input type="checkbox"/> Not Applicable <input type="checkbox"/> Specify		
<b>Note:</b>				
<sup>1</sup> Per the TRC Health and Safety Policy and Procedure Manual, each TRC project will have at least one certified CPR/first aid trained person on site at all times. All Project Managers and anyone acting as the on-site Health and Safety Officer must be current in First Aid/CPR.				
<sup>2</sup> Compressed Gas Association's Commodity Specification for Air				
<sup>4</sup> TRC RMD Hand Protection Policy, August 2012				
<sup>5</sup> Guidelines for Employers to Reduce Motor Vehicle Crashes (joint white paper by NETS, NHTSA and OSHA)				
<sup>6</sup> TRC Driver and Vehicle Management Policy and Procedure Manual, Rev 1 (April 2012)				

Project training requirements beyond those provided in the above table will require a HASP revision/upgrade or concurrence of the TRC Safety Director or RMD Safety Manager.

## 12. Medical Monitoring

Medical monitoring will apply routinely to all employees who are or may be exposed to hazardous substances or health hazards at or above the established permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year (40 CFR 1910.120[f][2][i]). Said TRC field personnel will have the medical surveillance outlined in the table below prior to commencing on-site work activities.

Table 15 - Medical Surveillance Required			
*Baseline is minimum recommended.			
	29 CFR 1910	29 CFR 1926 or Other	Notes
<input checked="" type="checkbox"/> HAZWOPER Physical - Baseline*	1910.120	1926.65	
<input checked="" type="checkbox"/> HAZWOPER Physical – Annual	1910.120	1926.65	
<input checked="" type="checkbox"/> HAZWOPER Physical - Biennial*	1910.120	1926.65	
<input type="checkbox"/> Medical clearance for respirator use	1910.134	N/A	Unrestricted clearance.
Client-specific drug testing <sup>1</sup>	<input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/> Specify		
Client-specific medical monitoring <sup>1</sup>	<input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/> Specify		
Site-specific medical monitoring:	<input checked="" type="checkbox"/> Not Applicable <input type="checkbox"/> Specify		
<b>Note:</b> N/A – Not applicable. <sup>1</sup> Client required drug testing or medical monitoring should be coordinated through the Project Manager.			

TRC has a Drug and Alcohol-Free Workplace Policy (TRC Academy Course #900013753). TRC may require employees or subcontractors to be tested upon reasonable suspicion, following accidents or incidents during work activities, or during travel to or from a project site. Client policies may be stricter in regard to procedures following an accident. Project Managers must be aware of these and inform employees and subcontractors of any additional requirements.

### 13. General Safety Requirements

The general safety rules listed below apply to all TRC personnel present at the site.

- A tailgate health and safety meeting will be held with all field team members and subcontractors each day prior to the start of work.
- Adhere to all requirements of this health and safety plan (HASP).
- Wear protective clothing appropriate for the designated level of protection and decontaminate before entering clean areas when applicable.
- Use safety equipment in accordance with OSHA guidance and labeling instructions.
- Maintain safety equipment in good condition and proper working order and make sure that the equipment is calibrated prior to use.
- Immediately report unsafe acts or conditions to the Project Manager and OSC.
- Eating, drinking, and smoking are prohibited on site, except in designated areas.
- Maintaining a position upwind from intrusive activities is encouraged.
- The emergency shutoff switch should be demonstrated to be working prior to initiating drilling.
- An adequately stocked first-aid kit will be maintained at the work site.

### 14. Tailgate Safety Meetings

A tailgate safety meeting will be conducted daily prior to commencement of the work day (see checklist provided in Appendix F) or if site conditions change.

Topics covered by the tailgate safety meeting will include, but not be limited to:

- Scope of work and who will conduct each task
- Potential hazards for the scope of work
- weather forecast
- PPE
- Emergency procedures and the route to the medical facility
- Site conditions and features
- Communication guidelines related to stakeholder engagement and visitors

Safety meetings will be held to address modifications to this HASP and any addenda prepared to supplement the HASP. Subcontractors and personnel present at the tailgate safety meeting shall be required to sign an acknowledgement form after each meeting.

### 15. Emergency/Contingency Plan

Before commencing any on-site operations, the TRC OHSO will advise all personnel of potential emergencies. Personnel will be advised on their roles in the event of an emergency, and the steps to take for a timely and controlled response.

Communication networks/chain of command - All on-site personnel will communicate any accident, injury or near miss to the TRC OHSO who will provide instruction on how to proceed further.

First Aid / Safety Equipment - First aid equipment should be readily available in the event of an emergency. First aid equipment should include a well-stocked first aid kit, fire extinguisher and emergency eye wash.

Evacuation Plans and Refuge Area - All personnel should safely remove themselves from danger in the event of an emergency and safely access the refuge area. The refuge area should be in an upwind location a safe distance from the work zone. The refuge area will be determined during the daily safety briefing.

Notifications of Fire, Police and Emergency Facilities - In the event of an emergency that cannot be controlled by on-site personnel, the appropriate emergency contact shall be notified. All personnel shall remove themselves from the area of danger and wait for the arrival of help in the predetermined refuge area. The following is a list of local emergency contacts:

### 15.1 Non-Emergency Medical Assistance

If an injury does occur and it is not life threatening, then the employee or employee's supervisor/project manager should contact WorkCare as soon as possible, but within the first hour after an injury. WorkCare information is proved in Appendix G. This information will help assist the injured employee by connecting them with instant access to a medically qualified professional in order to provide guidance on appropriate first aid measures and medications.

Table 16 - Non-Emergency Telephone Number		
Service	Telephone Numbers	Notes
TRC Work Care Service	888-449-787	See Appendix G

## **16. Observations**

Note that the Project Manager and/or OSC will notify field staff if their site activities may be the subject of Safety Observation, an integral part of the continuous improvement safety culture promoted at TRC. If subject to an observation, please note the following:

- ❖ The Observation will tend to focus on the highest risk activity (as a general example, drilling in a public right-of-way).
- ❖ Follow-up observations may need to occur on previous observes, depending on prior data collected.
- ❖ The observer's preparation before visiting the site will be a review of the HASP, JSAs, client-specific requirements, etc., and a review of the work scope with the Project Manager to ensure the context of the work is well understood in advance.
- ❖ Review items may include PPE, body use and positioning, work environment, operating procedures, and tools and equipment.
- ❖ The observation should last between 30 and 60 minutes.

Both positive and negative observations are candidates for documentation and discussion. The overarching goals are to identify and correct questionable practices, and to identify and promote good, safe and efficient practices. This data gathering process allows TRC safety specialists to identify root causes for safety issues in both categories to better inform policy decisions.

## **17. Incident/Near Miss Reporting**

In case of an accident, TRC personnel must report the incident or near miss immediately to their project manager/supervisor and/or OSC, and client's representative, and follow the TRC Incident Response and Reporting Process (see Appendix H). If neither is available, the incident shall be reported to the TRC Safety Director (Mike Glenn). Blue section of the TRC Incident Response and Reporting form must be completed within 24 hours following the incident. Accident/injury/exposure information must be recorded per TRC policy (see Appendix H) and will be the basis of any accident/incident investigations. A Near Miss Reporting "short form" is also included in Appendix L for use in expediting the reporting of near misses.

## **18. Acknowledgement**

TRC personnel working under this HASP must read the HASP and sign the acknowledgment in Appendix I.

## **19. Subcontractors and Health and Safety Planning**

TRC personnel must provide the complete HASP to all subcontractors for their reference in advance of the work. Subcontractors must prepare their own HASP and provide evidence of HASP preparation before the start of site work to ensure that the subcontractor has an understanding of the safety hazards associated with the work that they are performing. Subcontractor HASPs are not required to be included unless contractually/client required, or is so desired by the Project Manager or OSC.

## **20. Other Supporting Documentation**

Supporting documentation and plans may be appended per the discretion of the Project Manager or OSC.

## **Figures**



**TRC ENVIRONMENTAL CORP.**  
 41 Spring Street  
 New Providence, New Jersey 07974

**SITE LOCATION MAP**

CPB – EDMERE, NEW YORK

JOB NO.: 174788

HN

DATE: OCTOBER 15, 2008

FIGURE: 1

FAR ROCKAWAY BOULEVARD

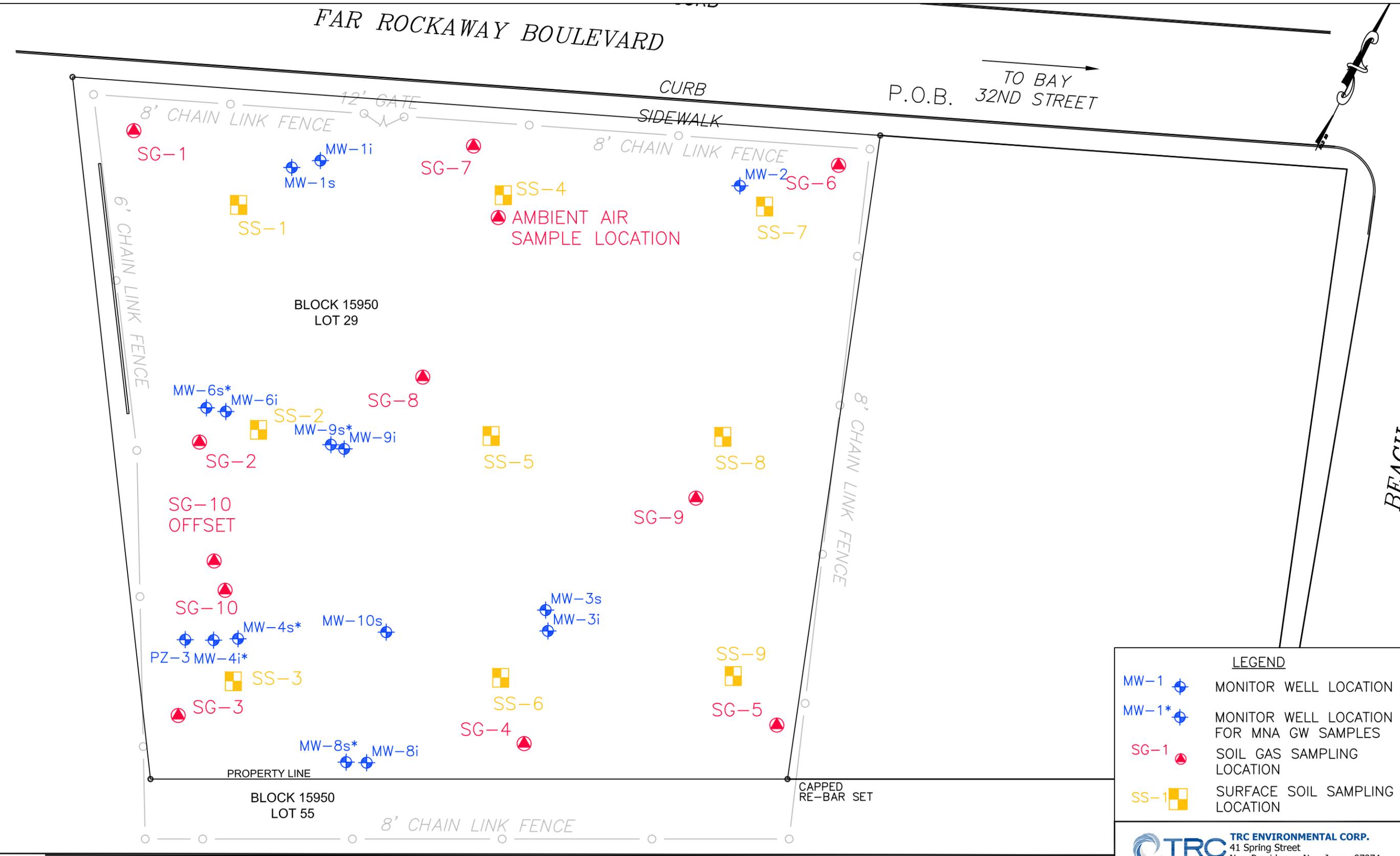
TO BAY  
P.O.B. 32ND STREET

BLOCK 15950  
LOT 24

BLOCK 15950  
LOT 29

BLOCK 15950  
LOT 55

ROCKAWAY FREEWAY



**LEGEND**

MW-1		MONITOR WELL LOCATION
MW-1*		MONITOR WELL LOCATION FOR MNA GW SAMPLES
SG-1		SOIL GAS SAMPLING LOCATION
SS-1		SURFACE SOIL SAMPLING LOCATION

**TRC ENVIRONMENTAL CORP.**  
41 Spring Street  
New Providence, New Jersey 07974

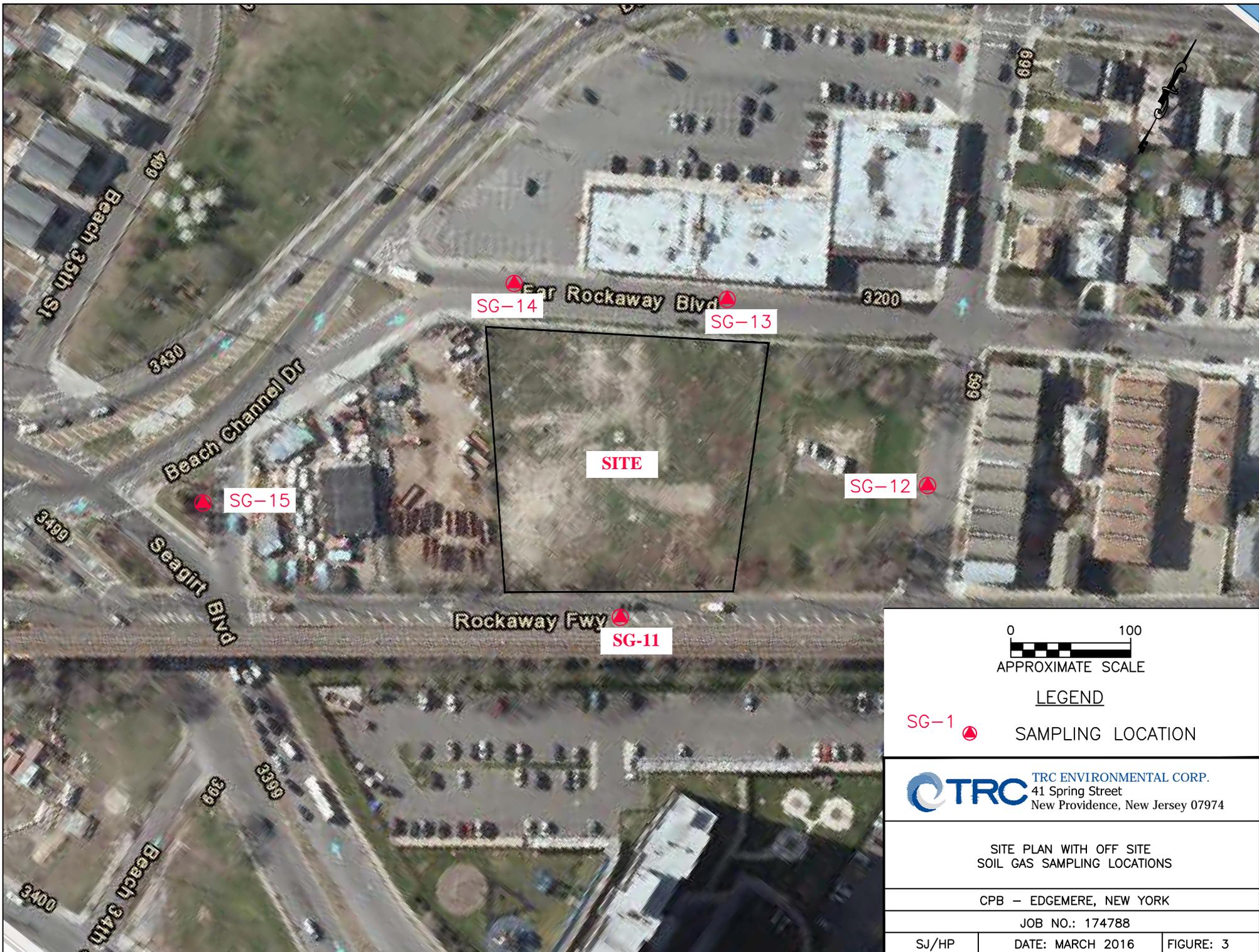
SITE PLAN WITH ON SITE  
GROUND WATER AND SOIL GAS  
SAMPLING LOCATIONS

CPB - EDMERE, NEW YORK

JOB NO.: 174788

SJ/HP	DATE: MARCH 2016	FIGURE: 2
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LEGEND

SG-1  SAMPLING LOCATION

**TRC** TRC ENVIRONMENTAL CORP.  
41 Spring Street  
New Providence, New Jersey 07974

SITE PLAN WITH OFF SITE  
SOIL GAS SAMPLING LOCATIONS

CPB – EDMERE, NEW YORK

JOB NO.: 174788

SJ/HP	DATE: MARCH 2016	FIGURE: 3
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FAR ROCKAWAY BOULEVARD

TO BAY  
P.O.B. 32ND STREET

BLOCK 15950  
LOT 24

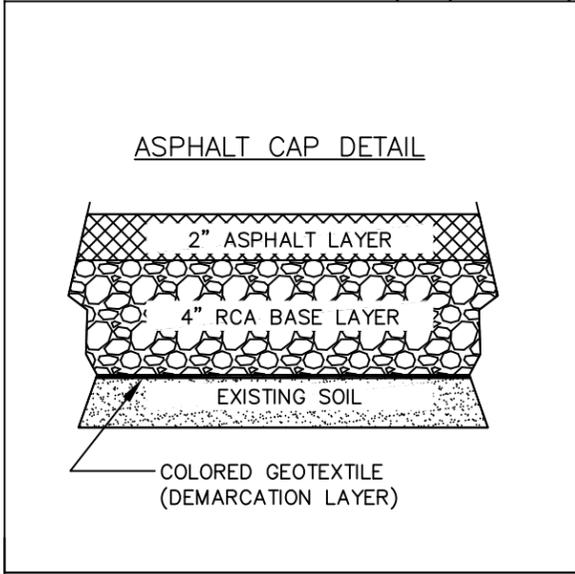
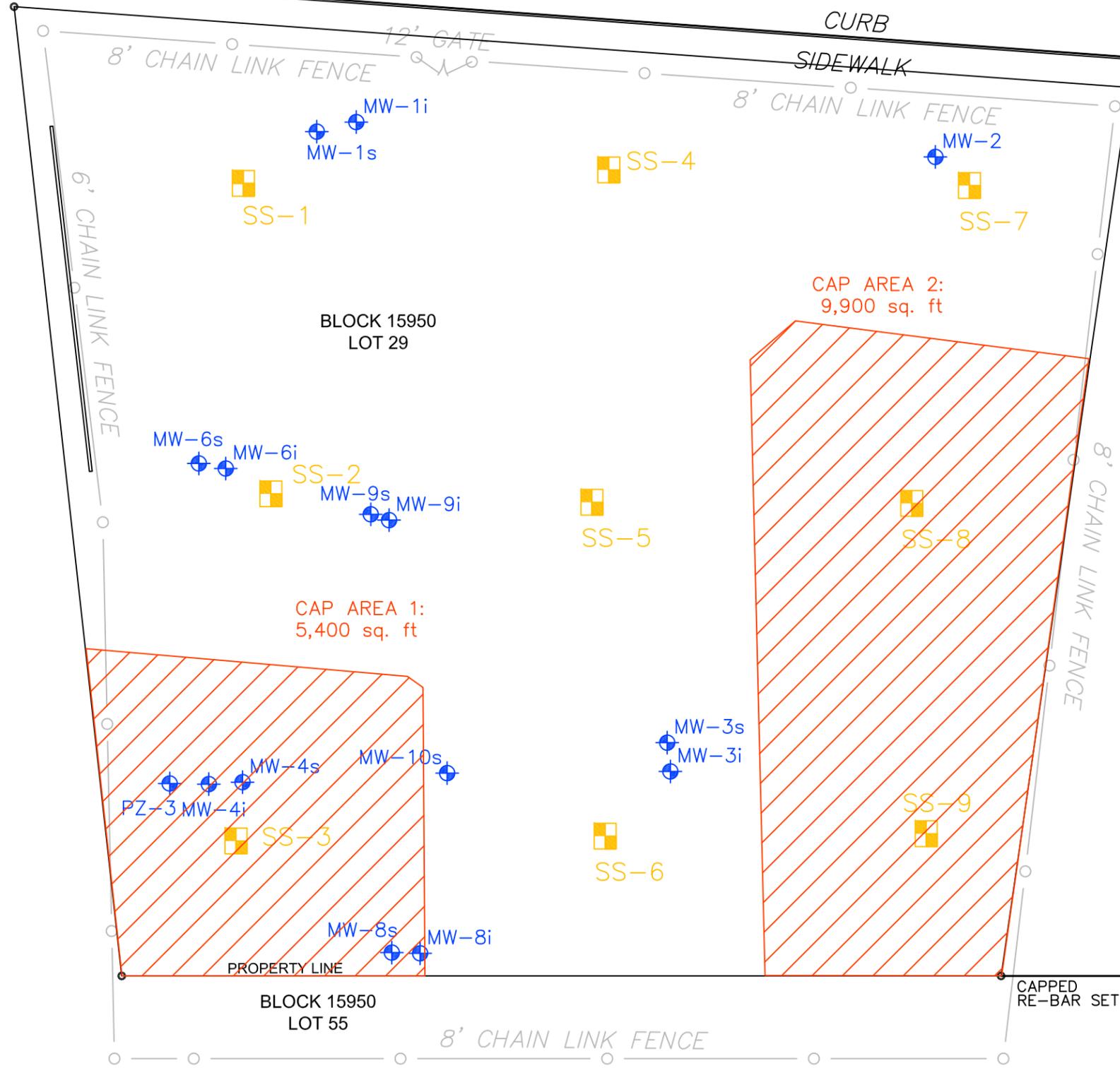
BLOCK 15950  
LOT 29

CAP AREA 1:  
5,400 sq. ft

CAP AREA 2:  
9,900 sq. ft

BLOCK 15950  
LOT 55

ROCKAWAY FREEWAY



- LEGEND**
- MW-1 MONITOR WELL LOCATION
  - SS-1 SURFACE SOIL SAMPLING LOCATION

**TRC ENVIRONMENTAL CORP.**  
41 Spring Street  
New Providence, New Jersey 07974

ENGINEERING CONTROL LOCATIONS  
AND ASPHALT CAP DETAILS

CPB - FAR ROCKAWAY, NEW YORK

JOB NO.: 174788

SJ/HP      DATE: MARCH 2016      FIGURE: 4



## **Appendix A Drilling, Borehole, Excavation Checklist**

# DRILLING / BOREHOLE / EXCAVATION CHECKLIST



Site Location, Name: \_\_\_\_\_

Date: \_\_\_\_\_

Project Task: \_\_\_\_\_

Contractor: \_\_\_\_\_

Sub-contractor: \_\_\_\_\_

Supervisor: \_\_\_\_\_

ACTIVITY	Yes	No/ N/A	COMMENTS INCLUDING JUSTIFICATION IF A RESPONSE IS <b><u>NO</u></b> OR <b><u>NOT APPLICABLE</u></b>
Personnel briefed on potential site/work hazards and safety. Sub-surface Clearance protocols have been reviewed with all site personnel involved in subsurface disturbance activities.			
All applicable local and site-specific permits have been obtained.			
Site access/permission has been secured. Landowner/occupant has been contacted.			
Most recent as-built drawings and/or site plans, surveys, utility maps obtained.			
Reviewed site information to identify subsurface structures relevant to planned site activities (easements, right-of-ways, historical plot plans, previous site investigations, soil surveys, boring logs, etc.).			
Utility locates have been performed by public utility company(s) and One-Call companies within required timeframe. Locates are clear/visible.			
Subsurface structure locates performed by private locate company within required timeframe. Locates clear/visible.			
Location of all aboveground indicators of subsurface utilities/services that may be leading to or from buildings within planned work area are identified.			
Location of area lights/signs and associated subsurface lines identified.			
Location of all telecommunication and associated subsurface lines identified.			
Location of all drains and associated interconnecting lines identified.			
Location of all electrical junction boxes and associated interconnecting lines identified.			
Location of all natural gas meters or connections and all interconnecting lines identified.			
Orientation, arrangement, location, sizes, of tanks and extractor covers identified. Burial depth of tank determined if relevant.			
Location of paving/soil scars indicative of subsurface structures identified.			
Presence of underground pipelines associated with pumps and pump galleries, manifolds, tank fields, compressors, production wells, loading racks and equipment identified.			
Presence of underground lines for instrumentation, process analyzer, and motor-operated valves are inspected/identified.			
Presence and tracing of process/storm sewers identified/understood. If other cement, fiberglass, untraced PVC lines are potentially in the ground disturbance area, identify means of identification in comments section.			
Locations of other pertinent surface or sub-surface features that may be of relevance to work scope have been identified.			
Clearance methods reviewed with Project Manager.			
Ground disturbance locations reviewed by Project Manager.			

# DRILLING / BOREHOLE / EXCAVATIONS CHECKLIST



ACTIVITY	Yes	No/ N/A	COMMENTS INCLUDING JUSTIFICATION IF A RESPONSE IS <b><u>NO</u></b> OR <b><u>NOT APPLICABLE</u></b>
Work area is secured. Emergency shut-off switch is located. Fire extinguishers/warning signs/barriers are present where needed. Signage in place for overhead power lines. Other safety equipment as needed.	<input type="checkbox"/>	<input type="checkbox"/>	
If subsurface structures exposed, extra precautions have been taken to ensure structural integrity.	<input type="checkbox"/>	<input type="checkbox"/>	

Comments / Findings	Actions to Close Out Items	Person Completing / Date

**Completed by:**

\_\_\_\_\_

Name (print)

\_\_\_\_\_

Company

\_\_\_\_\_

Signature

\_\_\_\_\_

Date

**Appendix B  
Material Safety Data Sheets for Preservatives and  
Decontamination Products**



☆☆☆☆☆ **Emergency Overview** ☆☆☆☆☆

Clear, colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Inhalation: irregular heart beat, drunkenness. Chronic: heart, liver and kidney damage, dermatitis. Birth defects and cancer may occur based on animal studies. Flammable.

**Potential Health Effects**

**Target Organs:** respiratory system, central nervous system (CNS), peripheral nervous system, cardiovascular system, liver, kidneys, skin

**Primary Entry Routes:** inhalation, skin contact, eye contact, ingestion (rarely)

**Acute Effects**

**Inhalation:** The vapor is mildly discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Anesthetics and narcotic effects (with dulling of senses and odor fatigue) are a consequence of exposure to chlorinated solvents.

Individual response varies widely; odor may not be considered objectionable at levels which quickly induce central nervous system effects.

High vapor concentrations may give a feeling of euphoria. This may result in reduced responses, followed by rapid onset of unconsciousness, possible respiratory arrest and death.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Evidence of acute human toxicity comes mainly from the use of TCE as an anesthetic, Tachypnea and ventricular arrhythmias are experienced at inhaled concentrations exceeding 15000 ppm. Systemic toxicity is low following anesthesia. Occasional hepatotoxicity (liver dysfunction) has been reported; this is probably due to the breakdown of TCE to dichloroacetylene and phosgene by soda-lime present in some anesthetic devices. The effects of TCE appear to be enhanced in some individuals by simultaneous exposure to caffeine, ethanol and other drngs. "Degreasers Flush" describes a reddening of facial, neck, and back skin and is seen after intake of substantial quantities of ethanol by certain individuals after exposures to TCE.

**Eye:** The liquid is highly discomforting to the eyes and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

The vapor is discomforting to the eyes.

The material may produce moderate eye irritation leading to inflammation.

Repeated or prolonged exposure to irritants may produce conjunctivitis.

**Skin:** The liquid is discomforting to the skin and may cause drying of the skin, which may lead to dermatitis.

Toxic effects may result from skin absorption.

Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.

The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic).

This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis.

Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Repeated exposures may produce severe ulceration.

Localized application may produce pustular eruptions, pruritus and erythema. A permeability coefficient of  $1.6 \times 10^{-2}$  cm/hr has been calculated by the US EPA. Percutaneous absorption is unlikely to contribute significantly to total body burdens unless dermatitis is present.

**Ingestion:** The liquid is highly discomforting and toxic if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Considered an unlikely route of entry in commercial/industrial environments.

**Carcinogenicity:** NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A5, Not suspected as a human carcinogen; EPA - Not listed; MAK - Class B, Justifiably suspected of having carcinogenic potential.

**Chronic Effects:** Sensitive humans may experience anesthetic effects from short exposures.

Chronic effects of exposure include fatigue, headache, irritability, vomiting, skin flush and intolerance to alcohol.

Liver, kidney, heart and neurological damage may also result from chronic overexposure.

Alcohol intake may increase the toxic effects of the material.

A variety of disturbances have been seen among workers exposed at concentrations ranging from 1 to 335 ppm. These disturbances increased with the length of exposure (to 5 years or more) and were more prominent when exposures exceeded 40 ppm. Increased complaints of alcohol intolerance, tremors, giddiness and anxiety were amongst symptoms recorded. Variation in effects in different occupational settings may be due to different physical workloads.

There appeared to be no increase in the expected rates of congenital defects in children born to women exposed to TCE over a 13 year period.  
Epidemiological studies consistently fail to show a link between cancers and TCE exposure. This is significant because of the tens of thousands of exposed workers monitored.

### Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

**Ingestion:** Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

Avoid giving milk or oils.

Avoid giving alcohol.

*After first aid, get appropriate in-plant, paramedic, or community medical support.*

**Note to Physicians:** Treat symptomatically.

Do not administer sympathomimetic drugs as they may cause ventricular arrhythmias.

Following acute or short-term continued exposures to trichloroethylene:

1. Trichloroethylene concentration in expired air correlates with exposure. 8 hours exposure to 100 ppm produces levels of 25 ppm immediately and 1 ppm 16 hours after exposures.

2. Most mild exposure respond to removal from the source and supportive care.

Serious toxicity most often results from hypoxemia or cardiac dysrhythmias so that oxygen, intubation, intravenous lines and cardiac monitoring should be started initially as the clinical situation dictates.

3. Ipecac syrup should be give to alert patients who ingest more than a minor amount and present within 2 hours.

4. The efficacy of activated charcoal and cathartics is unclear.

5. The metabolites, trichloroacetic acid, trichloroethanol and to a lesser degree, chloral hydrate, may be detected in the urine up to 16 days postexposure.

#### BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Trichloroacetic acid in urine	10 mg/gm creatinine	End of work-week	NS
Trichloroacetic acid AND Trichloroethanol in urine	300 mg/mg creatinine	End of shift at end of work-week	NS
Free Trichloroethanol in blood	4 mg/L	End of shift at end of work-week	NS
Trichloroethylene in end-exhaled air			SQ
Trichloroethylene in blood			SQ

NS: Non-specific determinant; also seen after exposure to other materials

SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

## Section 5 - Fire-Fighting Measures

**Flash Point:** 32.222 °C Closed Cup

**Autoignition Temperature:** 420 °C

**LEL:** 8% v/v

**UEL:** 10.5% v/v

**Extinguishing Media:** Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).

Carbon dioxide.

**General Fire Hazards/Hazardous Combustion Products:** Vapor will burn when in contact with high temperature flame.

May form a flammable/explosive mixture in an oxygen enriched atmosphere. Heating may cause expansion/vaporization with violent rupture of containers. Decomposes on heating and produces corrosive fumes of hydrochloric acid, carbon monoxide and small amounts of toxic phosgene.

**Fire Incompatibility:** Avoid reaction with strong oxidizing agents (particularly oxygen in gas or liquid form and nitrogen dioxide), strong bases, sodium and sodium-potassium alloys. Powdered metals; magnesium, zinc and aluminum.

Contact with water may result in the slow formation of hydrochloric acid.

Attacks natural rubber.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

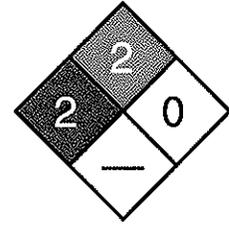
Use water delivered as a fine spray to control fire and cool adjacent area.

Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.



Fire Diamond

## Section 6 - Accidental Release Measures

**Small Spills:** Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Wipe up. Place in a suitable labeled container for waste disposal.

**Large Spills:** Clear area of personnel and move upwind.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Increase ventilation.

No smoking or bare lights within area.

Stop leak if safe to do so.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Collect and seal in labeled drums for disposal.

If contamination of drains or waterways occurs, advise emergency services.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid all personal contact, including inhalation.

Wear protective clothing when risk of overexposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

DO NOT allow material to contact humans, exposed food or food utensils.

Avoid smoking, bare lights or ignition sources. When handling, DO NOT eat, drink or smoke. Avoid contact with incompatible materials.

Keep containers securely sealed when not in used. Avoid physical damage to containers. Always wash hands with soap and water after handling. Working clothes should be laundered separately.

