

**DRAFT**

**REMEDIAL OPTIMIZATION WORK PLAN**

**ON-BASE GROUNDWATER AREAS OF CONCERN**

**FORMER GRIFFISS AIR FORCE BASE**

**ROME, NEW YORK**

**December 2016**

Prepared For:



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## REVIEW SHEET

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## ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFRPA	Air Force Real Property Agency
AHA	Activity Hazard Analysis
AOC	Area of Concern
bgs	Below ground surface
Bhate	Bhate Environmental Associates, Inc.
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/sec	centimeters per second
COC	Chemical of concern
CVOC	Chlorinated volatile organic compound
d <sup>-1</sup>	Per day
DCE	Dichloroethene
DHC	Dehalococcoides
DO	Dissolved oxygen
DoD	Department of Defense
DPT	Direct-push technology
EEEP	Ecology and Environment Engineering, P.C.
ERD	Enhanced reductive dechlorination
ESD	Explanation of significant difference
EVO	Emulsified vegetable oil
FFA	Federal Facilities Agreement
foc	Fraction organic carbon
FPM	FPM Group, Ltd. or FPM Remediations, Inc.
ft	Feet
ft/day	feet per day

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ft/ft	Feet per feet
GLDC	Griffiss Local Development Corporation
gms	Grams
gms/cm <sup>3</sup>	Grams per cubic centimeter
IC	Institutional control
IDW	Investigation derived waste
IRP	Installation Restoration Program
ISCO	In-situ chemical oxidation
K	hydraulic conductivity
LTM	Long-term management
LUC	Land use control
µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MNA	Monitored natural attenuation
mV	Millivolts
NPL	National Priorities List
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
OBGW	On-base Groundwater
OES	Optimized exit strategy
OPS	Operating properly and successfully
ORP	Oxidization-reduction potential
Parsons	Parsons Government Services, Inc.
PCE	Tetrachloroethene
PMP	Project Management Plan
POP	Period of performance
PVC	Polyvinyl chloride
RAO	Remedial Action Objective

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RA-O	Remedial Action Operation
ROI	Radius of influence
RAWP	Remedial Action Work Plan
RC	Response Complete
RI	Remedial Investigation
RO	Remedial Optimization
ROD	Record of Decision
SI	Supplemental Investigation
SMC	Six Mile Creek
SSHP	Site Safety and Health Plan
TCA	Trichloroethane
TCE	Trichloroethene
TMC	Three Mile Creek
UIC	Underground Injection Control
U.S.	United States
USEPA	U.S. Environmental Protection Agency
VC	Vinyl chloride
VOC	Volatile Organic Compound
WSA	Weapons Storage Area
ZVI	Zero valent iron

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# 1 INTRODUCTION

Bhate Environmental Associates, Inc. (Bhate), under contract with the Air Force Civil Engineer Center (AFCEC), is performing long-term management (LTM), site remediation, and site investigations at the former Griffiss Air Force Base (AFB), Rome, New York. Bhate has been tasked to prepare this Remedial Optimization (RO) Work Plan for the On-Base Groundwater (OBGW) Areas of Concern (AOCs): SD052-01 (Apron 2 Chlorinated Plume Site), SD052-02 (Building 775 Site), SD052-04 (Landfill 6 Trichloroethene [TCE] Site), and SD052-05 (Building 817 Weapons Storage Area [WSA]).

This optimization work plan addresses the tasks required to achieve the RO goals for each AOC as outlined in the *2016 Opening Phase, Project Management Plan, Former Griffiss Air Force Base* (Bhate, November 2016a).

## 1.1 Project Overview

Griffiss AFB is a former United States Air Force Installation located in Rome, Oneida County, New York, approximately 15 miles northwest of Utica in central New York State (**Figure 1**). Opened in 1942, the base closed pursuant to Base Realignment and Closure (BRAC) action in 1995. Currently, the airfield is occupied by Griffiss International Airport, owned by Oneida County.