Launder contaminated clothing before reuse.

Observe manufacturer's storing/handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

**Recommended Storage Methods:** Inhibited grades may be stored in metal drums.

DO NOT use aluminum or galvanized containers. Check that containers are clearly labeled and free from leaks.

Packaging as recommended by manufacturer.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** Local exhaust ventilation usually required.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.

Provide adequate ventilation in warehouse or closed storage area.

**Personal Protective Clothing/Equipment:**

**Eyes:** Safety glasses with side shields; chemical goggles. Full face shield.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** PVA gloves. Polyethylene gloves.

Viton gloves.

PVC boots.

**Respiratory Protection:**

Exposure Range >100 to <1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Note: odor threshold unknown

**Other:** Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

**Glove Selection Index:**

PE/EVAL/PE ..... Best selection

PVA ..... Best selection

TEFLON ..... Best selection

VITON ..... Satisfactory; may degrade after 4 hours continuous immersion

VITON/NEOPRENE ..... Poor to dangerous choice for other than short-term immersion

VITON/NITRILE..... Poor to dangerous choice for other than short-term immersion

HYPALON ..... Poor to dangerous choice for other than short-term immersion

NEOPRENE..... Poor to dangerous choice for other than short-term immersion

PVC..... Poor to dangerous choice for other than short-term immersion

NITRILE ..... Poor to dangerous choice for other than short-term immersion

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Colorless liquid with a sweetish, chloroform-like odor, miscible with most organic solvents.

**Physical State:** Liquid

**Vapor Pressure (kPa):** 7.87 at 20 °C

**Vapor Density (Air=1):** 4.54

**Formula Weight:** 131.38

**Specific Gravity (H<sub>2</sub>O=1, at 4 °C):** 1.47 at 15 °C

**pH:** Not applicable

**pH (1 % Solution):** Not applicable.

**Boiling Point:** 87 °C (189 °F)

**Freezing/Melting Point:** -73 °C (-99.4 °F)

**Volatile Component (% Vol):** 100

**Water Solubility:** < 1 mg/mL at 21 °C

## Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Decomposes in the presence of moisture to produce corrosive acid.

Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

**Storage Incompatibilities:** Avoid storage with strong oxidizers (particularly oxygen in gas or liquid form and nitrogen dioxide), strong bases, acetone, sodium/sodium-potassium alloys, magnesium, zinc and aluminum.

Avoid contact with water as the slow formation of hydrochloric acid results.

Attacks natural rubber.

Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidizable and polymerizable.

## Section 11 - Toxicological Information

### Toxicity

Oral (human) LD<sub>50</sub>: 7000 mg/kg  
 Oral (man) TD<sub>10</sub>: 2143 mg/kg  
 Oral (rat) LD<sub>50</sub>: 5650 mg/kg  
 Inhalation (man) LC<sub>10</sub>: 2900 ppm  
 Inhalation (human) TD<sub>10</sub>: 812 mg/kg  
 Inhalation (human) TC<sub>10</sub>: 6900 mg/m<sup>3</sup>/10 m  
 Inhalation (man) TC<sub>10</sub>: 2900 ppm  
 Inhalation (man) TC<sub>10</sub>: 110 ppm/8h  
 Inhalation (man) TC<sub>10</sub>: 160 ppm/83 m

### Irritation

Skin (rabbit): 500 mg/24h - SEVERE  
 Eye (rabbit): 20 mg/24h - SEVERE

See NIOSH, RTECS KX 4550000, for additional data.

## Section 12 - Ecological Information

**Environmental Fate:** No data found.

**Ecotoxicity:** LC<sub>50</sub> Sheepshead minnow 20 mg/l/96 hr. /Conditions of bioassay not specified; LC<sub>50</sub> Mexican axolotl (3-4 wk after hatching) 48 mg/l/48 hr /Conditions of bioassay not specified; LC<sub>50</sub> Clawed toad (3-4 wk after hatching) 45 mg/l/48 hr /Conditions of bioassay not specified; LC<sub>50</sub> Pimephales promelas (fathead minnow) 40.7 mg/l/96 hr (95% confidence limits 31.4-71.8 mg/l) /Flow-through test; EC<sub>10</sub> Pimephales promelas (fathead minnow) 15.2 mg/l/24 hr; 16.9 mg/l/48 hr; 15.5 mg/l/72 hr; 13.7 mg/l/96 hr; Toxic effect for all concentrations specified: loss of equilibrium. /Flow-through bioassay; Toxicity Threshold (Cell Multiplication Inhibition Test) Scenedesmus quadricauda (green algae) >1000 mg/l /Time not specified, conditions of bioassay not specified; Toxicity Threshold (Cell Multiplication Inhibition Test) Pseudomonas putida (bacteria) 65 mg/l ; LC<sub>50</sub> Grass shrimp 2 mg/l/96 hr. /Conditions of bioassay not specified

**Henry's Law Constant:**  $1 \times 10^{-2}$

**BCF:** bluegill 17 to 39

**Biochemical Oxygen Demand (BOD):** 0%, 20 days

**Octanol/Water Partition Coefficient:**  $\log K_{ow} = 2.29$

**Soil Sorption Partition Coefficient:**  $K_{oc} = 2.0$

## Section 13 - Disposal Considerations

**Disposal:** Recycle wherever possible. Consult manufacturer for recycling options.  
 Follow applicable federal, state, and local regulations.  
 Reclaim solvent at an approved site.  
 Evaporate or incinerate residue at an approved site.  
 Recycle containers if possible, or dispose of in an authorized landfill.

## Section 14 - Transport Information

### DOT Transportation Data (49 CFR 172.101):

**Shipping Name:** TRICHLOROETHYLENE

**Hazard Class:** 6.1(b)

**ID No.:** 1710

**Packing Group:** III

**Label:** Harmful[6]

## Section 15 - Regulatory Information

### **EPA Regulations:**

**RCRA 40 CFR:** Listed U228 Toxic Waste

**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

**SARA 40 CFR 372.65:** Listed

**SARA EHS 40 CFR 355:** Not listed

**TSCA:** Listed

**Section 16 - Other Information**

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.



Section 1 - Chemical Product and Company Identification

54/58

Material Name: Perchloroethylene

CAS Number: 127-18-4

Chemical Formula: C2Cl4

Structural Chemical Formula: Cl2C=CCl2

EINECS Number: 204-825-9

ACX Number: X1000034-7

Synonyms: ANKILOSTIN; ANTISAL 1; ANTISOL 1; CARBON BICHLORIDE; CARBON DICHLORIDE; CZTEROCHLOROETYLEN; DIDAKENE; DILATIN PT; DOW-PER; ENT 1,860; EPA PESTICIDE CHEMICAL CODE 078501; ETHENE, TETRACHLORO-; ETHYLENE TETRACHLORIDE; ETHYLENE, TETRACHLORO-; FEDAL-UN; NEMA; PCE; PER; PERAWIN; PERC; PERCHLOORETHYLEEN, PER; PERCHLOR; PERCHLORAETHYLEN, PER; PERCHLORETHYLENE; PERCHLORETHYLENE, PER; PERCHLOROETHYLENE; PERCLENE; PERCLENE D; PERCHLOROETILENE; PERCOSOLV; PERCOSOLVE; PERK; PERKLONE; PERSEC; TETLEN; TETRACAP; TETRACHLOORETHEEN; TETRACHLORAETHEN; TETRACHLORETHYLENE; TETRACHLOROETHENE; 1,1,2,2-TETRACHLOROETHYLENE; TETRACHLOROETHYLENE; TETRACLOROETENE; TETRAGUER; TETRALENO; TETRALEX; TETRAVEC; TETROGUER; TETROPIL

General Use: Used as a drycleaning solvent, a vapor-degreasing solvent; a drying agent for metals and certain other solids. Used also as a heat transfer medium and in the manufacture of fluorocarbons.

Section 2 - Composition / Information on Ingredients

Table with 3 columns: Name, CAS, %

OSHA PEL

TWA: 100 ppm; Ceiling 200 ppm; 300 ppm, 5-minute maximum peak in any 3 hours.

NIOSH REL

Minimize workplace exposure concentrations.

DFG (Germany) MAK

Skin.

OSHA PEL Vacated 1989 Limits

TWA: 25 ppm; 170 mg/m³.

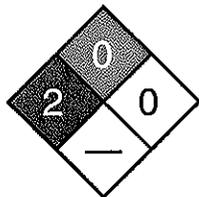
IDLH Level

150 ppm.

ACGIH TLV

TWA: 25 ppm; STEL: 100 ppm.

Section 3 - Hazards Identification



Fire Diamond

ChemWatch Hazard Ratings table with rows for Flammability, Toxicity, Body Contact, Reactivity, Chronic and columns for hazard levels 0-4.

HMIS hazard rating table with rows for Health, Flammability, Reactivity and columns for hazard levels 0-2.

ANSI Signal Word

Caution

Emergency Overview

Colorless liquid; ether-like odor. Irritating to eyes/skin/respiratory tract. Also causes: headache, dizziness, CNS depression, incoordination, slurred speech. Chronic: liver/kidney damage; possible cancer hazard based on animal studies.

Potential Health Effects

Target Organs: liver, kidneys, eyes, upper respiratory system, skin, central nervous system (CNS)

Primary Entry Routes: inhalation, skin contact, eye contact

**Acute Effects**

**Inhalation:** Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident. A single organ alone is (almost) never involved.

The vapor is highly discomforting to the upper respiratory tract and lungs.

Inhalation hazard is increased at higher temperatures.

Anesthetic and narcotic effects (with dulling of senses and odor fatigue) are a consequence of exposure to chlorinated solvents.

Individual response varies widely; odor may not be considered objectionable at levels which quickly induce central nervous system effects.

High vapor concentrations may give a feeling of euphoria. This may result in reduced responses, followed by rapid onset of unconsciousness, possible respiratory arrest and death.

Accidental high level exposure has produced lightheadedness, unconsciousness and liver and kidney damage in workers. In at least two cases such exposures were fatal. Subjects exposed to 106 ppm in laboratory studies experienced slight eye irritation; dizziness and sleepiness were reported at 216 ppm; at exposures of 280 ppm or 600 ppm for 10 minutes there was a loss of motor coordination. In another study subjects exposed for 7 hours at 101 ppm complained of eye irritation and subjective symptoms such headache, drowsiness and sleepiness.

**Eye:** The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. Eye contact may cause lachrymation (tears) and burning sensation.

The vapor is highly discomforting to the eyes.

The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

**Skin:** The liquid is highly discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.

Toxic effects may result from skin absorption.

Absorption by skin may readily exceed vapor inhalation exposure.

Symptoms for skin absorption are the same as for inhalation.

Bare unprotected skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic).

This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis.

Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

Industrial experience shows localized skin irritation. Prolonged dermal contact can cause chemical burns and blistering.

**Ingestion:** Considered an unlikely route of entry in commercial/industrial environments.

The liquid is highly discomforting and toxic if swallowed and may be fatal if swallowed in large quantity.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

When used in the treatment of hookworm (4.5 to 6.5 gm orally) the only adverse effect is inebriation. Transient hepatotoxicity in patients given single oral doses of up to 5 mL have been recorded.

**Carcinogenicity:** NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Not listed; MAK - Class B, Justifiably suspected of having carcinogenic potential.

**Chronic Effects:** Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Workers inhaling 232 to 385 ppm for 8 hours/day, 5 days/week for 2 to 6 years have shown abnormal hepatic function, including cirrhosis, with lightheadedness, headache, malaise and dizziness.

## Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

**Ingestion:** Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

Avoid giving milk or oils.

Avoid giving alcohol.

**After first aid, get appropriate in-plant, paramedic, or community medical support.**

**Note to Physicians:** Treat symptomatically.

Do not administer sympathomimetic drugs as they may cause ventricular arrhythmias.

For acute or short-term repeated exposures to perchloroethylene:

Tetrachloroethylene/perchloroethylene is well absorbed through the lungs with peak levels more important than duration in determining blood concentration.

Lungs excrete most of the absorbed tetrachloroethylene in an unchanged state; about 3% is converted by the liver to form trichloroacetic acid and subsequently excreted by the kidney. Exhaled material has a biological half-life of 65 hours.

**INHALATION:**

The treatment of acute inhalation exposures is supportive with initial attention directed to evaluation/support of ventilation and circulation.

As with all hydrocarbons care must be taken to reduce the risk of aspiration by proper positioning and medical observation.

**INGESTION:**

1. The ingestion level at which emesis should be induced is difficult to predict in the absence of extensive human studies.

2. The role of charcoal and cathartics remains uncertain.

**BIOLOGICAL EXPOSURE INDEX - BEI**

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Perchloroethylene in end-exhaled air	10 ppm	Prior to last shift of work-week	
Perchloroethylene in Blood	1 mg/L	Prior to last shift of work-week	
Trichloroacetic acid in urine	7 mg/L	End of work-week	NS,SQ

NS: Non-specific determinant; also seen after exposure to other materials

SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

## Section 5 - Fire-Fighting Measures

**Flash Point:** Nonflammable

**Autoignition Temperature:** 490 °C

**LEL:** 1.8% v/v

**UEL:** 11.5% v/v at 740 mm Hg 160 °C

**Extinguishing Media:** Use extinguishing media suitable for surrounding area.

**General Fire Hazards/Hazardous Combustion Products:** Nonflammable liquid. However vapor will burn when in contact with high temperature flame. Ignition ceases on removal of flame.

May form a flammable/explosive mixture in an oxygen enriched atmosphere. Heating may cause expansion/vaporization with violent rupture of containers. Decomposes on heating and produces corrosive fumes of hydrochloric acid, carbon monoxide and small amounts of toxic phosgene.

**Fire Incompatibility:** Avoid mixing with strong alkalis or powdered metals, particularly zinc as ignition may result.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.

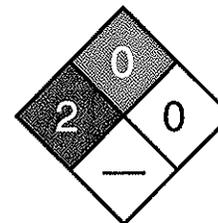
Wear breathing apparatus plus protective gloves for fire only. Prevent, by any means available, spillage from entering drains or waterways.

Use fire fighting procedures suitable for surrounding area.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.



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Equipment should be thoroughly decontaminated after use.

## Section 6 - Accidental Release Measures

**Small Spills:** Clean up all spills immediately.

Wear protective neoprene gloves and chemical goggles.

If risk of overexposure exists, wear NIOSH-approved respirator.

Wipe up and absorb small quantities with vermiculite or other absorbent material.

DO NOT discharge into sewer or waterways.

Place spilled material in clean, dry, sealable, labeled container.

**Large Spills:** Minor hazard. Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so. Contain spill with sand, earth or vermiculite.

Collect recoverable product into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing mist. Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

DO NOT allow material to contact humans, exposed food or food utensils.

Avoid contact with incompatible materials.

When handling, DO NOT eat, drink or smoke.

Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.

Launder contaminated clothing before reuse.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

**Recommended Storage Methods:** Check that containers are clearly labeled. Glass container.

Heavy gauge metal packages/heavy gauge metal drums.

Avoid storage with zinc, galvanized or diecast metal (including bungs).

DO NOT use aluminum or galvanized containers.

Packaging as recommended by manufacturer.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area.

Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

If inhalation risk exists, wear NIOSH-approved organic-vapor respirator or air supplied breathing apparatus.

**Personal Protective Clothing/Equipment:**

**Eyes:** Chemical goggles. Full face shield.

**Hands/Feet:** Neoprene gloves; Viton gloves.

PVA gloves.

PVC gloves.

Protective footwear.

**Respiratory Protection:**

Exposure Range >100 to <150 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 150 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Note: poor warning properties

**Other:** Overalls. Eyewash unit. Ensure there is ready access to an emergency shower.

**Glove Selection Index:**

PE/EVAL/PE ..... Best selection

VITON/CHLOROBUTYL .....	Best selection
VITON/NITRILE.....	Best selection
VITON .....	Best selection
PVA .....	Best selection
CPE .....	Best selection
NITRILE .....	Satisfactory; may degrade after 4 hours continuous immersion
TEFLON .....	Satisfactory; may degrade after 4 hours continuous immersion
NITRILE+PVC .....	Poor to dangerous choice for other than short-term immersion
SARANEX-23 2-PLY.....	Poor to dangerous choice for other than short-term immersion
SARANEX-23 .....	Poor to dangerous choice for other than short-term immersion
PVC.....	Poor to dangerous choice for other than short-term immersion
BUTYL .....	Poor to dangerous choice for other than short-term immersion
NEOPRENE.....	Poor to dangerous choice for other than short-term immersion

### Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Colorless liquid, with a chloroform-like odor. Extremely stable, resists hydrolysis. Miscible with alcohol, ether and oils.

**Physical State:** Liquid

**Vapor Pressure (kPa):** 2.11 at 22 °C

**Vapor Density (Air=1):** 5.83

**Formula Weight:** 165.82

**Specific Gravity (H<sub>2</sub>O=1, at 4 °C):** 1.63 at 15 °C

**Evaporation Rate:** 0.09 Ether=1

**pH:** Not applicable

**pH (1 % Solution):** Not applicable.

**Boiling Point:** 121 °C (250 °F) at 760 mm Hg

**Freezing/Melting Point:** -19 °C (-2.2 °F)

**Volatile Component (% Vol):** 100

**Water Solubility:** 0.02% by weight

### Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Product is considered stable and hazardous polymerization will not occur.

**Storage Incompatibilities:** Avoid reaction with oxidizing agents. Segregate from strong alkalis.

Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidizable and polymerizable.

The presence of 0.5% trichloroethylene as an impurity caused generation of dichloroacetylene during unheated drying over solid sodium hydroxide.

Subsequent fractional distillation produced an explosion.

### Section 11 - Toxicological Information

#### Toxicity

Oral (rat) LD<sub>50</sub>: 2629 mg/kg

Inhalation (man) LD<sub>Lo</sub>: 2857 mg/kg

Inhalation (human) TC<sub>Lo</sub>: 96 ppm/7 hrs

Inhalation (man) TC<sub>Lo</sub>: 280 ppm/2 hrs

Inhalation (man) TC<sub>Lo</sub>: 600 ppm/10 min

Inhalation (rat) LC<sub>Lo</sub>: 34200 mg/m<sup>3</sup>/8 hr

#### Irritation

Skin (rabbit): 810 mg/24h -SEVERE

Eye (rabbit): 162 mg -mild

See NIOSH, RTECS KX 3850000, for additional data.

### Section 12 - Ecological Information

**Environmental Fate:** If it is released to soil, it will be subject to evaporation into the atmosphere and to leaching to the groundwater. Biodegradation may be an important process in anaerobic soils based on laboratory tests with methanogenic columns. Slow biodegradation may occur in groundwater where acclimated populations of microorganisms exist. If released to water, it will be subject to rapid volatilization with estimated half-lives ranging from <1 day to several weeks. It will not be expected to significantly biodegrade, bioconcentrate in aquatic organisms or significantly adsorb to sediment. It will not be expected to significantly hydrolyze in soil or water under normal environmental conditions. If released to the atmosphere, it will exist mainly in the gas-phase and it will be subject to photooxidation with estimates of degradation time scales ranging from an approximate half-life of 2 months to complete degradation in an hour. Some in the atmosphere may be subject to washout in rain based on the solubility in water.

**Ecotoxicity:** LC<sub>50</sub> Tanytarsus dissimilis (midge) 30, 840 ug/l/48 hr, static bioassay; LC<sub>50</sub> Poecilia reticulata (guppy) 18 ppm/7 days /Conditions of bioassay not specified; LC<sub>50</sub> Daphnia magna (water flea) 18 mg/l/48 hr, static bioassay, at 22 °C; LC<sub>50</sub> Salmo gairdneri (rainbow trout) 5 mg/l/96 hr, static bioassay at 12 °C

**Henry's Law Constant:** 2.87 x10<sup>-2</sup>

**BCF:** fathead minnow 38.9

**Biochemical Oxygen Demand (BOD):** none

**Octanol/Water Partition Coefficient:** log K<sub>ow</sub> = 3.40

**Soil Sorption Partition Coefficient:** K<sub>oc</sub> = 209

### Section 13 - Disposal Considerations

**Disposal:** Reclaim solvent at an approved site.  
Allow absorbed spillage to evaporate in an open top container, away from habitation.  
Incinerate residue at an approved site.  
Used containers should be left upside down with bungs out.  
Return containers to drum reconditioner or recycler.

### Section 14 - Transport Information

#### DOT Transportation Data (49 CFR 172.101):

**Shipping Name:** TETRACHLOROETHYLENE  
**Additional Shipping Information:** PERCHLOROETHYLENE  
**Hazard Class:** 6.1(b)  
**ID No.:** 1897  
**Packing Group:** III  
**Label:** Harmful[6]

### Section 15 - Regulatory Information

#### EPA Regulations:

**RCRA 40 CFR:** Listed U210 Toxic Waste

**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

**SARA 40 CFR 372.65:** Listed

**SARA EHS 40 CFR 355:** Not listed

**TSCA:** Listed

### Section 16 - Other Information

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

**Section 1 - Chemical Product and Company Identification 55/60**

**Material Name:** cis-Acetylene Dichloride **CAS Number:** 156-59-2  
**Chemical Formula:** C<sub>2</sub>H<sub>2</sub>Cl<sub>2</sub>  
**Structural Chemical Formula:** CHCl=CHCl  
**EINECS Number:** 205-859-7  
**ACX Number:** X1007815-0  
**Synonyms:** ACETALYNE DICHLORIDE; CIS-ACETYLENE DICHLORIDE; CIS-1,2-DICHLOROETHYLENE; CIS-1,2-DICHLOROETHENE; (Z)-1,2-DICHLOROETHYLENE; 1,2-CIS-DICHLOROETHYLENE; CIS-1,2-DICHLOROETHYLENE; CIS-DICHLOROETHYLENE; ETHENE,1,2-DICHLORO-,(Z)-; ETHYLENE,1,2-DICHLORO-,(Z)-  
**General Use:** solvent for waxes, resins, fats, phenol, camphor, acetyl cellulose, organic materials and heat-sensitive substances such as caffeine; in rubber manufacture, as a refrigerant, as an additive to dye and lacquer solutions, in retarding fermentation, in organic synthesis, in medicines, in dye extraction, in chlorination reactions and in the manufacture of artificial pearls; a constituent of perfumes and thermoplastics

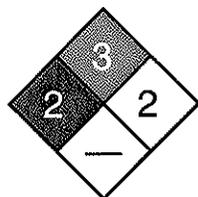
**Section 2 - Composition / Information on Ingredients**

Name	CAS	%
cis-acetylene dichloride	156-59-2	>98

<b>OSHA PEL</b> TWA: 200 ppm; 790 mg/m <sup>3</sup> .	<b>NIOSH REL</b>	<b>DFG (Germany) MAK</b> TWA: 200 ppm; PEAK: 400 ppm.
<b>ACGIH TLV</b> TWA: 200 ppm.		

**Section 3 - Hazards Identification**



Fire Diamond

	ChemWatch Hazard Ratings				
	0	1	2	3	4
Flammability					
Toxicity					
Body Contact					
Reactivity					
Chronic					
	Min	Low	Moderate	High	Extreme

HMIS	
2	Health
3	Flammability
2	Reactivity

**ANSI Signal Word**  
**Warning!**



☆☆☆☆☆ **Emergency Overview** ☆☆☆☆☆

Colorless liquid; sweetish odor. Irritating to eyes/skin/respiratory tract. Harmful. Other Acute Effects: narcotic effect. Flammable.

**Potential Health Effects**

**Target Organs:** eyes, skin, respiratory system, nervous system, liver, kidneys

**Primary Entry Routes:** inhalation of vapor, skin/eye contact

**Acute Effects**

**Inhalation:** There is a single report of an industrial poisoning, a fatality caused by the inhalation of a vapor in a small enclosure. Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident, a single organ alone is (almost) never involved. Depression of the central nervous system is the most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin). The most important effects of exposure are narcosis and irritation of the central nervous system. Liver responses may occur after repeated narcotic doses and involves fatty liver degeneration. Vapor exposure may produce central nervous system depression or in milder exposures, nausea, vomiting, weakness, tremor and epigastric cramps. Recovery is usually rapid.

**Eye:** The vapor when concentrated has pronounced eye irritation effect; this gives some warning of high vapor concentrations. If eye irritation occurs seek to reduce exposure with available control measures, or evacuate area. Exposure to the trans isomer at 2200 ppm caused burning of the eyes, vertigo, nausea. Reversible corneal clouding has been described in exposures to acetylene dichloride.

**Skin:** The liquid may produce skin discomfort following prolonged contact. Defatting and/ or drying of the skin may lead to dermatitis.

**Ingestion:** The liquid is discomforting to the gastrointestinal tract and toxic if swallowed. Considered an unlikely route of entry in commercial/industrial environments.

**Carcinogenicity:** NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

**Chronic Effects:** The material may accumulate in the human body and progressively cause tissue damage.

### Section 4 - First Aid Measures

**Inhalation:** • If fumes or combustion products are inhaled, remove to fresh air.

- Lay patient down. Keep warm and rested.
- If breathing is shallow or has stopped, ensure clear airway and apply resuscitation, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital or doctor.



**Eye Contact:** • Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** • Immediately remove all contaminated clothing, including footwear (after rinsing with water).

- Wash affected areas thoroughly with water (and soap if available).
- Seek medical attention in event of irritation.

**Ingestion:** Contact a Poison Control Center. Do NOT induce vomiting. Give a glass of water.

*After first aid, get appropriate in-plant, paramedic, or community medical support.*

**Note to Physicians:** Treatment should follow that practiced in carbon tetrachloride exposures:

- Acute exposures to carbon tetrachloride present, initially, with CNS depression followed by hepatic and renal dysfunction.
- Respiratory depression and cardiac dysrhythmias are an immediate threat to life.
- Since a major fraction of absorbed carbon tetrachloride is exhaled in first hour, good tidal volumes should be maintained in severely poisoned patients; hyperventilation may be an additional therapeutic modality.
- Ipecac syrup, lavage, activated charcoal or catharsis may all be used in the first 4 hours.
- Since reactive metabolites may cause hepatorenal toxicity, administration of N-acetyl-L-cysteine may reduce complications. Experience with this therapy is limited.

## Section 5 - Fire-Fighting Measures

**Flash Point:** 2.2 to 3.9 °C Closed Cup

**Autoignition Temperature:** 460 °C

**LEL:** 9.7% v/v

**UEL:** 12.8% v/v

**Extinguishing Media:** Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide. Water spray or fog - Large fires only.

**General Fire Hazards/Hazardous Combustion Products:** • Liquid and vapor are highly flammable.

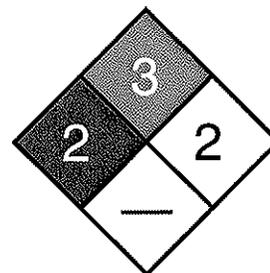
- Severe fire hazard when exposed to heat, flame and/or oxidizers.
- Vapor forms an explosive mixture with air.
- Severe explosion hazard, in the form of vapor, when exposed to flame or spark.
- Vapor may travel a considerable distance to source of ignition.
- Heating may cause expansion/decomposition with violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include hydrogen chloride and phosgene.

**Fire Incompatibility:** Avoid contamination with oxidizing agents i.e., nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

**Fire-Fighting Instructions:** • Contact fire department and tell them location and nature of hazard.

- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- Consider evacuation (or protect in place).
- Fight fire from a safe distance, with adequate cover.
- If safe, switch off electrical equipment until vapor fire hazard removed.
- Use water delivered as a fine spray to control the fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- Do not approach containers suspected to be hot.
- Cool fire-exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.

See  
DOT  
ERG



Fire Diamond

## Section 6 - Accidental Release Measures

**Small Spills:** • Remove all ignition sources.

- Clean up all spills immediately.
- Avoid breathing vapors and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb small quantities with vermiculite or other absorbent material.
- Wipe up.
- Collect residues in a flammable waste container.

**Large Spills:** • Clear area of personnel and move upwind.

- Contact fire department and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- No smoking, bare lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse/absorb vapor.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labeled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

See  
DOT  
ERG

## Section 7 - Handling and Storage

**Handling Precautions:** • Avoid all personal contact, including inhalation.

- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.

- DO NOT enter confined spaces until atmosphere has been checked.
- Avoid smoking, bare lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Follow good occupational work practices.
- Observe manufacturer's storage and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

**Recommended Storage Methods:** Check that containers are clearly labeled. Packaging as recommended by manufacturer. DO NOT use aluminum or galvanized containers.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** Local exhaust ventilation usually required. If risk of overexposure exists, wear NIOSH-approved respirator. Provide adequate ventilation in warehouse or closed storage area.

### Personal Protective Clothing/Equipment:

**Eyes:** Safety glasses with side shields or, as required, chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Butyl rubber gloves. Neoprene gloves.

**Respiratory Protection:** Respirator protection may be required. Consult your supervisor.

**Other:** • Overalls.

• Barrier cream.

• Eyewash unit.

### Glove Selection Index:

VITON ..... Poor to dangerous choice for other than short-term immersion

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Colorless liquid with pleasant chloroform-like odor.

**Physical State:** colorless liquid

**Specific Gravity (H<sub>2</sub>O=1, at 4 °C):** 1.2837 at 20 °C/4 °C

**Vapor Pressure (kPa):** 200 mm Hg at 25 °C

**Vapor Density (Air=1):** 3.34

**Boiling Point:** 60.3 °C (141 °F) at 760 mm Hg

**Formula Weight:** 96.94

**Freezing/Melting Point:** -80.5 °C (-112.9 °F)

**Water Solubility:** 1 to 5 mg/mL at 16 °C

## Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Product is considered stable. Hazardous polymerization will not occur.

**Storage Incompatibilities:** Avoid reaction with oxidizing agents. Acetylene dichloride in contact with solid caustic alkalies or their concentrated solutions will form chloroacetylene which ignites in air. Haloalkenes are highly reactive.

## Section 11 - Toxicological Information

### Toxicity

Inhalation (mouse) LC<sub>50</sub>: 65000 mg/m<sup>3</sup>/2 hr

Rat liver cell mutagen in vitro

### Irritation

Nil reported

See RTECS KV9420000, for additional data.

## Section 12 - Ecological Information

**Environmental Fate:** If released on soil, it should evaporate and/or leach into the groundwater where very slow biodegradation should occur. If released into water, it will be lost mainly through volatilization (half life 3 hr in a model river). Biodegradation, adsorption to sediment, and bioconcentration in aquatic organisms should not be significant. In the atmosphere it will be lost by reaction with photochemically produced hydroxyl radicals (half life 8 days) and scavenged by rain. Because it is relatively long lived in the atmosphere, considerable dispersal from source areas should occur.

**Ecotoxicity:** LC<sub>50</sub> Lepomis macrochirus (bluegill) 135,000 ug/l/96 hr in a static unmeasured bioassay

**Henry's Law Constant:** estimated at 0.00337

BCF: calculated at 15  
 Octanol/Water Partition Coefficient:  $\log K_{ow} = 1.86$   
 Soil Sorption Partition Coefficient:  $K_{oc} = 49$

### Section 13 - Disposal Considerations

- Disposal:**
- Consult manufacturer for recycling options and recycle where possible.
  - Follow applicable local, state, and federal regulations.
  - Incinerate residue at an approved site.
  - Recycle containers if possible, or dispose of in an authorized landfill.

### Section 14 - Transport Information

#### DOT Hazardous Materials Table Data (49 CFR 172.101):

**Shipping Name and Description:** 1,2-Dichloroethylene

**ID:** UN1150

**Hazard Class:** 3 - Flammable and combustible liquid

**Packing Group:** II - Medium Danger

**Symbols:**

**Label Codes:** 3 - Flammable Liquid

**Special Provisions:** IB2, T7, TP2

**Packaging:** Exceptions: 150 Non-bulk: 202 Bulk: 242

**Quantity Limitations:** Passenger aircraft/rail: 5 L Cargo aircraft only: 60 L

**Vessel Stowage:** Location: B Other:



### Section 15 - Regulatory Information

**EPA Regulations:**

**RCRA 40 CFR:** Not listed

**CERCLA 40 CFR 302.4:** Not listed

**SARA 40 CFR 372.65:** Not listed

**SARA EHS 40 CFR 355:** Not listed

**TSCA:** Listed

### Section 16 - Other Information

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

**Section 1 - Chemical Product and Company Identification****54/60****Material Name:** Vinyl Chloride**CAS Number:** 75-01-4**Chemical Formula:** C<sub>2</sub>H<sub>3</sub>Cl**Structural Chemical Formula:** CH<sub>2</sub>=CHCl**EINECS Number:** 200-831-0**ACX Number:** X1003494-5

**Synonyms:** CHLORETHENE; CHLORETHYLENE; CHLOROETHENE; CHLOROETHYLENE; CHLORURE DE VINYLE; CLORURO DI VINILE; ETHENE,CHLORO-; ETHYLENE MONOCHLORIDE; ETHYLENE,CHLORO-; MONOCHLOROETHENE; MONOCHLOROETHYLENE; MONOCHOROETHENE; MONOVINYL CHLORIDE (MVC); TROVIDUR; VC; VCM; VINILE (CLORURO DI); VINYL C MONOMER; VINYL CHLORIDE; VINYL CHLORIDE MONOMER; VINYL CHLORIDE MONOMER (VCM); VINYL CHLORIDE,INHIBITED; VINYLCHLORID; VINYLE(CHLORURE DE); WINYLU CHLOREK

**General Use:** Used in the plastics industry; as a refrigerant; in organic syntheses**Section 2 - Composition / Information on Ingredients**

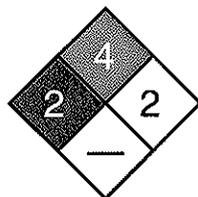
Name	CAS	%
vinyl chloride	75-01-4	>98

**OSHA PEL****NIOSH REL**

TWA: 1 ppm; Ceiling: 5 ppm, 15-minute; 1910.1017.

**ACGIH TLV**

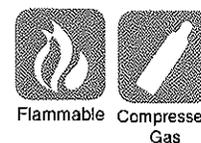
TWA: 1 ppm.

**Section 3 - Hazards Identification**

Fire Diamond

	ChemWatch Hazard Ratings			
Flammability	2	2	2	2
Toxicity	4	4	4	4
Body Contact	2	2	2	2
Reactivity	2	2	2	2
Chronic	1	1	1	1
	0 Min	1 Low	2 Moderate	3 High
				4 Extreme

HMIS	
3	Health
4	Flammability
2	Reactivity

**ANSI Signal Word****Danger!**

Flammable Compressed Gas

**☆☆☆☆☆ Emergency Overview ☆☆☆☆☆**

Colorless gas; pleasant ethereal odor. Compressed gas can cause frostbite. Toxic. Other Acute Effects: CNS depression. Chronic Effects: reproductive effects, skin/blood changes, arthralgias, bone effects (hand), vascular disorder (fingers/toes). Cancer hazard. Flammable

**Potential Health Effects****Target Organs:** liver, central nervous system (CNS), respiratory system, lymphatic system, bone, connective tissue of the skin**Primary Entry Routes:** inhalation, skin contact, eye contact**Acute Effects****Inhalation:** The gas is highly discomforting and may be fatal if inhaled.

Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident. A single organ alone is (almost) never involved.

Depression of the central nervous system is the most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin).

A single 5 minute inhalation exposure of 8000-25000 ppm caused nausea, headache and dizziness among volunteers. After cessation of exposure only 3-5% of the parent compound was exhaled unchanged. Metabolism by microsomal cytochrome P-450 results in the production of chloroethylene oxide and 2-chloroacetaldehyde and subsequent urinary elimination as thiodiglycolic acid. Half-life is 4-5 hours.

Vinyl chloride and related vinyl monomers possess narcotic action and produce depending upon concentration, characteristic neurological effects, a state of euphoria, followed by a state of inebriation, similar to ethanol intoxication.

Exposure of mice, rats and guinea pigs at 100,000-300,000 ppm caused concentration-dependent mortality. Pulmonary edema, inflammation, hyperemia, congestion and engorgement were recorded - liver and kidney involvement was surprisingly low. Deaths were due to central arrest in narcosis.

**Eye:** The vapor is discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

**Skin:** The vapor is mildly discomforting to the skin.

Toxic effects may result from skin absorption.

Vinyl chloride acts upon the skin and produces a sensation of heat.

Vaporizing liquid causes rapid cooling and contact may cause cold burns, frostbite.

**Ingestion:** Not normally a hazard due to physical form of product.

**Carcinogenicity:** NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Listed; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

**Chronic Effects:** Repeated exposure of laboratory animals to vinyl chloride produced little liver or kidney damage. Repeated exposures produce neurological effects in man with somnolence prominent. Dyspeptic disturbances include epigastric pain, swelling, discomfort, heaviness in the right hypochondrium and anorexia. Congestive hepatomegaly may mimic toxic hepatitis without jaundice. Some cases become chronic. Allergic dermatitis and scleroderma and Raynaud's syndrome have been observed. Repeated exposure of workers has caused increased liver enzyme concentrations, restricted blood flow, bone degeneration in the fingers, liver and spleen enlargement, nervous system disturbance, CNS depression, decreased respiratory function and emphysema.

A dose-dependent relationship between exposure and the incidence of several tumor types has been established.

Exposures to high concentrations have little additional effect because the action of metabolites is responsible for the carcinogenicity rather than the action of the parent molecule. Formation rates of the metabolites are limited and dose-dependent and once the enzyme systems responsible for vinyl chloride activation are saturated, greater doses do not produce a corresponding increase in tumor incidence. Reports of hepatic angiosarcoma and respiratory cancers in vinyl chloride workers have appeared over many years. Cancers of the respiratory system (primarily angiosarcoma), brain as well as lymphomas occur more often than might be expected among men occupationally exposed to vinyl chloride for at least one year.

## Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately flush body and clothes with large amounts of water, using safety shower if available. Quickly remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

In case of cold burns (frostbite): Bathe the affected area immediately in cold water for 10 to 15 minutes, immersing if possible and without rubbing.

Do not apply hot water or radiant heat. Apply a clean, dry dressing.

Transport to hospital or doctor.

**Ingestion:** Not normally a hazard due to physical form of product. DO NOT delay. Immediately transport to hospital or doctor.

*After first aid, get appropriate in-plant, paramedic, or community medical support.*

**Note to Physicians:** Treat symptomatically. Do not give adrenalin (epinephrine) or related drugs.

See  
DOT  
ERG

## Section 5 - Fire-Fighting Measures

**Flash Point:** -78 °C Open Cup

**Autoignition Temperature:** 472 °C

**LEL:** 3.6% v/v

**UEL:** 33% v/v

**Extinguishing Media:** Dry chemical powder. DANGER: Deliver media remotely.

For minor fires: Flooding quantities only.

For large fires: Do not attempt to extinguish.

**General Fire Hazards/Hazardous Combustion Products:** WARNING: Long standing in contact with air and light may result in the formation of potentially explosive peroxides.

Liquid and vapor are highly flammable.

Dangerous hazard when exposed to heat or flame.

Severe vapor explosion hazard, when exposed to flame or spark.

Heating may cause expansion or decomposition leading to violent rupture of containers.

Decomposition may produce toxic fumes of hydrogen chloride.

**Fire Incompatibility:** Avoid reaction with copper, aluminum, oxidizing agents and certain catalytic impurities.

Explosion hazard may follow contact with incompatible materials. Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.

Fight fire from a safe distance, with adequate cover.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Consider evacuation.

If safe to do so, switch off electrical equipment until vapor fire hazard is removed.

If safe to do so, stop flow of gas.

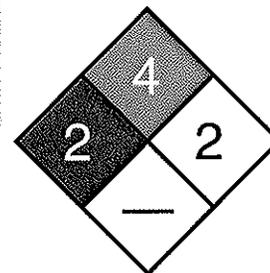
Do not approach cylinders suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

Use water delivered as a fine spray to control the fire and cool adjacent area.

Given its high vapor density spilled vinyl chloride is slow to disperse and will collect in low lying areas.

See  
DOT  
ERG



Fire Diamond

## Section 6 - Accidental Release Measures

**Small Spills:** Erect warning notices and seal off area.

1. Avoid breathing vapor and any contact with liquid or gas. Protective equipment including respirator should be used.

2. Do NOT enter confined spaces where gas may have accumulated.

3. Shut off all sources of possible ignition and increase ventilation.

4. Clear area of personnel.

5. Stop leak only if safe to do so.

6. Remove leaking cylinders to safe place. Release pressure under safe controlled conditions by opening valve.

7. Keep area clear of personnel until gas has dispersed.

**Large Spills:** Supply maximum air ventilation (explosion proof equipment) to keep concentration well below lower flammability limit.

1. Clear area of all unprotected personnel and move upwind.

2. Contact fire department and advise them of the location and nature of hazard.

3. May be violently or explosively reactive.

4. Wear full body clothing with breathing apparatus.

5. Consider evacuation.

6. Shut off all possible sources of ignition and increase ventilation.

7. No smoking or bare lights within area.

8. Use extreme caution to prevent violent reaction.

9. Stop leak only if safe to do so.

10. Water spray or fog may be used to disperse vapor.

11. Do NOT enter confined space where gas may have collected.

12. Keep area clear until gas has dispersed.

When leaking containers have been removed or leak has been stopped, hose spill area down with copious quantities of water. Allow any liquid to evaporate prior to wash down.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

See  
DOT  
ERG

## Section 7 - Handling and Storage

**Handling Precautions:** Used in closed pressurized systems, fitted with safety relief valve.

Vented gas is flammable, denser than air and will spread. Vent path must not contain ignition sources, pilot lights, bare flames.

Atmospheres must be tested and O.K. before work resumes after leakage.  
 Obtain a work permit before attempting any repairs.  
 Do not attempt repair work on lines, vessels under pressure.  
 Handle and open container with care.  
 Avoid all personal contact, including inhalation.  
 Wear protective clothing when risk of exposure occurs.  
 Use in a well-ventilated area. Prevent concentration in hollows and sumps.  
 DO NOT enter confined spaces until atmosphere has been checked.  
 Avoid smoking, bare lights, heat or ignition sources.  
 When handling, DO NOT eat, drink or smoke.  
 Vapor may ignite on pumping or pouring due to static electricity.  
 DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.  
 Avoid contact with incompatible materials.  
 Keep containers securely sealed. Avoid physical damage to containers.  
 Always wash hands with soap and water after handling.  
 Work clothes should be laundered separately.  
 Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.  
 DO NOT transfer gas from one cylinder to another.

**Recommended Storage Methods:** Check that containers are clearly labeled.

Cylinder fitted with valve protector cap.  
 Ensure the use of equipment rated for cylinder pressure.  
 Ensure the use of compatible materials of construction.  
 Cylinder valve must be closed when not in use or when empty.  
 Cylinder must be properly secured either in use or in storage.  
 WARNING: Suckback into cylinder may result in rupture.  
 Use back-flow preventive device in piping.  
 Aerosol pack.  
 Vacuum insulated container.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** Fans and electrical equipment must be explosion-proof to meet TLV requirements. Approved respirators must be available for non-routine and emergency situations.  
 Areas where gas cylinders are stored/used require discrete, controlled exhaust ventilation.  
 Local exhaust ventilation usually required.  
 If risk of overexposure exists, wear NIOSH-approved respirator.  
 Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.  
 Provide adequate ventilation in warehouse or closed storage area.

### Personal Protective Clothing/Equipment:

**Eyes:** Close fitting gas tight goggles and DO NOT wear contact lenses.  
 Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Neoprene rubber gloves.

### Respiratory Protection:

Exposure Range >1 to 50 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask  
 Exposure Range >50 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face  
 Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face  
 Note: poor warning properties

**Other:** Protective overalls, closely fitted at neck and wrist. Eye-wash unit.

### IN CONFINED SPACES:

1. Non-sparking protective boots
2. Static-free clothing.

### Glove Selection Index:

VITON ..... Best selection  
 NITRILE ..... Satisfactory; may degrade after 4 hours continuous immersion

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** A colorless poisonous gas at ambient temperature, with a mild sweet odor in high concentrations. It liquefies readily under increased pressure or at reduced temperatures. Soluble in alcohol, ether, carbon tetrachloride and benzene.

**Physical State:** Liquefied gas

**Vapor Pressure (kPa):** 343.5 at 20 °C

<b>Vapor Density (Air=1):</b> 2.2	<b>pH (1% Solution):</b> Not applicable.
<b>Formula Weight:</b> 62.5	<b>Boiling Point:</b> -13.37 °C (8 °F)
<b>Specific Gravity (H<sub>2</sub>O=1, at 4 °C):</b> 0.912 at 20 °C	<b>Freezing/Melting Point:</b> -153.8 °C (-244.84 °F)
<b>Evaporation Rate:</b> Not applicable	<b>Volatile Component (% Vol):</b> 100
<b>pH:</b> Not applicable	<b>Water Solubility:</b> Slightly soluble

### Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Presence of heat source and direct sunlight (ultra-violet radiation).  
 Presence of elevated temperatures.  
 Presence of an ignition source.  
 Storage in unsealed containers.  
 Stable under normal storage conditions. Polymerization may occur at elevated temperatures and in the presence of ignition sources.

**Storage Incompatibilities:** Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Avoid peroxides, copper and copper alloys and plastics.

Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidizable and polymerizable.

If peroxidation occurs, vinyl chloride tends to self-polymerize violently and this has resulted in several industrial accidents.

Accidental exposure of the recovered monomer to atmospheric oxygen for a long period resulted in the formation of an unstable polyperoxide which initiated explosion. A 20-30% aqueous solution has been used to destroy the peroxide.

An explosion in a valve in a liquid monomer line appears to have been caused by traces of nitrogen oxides remaining after passivation of the line by nitric acid.

### Section 11 - Toxicological Information

#### Toxicity

Oral (rat) LD<sub>50</sub>: 500mg/kg

Oral (rat) TD<sub>Lo</sub>: 3463mg/kg/52w

Inhalation (rat) TC<sub>Lo</sub>: 1ppm/4h/52w

Inhalation (man) TC<sub>Lo</sub>: 200ppm/14y

Tumors of the sense organs, vascular system, respiratory system, gastrointestinal system, skin and liver, lymphoma, paternal effects, effects on fertility, fetotoxicity, specific developmental abnormalities involving the musculoskeletal system recorded.

#### Irritation

Nil reported

See RTECS YZ 3200000, for additional data.

### Section 12 - Ecological Information

**Environmental Fate:** If released to soil, it will be subject to rapid volatilization with reported half-lives of 0.2 and 0.5 days for evaporation from soil at 1 and 10 cm incorporation, respectively. Any which does not evaporate will be expected to be highly to very highly mobile in soil and it may leach to the groundwater. It may be subject to biodegradation under anaerobic conditions such as exists in flooded soil and groundwater. If released to water, it will not be expected to hydrolyze, to bioconcentrate in aquatic organisms or to adsorb to sediments. It will be subject to rapid volatilization with an estimated half-life of 0.805 hr for evaporation from a river 1 m deep with a current of 3 m/sec and a wind velocity of 3 m/sec. In waters containing photosensitizers such as humic acid, photodegradation will occur fairly rapidly. Limited existing data indicate that it is resistant to biodegradation in aerobic systems and therefore, it may not be subject to biodegradation in aerobic soils and natural waters. It will not be expected to hydrolyze in soils or natural waters under normal environmental conditions. If released to the atmosphere, it can be expected to exist mainly in the vapor-phase in the ambient atmosphere and to degrade rapidly in air by gas-phase reaction with photochemically produced hydroxyl radicals with an estimated half-life of 1.5 days.

**Ecotoxicity:** No data found.

**Henry's Law Constant:** 0.0560

**BCF:** estimated at 7

**Biochemical Oxygen Demand (BOD):** none

**Octanol/Water Partition Coefficient:** log K<sub>ow</sub> = calculated at 0.6

**Soil Sorption Partition Coefficient:** K<sub>oc</sub> = estimated at 56

### Section 13 - Disposal Considerations

**Disposal:** The gas should be burned in a high temperature furnace equipped with an afterburner and scrubber to remove HCl formed.  
Follow applicable federal, state, and local regulations.  
Return all damaged and empty cylinders and containers to the supplier.

### Section 14 - Transport Information

#### DOT Hazardous Materials Table Data (49 CFR 172.101):

**Shipping Name and Description:** Vinyl chloride, stabilized

**ID:** UN1086

**Hazard Class:** 2.1 - Flammable gas

**Packing Group:**

**Symbols:**

**Label Codes:** 2.1 - Flammable Gas

**Special Provisions:** 21, B44, T50

**Packaging:** Exceptions: 306 Non-bulk: 304 Bulk: 314, 315

**Quantity Limitations:** Passenger aircraft/rail: Forbidden Cargo aircraft only: 150 kg

**Vessel Stowage:** Location: B Other: 40



### Section 15 - Regulatory Information

**EPA Regulations:**

**RCRA 40 CFR:** Listed U043 Toxic Waste

**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 1 lb (0.454 kg)

**SARA 40 CFR 372.65:** Listed

**SARA EHS 40 CFR 355:** Not listed

**TSCA:** Listed

### Section 16 - Other Information

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

**Section 1 - Chemical Product and Company Identification**

**54/59**

**Material Name:** Acetone

**CAS Number:** 67-64-1

**Chemical Formula:** C<sub>3</sub>H<sub>6</sub>O

**Structural Chemical Formula:** CH<sub>3</sub>COCH<sub>3</sub>

**EINECS Number:** 200-662-2

**ACX Number:** X1001253-6

**Synonyms:** ACETON; ACETONE; CHEVRON ACETONE; DIMETHYL KETONE; DIMETHYLFORMALDEHYDE; DIMETHYLKETAL; EPA PESTICIDE CHEMICAL CODE 004101; KETONE PROPANE; KETONE, DIMETHYL; BETA-KETOPROPANE; METHYL KETONE; 2-PROPANONE; PROPANONE; PYROACETIC ACID; PYROACETIC ETHER

**General Use:** Solvent for fats, oils, waxes, resins, rubber, plastics, lacquers.

Used in manufacture of methyl isobutyl ketone, mesityl oxide, acetic acid, diacetone alcohol, isoprene. Used in solvent extraction processes.

Solvent in the manufacture of explosives and rayon. Component of adhesives, glues, cleaning solvents, lacquer thinners, nail polish, paint removers.

Storing acetylene gas (takes up about 24 times its volume of the gas).

Purifying paraffin and biomedical hardening and dehydrating tissues.

Minor food additive, permitted in USA.

**Section 2 - Composition / Information on Ingredients**

Name	CAS	%
acetone	67-64-1	95-99.5

**OSHA PEL**

TWA: 1000 ppm; 2400 mg/m<sup>3</sup>.

**NIOSH REL**

TWA: 250 ppm, 590 mg/m<sup>3</sup>.

**DFG (Germany) MAK**

TWA: 500 ppm; PEAK: 1000 ppm.

**OSHA PEL Vacated 1989 Limits**

TWA: 750 ppm; 1800 mg/m<sup>3</sup>;  
STEL: 1000 ppm; 2400 mg/m<sup>3</sup>.

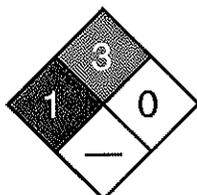
**IDLH Level**

2500 ppm (10% LEL).

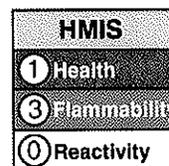
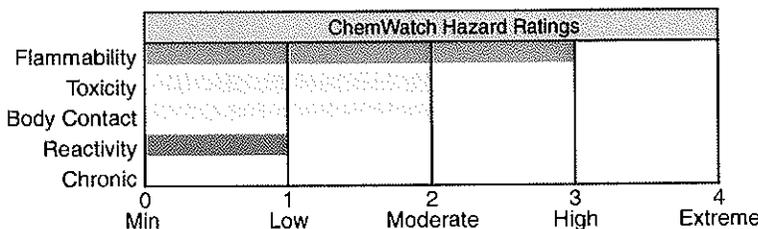
**ACGIH TLV**

TWA: 500 ppm; STEL: 750 ppm.

**Section 3 - Hazards Identification**



Fire Diamond



**ANSI Signal Word**  
**Danger!**



Flammable

**☆☆☆☆☆ Emergency Overview ☆☆☆☆☆**

Colorless, highly volatile liquid; sweet odor. Irritating. Other Acute Effects: muscle weakness, mental confusion, coma (high concentrations). Ingestion: GI irritation, kidney/liver damage, metabolic changes, coma. Chronic Effects: dermatitis. Highly flammable.

**Potential Health Effects**

**Target Organs:** respiratory system, central nervous system (CNS), skin

**Primary Entry Routes:** inhalation, skin contact, eye contact, ingestion

**Acute Effects**

**Inhalation:** The vapor is discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Exposure to ketone vapors may produce nose, throat and mucous membrane irritation. High concentrations of vapor may produce central nervous system depression characterized by headache, vertigo, loss of coordination, narcosis and cardiorespiratory failure. Some ketones produce neurological disorders (polyneuropathy) characterized by bilateral symmetrical paresthesia and muscle weakness primarily in the legs and arms.

Symptoms of exposure may include restlessness, headache, vomiting, stupor, low blood pressure and rapid and irregular pulse, eye and throat irritation, weakness of the legs, dizziness and lightheadedness.

Inhalation of high concentrations produces dryness of the mouth and throat, dizziness, nausea, incoordinated movements, loss of coordinated speech, drowsiness, and in extreme cases, coma.

Inhalation of acetone vapors over long periods causes irritation of the respiratory tract, coughing, headache. Acetone concentrations of 52200 ppm for 1 hour produced narcosis in rats and fatalities at 126600 ppm.

**Eye:** The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration.

The vapor is discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

**Skin:** The liquid is discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

**Ingestion:** Considered an unlikely route of entry in commercial/industrial environments.

The liquid is highly discomforting and mildly toxic if swallowed but may be harmful if swallowed in quantity.

Small amounts or low dose rates are regarded as practically non-harmful.

**Carcinogenicity:** NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

**Chronic Effects:** Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Workers exposed to 700 ppm acetone for 3 hours/day for 7-15 years showed inflammation of the respiratory tract, stomach and duodenum, attacks of giddiness and loss of strength. Exposure to acetone may enhance liver toxicity of chlorinated solvents.

## Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

**Eye Contact:** Immediately hold the eyes open and flush with fresh running water.

Ensure irrigation under the eyelids by occasionally lifting upper and lower lids. If pain persists or recurs seek medical attention.

Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

**Ingestion:** Rinse mouth out with plenty of water.

Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

*After first aid, get appropriate in-plant, paramedic, or community medical support.*

**Note to Physicians:** For acute or short-term repeated exposures to acetone:

1. Symptoms of acetone exposure approximate ethanol intoxication.

2. About 20% is expired by the lungs and the rest is metabolized.

Alveolar air half-life is about 4 hours following two hour inhalation at levels near the Exposure Standard; in overdose, saturable metabolism and limited clearance, prolong the elimination half-life to 25-30 hours.

3. There are no known antidotes and treatment should involve the usual methods of decontamination followed by supportive care.

## Section 5 - Fire-Fighting Measures

**Flash Point:** -20 °C

**Autoignition Temperature:** 465 °C

**LEL:** 2.15% v/v

**UEL:** 13% v/v

**Extinguishing Media:** Water spray or fog; alcohol stable foam.

Dry chemical powder.

Bromochlorodifluoromethane (BCF) (where regulations permit).

Carbon dioxide.

**General Fire Hazards/Hazardous Combustion Products:** Liquid and vapor are highly flammable.

Severe fire hazard when exposed to heat, flame and/or oxidizers.

Vapor forms an explosive mixture with air.

Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion/decomposition with violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include carbon dioxide (CO<sub>2</sub>).

**Fire Incompatibility:** Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

PLEASE NOTE: 10% of acetone in water has a flash point below 20 deg. C.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

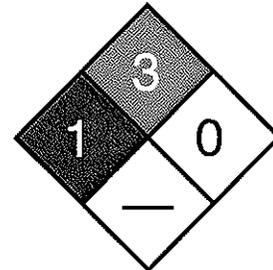
If safe, switch off electrical equipment until vapor fire hazard removed.

Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protective location.

If safe to do so, remove containers from path of fire.



Fire Diamond

## Section 6 - Accidental Release Measures

**Small Spills:** Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

**Large Spills:** Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

Avoid breathing vapors and contact with skin and eyes.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Shut off all possible sources of ignition and increase ventilation.

Water spray or fog may be used to disperse vapor.

Stop leak if safe to do so. Contain spill with sand, earth or vermiculite.

Collect residues and place in flammable waste container.

Any electric cleaning equipment must be explosion proof.

Wash spill area with large quantities of water.

If contamination of drains or waterways occurs, advise emergency services.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

Avoid smoking, bare lights, heat or ignition sources.

When handling, DO NOT eat, drink or smoke.

Vapor may ignite on pumping or pouring due to static electricity.  
 DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.  
 Avoid contact with incompatible materials.  
 Keep containers securely sealed. Avoid physical damage to containers.  
 Always wash hands with soap and water after handling.  
 Work clothes should be laundered separately.  
 Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.  
**Recommended Storage Methods:** Metal can; metal drum. Packing as recommended by manufacturer.  
 Check all containers are clearly labeled and free from leaks.  
**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.  
 None required when handling small quantities. OTHERWISE: If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.

### Personal Protective Clothing/Equipment:

**Eyes:** Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Barrier cream with polyethylene gloves or Butyl rubber gloves or Neoprene rubber gloves.

Safety footwear.

### Respiratory Protection:

Exposure Range >1000 to <2500 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face

Exposure Range 2500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Note: use ov (black) cartridge for nuisance(<1000)

**Other:** Overalls. Ensure that there is ready access to eye wash unit and Ensure there is ready access to an emergency shower.

### Glove Selection Index:

BUTYL/NEOPRENE .....Best selection

PE/EVAL/PE .....Best selection

PVDC/PE/PVDC .....Best selection

BUTYL .....Best selection

SARANEX-23 2-PLY .....Satisfactory; may degrade after 4 hours continuous immersion

TEFLON .....Satisfactory; may degrade after 4 hours continuous immersion

SARANEX-23 .....Poor to dangerous choice for other than short-term immersion

CPE .....Poor to dangerous choice for other than short-term immersion

HYPALON .....Poor to dangerous choice for other than short-term immersion

NITRILE+PVC .....Poor to dangerous choice for other than short-term immersion

PVA .....Poor to dangerous choice for other than short-term immersion

VITON/NEOPRENE .....Poor to dangerous choice for other than short-term immersion

NEOPRENE .....Poor to dangerous choice for other than short-term immersion

PVC .....Poor to dangerous choice for other than short-term immersion

NATURAL+NEOPRENE .....Poor to dangerous choice for other than short-term immersion

NATURAL RUBBER .....Poor to dangerous choice for other than short-term immersion

NITRILE .....Poor to dangerous choice for other than short-term immersion

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Clear, colorless, highly volatile, highly flammable liquid with characteristic sweet odor.  
 Mixes in alcohol, ether, most hydrocarbons and oils.

**Physical State:** Liquid

**Vapor Pressure (kPa):** 24 at 20 °C

**Vapor Density (Air=1):** 2.0

**Formula Weight:** 58.08

**Specific Gravity (H<sub>2</sub>O=1, at 4 °C):** 0.79 at 20 °C

**Evaporation Rate:** 11 (BuAc=1) VFast

**pH:** Not applicable

**pH (1% Solution):** Not applicable.

**Boiling Point:** 56.2 °C (133 °F) at 760 mm Hg

**Freezing/Melting Point:** -95.35 °C (-139.63 °F)

**Volatile Component (% Vol):** 100

**Water Solubility:** Miscible

## Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Product is considered stable. Hazardous polymerization will not occur.  
**Storage Incompatibilities:** Avoid storage with oxidizers, strong acids and strong alkalis.  
 Reacts violently with bromoform and chloroform in the presence of alkalies or in contact with alkaline surfaces.

## Section 11 - Toxicological Information

### Toxicity

Oral (man) TD<sub>L0</sub>: 2857 mg/kg  
 Oral (rat) LD<sub>50</sub>: 5800 mg/kg  
 Inhalation (human) TC<sub>L0</sub>: 500 ppm  
 Inhalation (man) TC<sub>L0</sub>: 12000 ppm/4 hr  
 Inhalation (man) TC<sub>L0</sub>: 10 mg/m<sup>3</sup>/6 hr  
 Inhalation (rat) LC<sub>50</sub>: 50100 mg/m<sup>3</sup>/8 hr  
 Dermal (rabbit) LD<sub>50</sub>: 20000 mg/kg

### Irritation

Eye (human): 500 ppm - irritant  
 Eye (rabbit): 3.95 mg - SEVERE  
 Eye (rabbit): 20 mg/24 hr - moderate  
 Skin (rabbit): 395 mg (open) - mild  
 Skin (rabbit): 500 mg/24 hr - mild

See RTECS AL 3150000, for additional data.

## Section 12 - Ecological Information

**Environmental Fate:** If released on soil, it will both volatilize and leach into the ground and probably biodegrade. If released into water, it will probably biodegrade. It will also be lost due to volatilization (estimated half-life 20 hr from a model river). Bioconcentration in aquatic organisms and adsorption to sediment should not be significant. In the atmosphere, it will be lost by photolysis and reaction with photochemically produced hydroxyl radicals. Half-life estimates from these combined processes average 22 days and are shorter in summer and longer in winter. It will also be washed out by rain.

**Ecotoxicity:** LD<sub>100</sub> *Asellus aquaticus* 3 ml/l (within 3 days of exposure) /Conditions of bioassay not specified; LC<sub>50</sub> Mexican axolotl 20.0 mg/l/48 hr (3-4 weeks after hatching) /Conditions of bioassay not specified; TL<sub>m</sub> Mosquito fish 13,000 mg/l/24, 48, 96 hr /Conditions of bioassay not specified; LD<sub>100</sub> *Gammarus fossarum* 10 ml/l (within 48 hr) /Conditions of bioassay not specified; LC<sub>50</sub> *Poecilia reticulata* (guppy) 7,032 ppm/14 days /Conditions of bioassay not specified; LC<sub>50</sub> Ring-necked pheasant oral greater than 40,000 ppm, in diet, age 10 days, (no mortality to 40,000 ppm); LC<sub>50</sub> *Salmo gairdneri* (Rainbow trout) 5,540 mg/l/96 hr at 12 °C (95% confidence limit 4,740-6,330 mg/l), wt 1.0 g /static bioassay; LC<sub>50</sub> Clawed toad 24.0 mg/l/48 hr (3-4 weeks after hatching) /Conditions of bioassay not specified; TL<sub>m</sub> *Daphnia magna* 10 mg/l/24, 48 hr /Conditions of bioassay not specified

**Henry's Law Constant:** 3.97 x 10<sup>-5</sup>

**BCF:** negligible

**Biochemical Oxygen Demand (BOD):** theoretical 122%, 5 days

**Octanol/Water Partition Coefficient:** log K<sub>ow</sub> = -0.24

## Section 13 - Disposal Considerations

**Disposal:** Consult manufacturer for recycling options and recycle where possible.  
 Follow applicable federal, state, and local regulations.  
 Incinerate residue at an approved site.  
 Recycle containers where possible, or dispose of in an authorized landfill.

## Section 14 - Transport Information

### DOT Hazardous Materials Table Data (49 CFR 172.101):

**Shipping Name and Description:** Acetone

**ID:** UN1090

**Hazard Class:** 3 - Flammable and combustible liquid

**Packing Group:** II - Medium Danger

**Symbols:**

**Label Codes:** 3 - Flammable Liquid

**Special Provisions:** IB2, T4, TP1

**Packaging:** Exceptions: 150 Non-bulk: 202 Bulk: 242  
**Quantity Limitations:** Passenger aircraft/rail: 5 L Cargo aircraft only: 60 L  
**Vessel Stowage:** Location: B Other:

### Section 15 - Regulatory Information

**EPA Regulations:**

**RCRA 40 CFR:** Listed U002 Ignitable Waste

**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001 5000 lb (2268 kg)

**SARA 40 CFR 372.65:** Not listed

**SARA EHS 40 CFR 355:** Not listed

**TSCA:** Listed

### Section 16 - Other Information

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

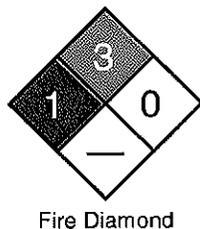
**Section 1 - Chemical Product and Company Identification 54/60**

**Material Name:** n-Hexane **CAS Number:** 110-54-3  
**Chemical Formula:** C<sub>6</sub>H<sub>14</sub>  
**Structural Chemical Formula:** H<sub>3</sub>C(CH<sub>2</sub>)<sub>4</sub>CH<sub>3</sub>  
**EINECS Number:** 203-777-6  
**ACX Number:** X1001498-5  
**Synonyms:** DIPROPYL; ESANI; GETTYSOLVE-B; HEKSAN; HEXANE; N-HEXANE; N-HEXANE; HEXANEN; HEXYL HYDRIDE; NORMAL HEXANE; NORMAL-HEXANE; SKELLYSOLVE-B; SKELLYSOLVE B  
**General Use:** An incidental component of many aliphatic solvent mixes used as lacquer, paint and enamel thinners, also in ink reducers and cleaning solvents.  
 Also used for solvent extraction of oil seeds and in pesticide residue analysis and gas chromatography.