Numerous studies, investigations, and remedial actions under the United States (U.S.) Department of Defense (DoD) Installation Restoration Program (IRP) have been performed to locate, assess, quantify, and remove contaminant sources at the past toxic and hazardous waste storage, disposal, and spill sites. Pursuant to Section 105 of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Griffiss AFB was included on the National Priorities List (NPL) on July 15, 1987. On March 20, 2009, 2,897.2 acres of the 3,552 acres at the former Griffiss AFB were removed from the NPL. On August 21, 1990, the Air Force, United States Environmental Protection Agency (USEPA), and New York State Department of Environmental Conservation (NYSDEC) entered into a Federal Facilities Agreement (FFA) under Section 120 of CERCLA. Starting in 2002, LTM was implemented at the former Griffiss AFB. LTM is currently conducted at several sites, including the on-base groundwater AOCs. The locations of the four on-base groundwater AOCs are adjacent to the Griffiss International Airport runways and are presented on **Figure 1**.

## 1.2 Project Objectives

The primary goal of the optimized exit strategy (OES) at SD052-01, SD052-04, and SD052-05 is to enhance chemical of concern (COC) reductions achieved as a result of previous remedial efforts and to optimize groundwater monitoring to reduce future liability to the Air Force.

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Similarly the primary goal of Response Complete (RC) at SD052-02 is to optimize the current remedial approach to reduce COCs to below NYSDEC Class GA Groundwater Quality Standards. The project objective and a description of the technical approach for each AOC is presented in **Table 1**.

**Table 1. On-Base Groundwater AOCs Project Objectives**

Sites	Project Objective	Brief Description of Technical Approach
SD052-01: Apron 2 Chlorinated Plume	OES	Complete pilot study to evaluate enhanced reductive dechlorination (ERD) to enhance the existing monitored natural attenuation (MNA) remedy. Prepare explanation of significant difference (ESD), if appropriate. Use statistical analysis to optimize groundwater monitoring; conduct land use control (LUC)/institutional control (IC) monitoring and Five Year Review. Prepare Optimization Plan and OES Report.
SD052-02: Building 775 Site	RC	Complete pilot study to evaluate ERD and then prepare a focused Feasibility Study. Prepare a Record of Decision (ROD) Amendment to support ERD with MNA remedy. Conduct injections throughout the site to enhance reductive dechlorination; conduct LUC/IC monitoring and reporting and Five Year Review.
SD052-04: Landfill 6 TCE Site	OES	Conduct focused ERD injections at the hot spot using existing injection wells; use statistical analysis to optimize groundwater monitoring; conduct LUC/IC monitoring and Five Year Review. Prepare Optimization Plan and OES Report.
SD052-05: Building 817/WSA	OES	Conduct focused, follow-on injections for ERD in hot spot areas; use statistical analysis to optimize groundwater monitoring; conduct LUC/IC monitoring and Five Year Review. Prepare Optimization Plan and OES Report.

### 1.3 Summary of Previous Remedial Investigations

Much of the following information presented in Sections 1.3.1, 1.3.2, 1.3.3, and 1.3.4 was obtained from the Final Spring 2014 Annual Report Performance Monitoring (FPM Remediations, Inc. [FPM], June 2015).

#### 1.3.1 SD052-01 Apron 2 Chlorinated Plume Site Description and History

The chlorinated volatile organic compound (CVOC) contamination in the Apron 2 area is present as a plume approximately 2,800 feet (ft) long and 500 ft wide and appears to originate in the area of the nosedock wash water system near Building 786 (**Figure 2**).

The site-specific geology in the vicinity of Apron 2 is characterized by dense soils consisting mainly of fine to medium sands with silt and occasional clay layering. During construction of Apron 2, approximately 15 feet of fill was added to the entire area. Soil screening conducted during the SI confirmed that fill material appears to exist to an approximate depth of 15 ft