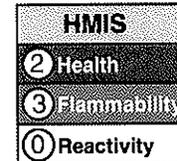
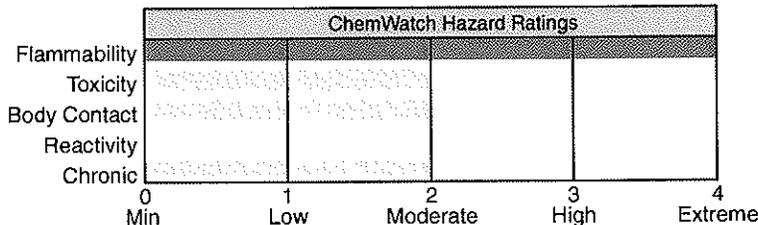
**Section 2 - Composition / Information on Ingredients**

Name	CAS	%
n-hexane	110-54-3	> 95
<b>OSHA PEL</b> TWA: 500 ppm; 1800 mg/m <sup>3</sup> .	<b>NIOSH REL</b> TWA: 50 ppm, 180 mg/m <sup>3</sup> .	<b>DFG (Germany) MAK</b> TWA: 50 ppm; PEAK: 400 ppm.
<b>OSHA PEL Vacated 1989 Limits</b> TWA: 50 ppm; 180 mg/m <sup>3</sup> .	<b>IDLH Level</b> 1100 ppm (10% LEL).	
<b>ACGIH TLV</b> TWA: 50 ppm; skin.		

**Section 3 - Hazards Identification**



Fire Diamond



**ANSI Signal Word**  
**Danger!**



Flammable

☆☆☆☆☆ **Emergency Overview** ☆☆☆☆☆

Colorless, volatile liquid; sweet/gasoline odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, fatigue, muscle weakness, hallucinations. Chronic Effects: muscle weakness, motor loss, sensory disturbances. Flammable.

**Potential Health Effects**

**Target Organs:** eyes, skin, respiratory system, central nervous system (CNS), peripheral nervous system

**Primary Entry Routes:** inhalation, skin contact/absorption, eyes, ingestion

**Acute Effects**

**Inhalation:** The vapor is discomfoting and harmful to the upper respiratory tract.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

**Eye:** The liquid is highly discomfoting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is irritating to the eyes and may cause smarting, pain and redness.  
 The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

**Skin:** The liquid is discomforting to the skin and is capable of causing skin reactions which may lead to dermatitis. Toxic effects may result from skin absorption.

**Ingestion:** The liquid is highly discomforting and harmful if swallowed. Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Considered an unlikely route of entry in commercial/industrial environments.

**Carcinogenicity:** NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

**Chronic Effects:** Chronic inhalation or skin exposure to n-hexane may cause peripheral neuropathy, which is damage to nerve ends in extremities, e.g. fingers, with loss of sensation and characteristic thickening. Nerve damage has been documented with chronic exposures of greater than 500 ppm.

Improvement in condition does not immediately follow removal from exposure and symptoms may progress for two or three months. Recovery may take a year or more depending on severity of exposure, and may not always be complete. Exposure to n-hexane with methyl ethyl ketone (MEK) will accelerate the appearance of damage, but MEK alone will not cause the nerve damage.

Other isomers of hexane do not cause nerve damage.

### Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

**Ingestion:** Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

*After first aid, get appropriate in-plant, paramedic, or community medical support.*

**Note to Physicians:** Following acute or short-term repeated exposures to n-hexane:

1. Large quantities of n-hexane are expired by the lungs after vapor exposure (50-60%). Humans exposed to 100 ppm demonstrate an n-hexane biological half life of 2 hours.

2. Initial attention should be directed towards evaluation and support of respiration. Cardiac dysrhythmias are a potential complication.

**INGESTION:**

1. Ipecac syrup should be considered for ingestion of pure hexane exceeding 2-3 mL/kg. Extreme caution must be taken to avoid aspiration since small amounts of n-hexane intratracheally, produce a severe chemical pneumonitis

**BIOLOGICAL EXPOSURE INDEX - BEI**

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
2,5-hexanedione in urine	5 mg/gm creatinine	End of shift	NS

n-Hexane in end-exhaled air			SQ
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NS: Non-specific determinant; Metabolite observed following exposure to other materials.

SQ: Semi-quantitative determinant; Interpretation may be ambiguous - should be used as a screening test or confirmatory test.



## Section 5 - Fire-Fighting Measures

**Flash Point:** -22 °C

**Autoignition Temperature:** 225 °C

**LEL:** 1.1% v/v

**UEL:** 7.5% v/v

**Extinguishing Media:** Dry chemical powder. Foam.  
Carbon dioxide.

**General Fire Hazards/Hazardous Combustion Products:** Liquid and vapor are highly flammable.

Severe fire hazard when exposed to heat, flame and/or oxidizers.

Vapor forms an explosive mixture with air.

Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion/decomposition with violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO). May emit clouds of acrid smoke.

**Fire Incompatibility:** Avoid reaction with oxidizing agents.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

If safe, switch off electrical equipment until vapor fire hazard removed.

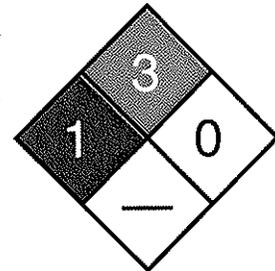
Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protective location.

If safe to do so, remove containers from path of fire.

See  
DOT  
ERG



Fire Diamond

## Section 6 - Accidental Release Measures

**Small Spills:** Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

**Large Spills:** Pollutant - clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so.

Water spray or fog may be used to disperse/absorb vapor.

Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.

Collect recoverable products into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

See  
DOT  
ERG

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing mist. Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

Avoid smoking, bare lights, heat or ignition sources.

When handling, DO NOT eat, drink or smoke.

Vapor may ignite on pumping or pouring due to static electricity.

DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.

Avoid contact with incompatible materials.

Keep containers securely sealed. Avoid physical damage to containers.

Always wash hands with soap and water after handling.

Work clothes should be laundered separately.  
 Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.  
 Avoid concurrent exposure to materials containing Methyl Ethyl Ketone MEK  
**Recommended Storage Methods:** Metal can; metal drum. Packing as recommended by manufacturer.  
 Check all containers are clearly labeled and free from leaks.

**Regulatory Requirements:** Follow applicable OSHA regulations.

**Section 8 - Exposure Controls / Personal Protection**

**Engineering Controls:** Use in a well-ventilated area.  
 General exhaust is adequate under normal operating conditions.  
 Local exhaust ventilation may be required in specific circumstances.  
 If risk of overexposure exists, wear NIOSH-approved respirator.  
 Correct fit is essential to obtain adequate protection.  
 Provide adequate ventilation in warehouse or closed storage areas.

**Personal Protective Clothing/Equipment:**

**Eyes:** Safety glasses with side shields; or as required, chemical goggles.  
 Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Polyethylene gloves. Wear chemical protective gloves, eg. PVC.  
 Wear safety footwear.

Do NOT use this product to clean the skin.

**Respiratory Protection:**

Exposure Range >500 to <1100 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask  
 Exposure Range 1100 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face  
 Note: poor warning properties

**Other:** Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

**Glove Selection Index:**

- PE/EVAL/PE ..... Best selection
- PVA ..... Best selection
- SARANEX-23 2-PLY..... Best selection
- VITON ..... Best selection
- VITON/CHLOROBUTYL ..... Best selection
- TEFLON ..... Satisfactory; may degrade after 4 hours continuous immersion
- NITRILE ..... Satisfactory; may degrade after 4 hours continuous immersion
- NEOPRENE..... Poor to dangerous choice for other than short-term immersion
- NEOPRENE/NATURAL..... Poor to dangerous choice for other than short-term immersion
- NITRILE+PVC ..... Poor to dangerous choice for other than short-term immersion
- PVC..... Poor to dangerous choice for other than short-term immersion
- BUTYL ..... Poor to dangerous choice for other than short-term immersion

**Section 9 - Physical and Chemical Properties**

**Appearance/General Info:** Clear highly flammable liquid with typical paraffinic odor; floats on water. Mixes with most other organic solvents, chloroform, ether, alcohol. A very volatile liquid, it readily forms explosive vapor /air mixes.

<b>Physical State:</b> Liquid	<b>Boiling Point:</b> 68.89 °C (156 °F)
<b>Vapor Pressure (kPa):</b> 13.33	<b>Freezing/Melting Point:</b> -100 °C (-148 °F) to -95 °C (-139 °F)
<b>Vapor Density (Air=1):</b> 2.97	<b>Volatile Component (% Vol):</b> 100
<b>Formula Weight:</b> 86.17	<b>Water Solubility:</b> 0.002% by weight
<b>Specific Gravity (H<sub>2</sub>O=1, at 4 °C):</b> 0.6603 at 20 °C	
<b>pH:</b> Not applicable	
<b>pH (1% Solution):</b> Not applicable	

**Section 10 - Stability and Reactivity**

**Stability/Polymerization/Conditions to Avoid:** Presence of heat source and ignition source. Hazardous polymerization will not occur.

**Storage Incompatibilities:** Avoid storage with oxidizers.

## Section 11 - Toxicological Information

### Toxicity

Oral (rat) LD<sub>50</sub>: 28710 mg/kg  
 Inhalation (human) TC<sub>Lo</sub>: 190 ppm/8W  
 Inhalation (rat) LD<sub>50</sub>: 48000 ppm/4h

### Irritation

Eye (rabbit): 10 mg - mild

See RTECS MN9275000, for additional data.

## Section 12 - Ecological Information

**Environmental Fate:** Photolysis, hydrolysis or bioconcentration are not expected to be an important environmental fate processes. Biodegradation may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A  $K_{oc}$  range of 1250 to 4100 indicates a low to slight mobility class in soil. In aquatic systems it may partition from the water column to organic matter contained in sediments and suspended materials. A Henry's Law constant of 1.81 atm-cu m/mole at 25 °C suggests rapid volatilization from environmental waters. The volatilization half-lives from a model river and a model pond, the latter considers the effect of adsorption, have been estimated to be 2.7 hr and 6.8 days, respectively. It is expected to exist entirely in the vapor-phase in ambient air. Reactions with photochemically produced hydroxyl radicals in the atmosphere have been shown to be important (average estimated half-life of 2.9 days). Data also suggests that nighttime reactions with nitrate radicals may contribute to atmospheric transformation, especially in urban environments.

**Ecotoxicity:** No data found.

**Henry's Law Constant:** calculated at 1.81

**BCF:** estimated at 2.24 to 2.89

**Biochemical Oxygen Demand (BOD):** theoretical 0%, 7 days

**Octanol/Water Partition Coefficient:**  $\log K_{ow} = 4.11$

**Soil Sorption Partition Coefficient:**  $K_{oc} =$  estimated at 1250 to 4100

## Section 13 - Disposal Considerations

**Disposal:** Consult manufacturer for recycling options and recycle where possible.

Follow applicable federal, state, and local regulations.

Incinerate residue at an approved site.

Recycle containers where possible, or dispose of in an authorized landfill.

## Section 14 - Transport Information

### DOT Hazardous Materials Table Data (49 CFR 172.101):

**Shipping Name and Description:** Hexanes

**ID:** UN1208

**Hazard Class:** 3 - Flammable and combustible liquid

**Packing Group:** II - Medium Danger

**Symbols:**

**Label Codes:** 3 - Flammable Liquid

**Special Provisions:** IB2, T4, TP1

**Packaging:** Exceptions: 150 Non-bulk: 202 Bulk: 242

**Quantity Limitations:** Passenger aircraft/rail: 5 L Cargo aircraft only: 60 L

**Vessel Stowage:** Location: E Other:



## Section 15 - Regulatory Information

### EPA Regulations:

**RCRA 40 CFR:** Not listed

**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001 5000 lb (2268 kg)

**SARA 40 CFR 372.65:** Listed

**SARA EHS 40 CFR 355:** Not listed

**TSCA:** Listed

**Section 16 - Other Information**

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.



**Section 1 - Chemical Product and Company Identification** **54/58**

**Material Name:** Unleaded Petrol **CAS Number:** 8006-61-9  
**Chemical Formula:** Mixture of hydrocarbons  
**EINECS Number:** 232-349-1  
**ACX Number:** X1003056-5  
**Synonyms:** AUTOMOTIVE GASOLINE, LEAD-FREE; GASOLINE; MOTOR FUEL; MOTOR SPIRITS;  
NATURAL GASOLINE; PETROL; UNLEADED PETROL  
**General Use:** Lead free motor fuel for internal combustion engines, 2-stroke and 4-stroke.

**Section 2 - Composition / Information on Ingredients**

Name	CAS	%
gasoline	8006-61-9	>90
benzene	71-43-2	5 max.

**OSHA PEL**

**NIOSH REL**

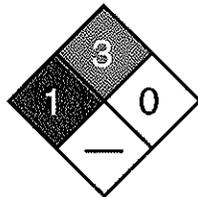
**OSHA PEL Vacated 1989 Limits**

TWA: 300 ppm; 900 mg/m<sup>3</sup>;  
STEL: 500 ppm; 1500 mg/m<sup>3</sup>.

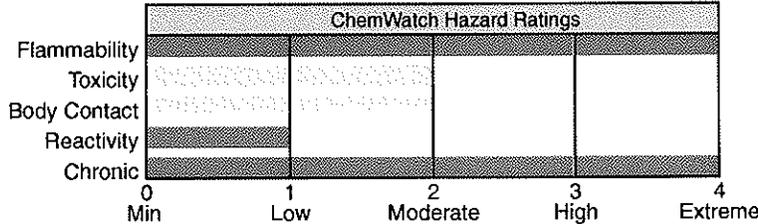
**ACGIH TLV**

TWA: 300 ppm, 890 mg/m<sup>3</sup>;  
STEL: 500 ppm, 1480 mg/m<sup>3</sup>.

**Section 3 - Hazards Identification**



Fire Diamond



HMIS	
2	Health
3	Flammability
1	Reactivity

**ANSI Signal Word**

**Danger!**



Flammable

**☆☆☆☆☆ Emergency Overview ☆☆☆☆☆**

Clear liquid; distinctive odor. Irritating to eyes/skin/respiratory tract. Also causes: dizziness, drunkenness, unconsciousness. Absorbed through skin. Chronic: dermatitis. Possible cancer hazard. Flammable. Can form explosive mixtures in air.

**Potential Health Effects**

**Target Organs:** skin, eye, respiratory system, central nervous system (CNS)

**Primary Entry Routes:** inhalation, ingestion, skin contact

**Acute Effects**

**Inhalation:** The vapor is discomforting to the upper respiratory tract and may be harmful if exposure is prolonged. Inhalation hazard is increased at higher temperatures. Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

**WARNING:** Intentional misuse by concentrating/inhaling contents may be lethal. High inhaled concentrations of mixed hydrocarbons may produce narcosis characterized by nausea, vomiting and lightheadedness. Inhalation of aerosols may produce severe pulmonary edema, pneumonitis and pulmonary hemorrhage. Inhalation of petroleum hydrocarbons consisting substantially of low molecular weight species may produce irritation of mucous membranes, incoordination, giddiness, nausea, vertigo, confusion, headache, appetite loss, drowsiness, tremors and anesthetic stupor. Massive exposures may produce central nervous system depression with sudden collapse and deep coma; fatalities have been recorded. Irritation of the brain and/or apneic anoxia may produce convulsions. Although recovery following overexposure is generally complete, cerebral micro- hemorrhage of focal post-inflammatory scarring may produce epileptiform seizures some months after the exposure. Pulmonary episodes may include chemical pneumonitis with edema and hemorrhage. The lighter hydrocarbons may produce kidney and neurotoxic effects. Liquid paraffins may produce anesthesia and depressant actions leading to weakness, dizziness, slow and shallow respiration, unconsciousness, convulsions and death. C<sub>5,7</sub> paraffins may also produce polyneuropathy. Aromatic hydrocarbons accumulate in lipid-rich tissues (typically the brain, spinal cord and peripheral nerves) and may produce functional impairment manifested by nonspecific symptoms such as nausea, weakness, fatigue, vertigo; severe exposures may produce inebriation or unconsciousness. Many of the petroleum hydrocarbons are cardiac sensitizers and may cause ventricular fibrillations.

**Eye:** The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. The vapor is discomforting to the eyes. Petroleum hydrocarbons may produce pain after direct contact with the eyes. Slight, but transient, disturbances of the corneal epithelium may also result. The aromatic fraction may produce irritation and lachrymation. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

**Skin:** The material is moderately discomforting to the skin if exposure is prolonged. The material contains a component that may be absorbed through the skin and may cause drying of the skin, which may lead to dermatitis from repeated exposures over long periods. Toxic effects may result from skin absorption. Open cuts, abraded or irritated skin should not be exposed to this material. The material may accentuate any pre-existing dermatitis condition.

**Ingestion:** Considered an unlikely route of entry in commercial/industrial environments. The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis. Ingestion of petroleum hydrocarbons may produce irritation of the pharynx, esophagus, stomach and small intestine with edema and mucosal ulceration. Resulting symptoms include a burning sensation in the mouth and throat. Large amounts may produce narcosis with nausea and vomiting, weakness or dizziness, slow and shallow respiration, swelling of the abdomen, unconsciousness and convulsions. Myocardial injury may produce arrhythmias, ventricular fibrillation and electrocardiographic changes. Central nervous system depression may also occur. Light aromatic hydrocarbons produce a warm, sharp, tingling sensation on contact with taste buds and may anesthetize the tongue. Aspiration into the lungs may produce coughing, gagging, and a chemical pneumonitis with pulmonary edema and hemorrhage.

**Carcinogenicity:** NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Not listed; MAK - Not listed.

**Chronic Effects:** Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes. Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following. Chronic poisoning may occur from vapor inhalation or skin absorption. The most significant toxic effect is insidious and irreversible injury to the blood-forming tissue by benzene. Leukemia may develop. Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes. Gasoline "sniffing" has caused severe nerve damage. Repeated or prolonged exposure to mixed hydrocarbons may produce narcosis with dizziness, weakness, irritability, concentration and/or memory loss, tremor in the fingers and tongue, vertigo, olfactory disorders, constriction of visual field, paresthesias of the extremities, weight loss and anemia and degenerative changes in the liver and kidney. Chronic exposure by petroleum workers to the lighter hydrocarbons has been associated with visual disturbances, damage to the central nervous system, peripheral neuropathies (including numbness and paresthesias), psychological and neurophysiological deficits, bone marrow toxicities (including hypoplasia, possibly due to benzene) and hepatic and renal involvement. Chronic dermal exposure to petroleum hydrocarbons may result in defatting which produces localized dermatoses. Surface cracking and erosion may also increase susceptibility to infection by microorganisms.

**Section 4 - First Aid Measures**

**Inhalation:** Remove to fresh air. Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital, or doctor.

**Eye Contact:** Immediately hold the eyes open and wash continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids. Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately remove all contaminated clothing, including footwear (after rinsing with water). Wash affected areas thoroughly with water (and soap if available). Seek medical attention in event of irritation.

**Ingestion:** Contact a Poison Control Center. If swallowed, do NOT induce vomiting. Give a glass of water.

*After first aid, get appropriate in-plant, paramedic, or community medical support.*

**Note to Physicians:** For acute or short term repeated exposures to petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO<sub>2</sub> <50 mm Hg or pCO<sub>2</sub> >50 mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines. Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

### Section 5 - Fire-Fighting Measures

**Flash Point:** -43 °C

**Autoignition Temperature:** 280 °C

**LEL:** 1.4% v/v

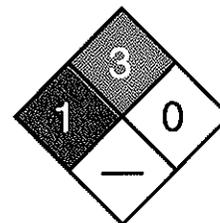
**UEL:** 7.6% v/v

**Extinguishing Media:** Foam. Dry chemical powder. Bromochlorodifluoromethane (BCF) (where regulations permit). Carbon dioxide.

**General Fire Hazards/Hazardous Combustion Products:** Liquid and vapor are highly flammable. Severe fire hazard when exposed to heat, flame and/or oxidizers. Vapor forms an explosive mixture with air. Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition. Heating may cause expansion/decomposition with violent rupture of containers. On combustion, may emit toxic fumes of carbon monoxide (CO).

**Fire Incompatibility:** Avoid contamination with oxidizing agents, i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc., as ignition may result.

**Fire-Fighting Instructions:** Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. If safe, switch off electrical equipment until vapour fire hazard removed. Use water delivered as a fine spray to control fire and cool adjacent area. Avoid spraying water onto liquid pools. Do not approach containers suspected to be hot. Cool fire exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire.



Fire Diamond

### Section 6 - Accidental Release Measures

**Small Spills:** Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapors and contact with skin and eyes. Control personal contact by using protective equipment. Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

**Large Spills:** Clear area of personnel and move upwind. Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. No smoking, naked lights or ignition sources. Increase ventilation. Stop leak if safe to do so.

Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite. Use only spark-free shovels and explosion proof equipment. Collect recoverable product into labeled containers for recycling. Absorb remaining product with sand, earth or vermiculite. Collect solid residues and seal in labelled drums for disposal. Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing mist. Avoid all personal contact, including inhalation. Wear protective clothing when risk of exposure occurs. Use in a well-ventilated area. Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked. Avoid smoking, bare lights, heat or ignition sources. When handling, DO NOT eat, drink or smoke. Vapor may ignite on pumping or pouring due to static electricity. DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling. Avoid contact with incompatible materials. Keep containers securely sealed. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

**Recommended Storage Methods:** Metal can, metal drum. Packing as recommended by manufacturer. Check all containers are clearly labeled and free from leaks.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area. If inhalation risk of overexposure exists, wear a NIOSH approved organic-vapor respirator. Correct respirator fit is essential to obtain adequate protection. In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas.

### Personal Protective Clothing/Equipment:

**Eyes:** Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Barrier cream with polyethylene gloves or PVC gloves. Safety footwear. Do NOT use this product to clean the skin.

### Respiratory Protection:

Exposure Range >300 to 1000 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range >1000 to 15,000 ppm: Air Purifying, Negative Pressure, Full Face

Exposure Range >15,000 to 300,000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face

Exposure Range >300,000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black

**Other:** Overalls. Ensure that there is ready access to eye wash unit. Ensure there is ready access to an emergency shower.

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Purple, highly flammable, volatile liquid with characteristic sharp odor. Floats on water. Consists of a complex mixture of hydrocarbons with small amounts of residual benzene from the refining operations.

**Physical State:** Liquid

**Vapor Pressure (kPa):** 53.33 at 20 °C

**Vapor Density (Air=1):** > 2

**Formula Weight:** Not applicable.

**Specific Gravity (H<sub>2</sub>O=1, at 4 °C):** 0.72-0.735 at 15 °C

**Evaporation Rate:** Fast

**pH:** Not applicable

**pH (1% Solution):** Not applicable.

**Boiling Point:** 38.89 °C (102 °F)

**Freezing/Melting Point:** Not available

**Volatile Component (% Vol):** 100

**Decomposition Temperature (°C):** Not available.

**Water Solubility:** Insoluble

## Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Presence of incompatible materials. Product is considered stable.

Hazardous polymerization will not occur.

**Storage Incompatibilities:** Avoid storage with oxidizers.

## Section 11 - Toxicological Information

### **Toxicity**

Oral (rat) LD<sub>50</sub>: 18800 mg/kg

### **Irritation**

Skin (rabbit): 500 mg/24h mild

## Section 12 - Ecological Information

**Environmental Fate:** No data found.

**Ecotoxicity:** No data found.

**Biochemical Oxygen Demand (BOD):** 8%, 5 days

## Section 13 - Disposal Considerations

**Disposal:** Consult manufacturer for recycling options and recycle where possible. Follow all applicable federal, state, and local laws. Incinerate residue at an approved site. Recycle containers where possible, or dispose of in an authorized landfill.

**BEWARE:** Empty solvent, paint, lacquer and flammable liquid drums present a severe explosion hazard if cut by flame torch or welded. Even when thoroughly cleaned or reconditioned, the drum seams may retain sufficient solvent to generate an explosive atmosphere in the drum.

## Section 14 - Transport Information

### **DOT Transportation Data (49 CFR 172.101):**

**Shipping Name:** MOTOR SPIRIT OR  
GASOLINE OR PETROL

**Additional Shipping Information:** PETROL

**Hazard Class:** 3.1

**ID No.:** 1203

**Packing Group:** II

**Label:** Flammable Liquid[3]

## Section 15 - Regulatory Information

### **EPA Regulations:**

**RCRA 40 CFR:** Not listed

**CERCLA 40 CFR 302.4:** Not listed

**SARA 40 CFR 372.65:** Not listed

**SARA EHS 40 CFR 355:** Not listed

**TSCA:** Listed

## Section 16 - Other Information

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.



**Section 1 - Chemical Product and Company Identification** **54/58**

**Material Name:** Nitric Acid **CAS Number:** 7697-37-2  
**Chemical Formula:** HNO<sub>3</sub>  
**Structural Chemical Formula:** HNO<sub>3</sub>  
**EINECS Number:** 231-714-2  
**ACX Number:** X1002177-5

**Synonyms:** ACIDE NITRIQUE; ACIDO NITRICO; AQUA FORTIS; AZOTIC ACID; AZOTOWY KWAS; ENGRAVER'S ACID; ENGRAVERS ACID; HYDROGEN NITRATE; KYSELINA DUSICNE; NITAL; NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH >70% NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH NOT >70% NITRICACID; NITROUS FUMES; NITRYL HYDROXIDE; RED FUMING NITRIC ACID (RFNA); SALPETERSAURE; SALPETERZUUROPFLOSSINGEN; WHITE FUMING NITRIC ACID (WFNA)

**General Use:** Manufacture of organic and inorganic nitrates and nitro compounds for fertilizers, dye intermediates and many organic chemicals.  
Used for etching and cleaning metals.  
Operators should be trained in procedures for safe use of this material.

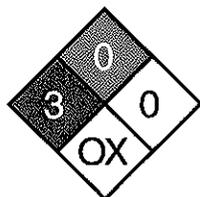
**Section 2 - Composition / Information on Ingredients**

Name	CAS	%
nitric acid	7697-37-2	>95

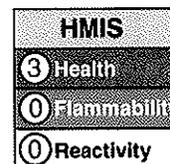
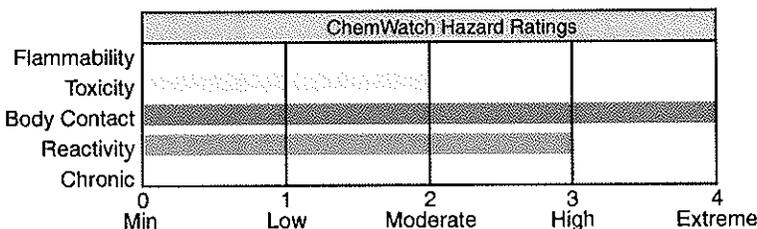
  

<b>OSHA PEL</b> TWA: 2 ppm; 5 mg/m <sup>3</sup> .	<b>NIOSH REL</b> TWA: 2 ppm, 5 mg/m <sup>3</sup> ; STEL: 4 ppm, 10 mg/m <sup>3</sup> .	<b>DFG (Germany) MAK</b> TWA: 2 ppm; PEAK: 2 ppm.
<b>OSHA PEL Vacated 1989 Limits</b> TWA: 2 ppm; 5 mg/m <sup>3</sup> ; STEL: 4 ppm; 10 mg/m <sup>3</sup> .	<b>IDLH Level</b> 25 ppm.	
<b>ACGIH TLV</b> TWA: 2 ppm; STEL: 4 ppm.		

**Section 3 - Hazards Identification**



Fire Diamond



**ANSI Signal Word**  
**Danger!**



Corrosive

**☆☆☆☆☆ Emergency Overview ☆☆☆☆☆**  
Clear to yellow fuming liquid; acrid, suffocating odor. Corrosive, causes severe burns to eyes/skin/respiratory tract. Also causes: heavy exposures: lung damage. Chronic: tooth erosion, bronchitis. Strong oxidizer capable of igniting combustibles.

**Potential Health Effects**

**Target Organs:** eyes, skin, respiratory system, teeth  
**Primary Entry Routes:** inhalation, ingestion, skin contact, eye contact  
**Acute Effects**

**Inhalation:** The vapor is extremely discomforting and corrosive to the upper respiratory tract and lungs and the material presents a hazard from a single acute exposure or from repeated exposures over long periods.

Inhalation hazard is increased at higher temperatures.

Reactions may occur following a single acute exposure or may only appear after repeated exposures.

Reactions may not occur on exposure but response may be delayed with symptoms only appearing many hours later.

The material may produce respiratory tract irritation which produces an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system. Unlike most organs the lung can respond to a chemical insult or agent by first trying to remove or neutralize the irritant and then repairing the damage. The repair process, which initially developed to protect mammalian lungs from foreign matter and antigens, may however, cause further damage the lungs when activated by hazardous chemicals. The result is often the impairment of gas exchange, the primary function of the lungs.

Inhalation of nitric acid mist or fumes at 2 to 25 ppm over an 8 hour period may cause pulmonary irritation and symptoms of lung damage.

Only several minutes of exposure to concentrated atmosphere i.e. 200 ppm may cause severe pulmonary damage and even fatality. Death may be delayed for several days.

Exposure to nitric acid fumes (with concurrent inhalation of nitrogen dioxide and nitric oxide) may elicit prompt irritation of the upper respiratory tract leading to coughing, gagging, chest pain, dyspnea, cyanosis if concentrations are sufficiently high and duration of exposure sufficiently long, pulmonary edema.

**Eye:** The liquid is extremely corrosive to the eyes and contact may cause rapid tissue destruction and is capable of causing severe damage with loss of sight.

The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated. The material may produce moderate eye irritation leading to inflammation.

Repeated or prolonged exposure to irritants may produce conjunctivitis.

Eye contact with concentrated acid may give no pain, whilst diluted solution causes intense pain and both can cause permanent eye damage or blindness. Burns may result in shrinkage of the eyeball, symblepharon (adhesions between tarsal and bulbar conjunctivae), permanent corneal opacification, and visual impairment leading to blindness.

**Skin:** The liquid is extremely corrosive to the skin and contact may cause tissue destruction with severe burns.

Bare unprotected skin should not be exposed to this material.

The vapor is highly discomforting to the skin.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Skin contact causes yellow discoloration of the skin, blisters and scars that may not heal. The skin may be stained bright-yellow or yellowish brown due to the formation of xanthoproteic acid. Dilute solutions may harden the epithelium without producing overt corrosion.

**Ingestion:** Considered an unlikely route of entry in commercial/industrial environments.

The material is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal.

Even a small amount causes severe corrosion of the stomach, burning pain, vomiting and shock, possibly causing non-healing scarring of the gastrointestinal tract and stomach. Death may be delayed 12 hours to 14 days or to several months. Such late fatalities are attributed to a chemical lobular pneumonitis secondary to aspiration. Survivors show stricture of the gastric mucosa and subsequent pernicious anemia.

**Carcinogenicity:** NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

**Chronic Effects:** Prolonged or repeated overexposure to low concentrations of vapor may cause chronic bronchitis, corrosion of teeth, even chemical pneumonitis.

## Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Immediately transport to hospital or doctor. DO NOT delay.

**Skin Contact:** Immediately flush body and clothes with large amounts of water, using safety shower if available.

Quickly remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor. DO NOT delay.

**Ingestion:** Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

Immediately transport to hospital or doctor. DO NOT delay.

*After first aid, get appropriate in-plant, paramedic, or community medical support.*

**Note to Physicians:** For acute or short-term repeated exposures to strong acids:

1. Airway problems may arise from laryngeal edema and inhalation exposure.

Treat with 100% oxygen initially.

2. Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.

4. Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

**INGESTION:**

1. Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.

2. Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.

3. Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.

4. Charcoal has no place in acid management.

5. Some authors suggest the use of lavage within 1 hour of ingestion.

**SKIN:**

1. Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.

2. Deep second-degree burns may benefit from topical silver sulfadiazine.

**EYE:**

1. Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.

2. Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.

3. Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

## Section 5 - Fire-Fighting Measures

**Flash Point:** Nonflammable

**Autoignition Temperature:** Not applicable

**LEL:** Not applicable

**UEL:** Not applicable

**Extinguishing Media:** Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).

Carbon dioxide.

**General Fire Hazards/Hazardous Combustion Products:** Will not burn but increases intensity of fire.

Heating may cause expansion or decomposition leading to violent rupture of containers. Heat affected containers remain hazardous.

Contact with combustibles such as wood, paper, oil or finely divided metal may cause ignition, combustion or violent decomposition.

May emit irritating, poisonous or corrosive fumes.

Decomposes on heating and produces toxic fumes of nitrogen oxides (NO<sub>x</sub>) and nitric acid.

**Fire Incompatibility:** Oxidizing agents as a class are not necessarily combustible themselves, but can increase the risk and intensity of fire in many other substances.

Reacts vigorously with water and alkali.

Avoid reaction with organic materials/compounds, powdered metals, reducing agents and hydrogen sulfide (H<sub>2</sub>S) as ignition may result.

Reacts with metals producing flammable/explosive hydrogen gas.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

Extinguishers should be used only by trained personnel.

Use water delivered as a fine spray to control fire and cool adjacent area.

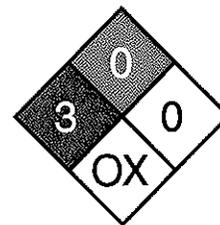
Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

If fire gets out of control withdraw personnel and warn against entry.



Fire Diamond

Equipment should be thoroughly decontaminated after use.

## Section 6 - Accidental Release Measures

**Small Spills:** Dangerous levels of nitrogen oxides may form during spills of nitric acid.

Wear fully protective PVC clothing and breathing apparatus.

Clean up all spills immediately. No smoking, bare lights, ignition sources.

Avoid all contact with any organic matter including fuel, solvents, sawdust, paper or cloth and other incompatible materials, as ignition may result.

Avoid breathing dust or vapors and all contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb spill with dry sand, earth, inert material or vermiculite. DO NOT use sawdust as fire may result.

Scoop up solid residues and seal in labeled drums for disposal.

Neutralize/decontaminate area.

Use soda ash or slaked lime to neutralize.

**Large Spills:** DO NOT touch the spill material. Restrict access to area.

Clear area of personnel and move upwind. Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

No smoking, flames or ignition sources. Increase ventilation.

Contain spill with sand, earth or other clean, inert materials.

NEVER use organic absorbents such as sawdust, paper, cloth; as fire may result. Avoid any contamination by organic matter.

Use spark-free and explosion-proof equipment.

Collect any recoverable product into labeled containers for possible recycling. DO NOT mix fresh with recovered material.

Collect residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains. Decontaminate equipment and launder all protective clothing before storage and reuse.

If contamination of drains or waterways occurs advise emergency services.

DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing mist. Do not allow clothing wet with material to stay in contact with skin.

Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area.

**WARNING:** To avoid violent reaction, ALWAYS add material to water and NEVER water to material.

Avoid smoking, bare lights or ignition sources.

Avoid contact with incompatible materials.

When handling, DO NOT eat, drink or smoke.

Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.

Launder contaminated clothing before reuse.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

**Recommended Storage Methods:** Stainless steel drum. Check that containers are clearly labeled.

Packaging as recommended by manufacturer.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** Use in a well-ventilated area.

Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection.

In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

**Personal Protective Clothing/Equipment:**

**Eyes:** Chemical goggles. Full face shield.

DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Bare unprotected skin should not be exposed to this material. Impervious, gauntlet length gloves i.e., butyl rubber gloves or Neoprene rubber gloves or wear chemical protective gloves, e.g. PVC.  
Wear safety footwear or safety gumboots, e.g. Rubber.

**Respiratory Protection:**

Exposure Range >2 to <25 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask  
Exposure Range 25 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

**Other:** Operators should be trained in procedures for safe use of this material.

- Acid-resistant overalls or Rubber apron or PVC apron.
- Ensure there is ready access to an emergency shower.
- Ensure that there is ready access to eye wash unit.
- Ensure that there is ready access to breathing apparatus.

**Glove Selection Index:**

- BUTYL ..... Best selection
- HYPALON ..... Best selection
- NEOPRENE..... Best selection
- NEOPRENE/NATURAL..... Best selection
- PE/EVAL/PE ..... Best selection
- SARANEX-23 ..... Best selection
- NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion
- NATURAL+NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion
- PVC..... Poor to dangerous choice for other than short-term immersion
- NITRILE+PVC ..... Poor to dangerous choice for other than short-term immersion

**Section 9 - Physical and Chemical Properties**

**Appearance/General Info:** Clear, colorless to slightly yellow liquid. Sharp strong odor.

**CAUTION:** exothermic dilution hazard.

**HIGHLY CORROSIVE.** Corrosive to most metals. Powerful oxidizing agent.

Darkens to brownish color on aging and exposure to light.

**Physical State:** Liquid

**Vapor Pressure (kPa):** 8.26

**Vapor Density (Air=1):** 1.5

**Formula Weight:** 63.02

**Specific Gravity (H<sub>2</sub>O=1, at 4 °C):** 1.3-1.42

**pH:** < 1

**pH (1% Solution):** 1

**Boiling Point:** 83 °C (181 °F) at 760 mm Hg

**Freezing/Melting Point:** -42 °C (-43.6 °F)

**Volatile Component (% Vol):** 100 (nominal)

**Decomposition Temperature (°C):** Not applicable

**Water Solubility:** Soluble in all proportions

**Section 10 - Stability and Reactivity**

**Stability/Polymerization/Conditions to Avoid:** Presence of heat source and direct sunlight. Storage in unsealed containers. Hazardous polymerization will not occur.

**Storage Incompatibilities:** Segregate from reducing agents, finely divided combustible materials, combustible materials, sawdust, metals and powdered metals.

Avoid contamination of water, foodstuffs, feed or seed.

Segregate from alkalis, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

**Section 11 - Toxicological Information**

**Toxicity**

Oral (human) LD<sub>50</sub>: 430 mg/kg

Inhalation (rat) LC<sub>50</sub>: 2500 ppm/1 hr

Unreported (man) LD<sub>50</sub>: 110 mg/kg

**Irritation**

Nil reported

See NIOSH, RTECS QU 5775000, for additional data.

**Section 12 - Ecological Information**

**Environmental Fate:** No data found.

**Ecotoxicity:** LC<sub>50</sub> Starfish 100-300 mg/l/48 hr /Aerated water conditions; LC<sub>50</sub> Shore crab 180 mg/l/48 hr /Static, aerated water conditions; LC<sub>50</sub> Cockle 330-1000 mg/l/48 hr /Aerated water conditions

**BCF:** no food chain concentration potential

**Biochemical Oxygen Demand (BOD):** none

**Section 13 - Disposal Considerations**

**Disposal:** Recycle wherever possible. Special hazards may exist - specialist advice may be required.  
Consult manufacturer for recycling options.  
Follow applicable federal, state, and local regulations.  
Treat and neutralize at an approved treatment plant.  
Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.  
Puncture containers to prevent reuse and bury at an authorized landfill.

**Section 14 - Transport Information****DOT Transportation Data (49 CFR 172.101):**

**Shipping Name:** NITRIC ACID  
**Hazard Class:** 8  
**ID No.:** 2031  
**Packing Group:** I  
**Label:** Corrosive[8],Oxid.Agent

**Section 15 - Regulatory Information**

**EPA Regulations:**  
**RCRA 40 CFR:** Not listed  
**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)  
**SARA 40 CFR 372.65:** Listed  
**SARA EHS 40 CFR 355:** Listed  
**RQ:** 1000 lb  
**TPQ:** 1000 lb  
**TSCA:** Listed

**Section 16 - Other Information**

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

**Section 1 - Chemical Product and Company Identification**

**61**

**Material Name:** Hydrochloric Acid

**CAS Number:** 7647-01-0

**Chemical Formula:** ClH

**Structural Chemical Formula:** HCl

**EINECS Number:** 231-595-7

**ACX Number:** X1002202-3

**Synonyms:** 4-D BOWL SANITIZER; ACIDE CHLORHYDRIQUE; ACIDO CLORHIDRICO; ACIDO CLORIDRICO; ANHYDROUS HYDROCHLORIC ACID; ANHYDROUS HYDROGEN CHLORIDE; AQUEOUS HYDROGEN CHLORIDE; BOWL CLEANER; CHLOORWATERSTOF; CHLOROHYDRIC ACID; CHLOROWODOR; CHLORURE D'HYDROGENE; CHLORURE D'HYDROGENE ANHYDRE; CHLORURO DE HIDROGENO; CHLORWASSERSTOFF; CLORURO DE HIDROGENO ANHIDRO; EMULSION BOWL CLEANER; EPA PESTICIDE CHEMICAL CODE 045901; HYDROCHLORIC ACID; HYDROCHLORIC ACID GAS; HYDROCHLORIDE; HYDROGEN CHLORIDE; HYDROGEN CHLORIDE (HCL); HYGEIA CREME MAGIC BOWL CLEANER; MURIATIC ACID; MURIATIC ACID); NOW SOUTH SAFTI-SOL BRAND CONCENTRATED BOWL CLEANSE WITHMAGIC ACTIO; PERCLEEN BOWL AND URINAL CLEANER; SPIRITS OF SALT; VARLEY'S OCEAN BLUE SCENTED TOILET BOWL CLEANER; VARLEY POLY-PAK BOWL CREME; WHITE EMULSION BOWL CLEANER; WUEST BOWL CLEANER SUPER CONCENTRATED

**General Use:** Hydrogen chloride is used to produce pharmaceutical hydrochlorides; vinyl chloride from acetylene; alkyl chlorides from olefins and arsenious chloride from arsenious oxide; electronic grade for etching semiconductor crystals. Used in the chlorination of rubber; in organic reactions involving isomerization, polymerization and alkylation; as a catalyst and condensing agent; for making chlorine where economical; in the separation of cotton from wool and cotton de-linting; as flux in the babbitt type of metal alloy; etching semi-conductor crystals. Hydrochloric acid is used for pickling and heavy duty cleaning of metal parts; rust and scale removal. The production of chlorides; neutralizing bases; a laboratory reagent. For hydrolyzing starch and proteins in preparations for food. As a catalyst and solvent in organic synthesis. As "spirits of salts" for cleaning of lime and masonry from new brickwork. As flux or flux component for soldering; manufacture of "killed spirits".

**Section 2 - Composition / Information on Ingredients**

Name	CAS	%
hydrogen chloride	7647-01-0	> 99.0

**OSHA PEL**  
Ceiling: 5 ppm, 7 mg/m<sup>3</sup>.

**NIOSH REL**  
Ceiling: 5 ppm (7 mg/m<sup>3</sup>).

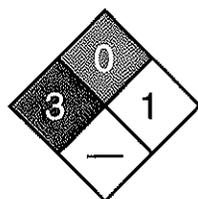
**DFG (Germany) MAK**  
TWA: 5 ppm; PEAK: 5 ppm.

**ACGIH TLV**  
Ceiling: 2 ppm.

**IDLH Level**  
50 ppm.

**EU OEL**  
TWA: 5 ppm; STEL: 10 ppm.

**Section 3 - Hazards Identification**

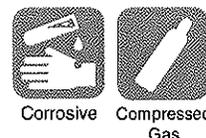


Fire Diamond

	ChemWatch Hazard Ratings				
	0	1	2	3	4
	Min	Low	Moderate	High	Extreme
Flammability					
Toxicity					
Body Contact					
Reactivity					
Chronic					

HMIS	
2	Health
0	Flammability
0	Reactivity

**ANSI Signal Word**  
**Danger!**



☆☆☆☆ **Emergency Overview** ☆☆☆☆

Colorless gas; characteristic suffocating, pungent odor. Corrosive. Stored as compressed gas which may cause frostbite. Chronic Effects: erosion of teeth.

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### Potential Health Effects

**Target Organs:** eyes, skin, respiratory system, liver (in animals)

**Primary Entry Routes:** inhalation, skin contact, eye contact

#### Acute Effects

**Inhalation:** The vapor is extremely discomforting to the upper respiratory tract, may cause severe mucous membrane damage and may be harmful if inhaled.

Inhalation of quantities of liquid mist may be extremely hazardous, even lethal due to spasm, extreme irritation of larynx and bronchi, chemical pneumonitis and pulmonary edema.

A single severe exposure may cause coughing and choking; bleeding of nose, inflammation and occasionally ulceration of the nose, throat and larynx. Fluid on the lungs followed by generalized lung damage may follow. Breathing of vapor may aggravate asthma and inflammatory or fibrotic pulmonary disease.

High concentrations cause necrosis of the tracheal and bronchial epithelium, pulmonary edema, atelectasis and emphysema and damage to the pulmonary blood vessels and liver.

Inhalation hazard is increased at higher temperatures.

The vapor from heated material is extremely discomforting to the upper respiratory tract and lungs if inhaled.

Continued severe exposure can result in pulmonary edema and corrosion of tissues in the nose and throat.

**Eye: Hydrogen Chloride:** The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

**Hydrochloric Acid:** Eye contact is extremely painful and may cause rapid corneal damage. The liquid is extremely corrosive to the eyes and is capable of causing severe damage with loss of sight.

The vapor is highly discomforting and may be corrosive to the eyes. The vapor from heated material is extremely discomforting to the eyes.

**Skin:** The material is corrosive to the skin and may cause chemical burns.

Toxic effects may result from skin absorption. Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.

The vapor is discomforting to the skin.

**Ingestion:** Considered an unlikely route of entry in commercial/industrial environments.

The liquid is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal if swallowed in quantity. Ingestion may result in nausea, abdominal irritation, pain and vomiting.

**Carcinogenicity:** NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

**Chronic Effects:** Chronic exposure may cause discoloration or erosion of the teeth, bleeding of the nose and gums; and ulceration of the nasal mucous membranes.

Repeated exposures of animals to concentrations of about 34 ppm produced no immediate toxic effects.

Workers exposed to hydrochloric acid suffered from gastritis and a number of cases of chronic bronchitis have also been reported.

Repeated or prolonged exposure to dilute solutions may cause dermatitis. Repeated exposure to low vapor concentrations can cause skin tenderness, bleeding of the nose and gums, chronic bronchitis, gastritis.

### Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately flush body and clothes with large amounts of water, using safety shower if available.

Quickly remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

**Ingestion:** Contact a Poison Control Center. Rinse mouth out with plenty of water. Do NOT induce vomiting. Give a glass of water.

*After first aid, get appropriate in-plant, paramedic, or community medical support.*

**Note to Physicians:** For acute or short-term repeated exposures to strong acids:

1. Airway problems may arise from laryngeal edema and inhalation exposure.

Treat with 100% oxygen initially.

2. Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

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DOT  
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- Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
- Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

**INGESTION:**

- Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
- Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
- Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
- Charcoal has no place in acid management.
- Some authors suggest the use of lavage within 1 hour of ingestion.

**SKIN:**

- Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- Deep second-degree burns may benefit from topical silver sulfadiazine.

**EYE:**

- Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
- Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
- Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

### Section 5 - Fire-Fighting Measures

**Flash Point:** Nonflammable**Autoignition Temperature:** Not applicable**LEL:** Not applicable**UEL:** Not applicable**Extinguishing Media:** Water spray or fog; foam;

Bromochlorodifluoromethane (BCF) (where regulations permit); Dry agent; Carbon dioxide.

**General Fire Hazards/Hazardous Combustion Products:** Noncombustible liquid. Will not burn, but heat produces highly toxic fumes/vapors.

Heating may cause expansion or decomposition leading to violent rupture of containers.

Decomposes on heating and produces toxic fumes of hydrogen chloride. Decomposition may produce toxic fumes of chlorine.

Reacts with metals producing flammable/explosive hydrogen gas. Contact with moisture or water may generate heat causing ignition. Reacts vigorously with alkalis. Moderate fire hazard when in contact with reducing agents.

**Fire Incompatibility:** Reacts with metals producing flammable/explosive hydrogen gas.

Avoid reactions with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate, unsaturated organics, metal acetylides, sulphuric acid.

Note: Compatibility with plastics should be confirmed prior to use.

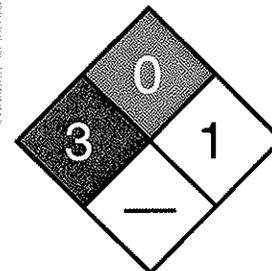
**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.

Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire. Equipment should be thoroughly decontaminated after use.

Water spray or fog may be used to disperse vapor. Do not approach cylinders suspected to be hot. If safe to do so, stop flow of gas.

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Fire Diamond

### Section 6 - Accidental Release Measures

**Small Spills:** DO NOT touch the spill material. Clean up all spills immediately. Wear fully protective PVC clothing and breathing apparatus. Contain and absorb spill with sand, earth, inert material or vermiculite. Use soda ash or slaked lime to neutralize. Collect residues and place in labeled plastic containers with vented lids. Clear area of personnel and move upwind. Avoid breathing vapors and contact with skin and eyes. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Water spray or fog may be used to disperse vapor.

**Large Spills:** Contact fire department and tell them location and nature of hazard. Clear area of personnel and move upwind. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Stop leak if safe to do so. Remove leaking cylinders to a safe place if possible. Release pressure under safe, controlled conditions by opening the valve. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Shut off all possible sources of ignition and increase ventilation. Water spray or fog may be used to disperse vapor. Use soda ash or slaked lime to neutralize. Collect and seal in labeled drums for disposal. Wash spill area with large quantities of water. If contamination of

See  
DOT  
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drains or waterways occurs, advise emergency services. After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing. DO NOT touch the spill material. Contain and absorb spill with sand, earth, inert material or vermiculite.

DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing mist and vapor, breathing vapors and contact with skin and eyes.

Avoid physical damage to containers. Use in a well-ventilated area. Wear protective clothing and gloves when handling containers. Handle and open container with care.

**WARNING:** To avoid violent reaction, ALWAYS add material to water and NEVER water to material. When handling, DO NOT eat, drink or smoke. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupational work practices. Observe manufacturer's storing and handling recommendations.

Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Local exhaust ventilation may be required for safe working, i.e. to keep exposures below required standards; otherwise, PPE is required.

Keep dry. Reacts violently with water.

Transport containers on a trolley. Avoid sources of heat. DO NOT transfer gas from one cylinder to another.

**Recommended Storage Methods:** Packaging as recommended by manufacturer. Check that containers are clearly labeled.

Cylinder. Ensure the use of equipment rated for cylinder pressure. Ensure the use of compatible materials of construction. Valve protection cap to be in place until cylinder is secured, connected. Cylinder must be properly secured either in use or in storage. Cylinder valve must be closed when not in use or when empty. Segregate full from empty cylinders. **WARNING:** Suckback into cylinder may result in rupture. Use back-flow preventive device in piping.

Hydrochloric acid: Packs of 2.5 litres or less require a child-resistant closure. Glass container or Plastic carboy or Polylined drum.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** If risk of overexposure exists, wear air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas. Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

If risk of inhalation or overexposure exists, wear NIOSH-approved respirator or work in fume hood. Hydrogen chloride vapors will not be adequately absorbed by organic vapor respirators.

### Personal Protective Clothing/Equipment:

**Eyes:** Chemical goggles. Full face shield.

DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Neoprene gloves; rubber gloves. Nitrile gloves.

Safety footwear. Rubber boots.

Hydrochloric acid: Barrier cream and Neoprene gloves or Elbow length PVC gloves. Nitrile gloves.

PVC boots or PVC safety gumboots.

### Respiratory Protection:

Exposure Range >5 to <50 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range 50 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: white

**Other:** Ensure there is ready access to a safety shower; Eyewash unit.

Acid-resistant overalls. Full protective suit. Operators should be trained in procedures for safe use of this material.

### Glove Selection Index:

BUTYL .....	Best selection
BUTYL/NEOPRENE .....	Best selection
HYPALON .....	Best selection
NEOPRENE.....	Best selection
NEOPRENE/NATURAL.....	Best selection
NITRILE+PVC .....	Best selection
PE/EVAL/PE .....	Best selection
SARANEX-23 .....	Best selection
VITON/NEOPRENE .....	Best selection
PVC.....	Best selection

NITRILE..... Best selection  
 NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion  
 NATURAL+NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion  
 NAT+NEOPR+NITRILE ..... Poor to dangerous choice for other than short-term immersion

### Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Hydrogen chloride: Colorless, corrosive gas. Pungent suffocating odor. White fumes in moist air. Soluble in methanol, ethanol, ether and benzene.

Hydrochloric acid: Clear to light yellow (orange tint for inhibited grades) fuming corrosive liquid with sharp, suffocating odor.

**Physical State:** Hydrogen chloride: Compressed gas;  
 Hydrochloric acid: Liquid

**pH:** Hydrochloric acid: < 1

**Boiling Point:** -85 °C (-121 °F)

**Odor Threshold:** 0.26 to 0.3 ppm

**Freezing/Melting Point:** -114.44 °C (-173.992 °F)

**Vapor Pressure (kPa):** < 24.8 at 25 °C

**Volatile Component (% Vol):** 100

**Vapor Density (Air=1):** 1.268 at 20 °C

**Decomposition Temperature (°C):** Not applicable

**Formula Weight:** 36.461

**Water Solubility:** 56.1 g/100 cc hot water at 60 °C

**Specific Gravity (H<sub>2</sub>O=1, at 4 °C):** < 1.19 at 20 °C

**Evaporation Rate:** Slow

### Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Decomposes in the presence of moisture to produce corrosive acid. May generate sufficient heat to ignite combustible materials. Presence of heat source and direct sunlight (ultra-violet radiation). Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

**Storage Incompatibilities:** Hydrogen chloride: Segregate from most common metals and their alloys, alkalis, unsaturated organics, fluorine, metal carbides, metal acetylides, potassium permanganate and sulfuric acid. Compatibility with plastics should be confirmed prior to use.

Hydrochloric acid: Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates. Avoid storage with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate. Reacts with zinc, brass, galvanized iron, aluminum, copper and copper alloys.

### Section 11 - Toxicological Information

#### Toxicity

Inhalation (human) LC<sub>50</sub>: 1300 ppm/30 m

Inhalation (human) LC<sub>10</sub>: 3000 ppm/5 m

Inhalation (rat) LC<sub>50</sub>: 3124 ppm/60 m

Inhalation (rat) LC<sub>50</sub>: 4701 ppm/30 m

Oral (rat) LD<sub>50</sub>: 900 mg/kg

#### Irritation

Eye (rabbit): 5 mg/30 s - mild

See RTECS MW 4025000, for additional data.

### Section 12 - Ecological Information

**Environmental Fate:** No data found.

**Ecotoxicity:** TL<sub>m</sub> Gambusia affinis (mosquito fish) 282 ppm/96 hr (fresh water) /Conditions of bioassay not specified; Lethal Lepomis macrochirus (bluegill sunfish) 3.6 mg/l/48 hr /Conditions of bioassay not specified; LC<sub>50</sub> Cockerle 330 to 1,000 mg/l/48 hr /Conditions of bioassay not specified; LC<sub>50</sub> Carassius auratus (goldfish) 178 mg/l (1 to 2 hr survival time) /Conditions of bioassay not specified; LC<sub>50</sub> Shore crab 240 mg/l/48 hr /Conditions of bioassay not specified; LC<sub>50</sub> Shrimp 100 to 330 ppm/48 hr (salt water) /Conditions of bioassay not specified; LC<sub>100</sub> Trout 10 mg/l 24 hr /Conditions of bioassay not specified

**Biochemical Oxygen Demand (BOD):** none

### Section 13 - Disposal Considerations

**Disposal:** Recycle wherever possible. Consult manufacturer for recycling options. Treat and neutralize at an effluent treatment plant. Bury residue in an authorized landfill. Decontaminate empty containers with a lime slurry. Return empty containers to supplier or bury empty containers at an authorized landfill.  
 Return empty cylinders to supplier.

## Section 14 - Transport Information

### DOT Hazardous Materials Table Data (49 CFR 172.101):

**Note:** This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

**Shipping Name and Description:** Hydrogen chloride, anhydrous

**ID:** UN1050

**Hazard Class:** 2.3 - Poisonous gas

**Packing Group:**

**Symbols:**

**Label Codes:** 2.3 - Poison Gas, 8 - Corrosive

**Special Provisions:** 3

**Packaging:**      **Exceptions:** None      **Non-bulk:** 304      **Bulk:** None

**Quantity Limitations:**      **Passenger aircraft/rail:** Forbidden      **Cargo aircraft only:** Forbidden

**Vessel Stowage:**      **Location:** D      **Other:** 40



**Shipping Name and Description:** Hydrochloric acid

**ID:** UN1789

**Hazard Class:** 8 - Corrosive material

**Packing Group:** II - Medium Danger

**Symbols:**

**Label Codes:** 8 - Corrosive

**Special Provisions:** A3, A6, B3, B15, IB2, N41, T8, TP2, TP12

**Packaging:**      **Exceptions:** 154      **Non-bulk:** 202      **Bulk:** 242

**Quantity Limitations:**      **Passenger aircraft/rail:** 1 L      **Cargo aircraft only:** 30 L

**Vessel Stowage:**      **Location:** C      **Other:**



**Shipping Name and Description:** Hydrochloric acid

**ID:** UN1789

**Hazard Class:** 8 - Corrosive material

**Packing Group:** III - Minor Danger

**Symbols:**

**Label Codes:** 8 - Corrosive

**Special Provisions:** IB3, T4, TP1, TP12

**Packaging:**      **Exceptions:** 154      **Non-bulk:** 203      **Bulk:** 241

**Quantity Limitations:**      **Passenger aircraft/rail:** 5 L      **Cargo aircraft only:** 60 L

**Vessel Stowage:**      **Location:** C      **Other:**



## Section 15 - Regulatory Information

### EPA Regulations:

**RCRA 40 CFR:** Not listed

**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4) 5000 lb (2268 kg)

**SARA 40 CFR 372.65:** Listed

**SARA EHS 40 CFR 355:** Listed

**RQ:** 5000 lb

**TPQ:** 500 lb

**TSCA:** Listed

## Section 16 - Other Information

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

**Section 1 - Chemical Product and Company Identification 54/60**

**Material Name:** Sulfuric Acid **CAS Number:** 7664-93-9  
**Chemical Formula:** H<sub>2</sub>O<sub>4</sub>S  
**Structural Chemical Formula:** H<sub>2</sub>SO<sub>4</sub>  
**EINECS Number:** 231-639-5  
**ACX Number:** X1002217-4  
**Synonyms:** ACIDE SULFURIQUE; ACIDO SOLFORICO; ACIDO SULFURICO; BATTERY ACID; BOV; DIHYDROGEN SULFATE; DIPPING ACID; ELECTROLYTE ACID; EPA PESTICIDE CHEMICAL CODE 078001; HYDROGEN SULFATE; MATTLING ACID; OIL OF VITRIOL; SCHWEFELSAEURELOESUNGEN; SULFURIC ACID; SULFURIC ACID (AQUEOUS); SULFURIC ACID, SPENT; SULPHURIC ACID; VITRIOL BROWN OIL; ZWAVELZUUROPFLOSSINGEN  
**General Use:** The manufacture of superphosphate fertilizer, inorganic and petro-chemicals, explosives and pigments. Component of heavy duty metal cleaners, pickles. In manufacture of rayon, cellulose film. As battery electrolyte and also in electroplating processes.

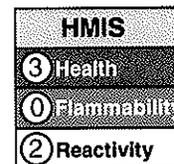
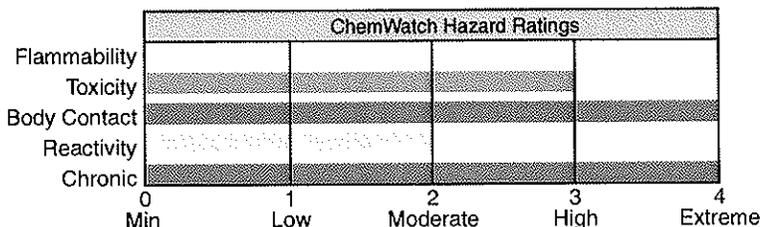
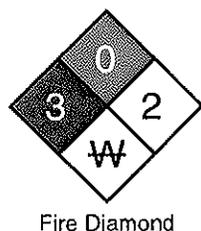
**Section 2 - Composition / Information on Ingredients**

Name	CAS	%
sulfuric acid	7664-93-9	>51
water	7732-18-5	remainder

<b>OSHA PEL</b> TWA: 1 mg/m <sup>3</sup> .	<b>NIOSH REL</b> TWA: 1 mg/m <sup>3</sup> .	<b>DFG (Germany) MAK</b> TWA: 0.1 mg/m <sup>3</sup> ; PEAK: 0.1 mg/m <sup>3</sup> ; Ceiling: 0.2 mg/m <sup>3</sup> ; measured as inhalable fraction of the aerosol.
<b>ACGIH TLV</b> TWA: 1 mg/m <sup>3</sup> ; STEL: 3 mg/m <sup>3</sup> ; A2 = as contained in strong inorganic acid mists.	<b>IDLH Level</b> 15 mg/m <sup>3</sup> .	

**Section 3 - Hazards Identification**



**ANSI Signal Word**  
**Danger!**



☆☆☆☆☆ **Emergency Overview** ☆☆☆☆☆  
 Colorless to dark-brown, oily, odorless liquid. Corrosive. Other Acute Effects: blindness. Chronic Effects: tooth erosion, GI disturbances, dermatitis. Reaction with water produces excessive heat.

**Potential Health Effects**

**Target Organs:** respiratory system, eyes, skin, teeth

**Primary Entry Routes:** inhalation, skin contact, eye contact

**Acute Effects**

**Inhalation:** The vapor is extremely discomforting to the upper respiratory tract and is capable of causing severe mucous membrane irritation, upper respiratory tract inflammation.

Exposure to high concentrations causes bronchitis and is characterized by the onset of hemorrhagic pulmonary edema.

Mists are highly irritating to eyes, mucous membranes and respiratory tract and high mist concentrations may lead to pulmonary edema.

**Eye:** HIGHLY CORROSIVE The liquid is extremely corrosive to the eyes and any contact may cause rapid tissue destruction and is capable of causing severe damage with loss of sight.

The mist is highly corrosive and contact may cause rapid tissue destruction.

The vapor is extremely discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

**Skin:** HIGHLY CORROSIVE. The liquid is extremely corrosive to the skin and any contact may cause rapid tissue destruction with severe burns.

The mist is highly discomforting to the skin and may cause deep ulceration to body tissue.

Topical application of a 10% solution to skin on the scapula or waist produces only negligible evidence of irritation.

**Ingestion:** HIGHLY CORROSIVE and Considered toxic by all exposure routes.

The liquid is extremely corrosive and may rapidly cause severe burns to the gastrointestinal tract and may be fatal if swallowed in quantity.

Considered an unlikely route of entry in commercial/industrial environments.

**Carcinogenicity:** NTP - Not listed; IARC - Group 1, Carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A2, Suspected human carcinogen; EPA - Not listed; MAK - Not listed.

**Chronic Effects:** Repeated minor exposure to mists can cause erosion of teeth and inflammation of the upper respiratory tract leading to chronic bronchitis.

Repeated skin contact with dilute solutions may cause dermatitis.

Lungs of sulfuric acid plant workers appear to be less affected than the lungs of workers exposed to "dust".

There is evidence that the corrosion of tooth enamel occurs at 1 mg/m<sup>3</sup> but that acclimatized workers could tolerate three to four times that level. Forming room workers in a battery factory exposed to 3 to 16 mg/m<sup>3</sup> sulfuric acid mist concentrations exhibited the most serious signs of erosion whilst charging room workers exposed to 0.08 to 2.5 mg/m<sup>3</sup> were affected to a lesser degree.

Workers chronically exposed to sulfuric acid mists may show various skin lesions, tracheobronchitis, stomatitis, conjunctivitis and gastritis.

Increased risk of laryngeal cancer is associated with chronic exposures.

## Section 4 - First Aid Measures

**Inhalation:** Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

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**Eye Contact:** Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**Skin Contact:** Immediately flush body and clothes with large amounts of water, using safety shower if available.

Quickly remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

DO NOT attempt to neutralize burns with alkaline solutions.

**Ingestion:** Rinse mouth out with plenty of water.

Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

*After first aid, get appropriate in-plant, paramedic, or community medical support.*

**Note to Physicians:** For acute or short-term repeated exposures to strong acids:

1. Airway problems may arise from laryngeal edema and inhalation exposure.

Treat with 100% oxygen initially.

2. Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.

4. Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

**INGESTION:**

1. Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.

2. Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.

3. Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.

4. Charcoal has no place in acid management.

5. Some authors suggest the use of lavage within 1 hour of ingestion.

**SKIN:**

- 1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
- 2.Deep second-degree burns may benefit from topical silver sulfadiazine.

**EYE:**

- 1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
- 2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
- 3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

**Section 5 - Fire-Fighting Measures****Flash Point:** Nonflammable**Autoignition Temperature:** Not applicable**LEL:** Not applicable**UEL:** Not applicable**Extinguishing Media:** Use extinguishing media suitable for surrounding area. Water spray or fog, from a safe distance only.**General Fire Hazards/Hazardous Combustion Products:** HIGHLY CORROSIVE.

Noncombustible liquid. Reacts vigorously with water.

Heating may cause expansion or decomposition leading to violent rupture of containers.

Contact with readily oxidizable organic material may cause ignition /fire.

Reacts with metals producing flammable/explosive hydrogen gas.

Decomposes on heating and produces acrid and toxic fumes of sulfur oxides (SO<sub>x</sub>).**Fire Incompatibility:** Reacts with mild steel, galvanized steel/zinc producing hydrogen gas which may form an explosive mixture with air.

Contact with readily oxidizable organic material may cause ignition /fire.

Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous.

**Fire-Fighting Instructions:** Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Use water delivered as a fine spray to control fire and cool adjacent area.