below ground surface (bgs). The fill material consists mainly of fine to medium sands with varying amounts of silt and clay. Dense, unsaturated soils in the area of Apron 2 are most likely the result of thorough compaction of fill material during the construction of the area prior to the installation of the Apron 2 concrete pad. Beneath the fill is silty sand to an approximate depth of 23 ft bgs, under which occasionally, in the vicinity of the middle part of Apron 2, is a clay layer, up to 3 ft thick, which appears to support perched groundwater conditions at some locations. Beneath the clay is a loose, coarse to fine gravel layer, approximately 10 ft thick, associated within the first 10 ft of the top of the groundwater table beneath the site. A fine to medium uniform sand or dense silt underlies the gravel layer, followed by till down to the top of the bedrock. The hydraulic gradient was calculated at  $4.6 \times 10^{-3}$  feet per foot (ft/ft), compared to the hydraulic gradient for the area extending from the northeast edge of Apron 2 to Six Mile Creek, calculated at  $9 \times 10^{-3}$  ft/ft. The hydraulic conductivity was assumed to be 11.03 feet per day (ft/day); this value was derived by taking the average of the average hydraulic conductivity of the fine to medium sand formation and the average hydraulic conductivity of the gravel formation (FPM., March 2004). Depth to groundwater is approximately 21.26 ft bgs at 782VMW-105B.

Chlorinated solvent use probably occurred in all nosedock facilities and multiple small sources could exist along floor drains, sewer lines, and oil water separators. There are three primary contaminants exceeding New York State (NYS) Class GA Groundwater Standards: TCE, and its breakdown products cis-1,2-dichloroethene (DCE) and vinyl chloride (VC). The plume is commingled with several petroleum fuel plumes originating from the Apron 2 fueling system. At locations where TCE and fuel contaminants are commingled, significant reductive dechlorination is occurring and TCE is almost completely degraded to cis-1,2-DCE and VC.

The ROD for Site SD052-01 was signed on 6 March 2009. The Remedial Action Objectives (RAOs) for SD025-01 outlined in the ROD are as follows:

- Achieve the cleanup goals for COCs cis-1,2-DCE, TCE, and vinyl chloride, which are 5 micrograms per liter ( $\mu\text{g/L}$ ), 5  $\mu\text{g/L}$ , and 2  $\mu\text{g/L}$ , respectively.
- Prevent human exposure to groundwater through groundwater use restrictions until cleanup goals are achieved.
- Prevent contaminated groundwater from the site from adversely impacting surface water (in Six Mile Creek), which is defined as surface water concentrations above performance indicators (NYSDEC Class GA Groundwater Quality Standard of 2  $\mu\text{g/L}$  for vinyl chloride).
- Prevent development and use of the property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.

The selected remedy (Alternative 3) for the Nosedocks/Apron 2 OBGW site consists of MNA, including groundwater and surface water monitoring. Monitoring will be conducted to verify that assumptions from the Feasibility Study are valid and that human health and the

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environment are protected. The final Remedial Action Work Plan (RAWP) (Parsons Government Services, Inc. [Parsons], July 2008) specifies MNA as the selected remedy using the ongoing physical, chemical, and natural biological process that reduce the contaminants within the aquifer.

Based on previous investigations and studies, it has been determined that natural attenuation is evident at the Apron 2 Chlorinated Plume Site. However, based upon recent groundwater data, the site is experiencing VC build up likely due to naturally occurring microbes lacking the VC-reductase gene necessary for complete biodegradation of TCE to ethane. As shown on **Figure 2**, only monitoring wells 782VMW-81 and 782VMW-105B have TCE that exceeds the NYS Class GA Groundwater Standards and has shown a decreasing trend. VC is currently the primary COC and has the potential to adversely impact surface water. Surface water has not had VC detected above the action level of 2 µg/L and has not triggered the ROD-requirement of a contingent action. Discussion regarding contingent action is presented in Section 2.1.4.

The groundwater is primarily anaerobic due to the former petroleum release sites upgradient and cross-gradient of SD052-01. However, some monitoring wells are showing aerobic readings (dissolved oxygen [DO] greater than 4 milligrams per liter [mg/L]), which is expected to continue as the petroleum releases are cleaned up. Oxidation-reduction potential (ORP) is generally less than -50 millivolts (mV).