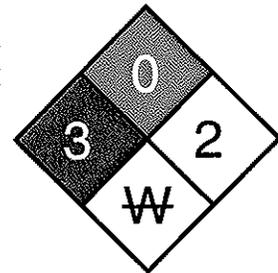
Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

Equipment should be thoroughly decontaminated after use.

See  
DOT  
ERG

Fire Diamond

**Section 6 - Accidental Release Measures****Small Spills:** Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Wipe up. Place in a suitable labeled container for waste disposal.

Use soda ash or slaked lime to neutralize.

**Large Spills:** DO NOT touch the spill material. Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Stop leak if safe to do so.

Contain spill with sand, earth or vermiculite.

Collect recoverable product into labeled containers for recycling.

Neutralize/decontaminate residue.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

If contamination of drains or waterways occurs, advise emergency services.

**DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.****Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).See  
DOT  
ERG

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid generating and breathing mist. Avoid all personal contact, including inhalation. Wear protective clothing when risk of exposure occurs. Use in a well-ventilated area.

**WARNING:** To avoid violent reaction, ALWAYS add material to water and NEVER water to material. Avoid smoking, bare lights or ignition sources. Avoid contact with incompatible materials. When handling, DO NOT eat, drink or smoke. Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Launder contaminated clothing before reuse. Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

**Recommended Storage Methods:** Glass carboy. Glass container is suitable for laboratory quantities. Plastic carboy. Polylined drum. Check that containers are clearly labeled. Packaging as recommended by manufacturer. DO NOT use mild steel or galvanized containers.

**Regulatory Requirements:** Follow applicable OSHA regulations.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** Use in a well-ventilated area. General exhaust is adequate under normal operating conditions. Local exhaust ventilation may be required in special circumstances. If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection. Provide adequate ventilation in warehouses and enclosed storage areas.

**Personal Protective Clothing/Equipment:**

**Eyes:** Chemical goggles. Full face shield. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

**Hands/Feet:** Wear chemical protective gloves, eg. PVC. Wear safety footwear or safety gumboots, eg. Rubber.

**Respiratory Protection:**

Exposure Range >1 to 10 mg/m<sup>3</sup>: Air Purifying, Negative Pressure, Half Mask  
 Exposure Range >10 to <15 mg/m<sup>3</sup>: Air Purifying, Negative Pressure, Full Face  
 Exposure Range 15 to unlimited mg/m<sup>3</sup>: Self-contained Breathing Apparatus, Pressure Demand, Full Face  
 Cartridge Color: white with dust/mist prefilter (use P100 or consult supervisor for appropriate dust/mist prefilter)

**Other:** Overalls. PVC apron. PVC protective suit may be required if exposure severe. Eyewash unit. Ensure there is ready access to a safety shower.

**Glove Selection Index:**

NATURAL RUBBER..... Best selection  
 NATURAL+NEOPRENE..... Best selection  
 NEOPRENE..... Best selection  
 NEOPRENE/NATURAL..... Best selection  
 NITRILE..... Best selection  
 PE..... Best selection  
 PVC..... Best selection  
 SARANEX-23..... Best selection

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Colorless, oily, dense, HIGHLY CORROSIVE liquid. Faint acid odor. Material is a powerful oxidizing and dehydrating agent causing rapid human tissue destruction on contact. Concentrated acid is very exothermic (generates heat) when mixed with water.

**DANGER:** Adding water to acid will cause violent steam explosion, scattering corrosive acid. Always add acid slowly to water.

Mixes with alcohol in all proportions. Available in technical, pure and analytical grades

<b>Physical State:</b> Liquid	<b>pH:</b> < 1
<b>Vapor Pressure (kPa):</b> 0.133 at 146 °C	<b>pH (1% Solution):</b> 1
<b>Vapor Density (Air=1):</b> 3.40	<b>Boiling Point:</b> About 290 °C (554 °F)
<b>Formula Weight:</b> 98.07	<b>Freezing/Melting Point:</b> 10.36 °C (50.648 °F)
<b>Specific Gravity (H<sub>2</sub>O=1, at 4 °C):</b> 1.6-1.84 at 15 °C	<b>Decomposition Temperature (°C):</b> 340
<b>Evaporation Rate:</b> Non Vol. at 38 °C	<b>Water Solubility:</b> Soluble in water

## Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Product is considered stable. Hazardous polymerization will not occur.

**Storage Incompatibilities:** Segregate from alkalis, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

Reacts vigorously with water and alkali.

Contact with readily oxidizable organic material may cause ignition /fire.

Avoid contamination of water, foodstuffs, feed or seed.

## Section 11 - Toxicological Information

### Toxicity

Oral (rat) LD<sub>50</sub>: 2140 mg/kg

Inhalation (rat) LC<sub>50</sub>: 510 mg/m<sup>3</sup>/2h

Inhalation (human) TC<sub>Lo</sub>: 3 mg/m<sup>3</sup>/24w

### Irritation

Eye (rabbit): 1.38 mg SEVERE

Eye (rabbit): 5 mg/30sec SEVERE

See RTECS WS 5600000, for additional data.

## Section 12 - Ecological Information

**Environmental Fate:** No data found.

**Ecotoxicity:** TL<sub>m</sub> Lepomis macrochirus (bluegill) 24.5 ppm/24 hr fresh water /Conditions of bioassay not specified; LC<sub>50</sub> Flounder 100 to 330 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC<sub>50</sub> Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC<sub>50</sub> Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified

**BCF:** no food chain concentration potential

**Biochemical Oxygen Demand (BOD):** none

## Section 13 - Disposal Considerations

**Disposal:** Recycle wherever possible or consult manufacturer for recycling options.

Follow applicable federal, state, and local regulations.

Treat and neutralize at an effluent treatment plant.

Use soda ash or slaked lime to neutralize.

Recycle containers, otherwise dispose of in an authorized landfill.

Bury residue in an authorized landfill.

## Section 14 - Transport Information

### DOT Hazardous Materials Table Data (49 CFR 172.101):

**Shipping Name and Description:** Sulfuric acid with more than 51 percent acid

**ID:** UN1830

**Hazard Class:** 8 - Corrosive material

**Packing Group:** II - Medium Danger

**Symbols:**

**Label Codes:** 8 - Corrosive

**Special Provisions:** A3, A7, B3, B83, B84, IB2, N34, T8, TP2, TP12

**Packaging:** Exceptions: 154 Non-bulk: 202 Bulk: 242

**Quantity Limitations:** Passenger aircraft/rail: 1 L Cargo aircraft only: 30 L

**Vessel Stowage:** Location: C Other: 14



## Section 15 - Regulatory Information

### EPA Regulations:

**RCRA 40 CFR:** Not listed

**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)

**SARA 40 CFR 372.65:** Listed

**SARA EHS 40 CFR 355:** Listed

**RQ:** 1000 lb

**TPQ:** 1000 lb

**TSCA:** Listed

**Section 16 - Other Information**

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.



**Section 1 - Chemical Product and Company Identification 51/58**

**Material Name:** Methanol **CAS Number:** 67-56-1  
**Chemical Formula:** CH<sub>3</sub>O  
**Structural Chemical Formula:** CH<sub>3</sub>OH  
**EINECS Number:** 200-659-6  
**ACX Number:** X1001287-2

**Synonyms:** ALCOHOL, METHYL; ALCOOL METHYLIQUE; ALCOOL METILICO; CARBINOL; X-CIDE 402 INDUSTRIAL BACTERICIDE; COAT-B1400; COLONIAL SPIRIT; COLONIAL SPIRITS; COLUMBIAN SPIRIT; COLUMBIAN SPIRITS; EPA PESTICIDE CHEMICAL CODE 053801; EUREKA PRODUCTS CRIOSINE DISINFECTANT; EUREKA PRODUCTS, CRIOSINE; FREERS ELM ARRESTER; IDEAL CONCENTRATED WOOD PRESERVATIVE; METANOL; METANOLO; METHANOL; METHYL ALCOHOL; METHYL HYDRATE; METHYL HYDROXIDE; METHYLALKOHOL; METHYLOL; METYLOWY ALKOHOL; MONOHYDROXYMETHANE; PMC REJEX-IT F-40ME; PYROLIGNEOUS SPIRIT; PYROXYLIC SPIRIT; PYROXYLIC SPIRITS; SURFLO-B17; WILBUR-ELLIS SMUT-GUARD; WOOD ALCOHOL; WOOD NAPHTHA; WOOD SPIRIT

**Derivation:** Prepared by wood pyrolysis; non-catalytic oxidation of hydrocarbons; as a by-product in the fisher-tropsch synthesis; or by reduction of carbon monoxide.

**General Use:** Used as an industrial solvent; starting material for organic synthesis; antifreeze for windshield washer fluid; in fuel antifreezes; gasoline octane booster; fuel for stoves; extractant for oils; denaturing ethanol; softening agent; food additive; in paint, varnish removers, and embalming fluids; in the manufacture of photographic film, celluloid, textile soap, wood stains, coated fabrics, shatterproof glass, paper coating, waterproofing formulations, artificial leather, dyes.

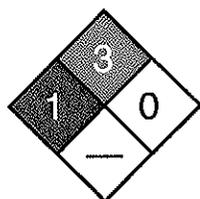
**Section 2 - Composition / Information on Ingredients**

Name	CAS	%
Methanol	67-56-1	ca 100% vol

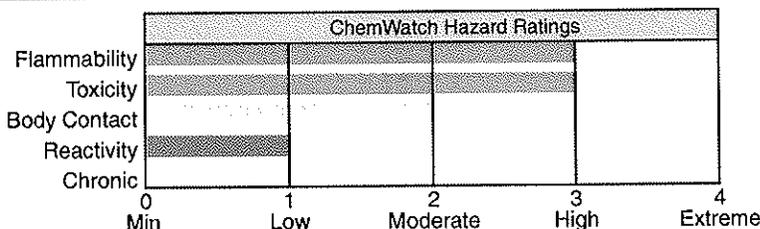
**Trace Impurities:** (Grade A): Acetone and aldehydes < 30 ppm, acetic acid < 30 ppm

OSHA PEL	NIOSH REL	DFG (Germany) MAK
TWA: 200 ppm; 260 mg/m <sup>3</sup> .	TWA: 200 ppm, 260 mg/m <sup>3</sup> ; STEL: 250 ppm, 325 mg/m <sup>3</sup> ; skin.	TWA: 200 ppm; PEAK: 800 ppm; skin.
<b>OSHA PEL Vacated 1989 Limits</b> TWA: 200 ppm; 260 mg/m <sup>3</sup> ; STEL: 250 ppm; 325 mg/m <sup>3</sup> .	<b>IDLH Level</b> 6000 ppm.	
<b>ACGIH TLV</b> TWA: 200 ppm; STEL: 250 ppm; skin.		

**Section 3 - Hazards Identification**



Fire Diamond



HMIS	
2	Health
3	Flammability
0	Reactivity

**ANSI Signal Word**  
**Warning!**



Flammable

☆☆☆☆☆ **Emergency Overview** ☆☆☆☆☆

Methanol is a colorless liquid with a slight alcohol odor when pure, or disagreeably pungent odor when crude. It is irritating to the eyes, skin, and respiratory tract. Exposure may result in headache, visual disturbance, blindness, and respiratory failure. Reproductive effects have been reported in animal testing. This flammable liquid is a moderate explosion hazard. When heated to decomposition, methanol emits carbon oxides (CO<sub>x</sub>), formaldehyde, acrid smoke, and irritating fumes.

**Potential Health Effects**

**Target Organs:** Eyes, skin, central nervous system (CNS), gastrointestinal (GI) tract, respiratory system

**Primary Entry Routes:** Inhalation, ingestion, skin and/or eye contact/absorption

**Acute Effects**

**Inhalation:** Irritation, breathing difficulty, headache, drowsiness, vertigo, light-headedness, nausea, vomiting, acidosis (decreased blood alkalinity), visual disturbance, and at high concentrations, CNS damage, convulsions, circulatory collapse, respiratory failure, coma and blindness can result from inhalation of methanol vapor. Concentration  $\geq$  200 ppm may cause headache; 50,000 ppm can cause death within 1-2 hrs.

**Eye:** Contact with liquid may result in irritation, inflamed lids, light sensitization, and superficial lesions.

**Skin:** Contact may cause irritation, dermatitis, swelling, scaling, and systemic effects listed under inhalation.

**Ingestion:** GI irritation and systemic effects (see Inhalation). Symptoms may be delayed 18-48 hours. Fatal dose - 2 to 8 ounces.

**Carcinogenicity:** NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

**Medical Conditions Aggravated by Long-Term Exposure:** None reported.

**Chronic Effects:** Exposure to methanol vapors has caused conjunctivitis, headache, giddiness, insomnia, GI disturbance, impaired vision. CNS damage is also likely. Methanol is slowly eliminated from the body; exposure is considered cumulative over the short term.

**Section 4 - First Aid Measures**

**Inhalation:** Remove exposed person to fresh air and support breathing as needed.

**Eye Contact:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation develops.

**Skin Contact:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

**Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

**After first aid, get appropriate in-plant, paramedic, or community medical support.**

**Note to Physicians:** Follow emesis with rehydration, correction of acidosis, and folate to enhance formate oxidation.

Consider IV administration of ethanol (if blood methanol  $>20$  mg/dL) to show metabolic oxidation of methanol. Assay formic acid in urine, blood pH and plasma bicarbonate.

**Section 5 - Fire-Fighting Measures**

**Flash Point:** 54 °F (12 °C), Closed Cup

**Burning Rate:** 1.7 mm/min

**Autoignition Temperature:** 867 °F (464 °C)

**LEL:** 6.0% v/v

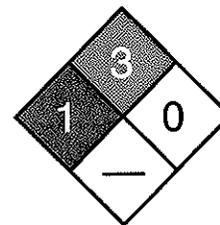
**UEL:** 36% v/v

**Flammability Classification:** OSHA Class IB Flammable Liquid.

**Extinguishing Media:** Use dry chemical, carbon dioxide, water spray, fog or alcohol-resistant foam. A water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.

**General Fire Hazards/Hazardous Combustion Products:** Heating methanol to decomposition can produce carbon oxides (CO<sub>x</sub>), formaldehyde, acrid smoke, and irritating fumes. Can form explosive mixtures in the air. The heavier-than-air vapors of methanol may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire.

**Fire-Fighting Instructions:** *Do not* scatter material with any more water than needed to extinguish fire. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Fire Diamond

## Section 6 - Accidental Release Measures

**Spill/Leak Procedures:** Isolate spill area for at least 330-660 feet (100-200 m) in all directions. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors.

**Small Spills:** Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Use clean non-sparking tools to collect absorbed material.

**Large Spills:** Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Ground all equipment. Use non-sparking tools.

**Regulatory Requirements:** Follow applicable OSHA regulations (29 CFR 1910.120).

## Section 7 - Handling and Storage

**Handling Precautions:** Avoid vapor inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves, goggles, and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

**Recommended Storage Methods:** Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

**Regulatory Requirements:** Follow applicable OSHA regulations. Also 29 CFR 1910.106 for Class 1B Flammable Liquids.

## Section 8 - Exposure Controls / Personal Protection

**Engineering Controls:** To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

**Administrative Controls:** Enclose operations and/or provide local explosion-proof exhaust ventilation at the site of chemical release. Where possible, transfer methanol from drums or other storage containers to process containers. Minimize sources of ignition in surrounding areas.

**Personal Protective Clothing/Equipment:** Wear chemically protective gloves, boots, aprons, and gauntlets of butyl rubber, Teflon, Viton, Saranex, 4H, Responder, Trelchem HPS, or Tychem 10000 (Breakthrough Time (BT) >8 hr) to prevent skin contact. Natural rubber, neoprene, nitrile rubber, polyethylene, polyvinyl alcohol and CPF 3 may degrade after contact and are not recommended. Wear splash-proof chemical safety goggles, and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

**Respiratory Protection:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For concentrations  $\leq$  2000 ppm, use a supplied air respirator;  $\leq$  5000 ppm, supplied air (SA) respirator in continuous flow mode;  $\leq$  6000 ppm, SA respirator with tight-fitting face mask operated in continuous flow mode, or SCBA with full facepiece, or SA respirator with full facepiece;  $>$  IDLH/unknown/emergency, SCBA with full facepiece operated in pressure-demand or other positive-pressure mode, or SA respirator with full facepiece operated in pressure-demand or other positive-pressure mode. For escape, use an appropriate escape-type SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

**Other:** Separate contaminated work clothes from street clothes. Launder before re-use. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

## Section 9 - Physical and Chemical Properties

**Appearance/General Info:** Colorless; slight alcohol odor when pure, disagreeably pungent odor when crude.

**Physical State:** Liquid

**Vapor Pressure (kPa):** 127 mm Hg at 77 °F (25 °C)

**Vapor Density (Air=1):** 1.11

**Bulk Density:** 6.59 lbs/gal at 68 F (20 °C)

**Formula Weight:** 32.04

**Density:** 0.796 g/mL at 59 °F (15 °C)

**Specific Gravity (H<sub>2</sub>O=1, at 4 °C):** 0.81 at 0 °C/4 °C

**Refractive Index:** 1.3292 at 68 °F (20 °C)

**pH:** Slightly acidic

**Boiling Point:** 148 °F (64.7 °C) at 760 mm Hg

**Freezing/Melting Point:** -144.04 °F (-97.8 °C)**Viscosity:** 0.614 mPa sec**Surface Tension:** 22.61 dynes/cm**Ionization Potential (eV):** 10.84 eV**Water Solubility:** Miscible**Other Solubilities:** Ethanol, acetone, benzene, chloroform, DMSO, ether, ketones, most organic solvents.

### Section 10 - Stability and Reactivity

**Stability/Polymerization/Conditions to Avoid:** Methanol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Vapor inhalation, oxidizers.

**Storage Incompatibilities:** Include beryllium dihydride, metals (potassium, magnesium), oxidants (barium perchlorate, bromine, chlorine, hydrogen peroxide, sodium hypochlorite, phosphorus trioxide), potassium tertbutoxide, carbon tetrachloride and metals, chloroform and heat, diethyl zinc, alkyl aluminum salts, acetyl bromide, chloroform and sodium hydroxide, cyanuric chloride, nitric acid, chromic anhydride, lead perchlorate.

**Hazardous Decomposition Products:** Thermal oxidative decomposition of methanol can produce carbon oxides (CO<sub>x</sub>), formaldehyde, acrid smoke, and irritating fumes.

### Section 11 - Toxicological Information

#### Acute Oral Effects:

Rat, oral, LD<sub>50</sub>: 5628 mg/kg.

Human, oral, LD<sub>Lo</sub>: 428 mg/kg produced toxic effects: behavioral - headache; lungs, thorax, or respiration - other changes.

Human, oral, LD<sub>Lo</sub>: 143 mg/kg produced optic nerve neuropathy, dyspnea, nausea or vomiting.

#### Acute Inhalation Effects:

Rat, inhalation, LC<sub>50</sub>: 64000 ppm/4 hr.

Human, inhalation, TC<sub>Lo</sub>: 300 ppm produced visual field changes, headache; lungs, thorax, or respiration - other changes.

#### Acute Skin Effects:

Rabbit, skin, LD<sub>50</sub>: 15800 mg/kg.

Monkey, skin, LD<sub>Lo</sub>: 393 mg/kg.

#### Irritation Effects:

Rabbit, standard Draize test: 100 mg/24 hr resulted in moderate irritation.

Rabbit, standard Draize test: 20 mg/24 hr resulted in moderate irritation.

#### Other Effects:

Rat, oral: 10 µmol/kg resulted in DNA damage.

Rat, inhalation: 50 mg/m<sup>3</sup>/12 hr/13 weeks intermittently produced degenerative changes to brain and coverings; muscle contraction or spasticity.

Rat, inhalation: 2610 ppm/6 hr/4 weeks intermittently produced toxic effects: endocrine - changes in spleen weight.

Multiple Dose Toxicity Effects - Rat, oral: 12 g/kg/8 weeks intermittently produced toxic effects: behavioral - ataxia; behavioral - alteration of operant conditioning.

Human, lymphocyte: 300 mmol/L resulted in DNA inhibition.

Rat (female), oral: 7500 mg/kg, administered during gestational days 17-19 produced effects on newborn - behavioral.

Rat (female), oral: 35295 mg/kg administered during gestational days 1-15 produced effects on the fertility index; pre implantation mortality; and post-implantation mortality.

Rat (female), inhalation: 20000 ppm/7 hr, administered during gestational days 1-22 produced specific developmental abnormalities - musculoskeletal system; cardiovascular (circulatory) system; urogenital system.

Rat (male), oral: 200 ppm/20 hr, 78 weeks prior to mating produced paternal effects - testes, epididymis, sperm duct.

See NIOSH, RTECS PC1400000, for additional data.

### Section 12 - Ecological Information

**Environmental Fate:** Bioconcentration (BCF, estimated at 0.2) is not expected to be significant. Physical removal from air can occur via rainfall. Relatively rapid evaporation from dry surfaces is likely to occur. If released to the atmosphere, it degrades via reaction with photochemically produced hydroxyl radicals with an approximate half-life of 17.8 days. If released to water or soil, biodegradation is expected to occur. A low K<sub>oc</sub> indicates little sorption and high mobility in the soil column.

**Ecotoxicity:** Trout, LC<sub>50</sub>: 8,000 mg/L/48 hr; *Pimephales promelas* (fathead minnow) LC<sub>50</sub>: 29.4 g/L/96 hr.

**Henry's Law Constant:** 4.55 x 10<sup>-6</sup> atm-m<sup>3</sup>/mole at 77 °F (25 °C)

**Octanol/Water Partition Coefficient:** log K<sub>ow</sub> = -0.77

**Soil Sorption Partition Coefficient:** K<sub>oc</sub> = 0.44

**Section 13 - Disposal Considerations**

**Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

**Section 14 - Transport Information****DOT Transportation Data (49 CFR 172.101):**

**Shipping Name:** Methanol

**Hazard Class:** 3

**ID No.:** UN1230

**Packing Group:** II

**Label:** FLAMMABLE LIQUID

**Section 15 - Regulatory Information****EPA Regulations:**

**RCRA 40 CFR:** Listed U154 Ignitable Waste

**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001 5000 lb (2268 kg)

**SARA 40 CFR 372.65:** Listed

**SARA EHS 40 CFR 355:** Not listed

**TSCA:** Listed

**Section 16 - Other Information**

**Disclaimer:** Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

## **Appendix C**

# **Glove Selection Guideline**

<b>GLOVE SELECTION GUIDELINE</b>			
<b>HAZARD</b>	<b>EXAMPLE TASKS</b>	<b>ANSI CUT/ABRASION RATING*</b>	<b>REPRESENTATIVE GLOVE</b>
Impact Hazards, Med/Heavy Duty Puncture Cut	Drilling/direct push activities. Construction. Heavy materials handling. Power tools. Air knifing. Excavation.	ANSI Cut and Abrasion Resistance <b>Level 5</b> <b>EN 388 4521</b>	Hexarmor®Chrome Hexarmor® GGT5 Hexarmor® L5 Hexarmor® SteelLeather III Ironclad® Kong Glove
Med/Heavy Duty Puncture Cut Oil/Solvent Resistant	Tasks where materials are treated with oil or solvents.	ANSI Cut and Abrasion Resistance <b>Level 3 - 4</b> <b>EN 388 4522</b>	Ansell Alpha-Tec ® Memphis® Ultra Tech Nitrile Cut & Splash Best® Neoprene 6780 Hexarmor™ TenX Threesixty
Medium Duty Cut/Puncture Gloves with Oily Surface Grip	Light materials handling, wet service	ANSI Cut and Abrasion Resistance <b>Level 3</b> <b>EN 388 44xx</b>	Best®Zorb-It Ultimate HV 4567 Ansell® Cut Protective Glove 97-505 Ansell HyFlex® 11-511 Ansell HyFlex® 11-624
Med/Heavy Duty Cut/Puncture	Light Materials Handling. System O&M. Use of Hand Tools. Hand Augering. Heavy Equipment Operator.	ANSI Cut and Abrasion Resistance <b>Level 2</b> <b>EN 388 33xx</b>	Perfect Fit® PF570 Hexarmor® Level Six 9010/9012 Ironclad® Cut Resistant Glove Ansell HyFlex® 11-511 Ansell HyFlex® 11-624 Ansell® Cut Protective Glove 97-505
Light Duty Cut/Puncture Abrasion Only	Handling soil and Groundwater Samples. Opening spoons. Well construction.	ANSI Cut and Abrasion Resistance <b>Level 2 - 4</b> <b>EN 388 21xx</b>	Memphis® Ninja Max N9676GL Memphis® UltraTech Dyneema 9676 Memphis® Ninja Ice (Cold Weather) Ansell HyFlex® 11-511 Ansell® Cut Protective Glove 97-505 Ansell® Powerflex 80-813 Ironclad™ Workforce
Light Duty Glove Cut/Abrasion (used under nitrile gloves)	Groundwater Sampling.	ANSI Cut and Abrasion Resistance <b>Level 2</b> <b>EN 388 21xx</b>	Ansell HyFlex® 11-500 Ansell HyFlex® 11-624 Ansell GoldKnit
* Reference to ANSI and EN 388 glove testing standards. Listed gloves meet the standards in the table, but are not the only gloves that meet the standard.			
This selection chart is not intended to address all chemical hazards. Gloves used for chemical protection shall provide cut/puncture resistance, or be used in tandem with cut/puncture protection. Nitrile gloves used for environmental sampling must be used in tandem with a cut/puncture resistant glove.			
Gloves available in high visibility colors have shown to be effective and are preferred.			

## **Appendix D Heat & Cold Stress**

## **COLD STRESS**

Ambient air temperatures during site activities may create cold stress for on-site workers. Procedures for recognizing and avoiding cold stress must be followed. Cold stress can range from frostbite to hypothermia. The signs and symptoms of cold stress are listed below.

**Frostbite** is defined as the actual freezing of one or more layers of skin. In severe cases, organs and structures below the skin can become frozen. Usually, body areas exposed to the most cold, and least body warmth, are affected first. These areas include fingers, toes, ears, and the tip of your nose. Frostbite is characterized by pain and loss of dexterity in the affected limb. The tissue initially appears reddened, but may progress to white, blue, or black.

**FIRST AID:** Bring the affected employee indoors and call the local emergency clinic. Rewarming of frostbitten parts is best left to a medical doctor in a controlled setting.

**Hypothermia** is the condition that occurs when the body's natural warming mechanisms (muscle activity and shivering) cannot counteract the loss of body heat to the environment. The onset of hypothermia is greatly hastened by being wet. Hypothermia is marked by severe, uncontrollable shivering. The patient will show signs of excessive fatigue, drowsiness, irritability, or euphoria. As hypothermia progresses, the patient will begin to lose consciousness, blood pressure will drop, shivering will cease, and the patient may slip into a coma and possibly die.

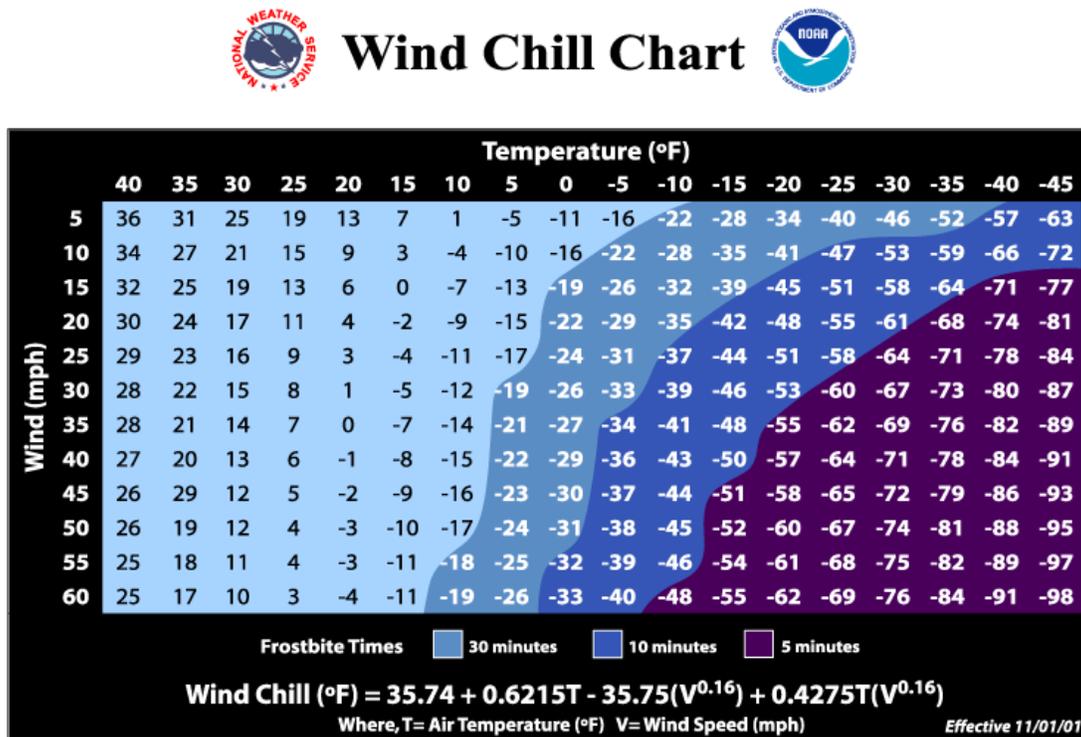
**FIRST AID:** If these symptoms occur, remove the patient to a warm, dry place. If clothing is wet, remove and replace with dry clothing. Keep the patient warm, but not overheated. The patient should be gradually rewarmed to prevent shock. If the patient is conscious and alert, warm liquids should be provided. Coffee and other caffeinated liquids should be avoided because of diuretic and circulatory effects. Notify the emergency clinic if conditions worsen, the patient loses consciousness, or the patient has an altered mental status. Have the patient transported to an emergency facility.

**General Precautions.** The reduction of adverse health effects from cold exposure can be achieved by adopting the following work practices.

- Provide adequate insulating clothing to maintain core temperature at 98.6° F if work is to be performed in air temperatures below 40° F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the air temperature in the work area, the greater the insulation value of the protective clothing should be.
- If the air temperature is 32° F or less, hands should be protected by mittens/gloves.
- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of clothing should be impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outer layer should be changed as it becomes wet. The outer garments should include provisions for easy ventilation in order to prevent wetting of the inner layer by sweat.
- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is available, or until weather conditions improve.
- For prolonged work, heated shelters should be available. Workers should be encouraged to use these at regular intervals, with the frequency depending on the severity of the environmental exposure. When entering the shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit heat evaporation, or a change of work clothing should be provided.

- Warm, sweet drinks, such as hot cocoa or soup, should be available at the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of diuretic and circulatory effects.
- The weight and bulk of cold-weather gear should be included in estimating the required work performance and weights to be lifted in the field.

Workers should be instructed in safety and health procedures regarding cold work environments as part of the pre-work safety meeting. The training program should include instruction in preventing, recognizing, and treating cold stress conditions.



## HEAT STRESS

There is a potential for heat stress from the use of protective clothing and climate conditions. One or more of the following procedures may be employed to alleviate potential heat stress problems in the event that site conditions warrant the use of personal protective equipment (PPE), or ambient temperatures exceed 85° F. Heat stress training must be emphasized during the daily safety meetings, and adequate supplies of potable water must be provided to workers each day.

**General Precautions.** Provide plenty of liquids. To replace body fluids (water and electrolytes) lost because of sweating, use a 0.1 percent saltwater solution, more heavily salted foods, or commercial drink mixes. The commercial mixes may be preferable for those employees on a low sodium diet. Employees on low sodium diets, or other special diets, are advised to contact their personal physician for recommendations regarding appropriate electrolyte replacement fluids/beverages.

In extremely hot weather, conduct operations in early morning or evening and rotate shifts of workers wearing impervious clothing. Install mobile showers and/or hose-down facilities to reduce body temperature and cool protective clothing.

Ensure that adequate shelter is available for breaks to protect personnel against heat, which can decrease physical efficiency and increase the probability of accidents.

Acclimatization for workers not accustomed to working in elevated temperature environments will be considered and implemented as appropriate in accordance with American Conference of Governmental and Industrial Hygienists (ACGIH) Guidelines.

### **Heat Stress Monitoring.**

For monitoring the body's recuperative ability toward excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70° F or above. Frequency of monitoring should increase as the ambient temperature increases or as slow recovery rates are indicated. When temperatures exceed 80° F, regardless of the use of Personal Protective Equipment (PPE), workers will be monitored for heat stress after every work period.

Good hygienic standards must be maintained by the employee to aid in the prevention of heat stress illnesses. At a minimum, frequent changes of clothing and daily showering should occur with clothing being allowed to dry during rest periods. Persons who notice skin problems should immediately inform their supervisor.

Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 25 percent. The HR is then measured again, once each minute for 2 minutes (a total of three measurements), after the initial rest period measurement. The HR should decrease by ten beats per minute between each measurement (a total reduction of 20 beats). If the HR does not decrease, the work period should be reduced by an additional 25 percent.

Body temperature can be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99°F. If it is greater than 99°F, the next work period should be shortened by 25 percent. The OT should be measured again at the end of the rest period to make sure that it has dropped below 99° F.

### **Effects of Heat Street**

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat loading, a number of physical reactions can occur. The severity of these reactions ranges from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to severe (fatal).

Heat-related illnesses include:

**Heat rash** (also known as prickly heat rash) is caused by continuous exposure to heat and humid air and aggravated by chafing clothes. Heat rash decreases the ability to tolerate heat as well as being a nuisance. Signs are not limited to, but may include, a red prickly rash.

**FIRST AID:** Employees exhibiting signs of heat rash will be directed to shower and change into clean, dry clothing.

**Heat cramps** are caused by profuse perspiration with inadequate fluid intake and electrolyte replacement (especially salts). Signs are muscle spasms and pain in the extremities and abdomen, and may occur several hours after work has stopped.

**FIRST AID:** Employees showing signs of heat cramps will be directed to lie in a cool, shady area, and drink cool fluids. If symptoms persist or worsen, the employee will be transported to an emergency facility.

**Heat exhaustion** is caused by increased stress on various organs to meet increased demands to cool the body. Signs are shallow breathing; pale, cool, moist skin; profuse sweating; dizziness and lassitude.

**FIRST AID:** Employees with signs of heat exhaustion will be brought to a cool, shady location and given fluids. After recovering, the employee will be dismissed for the day. If employee is unconscious, or conditions persist, the employee will be transported to a hospital.

**Heat stroke** is the most severe form of heat stress. The body must be cooled immediately to prevent severe injury and/or death. Signs and symptoms are red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and/or coma.

**FIRST AID:** HEAT STROKE IS A MEDICAL EMERGENCY. Employees will be brought to a cool area, aggressively treated by removing constricting clothes and applying wet towels or ice packs, and transported without delay to an emergency facility.

## **Appendix E Job Safety Analysis (JSA)**

# Job Safety Analysis #1

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		DATE	NEW/REVISED
TRC Environmental Corp./ CPB - Far Rockaway Project Far Rockaway, New York		3/23/16	<input checked="" type="checkbox"/> NEW <input type="checkbox"/> REVISED
WORK ACTIVITY (Description):			
<b>Ambient air monitoring for the presence of VOCs using a photo-ionization detector (PID) during subsurface clearance by subcontractor. Readings are collected continuously while work proceeds.</b>			
DEVELOPMENT TEAM	POSITION/TITLE	REVIEWED BY	POSITION/TITLE
Santhi Jagupilla	APM	Heath Potter	Senior Engineer
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR ADDITIONAL STEP-SPECIFIC REQUIREMENTS)			
<input checked="" type="checkbox"/> Reflective Vest or Bands <input checked="" type="checkbox"/> Hard Hat <input type="checkbox"/> Lifeline/Harness <input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Goggles if wind > 25mph <input type="checkbox"/> Face Shield <input checked="" type="checkbox"/> Hearing Protection: Ear plugs or Ear Muffs <input checked="" type="checkbox"/> Safety Shoes—Type: Steel-Toe	<input checked="" type="checkbox"/> Air purifying respirator (when action level reached) <input type="checkbox"/> Supplied respirator <input checked="" type="checkbox"/> PPE Clothing—Type: Long sleeves	<input checked="" type="checkbox"/> Gloves—Type: Cut-4 gloves <input type="checkbox"/> Other—Specify:
REMINDER: Always perform a Safety Assessment: 1) prior to starting work; 2) when changing tasks; and 3) throughout the day. Focus on each new task, procedures, and skill sets to be used.			
<sup>1</sup> JOB STEPS	<sup>2</sup> POTENTIAL HAZARDS	<sup>3</sup> CRITICAL ACTIONS TO MITIGATE HAZARDS	
1. Calibrate PID outside of vehicle	Dust or debris blown into eyes by wind.	Wear <b>safety glasses with side shields</b> , Upgrade to <b>goggles</b> if heavy wind (25mph) are present.	
	Miss calibration of PID leading to inhalation exposure	Wear <b>Cut-4 gloves</b> for improved dexterity while calibrating and operating PID	
2. Ambient air monitoring using a PID around workers.	Struck by tools or equipment used by workers	Stay out of workers line of fire	
		Stop work if you must move in closer to the work area get ambient air readings and let them restart if safe.	
		Do not approach heavy equipment unless visual contact with operator is made and "Show of Hands" is performed Wear <b>hard hat</b>	
	Inhalation Hazard from vapors from work area	When PID readings exceed action level. (see next page) Stop work and have all personnel working in area move upwind and don <b>respirators</b> with organic cartridges.	
	Foot crush hazard from falling tools or material while air monitoring around work area	Identify potential foot stubs or possible foot crushing hazards Wear <b>steel-toe-boots</b>	
	Hearing loss from excessive noise from equipment	Make sure to always have hearing protection available Wear <b>ear plugs</b> or <b>ear muffs</b> when noise is above 85db (regular in door speaking) and wear double hearing protection if noise above 95dbls	
Struck by Vehicle entering work area	Make sure to set up cones around the work area		
	Wear <b>reflective safety vest</b> to improve visibility		

<b>SELECTION CRITERIA FOR PERSONAL PROTECTION</b>		
<b>Meter Reading</b>	<b>Action</b>	<b>Level of Personal Protection</b>
0.5 ppm to 5 ppm on PID sustained	Use benzene detector tube (dt). (dt) < 0.5 ppm work proceeds (dt) > 0.5 ppm work proceeds	Modified Level D Level C
5 ppm to 25 ppm on PID	Work proceeds	Level C
25 ppm to 500 ppm on PID	Work stops and area is allowed to vent. If engineering controls cannot be implemented, Level B PPE will be used.	Level B
<b>CGI Reading (Lower Explosive Limit)</b>	<10% Work Proceeds >10% Stop Work, evacuate area, notify ExxonMobil supervisor	Modified Level D Evacuate Area

# Job Safety Analysis #2

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		DATE	NEW/REVISED
TRC Environmental Corp./ CPB - Far Rockaway Project Far Rockaway, New York		3/23/16	<input checked="" type="checkbox"/> NEW <input type="checkbox"/> REVISED
WORK ACTIVITY (Description):			
<b>Loading and Unloading of equipment and material</b>			
DEVELOPMENT TEAM	POSITION/TITLE	REVIEWED BY	POSITION/TITLE
Santhi Jagupilla	APM	Heath Potter	Senior Engineer
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR ADDITIONAL STEP-SPECIFIC REQUIREMENTS)			
<input checked="" type="checkbox"/> Reflective Vest or Bands <input checked="" type="checkbox"/> Hard Hat <input type="checkbox"/> Lifeline/Harness <input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Goggles if wind > 25mph <input type="checkbox"/> Face Shield <input checked="" type="checkbox"/> Hearing Protection Based on Subcontractor Operations <input checked="" type="checkbox"/> Safety Shoes—Type: Steel-Toe	<input type="checkbox"/> Air purifying respirator <input type="checkbox"/> Supplied respirator <input checked="" type="checkbox"/> PPE Clothing—Type: Long sleeves	<input checked="" type="checkbox"/> Gloves—Type: Cut-4 gloves <input type="checkbox"/> Other—Specify:
REMINDER: Always perform a Safety Assessment: 1) prior to starting work; 2) when changing tasks; and 3) throughout the day. Focus on each new task, procedures, and skill sets to be used.			
<sup>1</sup> JOB STEPS	<sup>2</sup> POTENTIAL HAZARDS	<sup>3</sup> CRITICAL ACTIONS TO MITIGATE HAZARDS	
1. Inspect unloading/loading area for obstructions	Dust or debris blown into eyes by wind.	Wear <b>safety glasses with side shields</b> , upgrade to <b>goggles</b> if heavy wind (25mph) are present.	
	Cut or abrasion from contact with obstruction if moving them from area	Avoid contact with obstructions when possible and mark out with cones Wear <b>Cut-4 gloves</b> to move small obstruction such as small of wire or scrap	
2. Unload /loading equipment/materials from vehicle	Struck by door or tailgate when opening/closing	Position body to stay out of line of fire Wear <b>hard hat</b>	
	Fingers or hands pinched in doors, tailgate or caught between equipment and materials	Identify pinch point contact areas and avoid Wear <b>Cut-4 gloves</b> to move small obstruction such as small of wire or scrap	
	Inhalation Hazard from vapors from work area	Stand upwind of possible vapor source	
	Foot crush hazard from falling tools or material while unloading and loading	Position body to stay out of line of fire Wear <b>steel-toe-shoes</b>	
	Unsecure and unstable footing	Visual inspect are for ground stability Choose safest route to destination based on how secure and stable the ground surface is	
	Back injury or strain from lifting and moving equipment/materials	For heavy or bulky equipment try to coordinate with subcontractor supervisor to have them drive it to well, sump, piezometers location Do not lift equipment or materials over 50 lbs without assistance Bend at the knees and not the back when lifting Make multiple trips to avoid carrying too much equipment or materials that could increase the chance of injury	
	Struck by Vehicle entering work area	Make sure to set up cones as per EM Practices Wear <b>reflective safety vest or bands</b> to improve visibility	
3. Secure equipment and materials	Damage to equipment, materials, personnel or environmental release due to un-secured items	Secure items before they are moved with rope or bungee cords, etc.	

# Job Safety Analysis #3

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		DATE	NEW/REVISED
TRC Environmental Corp./ CPB - Far Rockaway Project Far Rockaway, New York		3/23/16	<input checked="" type="checkbox"/> NEW <input type="checkbox"/> REVISED
WORK ACTIVITY (Description):			
<b>Oversight of Subcontractor operations.</b>			
DEVELOPMENT TEAM	POSITION/TITLE	REVIEWED BY	POSITION/TITLE
Santhi Jagupilla	APM	Heath Potter	Senior Engineer
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR ADDITIONAL STEP-SPECIFIC REQUIREMENTS)			
<input checked="" type="checkbox"/> Reflective Vest or Bands <input checked="" type="checkbox"/> Hard Hat <input type="checkbox"/> Lifeline/Harness <input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Goggles if wind > 25mph or BENS alert issued <input type="checkbox"/> Face Shield <input checked="" type="checkbox"/> Hearing Protection Based on Subcontractor Operations <input checked="" type="checkbox"/> Safety Shoes—Type: Steel-Toe	<input type="checkbox"/> Air purifying respirator <input type="checkbox"/> Supplied respirator <input checked="" type="checkbox"/> PPE Clothing—Type: Long Sleeves	<input checked="" type="checkbox"/> Gloves—Type: Cut-4 gloves <input type="checkbox"/> Other—Specify:
REMINDER: Always perform a Safety Assessment: 1) prior to starting work; 2) when changing tasks; and 3) throughout the day. Focus on each new task, procedures, and skill sets to be used.			
<sup>1</sup> JOB STEPS	<sup>2</sup> POTENTIAL HAZARDS	<sup>3</sup> CRITICAL ACTIONS TO MITIGATE HAZARDS	
1. Inspect subcontractors work area to make sure it complies with their JSA	Dust or debris blown into eyes by wind.	Wear <b>safety glasses with side shields</b> , Upgrade to <b>goggles</b> if heavy wind (25mph) are present.	
	Cut or abrasion from contact with subcontractor tools or equipment	Avoid contact with tools and equipment when checking condition Wear <b>Cut-4 gloves</b>	
2. Oversight of subcontractor operations.	Struck by tools or equipment used by workers	Stay out of workers line of fire Do not approach heavy equipment unless visual contact with operator is made and “Show of Hands” is performed Wear <b>hard hat</b>	
	Inhalation Hazard from vapors from work area	Stand upwind of possible vapor source	
	Foot crush hazard from falling tools or material while walking the area	Wear <b>steel-toe-boots</b>	
	Struck by Vehicle entering work area	Make sure to set up cones as per EM Practices Wear <b>reflective safety vest or bands with reflective stripes</b> to improve visibility	
	Hearing loss to loud noise from equipment or refinery process	Move away from source of noise when possible	
		Use <b>ear plugs</b> or <b>ear muffs</b>	

# Job Safety Analysis #4

COMPANY/PROJECT NAME or ID/LOCATION (City, State)		DATE	NEW/REVISED
TRC Environmental Corp. / CPB - Far Rockaway Project Far Rockaway, New York		4/6/16	<input checked="" type="checkbox"/> NEW <input type="checkbox"/> REVISED
WORK ACTIVITY (Description):			
<b>Site Inspection/Visit</b>			
DEVELOPMENT TEAM		POSITION/TITLE	REVIEWED BY
Santhi Jagupilla		APM	Heath Potter
			Senior Engineer
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR ADDITIONAL STEP-SPECIFIC REQUIREMENTS)			
<input checked="" type="checkbox"/> High Viz Reflective Vest or Bands <input checked="" type="checkbox"/> Hard Hat <input type="checkbox"/> Lifeline/Harness <input checked="" type="checkbox"/> Safety Glasses	<input checked="" type="checkbox"/> Goggles if wind > 25mph or BENS alert issued <input type="checkbox"/> Face Shield <input checked="" type="checkbox"/> Hearing Protection Based on Subcontractor Operations <input checked="" type="checkbox"/> Safety Shoes—Type: Safety-Toe (*must meet ASTM 2413 Standards for I, C, PR, EH)	<input type="checkbox"/> Air purifying respirator <input type="checkbox"/> Supplied respirator <input checked="" type="checkbox"/> PPE Clothing—Type: Long Sleeves	<input checked="" type="checkbox"/> Gloves—Type: Cut-4 gloves <input type="checkbox"/> Other—Specify: Personal H2S meter (alarms at 5ppm and 10ppm), two-way radio
REMINDER: Complete an SPSA at start of, and continuously throughout, job/task to identify additional and/or changing hazards to act on.			
*4 Foot Rule* must be followed as per COP SWP – If within 4ft of personnel in a higher level of PPE you must match level or leave area			
<sup>1</sup> JOB STEPS	<sup>2</sup> POTENTIAL HAZARDS	<sup>3</sup> CRITICAL ACTIONS TO MITIGATE HAZARDS	
1. Inspect/Visit work site for possible hazards and pre planning	Flying debris, falling tools, equipment or icicles from above.	Wear <b>hard hat</b> and <b>safety-toe-boots</b> when outside of Vehicle	
	Eye injury due to wind blowing dust and debris.	Wear safety <b>glasses with side shields</b> . If winds are very high (>25mph) upgrade to <b>goggles</b>	
	Injuries to hand caused by Slips, Trips, and Falls,	Stay aware of footing and do not run.	
		Watch for uneven or wet ground.	
		Keep areas clean and clear of debris	
	Heat Stress Hazards and Sunburn	Review TRC HASP – Appendix D Stay in shade when possible and wear sunblock	
	Injury due to using improper PPE.	Stop work, obtain proper PPE.	
Struck by vehicle	Stay out of the line of fire		
	Wear <b>reflective vest</b> or <b>bands</b> or FRC with reflective stripes		

Site Inspection/Visit JSA – Updates – 2014

\*Safety Toe boots must comply with ASTM Standards 2413 for

Impact (I), Compression (C), Electric Hazard (EH), Puncture Resistance (PR)

## **Appendix F Tailgate Meeting/Checklist**

## TAILGATE SAFETY MEETING CHECKLIST

**Date / Time of Tailgate Meeting:** \_\_\_\_\_

- Vehicle Inspection:** Driver will perform Driver's Daily Vehicle Inspection Checklist before leaving the yard or if changing drivers during the day.
- Personnel training/qualifications:** Check cards for OSHA HAZWOPER 40-hour certification/8-hour-refresher training (or any other specialized training to perform the task if appropriate). TRC personnel have been trained on the Company's Drug and Alcohol Policy and will inform all site personnel.
- Supplies:** Indicate location of first aid kit, fire extinguisher, clean water supply (drinking, eye wash), and Site Health and Safety Plan (HASP).
- Emergency services:** Discuss location of nearest telephone and directions to hospital. Map, directions, phone numbers are provided in the HASP (Attachment C).

The TRC Emergency Twenty-four Hour Number is 1-800-274-9072.

- **First-Aid/CPR volunteers:** \_\_\_\_\_

- Site background:** Discuss types, locations, and concentrations of chemicals found onsite, presence of free product, depth to groundwater, etc.
- Offsite Permits/Access Permits:** Discuss any permitting requirements for the site.
- [ ] **Work activities:** Discuss scope of work for the day and activities to be performed.
- Potential hazards: Review JSAs.** Discuss physical, chemical and biological hazards. Discuss the prohibiting of any eating, drinking, and/or smoking in the work zone.
- Personal protective equipment (PPE):** Discuss required level of protection; review additional PPE requirements in JSAs, as needed.
  - Hard Hat     Safety Shoes/Boots     Safety Vest     Eye Protection -  glasses
  - goggles     face shield
  - Hand Protection -  Kevlar     nitrile     other \_\_\_\_\_     Hearing Protection
  - Respiratory Protection -  APR Particulate     APR Chemical cartridge     other \_\_\_\_\_
  - Protective Clothing -  Tyvex     Nomex     Coveralls     other \_\_\_\_\_
- Utilities:** Utilities have been cleared/marked by appropriate divisions.
- Traffic control** (vehicular and pedestrian): Work area is properly delineated and cordoned off from traffic. Technician will put a traffic cone at all four corners of his parked vehicle. Upon completion of work, walk around vehicle to pick up cones and check all four sides and underneath vehicle for obstacles prior to moving truck.
- Dispenser Emergency Shut-off Switch:** Location has been identified/communicated with field personnel.
- Dealer Notification:** Notify dealer/owner of site work activities to be performed.

JSAs Reviewed: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**HASP COMPLIANCE AGREEMENT**

By signing below, I have completed the Tailgate Safety Meeting Checklist, reviewed this Site Health and Safety Plan and the Job Safety Analysis (JSA) and understand their contents. I hereby agree to comply with all safety requirements outlined herein:

**TRC**

Signature: \_\_\_\_\_, Site Safety Officer (SSO)

Print Name: \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_, Asst. Site Safety Officer (Asst. SSO)

Print Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Contractor:**

Signature: \_\_\_\_\_, Site Safety Officer (SSO)

Print Name: \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_, Asst. Site Safety Officer (Asst. SSO)

Print Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Contractor:**

Signature: \_\_\_\_\_, Site Safety Officer (SSO)

Print Name: \_\_\_\_\_ Date: \_\_\_\_\_

Signature: \_\_\_\_\_, Asst. Site Safety Officer (Asst. SSO)

Print Name: \_\_\_\_\_ Date: \_\_\_\_\_

**TRC Employees / Contractor Personnel / Visitors**

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Print Name: \_\_\_\_\_ Company: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Print Name: \_\_\_\_\_ Company: \_\_\_\_\_

**HASP COMPLIANCE AGREEMENT (cont.)**

By signing below, I have completed the Tailgate Safety Meeting Checklist, reviewed this Site Health and Safety Plan and the Job Safety Analysis (JSA) and understand their contents. I hereby agree to comply with all safety requirements outlined herein:

**TRC Employees / Contractor Personnel / Visitors (cont.)**

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Print Name: \_\_\_\_\_ Company: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Print Name: \_\_\_\_\_ Company: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
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Print Name: \_\_\_\_\_ Company: \_\_\_\_\_

## **Appendix G WorkCare Program Information**

## EARLY INCIDENT INTERVENTION<sup>®</sup>

*Immediate Access to Medical Advice for Work Related Incidents*

**(888) 449-7787**

### INTRODUCTION

WorkCare, Inc. (WorkCare) and TRC have partnered together to promote Incident Intervention<sup>®</sup>, a resource designed to support company safety goals/targets—while reducing runaway-costs associated with workplace injuries and illnesses.

### PURPOSE

Early Incident Intervention provides TRC employees with **IMMEDIATE** telephonic access to WorkCare clinicians at the time of a presumed, non-emergency workplace injury or illness. Clinicians provide expert guidance on the evaluation of symptoms, appropriate first aid, and the need for additional medical evaluation or treatment.

When utilizing this service within the first hour of an incident, known as the “Golden Hour,” licensed medical staff can guide the case so that medical evaluation and treatment are rendered appropriately.

*“...helps the worker  
traverse the unpredictable  
terrain of work-related  
injuries and illness.”*

### PRINCIPLES OF EARLY INCIDENT INTERVENTION

- Utilizes principles of the “Golden Hour.”
- Provides workers immediate clinician support at the time of an incident.
- Focuses on providing the right care, at the right time in the proper setting.

### BENEFITS FOR EMPLOYEES

- Instant access to a medically qualified professional for evaluation of symptoms and possible outcomes.
- Professional guidance on appropriate first aid measures and medications.
- Professional advice regarding the need for additional medical evaluation or treatment.

### BENEFITS FOR TRC

- Point of contact for emergency and non-emergency medical clinicians.
- Triage the incident to determine risk and urgency, delivering interventions that are consistent with medical guidelines for the specified injury and illness.
- Maintains communication with clinicians to ensure accurate and timely reporting.

## **Appendix H Incident Reporting**



### TRC Incident Report Form

(To be completed immediately after an Injury, Illness, Incident, Accident or Significant Near Miss by Employee's Supervisor and Employee involved)

TO BE COMPLETED BY EMPLOYEE AND SUPERVISOR, AND SUBMITTED WITHIN 24 HOURS OF INCIDENT

Incident Category	
<input type="checkbox"/> Employee Injury/Illness <input type="checkbox"/> Near Miss/Loss <input type="checkbox"/> Property Damage <input type="checkbox"/> Vehicle Accident <input type="checkbox"/> Fire <input type="checkbox"/> Other	
1	Incident Location:
2	Site Identification/Project No.:
3	Site Address:
4	Date Incident Occurred:
5	Time Incident Occurred:
6	Date Incident Reported:
7	Time Incident Reported:
8	Was WorkCare Contacted? <input type="checkbox"/> Yes <input type="checkbox"/> No
9	Client:

TRC Employee Information	
10	Name:
11	Office/Address:
12	Supervisor Name/Phone:
13	Employee Phone/Cell:
14	Title or Occupation:
15	Sector/Practice:

Type of Employee Injury or Illness (To be determined by Safety Director)	
16	<input type="checkbox"/> First Aid Only
17	<input type="checkbox"/> Medical Treatment Only
18	<input type="checkbox"/> Restricted Work-case
19	<input type="checkbox"/> Lost Workday
20	<input type="checkbox"/> Extended Time Away From Work (3 days or more)
21	<input type="checkbox"/> Fatality
22	<input type="checkbox"/> Other (specify):
23	Estimated Number of Days on Restricted Work:
24	Estimated Number of Days Away from Work:

Employee Injury or Illness Description	
25	Describe the Injury or Illness:
26	First Aid/Medical Treatment Administered:
27	Name of Doctor's Office, Clinic, or Hospital:
28	Address/Phone:



### TRC Incident Report Form

(To be completed immediately after an Injury, Illness, Incident, Accident or Significant Near Miss by Employee's Supervisor and Employee involved)

TO BE COMPLETED BY EMPLOYEE AND SUPERVISOR, AND SUBMITTED WITHIN 24 HOURS OF INCIDENT

Incident Description	
29	Equipment Involved: -----
30	Site Description: -----
31	Task Being Performed at Time of Incident: -----
32	Describe Incident in Detail: -----
33	Conditions at Time of Incident (weather, lighting, etc.): -----
34	Motor Vehicle Accident:
35	TRC Vehicle ID:
36	Year/Make/Model:
<input type="checkbox"/> DOT Regulated Vehicle <input type="checkbox"/> Towed From Scene <input type="checkbox"/> Airbag Deployed <input type="checkbox"/> Seatbelt in Use <input type="checkbox"/> TRC Fleet <input type="checkbox"/> Rental <input type="checkbox"/> Personal Vehicle	
37	Other Vehicle License Plate:
38	Other Vehicle Year/Make/Model:
39	Other Vehicle Driver Name:
40	Other Vehicle Insurance:
41	Other Injured Parties: <input type="checkbox"/> Yes <input type="checkbox"/> No
42	Description of Other Injuries: -----

Subcontractor Involvement / Description of Incident	
43	Subcontractor Involved: <input type="checkbox"/> Yes <input type="checkbox"/> No
44	Name of Company:
45	Address:
46	Contact Name and Phone Number:
47	Subcontractor Description of Incident: -----



### TRC Incident Report Form

(To be completed immediately after an Injury, Illness, Incident, Accident or Significant Near Miss by Employee's Supervisor and Employee involved)

<b>TO BE COMPLETED BY EMPLOYEE AND SUPERVISOR, AND SUBMITTED WITHIN 24 HOURS OF INCIDENT</b>	<b>Witness Involvement / Description of Incident</b>	
	48	Witnesses to Incident: <input type="checkbox"/> Yes <input type="checkbox"/> No
	49	Name(s) and Address(es): ----- -----
	50	Phone Number(s):
	51	Witness Description of Incident: ----- -----
	<b>Personal Protective Equipment (PPE)</b>	
	52	List PPE Required to Complete the Task (glasses, gloves, shoes, hard hat, respirator, hearing protection, etc.): ----- -----
	53	List the PPE Employee Used at the Time of Incident: ----- -----
	<b>Immediate Corrective Actions</b>	
	54	Describe the Immediate Corrective Actions Taken: ----- -----
	Immediate Supervisor: _____ Signature: _____ Date: _____	
	Employee: _____ Signature: _____ Date: _____	



## TRC Incident Report Form

(To be completed immediately after an Injury, Illness, Incident, Accident or Significant Near Miss by Employee's Supervisor and Employee involved)

TO BE COMPLETED BY SUPERVISOR WITH ASSISTANCE FROM  
RMD SAFETY COORDINATOR AND TRC SAFETY DIRECTOR

Supervisor's Post-Incident Review and Recommendations									
<b>Safety Violation</b> <input type="checkbox"/> Yes <input type="checkbox"/> No									
55	State the Company Safety Rule, OSHA Regulation, or Specific Training that was Violated:								
56	Describe the Training the Employee Received to Prevent this Violation:								
Root Cause Factors (RCF)									
#									
#1	Lack of skill or knowledge								
#2	In the past, did not follow procedures or acceptable practices, and no incident occurred (injury, product quality incident, equipment damage, regulatory assessment or production delay)								
#3	Doing the job according to procedures or acceptable practices takes more time/effort								
#4	Short-cutting procedures or acceptable practices are positively reinforced or tolerated								
#5	Lack of or inadequate operational procedures								
#6	Inadequate communication of expectations regarding procedures or acceptable practices								
#7	Inadequate tools or equipment (available, operable and safely maintained, proper task and workplace design)								
#8	External factors								
57	Root Cause(s)	Identified Root Cause(s):							
		#1	#2	#3	#4	#5	#6	#7	#8
A		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
H		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



### TRC Incident Report Form

(To be completed immediately after an Injury, Illness, Incident, Accident or Significant Near Miss by Employee's Supervisor and Employee involved)

<b>TO BE COMPLETED BY SUPERVISOR WITH ASSISTANCE FROM RMD SAFETY COORDINATOR AND TRC SAFETY DIRECTOR</b>	58	<b>Conclusion: Why did the Incident Occur?</b>						
	59	<b>Item No.</b>	<b>RCF No.</b>	<b>Recommended Corrective Action(s) How to Prevent Incident from Reoccurring</b>	<b>Responsible Person</b>	<b>Due Date</b>	<b>Completed (date)</b>	<b>Verified/ Validated (date)</b>
Supervisor: _____ Signature: _____ Date: _____								
TRC Safety Director: _____ Signature: _____ Date: _____								

# **Appendix I Acknowledgement**

**PERSONAL ACKNOWLEDGEMENT**

A component of the Health and Safety Plan (HASP), designed to provide personnel safety during this subsurface investigation requires that you receive training as described in the HASP prior to working at this site. Additionally, you are required to read and understand the HASP. When you have fulfilled these requirements, please sign and date this personal acknowledgement:

_____ Name (Printed)	_____ Signature	_____ Date

**APPENDIX B**  
**CONSTRUCTION QUALITY ASSURANCE PROJECT PLAN**



***CONSTRUCTION QUALITY ASSURANCE PROJECT PLAN***

**CPB – Property  
Block 15950, Lot 29  
Far Rockaway, New York  
BCP # 241158**

Prepared For:

Corporation of the Presiding Bishop (CPB) of The  
Church of Jesus Christ of Latter-day Saints, a Utah Corporation Sole  
50 E. North Temple St.  
Salt Lake City, Utah 84150

Prepared by:

TRC Environmental Corporation  
41 Spring St, Suite 102  
New Providence, NJ 07974

*TRC Job Number: 174788*

**April 2016**

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B	Daily Inspection Reports (DIR)
C	Initial (“Punch List”) and Final Inspection Report
D	Sample Copy of Meeting Log

## **1.0 INTRODUCTION**

This document presents the Construction Quality Assurance Project Plan (CQAPP) for CPB Site, located in Far Rockaway, Queens, New York (BCP Case Number C241158).

TRC Environmental Corporation (TRC) prepared this CQAPP on behalf of Corporation of the Presiding Bishop – Church of Jesus Christ of Latter-day Saints, a Utah Corporation Sole, pursuant to the Brownfields Cleanup Agreement, signed on May 30, 2014. Specifically, the CQAPP pertains to the remedial actions to address shallow soil contamination at the site, as identified in the Remedial Investigation Report (RIR) and Remedial Action Work Plan (RAWP).

### **1.1 Site Description and History**

The site is located between Far Rockaway Boulevard and the Rockaway Freeway (near Beach 32nd Street) in Far Rockaway, New York. Figure 1 provides a Site Location Map. The site is located approximately 580 ft. southwest of the Norton Basin of Jamaica Bay and approximately 2,100 ft. (0.4 miles) north of the Atlantic Ocean. The property is currently vacant, approximately 1.3 acres in size and has been designated on local tax maps as Block 15950, Lot 29. A site plan is included as part of the depiction of the Engineering Controls in Figure 2. CPB purchased the property on December 12, 2002.

### **1.2 Construction Quality Assurance Project Plan**

#### ***1.2.1 Definition***

The CQAPP is devoted to Construction Quality Assurance (CQA) procedures to be implemented during construction. In the context of this plan, CQA and Construction Quality Control (CQC) are defined as follows:

- CQA - A planned and systematic pattern of monitoring designed to ensure that construction work is in conformance with the Remedial Design.
- CQC - Activities performed by the field personnel to verify the construction material specifications are in accordance with the project Drawings and Specifications.

#### ***1.2.2 Purpose and Overview***

This CQAPP focuses on the installation of two asphalt caps over contaminated soil at the property.

This CQAPP has been prepared in general accordance with the USEPA Guidance on Quality Assurance for Environmental Technology, Design, Construction, and Operation (EPA 2005).

The CQAPP identifies the personnel, procedures, instructions, records and forms to be used in the QA management of this project. The objective of this CQAPP is to provide assurance that the required levels of quality will be achieved throughout the on-site operations, including work performed by subcontractors during remedial construction. This plan addresses each component of the Quality Assurance and Quality Control (QA/QC) system, including the responsibilities and authorities of project personnel, inspection programs, testing and sampling procedures and documentation and reporting requirements.

## **2.0 PLANNING AND MANAGEMENT**

This section describes the planning and management to implement the QA/QC procedures. It defines the roles and responsibilities of individuals to ensure the quality of products associated with the remedial construction.

### **2.1 Integration with Other Reports and Plans**

This CQAPP will be implemented in conjunction with the following plans:

- Remedial Action Work Plan (RAW);
- Health and Safety Plan (HASP); and
- Quality Assurance Project Plan (QAPP).

A general description of these documents and how they are integrated with the CQAPP are provided in the following sections.

#### **2.1.1 *Remedial Action Workplan***

The remedial actions for the site, which were described in the April 2016 RAWP, are:

- Installation of an asphalt cap near soil sample location SS-3, covering an area of approximately 5,400 square feet; and
- Installation of an asphalt cap near soil sample locations SS-8 and SS-9, covering an area of approximately 9,900 square feet.

A sub-slab depressurization system will be installed on-site in the future, but is not described in the CQAPP, as there are no current plans for site development.

#### **2.1.3 *Health and Safety Plan***

The HASP, Appendix 7 of the Site Management Plan (SMP), identifies the minimum health and safety requirements and procedures that will be used during construction, operations and maintenance at the site. The HASP will apply to TRC personnel and addresses coordination between the various parties and emergency response agencies and personnel (e.g., police

departments, fire department, and other response agencies) working at the site. Contractor Health and Safety Plans must meet the requirements of this document, but may also include additional health and safety procedures and requirements.