### 1.3.2 SD052-02 Building 775 Site Description and History

The Building 775 plume is located downgradient of former maintenance facilities in Buildings 774 and 776 and former fuel pump house Building 775 (**Figure 3**). It was originally thought that Building 775 (Pumphouse 3) was the origin of a TCE plume at the Building 775 OBGW site, but during the Remedial Investigation (RI) and Supplemental Investigation (SI), it was determined that the actual source of contamination was the degreasing room/vat in Building 774. This degreasing system used a monorail to carry equipment to the degreasing vat for solvent cleaning when the building was used as an armament and electronics shop. Solvent use was widespread in these facilities in the 1950s, 1960s, and early 1970s. The primary contaminant exceeding NYS Class GA Groundwater Standards is TCE with minor detections of 1,1,1-trichloroethane (TCA) and tetrachloroethene (PCE).

The aquifer is comprised of silty sands with an average thickness extending from 60 ft bgs to 120 ft bgs, where shale bedrock is encountered. Based on the results of the Spring 2000 SI conducted by EEPC, the average hydraulic conductivity (K) and hydraulic gradient at the Building 775 site are  $5.5 \times 10^{-4}$  centimeters per second (cm/sec) and 0.005 ft/ft respectively. The site also consists of uniform mixtures of silty sands and sand/silt mixtures with no adverse stratigraphy, such as the presence of low permeability layers continuous over large areas. The results of the SI conducted by EEPC in 2000 showed an average hydraulic conductivity of  $5.5 \times$

10 cm/s across the plume area, and a hydraulic gradient of 0.005 ft/ft. Given this hydraulic conductivity and gradient, and assuming a porosity of 0.3, Average groundwater velocities have been estimated at approximately 10 ft per year. Seepage velocity was not estimated during the FS.

Higher velocities may exist in discontinuous seams of coarse sand and gravel. Contamination is not found in the bedrock. Groundwater studies at nearby Landfill 6 TCE Site found relatively aerobic conditions and low dissolved organic carbon concentrations. The general absence of cis-1,2-DCE in the Building 775 plume confirms that reductive dechlorination is not occurring (Ecology and Environment Engineering, P.C. [EEEEPC], February 2008).

The ROD for Site SD052-02 was signed on 6 March 2009. The RAOs for SD052-02 outlined in the ROD are as follows:

- Achieve the cleanup goal for TCE of 5 µg/L.
- Prevent human exposure to groundwater through groundwater use restrictions until cleanup goals are achieved.
- Prevent contaminated groundwater from the site from adversely impacting surface water (in Three Mile Creek [TMC]), which is defined as surface water concentrations above performance indicators (NYSDEC Class GA Groundwater Quality Standards of 5 µg/L for DCE and 2 µg/L for vinyl chloride).
- Prevent development and use of the property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.

The selected remedy (Alternative 5) for the Building 775 OBGW site includes installation of recovery wells to extract the groundwater from the Building 775 plume and then treat the groundwater. The groundwater was discharged to the sanitary sewer for off-site treatment at a wastewater treatment facility or treated and discharged to TMC. The groundwater extraction system is designed to contain the TCE plume (> 50 µg/L) and extract the contaminants from the aquifer. Initially, one extraction well (775EW-1) was installed in July 2008 but deemed inappropriate for groundwater extraction. It was replaced by extraction well (775EW-1R) and an additional extraction well (775EW-3). Extraction well 775EW-1 was converted to a monitoring well and 775EW-1R and 775EW-3 were connected with a force main and the extracted contaminated groundwater is discharged to the existing sanitary sewer system for treatment at the City of Rome Water Pollution Control Facility. As part of the discharge permit, effluent sampling is performed every 90 days at the point of discharge. Effluent sampling will continue to be performed every 90 days.

Since start-up of the groundwater extraction and discharge system in December 2008, TCE decreased within the wells influenced by the extraction wells such that the goal of containing the TCE plume > 50 µg/L has been achieved. Therefore, the extraction system was shut-down in September 2016 with rebound sampling completed in November 2016.

### 1.3.3 SD052-04 Landfill 6 TCE Site Description and History

The Landfill 6 TCE Site plume is located downgradient and to the west of Landfill 6 (**Figure 4**). The most contaminated portion of the plume is located southwest of the landfill beneath the floodplain of TMC. Contaminants exceeding NYS Class GA Groundwater Standards (NYSDEC, June 1998) are TCE, DCE, and VC.