#### ***2.1.4 Quality Assurance Project Plan***

The QAPP, Appendix 6 of the SMP, describes QA procedures and requirements for aspects of the work other than construction. This includes the laboratory procedures to be utilized, the calibration of field and laboratory equipment, QA/QC of laboratory procedures, data evaluation procedures, performance and system audits, precision and accuracy performance standards, analytical methods/control procedures, and procedures for data handling, analysis, and reporting. The QAPP also contains Standard Operating Procedures (SOPs) for sampling and analysis associated with the site, including sample handling and preservation. In addition, the QAPP is used to assure that QC is documented for any chemical measurements made during construction.

### **2.2 Project Roles and Responsibilities**

This section identifies the organizations and key personnel participating in the construction of the remedial actions at the site. The specific roles and responsibilities of the key personnel and an explanation of the lines of authority, reporting relationships and communication pathways are provided in this section. Qualifications of key personnel are included in the resumes (Appendix A).

#### ***2.2.1 Project Organization Chart***

All organizations involved in this project are identified in the Project Organization Chart (Appendix A). The responsibilities of key personnel and communication pathway are described in the Section below.

#### ***2.2.2 Communication Pathways***

The lines of authority and communication specific to this remedial action are also presented in the Project Organization Chart (Appendix A). The TRC Project Manager will serve as the communication link between NYSDEC and TRC. The TRC Program Manager will be kept verbally apprised of the program's status by the TRC Project Manager/Project Engineer and TRC Field Team/QA Manager. These individuals will immediately notify the TRC Program Manager of any internal or subcontractor issues that potentially affect construction, design, quality, budget, schedule, and/or achievement of the project objectives. The TRC Program Manager or Project Manager will in turn communicate these issues to the NYSDEC Project Manager by telephone.

A representative of the TRC project management team will be responsible for providing periodic project updates to NYSDEC. At a minimum, such updates will occur when the field team believes that all field work is about to be completed at any particular area or in the event of an anticipated scope and/or schedule change. Ideally, representatives from the TRC project team

and NYSDEC will be able to meet in the field to review the findings of the field efforts prior to demobilizing from the site. In this way, a consensus can be reached regarding the adequate acquisition of all required field information.

### ***2.2.3 Personnel Responsibilities***

The responsibilities of management and field personnel are outlined below. Project personnel in responsible roles are identified in Appendix A, by name, title and affiliation.

### ***2.2.4 Management Responsibilities***

#### **NYSDEC Project Manager**

The NYSDEC Case Manager for the Site is Mr. Christopher Magee. His primary responsibilities include administration of NYSDEC responsibilities, oversight of the day-to-day activities and receipt of all required written material. Mr. Magee is also responsible for providing technical oversight and guidance and reviewing all technical deliverables, including plans and reports.

#### **TRC Program Manager**

The TRC Program Manager, Dr. Nidal Rabah, PE, will provide the senior leadership on the project. Other duties include, as necessary:

- Assuring adherence to project plans and obtaining approvals for any changes to the plans;
- Assuring that approved procedures meet project objectives;
- Assigning duties to project staff and orienting the staff to the specific needs and requirements of the project;
- Serving as the focus for coordination of all field task activities, communications, reports, and technical reviews, and other support functions, and facilitating activities with the technical requirements of the project;
- Coordinating field and office activities with the TRC Project Manager and TRC Field Team/ QA Manager;
- Initiating corrective actions;
- Ensuring successful completion of the project in terms of budget, schedule, and data quality objectives (DQOs);
- Monitoring schedules of field activities; and
- Maintaining the project file.

#### **TRC Project Manager/Project Engineer**

The TRC Project Manager, Mr. Heath Potter, will serve as a primary liaison to NYSDEC and other regulatory personnel and the main contact with the TRC Program Manager and TRC Field Team/QA Manager. The TRC Project Manager will ensure that all technical, administrative and

regulatory compliance objectives are met on a day-to-day basis. Other duties, as necessary, include:

- Assuring adherence to project plans and obtaining approvals for any changes to the plans;
- Assigning duties to project staff and orienting the staff to the specific needs and requirements of the project;
- Assisting in the coordination of all field task activities, communications, reports and technical reviews and other support functions and facilitating activities with the technical requirements of the project;
- Coordinating field and office activities with the TRC Program Manager and TRC Field Team/ QA Manager;
- Monitoring schedules of field activities; and
- Ensuring successful completion of the project in terms of budget, schedule, and DQOs.

### ***2.2.5 Field and Quality Assurance Responsibilities***

#### TRC Field Team/ QA Manager/Site Safety Officer

The TRC Field Team/QA Manager, Ms. Gail Bradbury has overall responsibility for completion of all the field activities safely and in accordance with the CQAPP and will be the communication link between the field team, subcontractors and TRC project management. Specific responsibilities include:

- Preparation and implementation of the CQAPP;
- Coordinating activities in the field;
- Ensuring all field activities are implemented in accordance with the HASP;
- Assigning specific duties to field team members;
- Ensuring site security and access;
- Training field staff;
- Overseeing and coordinating field data collection pertaining to construction;
- Mobilizing and demobilizing of the field team and subcontractors to and from the site;
- Resolving logistical problems that may hinder field activities, such as equipment malfunctions or availability, personnel conflicts, or weather-dependent work conditions;
- Implementing field QC procedures including issuance and tracking of measurement and test equipment; confirming construction is conducted in accordance with specifications, and control and collection of all field documentation;
- Assisting with report preparation;
- Providing QA technical assistance to field staff;
- Reporting on the adequacy, status, and effectiveness of the QA program to the TRC Project Manager;

- Reviewing and approving QA procedures, including any modifications to existing approved procedures;
- Ensuring that QA audits of the various phases of the project are conducted, as required;
- Following up on corrective action;
- Evaluating new hazards and operation changes, when necessary; and
- Correcting non-compliance promptly and stopping work in cases of immediate danger.

### ***2.2.6 Construction Contractor***

Construction Contractor(s) will be selected by TRC to perform construction activities, such as the installation of the asphalt cap. The contractor selection process includes prequalification screening of prospective bidders to determine that bidders have adequate experience and capability to perform the work.

The Construction Contractor(s) will be responsible for:

- Compliance with the contract established for the project work, understanding the remedial design plans and specifications and performing the site construction activities in accordance with the specifications;
- Performing work safely and in accordance with their HASP;
- Reporting work progress, schedule and compliance issues to TRC;
- Providing suggestions or requests for modifications to the design plans or specifications to improve the system quality and/or efficiency;
- Performing QC procedures as detailed in this document; and
- Documenting and providing results of all testing and other pertinent information to TRC.

## **3.0 SCOPE OF REMEDIATION WORK**

The remedial action for the site requires installing two asphalt caps at the property. A summary of the installation activities is provided below.

### **3.1 Asphalt Cap Installation**

Two separate asphalt caps will be installed at the site. The extent of the caps is provided in Figure 2. The installation of the capping system will include the following components:

- Survey the boundaries of the capping area;
- Clear and grub the capping area;
- Install a geotextile demarcation layer;
- Install the sub-base material, including grading and compaction;
- Hot roll asphalt over sub-base; and

- Survey final elevations

### ***3.1.1 Pre-Installation Survey***

TRC will oversee the surveying of the extent of the capping areas before construction work begins and will include the installation of control points to establish the perimeter of the caps. The base elevation will also be surveyed to establish an original elevation for comparison to the final grades.

### ***3.1.2 Clear and Grub The Capping Area***

Each capping area will be cleared of vegetation larger than grass. Any deep rooted plants or weeds will be mowed and removed to the extent necessary to install the asphalt capping system. Landscaping, consisting of mowing and weed control, is conducted routinely at the site and the scope of this pre-construction step will be limited.

### ***3.1.3 Geotextile Demarcation Later***

As depicted on the construction details in Figure 2, a geotextile demarcation layer will be installed prior to the sub-base material. The geotextile will be woven and will be staked to the ground prior to the installation of the sub-base.

### ***3.1.3 Sub-Base Installation***

The sub-base material will be placed in one lift and compacted in place. The surface of the sub-base material will be leveled, with a minimum thickness of four inches. Prior to placement, the on-site TRC engineer will inspect the sub-base material against the specifications and to ensure it is free of any foreign material such as roots or metal. The TRC field engineer will observe the installation process and photo document the sub-base layer.

### ***3.1.5 Hot Rolled Asphalt***

Asphalt will be placed over the sub-base material after it is leveled and compacted. The hot asphalt will be brought to the site shortly before application. The asphalt will be placed and roller compacted to a level grade. A minimum of two inches of asphalt will be placed over the capping area. Asphalt will be used to grade the top of the cap to the existing surface.

### ***3.1.7 Final Survey***

Upon completion of the construction activities, the corners and top elevation of the asphalt caps will be surveyed to ensure that the complete capping areas have been covered and that the requisite total thicknesses have been met. This survey, along with the field notes, will be used to generate a completion report and as-built drawings.

## **4.0 CONSTRUCTION INSPECTIONS, MONITORING AND VERIFICATION**

TRC will conduct inspections, testing and monitoring activities to assure compliance of the design included in the RAWP. The following sections summarize inspection, monitoring, and verification activities for each of the construction elements. Each construction element is described, potential concerns and remedies discussed and inspection, monitoring and verification requirements are stated. The results of inspections, sampling, testing, and monitoring activities will be documented, as described in Chapter 5.0. The inspections, sampling, testing and monitoring are performed to confirm that the described tasks have been implemented in accordance with the RAWP.

### **4.2 Installation of Asphalt Caps**

#### **4.2.1 *Description***

Two separate asphalt caps will be installed at the site. Cap Area 1 will be installed near former soil sample location SS-3 and will cover an area of approximately 5,400 ft<sup>2</sup>. Cap Area 2 will be installed near sample locations SS-8 and SS-9 and will cover an area of approximately 9,900 ft<sup>2</sup>. The capping activities will each involve following key steps:

- Establish capping limits;
  - Clear and grub the capping area;
  - Install the geotextile demarcation layer;
  - Install the sub-base layer;
  - Install asphalt layer; and
  - Final Survey.
1. A surveyor will be retained to identify and stake out the limits of capping prior to starting work. The surface elevation of the capping area will be surveyed for comparison with post-capping elevations.
  2. The work areas will be cleared of vegetation other than trimmed grass. The site is routinely landscaped, so no deep rooted plants are expected to be encountered in the work area.
  3. Installing geotextile layer: The layer will serve as a demarcation in the future, if the asphalt cap is disturbed. The geotextile will be staked into the ground at the edges.
  4. Installing the sub-base layer: The sub-base material will consist of [stone or recycled concrete aggregate] and will be placed to a minimum thickness of four inches. The sub-base layer will also serve as a grading layer in preparation of the asphalt placement. The

layer will be compacted prior to asphalt placement. Since this layer will consist of large diameter aggregate compaction, testing is not required.

5. Installing the asphalt layer: The top two inches of the cap will consist of a rolled layer of asphalt. The asphalt will be brought to the site and placed while still hot. The surface may be crowned down the middle to prevent ponding of water, however this crown will be minimal.
6. Final Survey: Prior to demobilizing from the site, the extent and elevation of the cap will be surveyed. The survey will ensure that the cap covers the minimum footprint depicted in the RAWP and that the completed thickness is equal to, or greater, than the minimum thickness specified in the RAWP.

#### ***4.2.2 Potential Concerns and Remedies***

1. Access to the site may be blocked by cars or trucks parked along the road. TRC will mobilize to the site at least two days before the work begins to place cones and maintain access to the gate.
2. During the clearing and grubbing, any unexpected, deep rooted plants will be dug out. The soil from the hand digging will be placed back in the excavation and clean gravel will be used to bring the excavation back to original grade.
3. The sub-base layer may not be level after initial placement. If the sub-base layer is not level, additional material will be added to the low spots to create a flat surface for the asphalt placement.

#### **4.4 Inspection and Monitoring**

Four phases of inspections will be conducted to ensure that all remedial construction/activities comply with the project plans and specifications. Specifically, TRC will perform the following four phases of inspection:

- Preparatory inspection;
- Construction inspection;
- Completion inspection; and
- Final Inspection

All the findings of the inspections will be recorded on the Daily Inspection Report (DIR) in the field by a TRC representative. A copy of the typical DIR is included as Appendix B. The DIR outlines a list of some key inspection points for each Remedial Action. The four inspection phases are described in the following sections.

#### ***4.4.1 Preparatory Inspection***

A preparatory inspection will be performed by TRC prior to the commencement of work for each Remedial Action. The preparatory meeting will be conducted between TRC and the construction contractor(s) to review the scope of work, safety measures that will be implemented at the site and schedule. TRC will:

- Review and provide comments on contractor's HASP;
- Discuss TRC's site specific HASP with the contractor(s);
- Review the applicable regulatory documents (e.g., RIR, RAWP, etc.);
- Review project plans and specifications;
- Conduct a physical examination of the required materials, equipment, and safety equipment to be used at the site;
- Review the appropriate activity hazard analysis to assure safety requirements are met; and
- Examine the work area to assure that all required preliminary work has been completed and is in compliance with the contract.

The results of the preparatory phase inspections, including the meeting minutes, will be documented in the DIR.

#### ***4.4.2 Construction Inspection***

The construction inspection for the Remedial Action will be performed by TRC on a daily/continuous basis until the Remedial Action is completed. During the initial inspection, TRC will, at the minimum:

- Examine and verify the quality of workmanship;
- Verify work daily to ensure compliance with the plan and specification;
- Review and verify construction methods;
- Verify the dimensional requirements;
- Confirm that the Remedial Action performed is in accordance with the plan and specifications;
- Inspect and identify defective or damaged materials or equipments;
- During the construction activity, the air quality will be continuously monitored for VOCs, and dust. The readings for the air quality will be recorded in the DIR.
- Document and record in the DIR any deficiency that may be observed during the initial inspection;
- Notify and instruct the contractor to address and repair deficiencies or errors; and
- Follow-up with contractor to ensure that the deficiencies/errors are corrected.

The results of the inspection will be recorded in the DIR.

#### ***4.4.3 Completion Inspection***

Upon completion of a Remedial Action, TRC will conduct an inspection to identify any item that is not in conformance with the plans and specifications. A “punch list” (Appendix C) will be generated, which outlines key items that will be required to be inspected upon completion of the Remedial Action. The punch list will also include the estimated time for completion. Contractors will be notified and will be asked to comply with the punch list. A final inspection will be conducted to confirm that any non-compliant items have been corrected.

#### ***4.4.4 Final Inspection***

The final inspection will be conducted to confirm that any non-compliant items identified in the punch list have been corrected and that the Remedial Actions are completed in accordance with the plans and specifications. The outcome of the final inspection will be recorded in the Final Inspection Report (Appendix C).

#### **4.5 Verification**

Each construction task will be field verified. The procedure for verification is briefly discussed below:

Asphalt Cap Inspection:

- The Contractor shall have major equipment items available for inspection by the TRC field personnel. Deficiencies in quality, quantity, or types of equipment shall be corrected prior to commencing work.
- TRC will inspect the geotextile and sub-base material to ensure they are suitable for use at the site.
- TRC will confirm that the asphalt is compacted and free of cracks and depressions.

## **5.0 DOCUMENTATION AND REPORTING**

This section summarizes the required submittals and records to be completed prior to, during and at the completion of construction. Project documentation prepared and collected by TRC field personnel will be reviewed and verified by the TRC Project Engineer, or their designee, for conformance with the specifications and the RAWP.

Successful implementation of the CQAPP depends on the identification and inspection of the various remedial activities and proper documentation of the Remedial Actions. TRC personnel will verify and inspect activities for conformance with their specifications. The procedures governing the documentation process are discussed in more detail in the following sections.

### **5.1 Pre-construction Documentation**

The design and the specifications for the construction of the capping systems, which is presented in the RAWP, HASP, QAPP and CQAPP, will be reviewed by TRC Engineers, TRC field personnel and Construction Contractor(s) prior to the implementation of the remedial action.

### **5.2 Construction Documentation**

Construction documentation will consist of Daily Inspection Reports, Meeting Minutes, Photographic Logs, Weekly Progress Report and Monthly Progress Reports. Memoranda, as necessary, may be generated to document any change in field conditions or conformance issues. Other construction documentation includes As-Built Drawings, Compliance Testing Report and Final Construction Completion Report.

#### **5.2.1 *Daily Inspection Report***

The DIR will be completed by TRC field personnel on a daily basis. A copy of the DIR is included as Appendix B. The DIR may include the following information:

- Date, project name, location and other pertinent information;
- Data on weather conditions;
- Results of field meetings, for example tailgate or pre-construction meetings;
- The locations of construction under way for the day;
- Lists of equipment and personnel, including contractors working for the day;
- List of visitors' names;
- Descriptions of work being inspected and documented;
- Description of materials received, including any quality verification documentation;
- Calibrations or recalibrations of test equipment (example, PID), including actions taken as a result of recalibration;
- Type of inspection activity and procedures used (reference to standard method when appropriate);

- Results of the inspection activity and comparison with specification requirements;
- Records of observation or test data, with all necessary calculations;
- Any change in work conditions or conformance issues;
- Any problems identified with materials or workmanship; The relevant corrective measures will be discussed with the contractor and will be recorded; and
- As-Built Sketch indicating the construction progress for the day.

Copies of the DIR will be compiled and submitted to NYSDEC in the Final Engineering Report (FER).

### ***5.2.3 Change Conditions and Conformance Issues***

In the event that a change or changed condition is encountered, the Project Manager/Project Engineer will review the condition and make a determination as to what revision in the construction activity or construction process will be required. This review and determination will be made in recognition of the RAWP. TRC will immediately notify NYSDEC of any changes encountered at the site. The discussions and decisions made with the NYSDEC will be recorded in a memorandum, which will be submitted to NYSDEC with the FER.

If QA inspections/tests reveal out-of-specification conditions, TRC will immediately contact the Contractor's Field Superintendent to determine what action will be taken to address the construction operation and correct the condition. The results of these discussions and follow-up corrective actions will be recorded in the DIR and included in the Final Engineering Report to NYSDEC.

### ***5.2.5 Photographic Logs***

Photographs of work in progress, problems and corrective measures will be recorded in the Photographic Logs on a daily basis. A Photographic Log will be submitted to NYSDEC with the FER.

## **5.3 Post-Construction Documentation**

Post-construction documentation will be submitted in the Final Engineering Report and will include as-built figures, a Photographic Log, a compilation of daily inspection reports and documentation of any deviations from the approved RAWP. The FER report will document the remedial construction activities performed and final site configuration following the implementation of the proposed Remedial Actions.

## 6.0 REFERENCES

- Air Force Center for Environmental Excellence, 2001. Guidance on Soil Vapor Extraction Optimization. Environmental Restoration Program, Brooks AFB, TX.
- American Academy of Environmental Engineers/US Environmental Protection Agency, 1998. Innovative Site Remediation Technology – Design & Application (Vol 7): “Vacuum Extraction and Air Sparging”, EPA 542-B-97-010. AAEE/WASTECH, Annapolis, MD.
- Kuo, J., 1999. Practical Design Calculations for Groundwater and Soil Remediation. Lewis Publishers, Boca Raton, FL.
- Leeson, A. and Hinchee, R.E., 1996b. Principles and Practices of Bioventing, Volume II: Bioventing Design. Battelle Memorial Institute, Columbus, OH.
- US Army Corps of Engineers, 2002. Engineering & Design: “Soil Vapor Extraction and Bioventing”. Engineer Manual EM 1110-1-4001.
- US Environmental Protection Agency, 1995. “How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites”: A Guide for Corrective Action Plan Reviewers. OSWER EPA 510-B-95-007, (5403W).
- US Environmental Protection Agency, 1996. User’s Guide to the VOCs in Soils Presumptive Remedy. OERR Directive No. 9355.0-63FS. EPA 540/F-96/008.
- US Environmental Protection Agency, 2005. Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation. EPA 240/B-05/001.
- Wisconsin Department of Natural Resources, 2002. Guidance for Design, Installation and Operation of Soil Venting Systems, PUB-RR-185.
- Crane Co., 1991. Flow of Fluids through Valves, Fittings, and Pipe (25<sup>th</sup> Printing), Technical Paper Number 410
- US Environmental Protection Agency, May 1993. “Guidelines for Making Environmentally Sound Decisions in the Superfund Remedial Process”
- US Environmental Protection Agency, April 2008. “Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites”. OSWER EPA 542-R-08-002
- US Environmental Protection Agency, April 2008. “Incorporating Sustainable Environmental Practices into Site Remediation”. OSWER EPA 542-F-08-002
- US Environmental Protection Agency, March 2010. “Green Remediation Best Management Practices: Soil Vapor Extraction & Air Sparging”. OSWER EPA 542-F-10-007

## FIGURES



**TRC ENVIRONMENTAL CORP.**  
 41 Spring Street  
 New Providence, New Jersey 07974

**SITE LOCATION MAP**

CPB – EDMERE, NEW YORK

JOB NO.: 174788

HN

DATE: OCTOBER 15, 2008

FIGURE: 1

FAR ROCKAWAY BOULEVARD

TO BAY  
P.O.B. 32ND STREET

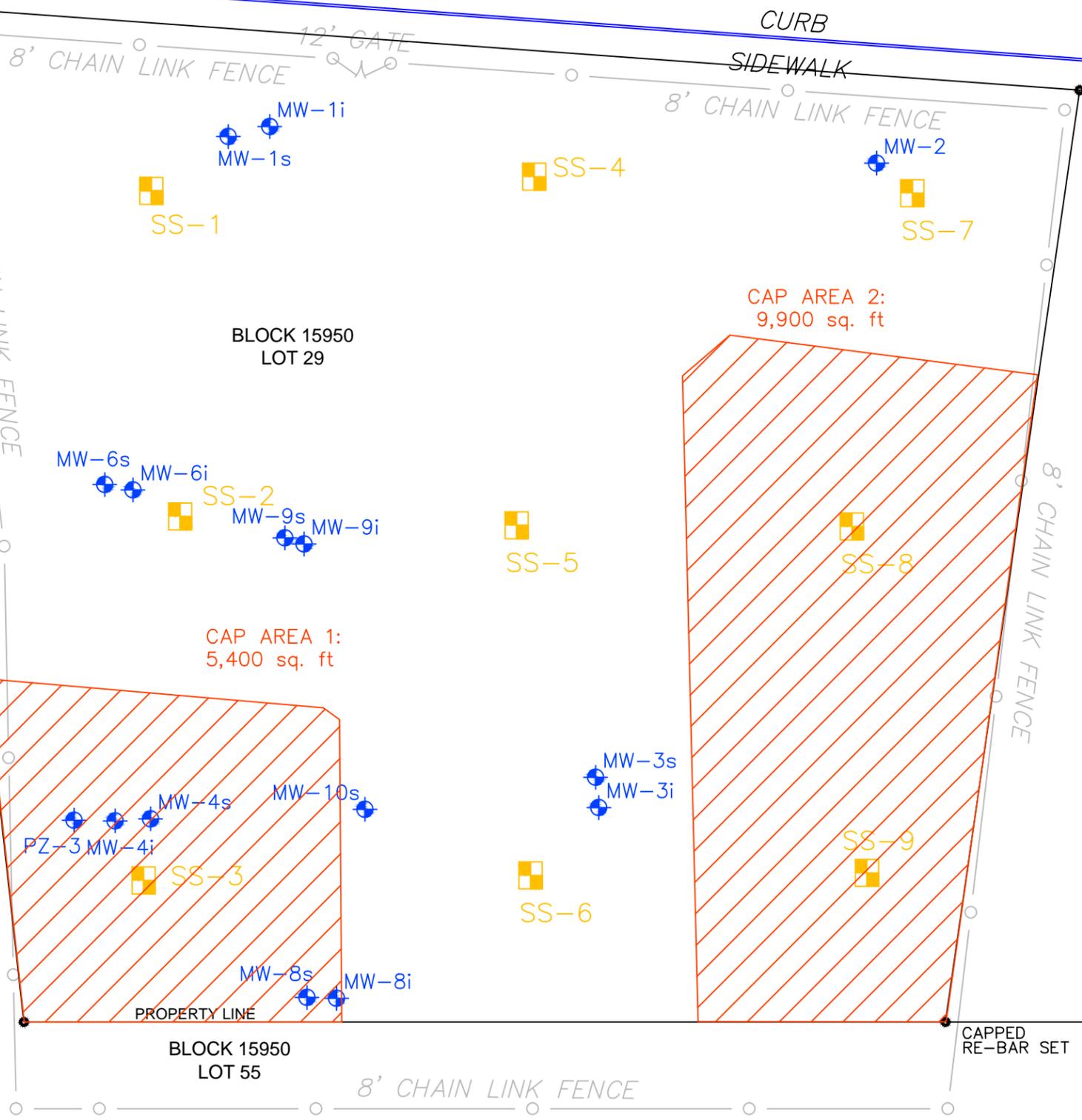
BLOCK 15950  
LOT 24

BLOCK 15950  
LOT 29

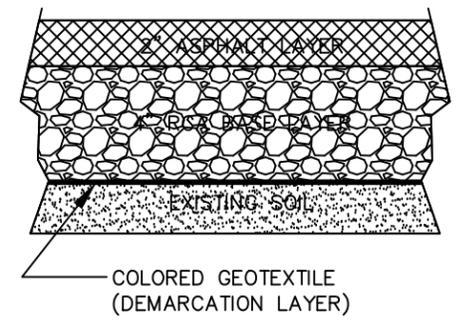
CAP AREA 1:  
5,400 sq. ft

CAP AREA 2:  
9,900 sq. ft

BLOCK 15950  
LOT 55



ASPHALT CAP DETAIL



LEGEND

- MW-1 MONITOR WELL LOCATION
- SS-1 SURFACE SOIL SAMPLING LOCATION

**TRC** TRC ENVIRONMENTAL CORP.  
41 Spring Street  
New Providence, New Jersey 07974

ENGINEERING CONTROL LOCATIONS  
AND ASPHALT CAP DETAILS

CPB - FAR ROCKAWAY, NEW YORK

JOB NO.: 174788

DL/GB	DATE: MARCH 2015	FIGURE: 2
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ROCKAWAY FREEWAY

**APPENDIX A**  
**PERSONNEL RESPONSIBILITIES**

**APPROVAL AUTHORITY:  
NYSDEC PROJECT MANAGER**  
Chris Magee (DEC)  
(518) 402-9813

**RESPONSIBLE PARTY:**  
CPB  
Grant Cooper, Ph.D, PE  
(801) 240-4074

**LEAD ORGANIZATION: TRC  
PROGRAM MANAGER**  
Nidal Rabah, Ph.D., P.E.,(TRC)  
(908) 988-1700

**PROJECT ENGINEER/  
PROJECT MANAGER**  
Heath Potter (TRC)  
(908) 988-1655

**SUBCONTRACTORS:**  
Organization: TBD  
Role: Driller, Excavation,  
Trucking and Disposal  
Contractor  
Project Contact: TBD  
(TBD)

**TECHNICAL REVIEW**  
Barry Tornick, (TRC)  
(908) 988-1624

**QUALITY ASSURANCE  
MANAGER**  
Elizabeth Denly, (TRC)  
(978) 656-3577

**FIELD TEAM/QA MANAGER/  
SITE SAFETY OFFICER**  
Gail Bradbury, (TRC)  
(908) 988-1651

**LEGEND**  
— Supervisory  
- - - Communication

**FIELD TEAM**  
TRC

**PROJECT ORGANIZATION CHART**  
CPB SITE  
BCP # C241158  
FAR ROCKAWAY, QUEENS, NEW YORK

 41 Spring Street  
New Providence, NJ 07974  
908-988-1700

TRC PROJ. NO.: 174788.0000.0000

**APPENDIX B**  
**DAILY INSPECTION REPORTS**



### DAILY INSPECTION REPORT

DATE:	TIME ARRIVAL:
WEATHER:	
PROJECT NUMBER: 174788	
BUILDING NO. AND WORK PHASE:	

TRC STAFF: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

EQUIPMENT: \_\_\_\_\_  
 \_\_\_\_\_

SUBCONTRACTORS \_\_\_\_\_  
 SUB PERSONNEL: \_\_\_\_\_

CONSTRUCTION ACTIVITY/LOCATION: \_\_\_\_\_

MEETINGS/DISCUSSIONS (e.g. Tail Gate Meeting) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

WORK BEING PERFORMED: \_\_\_\_\_

INSPECTION TYPE: \_\_\_\_\_

OBSERVATIONS OR TEST DATA: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

INSPECTION RESULTS COMPARED WITH SPECIFICATION REQUIREMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

OTHER INFORMATION: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



CPB SITE  
FAR ROCKAWAY, QUEENS, NEW YORK  
BCP # C241158



**AS-BUILT SKETCH**

LOCATION OF SKETCH AREA: \_\_\_\_\_

SKETCH AREA BELOW INCLUDES CROSS SECTION/PLAN VIEWS: \_\_\_\_\_

\_\_\_\_\_

SAMPLE



QA INSPECTIONS: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

MATERIALS RECEIVED:

SUBMITTAL STATUS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

PROBLEMS IDENTIFIED:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

WAS A CORRECTIVE MEASURE REPORT COMPLETED? \_\_\_\_\_

DRAWING/SPECIFICATION REFERENCE NO.: \_\_\_\_\_

DESCRIPTION/PROPOSED CHANGES TO ENGINEERED PLANS AND SPECS: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SAMPLE



**ACCEPTANCE OF COMPLETED COMPONENTS**

ITEMS COMPLETED: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

FIELD/QA REPRESENTATIVE ON SITE: \_\_\_\_\_ DATE: \_\_\_\_\_

\_\_\_\_\_  
Name Signature

SAMPLE

**APPENDIX C**  
**INITIAL AND FINAL INSPECTION REPORT**



**INITIAL INSPECTION CHECKLIST – “PUNCH LIST”**

DATE: \_\_\_\_\_

DESCRIPTION AND LOCATION OF WORK INSPECTED: \_\_\_\_\_

SPECS SECTION: \_\_\_\_\_

REFERENCE CONTRACT DRAWINGS: \_\_\_\_\_

A. PERSONNEL PRESENT

	<u>NAME</u>	<u>POSITION</u>	<u>COMPANY</u>
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____
8.	_____	_____	_____
9.	_____	_____	_____
10.	_____	_____	_____

B. MATERIALS BEING USED ARE IN STRICT COMPLIANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS. \_\_\_\_ YES \_\_\_\_ NO IF NOT, EXPLAIN: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

C. PROCEDURES AND/OR WORK METHODS WITNESSED ARE IN STRICT COMPLIANCE WITH THE REQUIREMENTS OF THE CONTRACT SPECIFICATIONS. \_\_\_\_ YES \_\_\_\_ NO IF NOT, EXPLAIN: \_\_\_\_\_

\_\_\_\_\_

D. SUMMARY OF INSPECTION RESULTS: \_\_\_\_\_

\_\_\_\_\_

E. ACCEPTANCE CRITERIA: \_\_\_\_ YES \_\_\_\_ NO IF NOT, EXPLAIN: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

F. SAFETY VIOLATIONS AND CORRECTIVE ACTION TAKEN: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



CPB SITE  
FAR ROCKAWAY, QUEENS, NEW YORK  
BCP # C241158



G. PASS/FAIL INSPECTION: \_\_\_\_\_

H. RE-INSPECTION DETAILS (Date, requirements, etc.): \_\_\_\_\_  
\_\_\_\_\_

FIELD/QA REPRESENTATIVE ON SITE: \_\_\_\_\_

DATE: \_\_\_\_\_

\_\_\_\_\_  
Name

\_\_\_\_\_  
Signature

SAMPLE



**FINAL INSPECTION CHECKLIST**

DATE: \_\_\_\_\_

DESCRIPTION AND LOCATION OF WORK INSPECTED: \_\_\_\_\_

SPECS SECTION: \_\_\_\_\_

REFERENCE CONTRACT DRAWINGS: \_\_\_\_\_

A. PERSONNEL PRESENT

	<u>NAME</u>	<u>POSITION</u>	<u>COMPANY</u>
11.	_____	_____	_____
12.	_____	_____	_____
13.	_____	_____	_____
14.	_____	_____	_____
15.	_____	_____	_____
16.	_____	_____	_____
17.	_____	_____	_____
18.	_____	_____	_____
19.	_____	_____	_____
20.	_____	_____	_____

B. STATUS OF INSPECTION:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

C. WORKMANSHIP IS ACCEPTABLE.  YES  NO IF NOT, EXPLAIN: \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_

FIELD/QA REPRESENTATIVE ON SITE: \_\_\_\_\_

DATE: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**APPENDIX D**  
**SAMPLE COPY OF MEETING LOG**



**MEETING LOG**

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

LOCATION:  
\_\_\_\_\_

PARTICIPANTS:  
\_\_\_\_\_

SUBJECT:  
\_\_\_\_\_

MINUTES OF MEETING: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- ACTION ITEMS AND DUE DATES:
1. \_\_\_\_\_
  2. \_\_\_\_\_
  3. \_\_\_\_\_

COMMENTS:  
\_\_\_\_\_

SAMPLE