The depth to groundwater ranges from 2.6 feet to 64.7 feet with an average of about 19 feet across the site. Given a hydraulic conductivity at the site of  $1 \times 10^{-4}$  cm/s and a hydraulic gradient of 0.005 ft/ft, and assuming a porosity of 0.3, the groundwater velocity in the plume was estimated using Darcy's law at  $4 \times 10^{-7}$  cm/s or  $7.9 \times 10^{-7}$  feet per minute. (EEPC, August 2000). Seepage velocity was not estimated during the FS.

The ROD for Site SD052-04 was signed on 6 March 2009. For Site SD052-04, the RAOs are to:

- Achieve the cleanup goals for COCs cis-1,2-DCE, TCE, and vinyl chloride, which are 5 µg/L, 5 µg/L, and 2 µg/L, respectively.
- Prevent human exposure to groundwater through groundwater-use restrictions until cleanup goals are achieved.
- Prevent contaminated groundwater from the site from adversely impacting surface water (in TMC), which is defined as surface water concentrations above performance indicators (NYSDEC Class GA Groundwater Quality Standards of 5 µg/L for DCE and 2 µg/L for vinyl chloride).
- Prevent intrusive work or other activities that will impact the effectiveness of the landfill closure and post-closure activities.
- Prevent development and use of the property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.

The selected remedy (Alternative 6) for SD052-04 includes bioremediation of the plume in the area exhibiting the highest COC concentration. The in-situ bioreactor has been created by increasing and sustaining a higher level of dissolved organic carbon in the groundwater contaminated with greater than 500 µg/L of total VOCs which represents the area of the plume with the highest COC concentrations. As listed in the final RAWP (Parsons, July 2008), this process is intended to increase biodegradation of the groundwater contaminants by injecting a vegetable oil emulsion. The vegetable oil emulsion increases the natural breakdown of the chemicals, reducing the concentration of contaminants.

The emulsified vegetable oil (EVO) injection was performed at injection wells LF6IW-01 through LF6IW-06 in July 2008, August 2010, and again in October 2013. These injection wells are located in a cluster slightly upgradient of the cluster of monitoring wells in the hot spot (LF6MW-12, LF6MW-16, LF6MW-17, and LF6MW-20) as shown on **Figure 4**.

Additional investigation was completed at Landfill 6 on 13 through 15 May 2015. Twenty-nine soil samples and eight groundwater samples were collected. Samples were collected from 20 to 60 ft bgs. Soil profiling activities were also completed to better characterize the subsurface materials. No lenses of low permeability were found that would result in rebound of CVOCs. PCE was not detected in any samples. VC was only detected in one boring, LF6SB-1, but below the cleanup goal. Given that DCE was found in the soil samples, ERD appears to be occurring but not at rates that allow for full degradation to ethane throughout the plume. This assertion is further demonstrated by the total Volatile Organic Compounds (VOCs) remaining the same from 2010 through 2014 despite multiple EVO injections. The highest concentrations of CVOCs in soil were near the plume hot spot (near LF6-MW12) and in the 40 to 50 ft bgs depth. The groundwater at Site SD052-04 has a neutral pH, low DO, and negative ORP (typically less than -100 mV).

### **1.3.4 SD052-05 Building 817/WSA Site Description and History**

The Building 817/WSA Site is located on the north side of the main runway between Building 817 and the culverted section of Six Mile Creek (SMC) south of the former WSA (**Figure 5**). Building 817 was formerly used for electronic parts maintenance. PCE and TCE were solvents used in small quantities at this location.

The depth to groundwater is approximately 3.6 feet bgs in the area of WSA-MW16. Soil are described as poor to well graded gravelly sands in the saturated zone down to the Utica shale. The groundwater flow velocity of 0.04 ft/day was obtained using a hydraulic conductivity of  $1 \times 10^{-4}$  cm/sec, a hydraulic gradient of 0.04 ft/ft and an aquifer porosity of 0.3. (E & E SI 2000). Seepage velocity was not estimated during the FS.

Results from a SI, performed by Parsons in 2014 and 2015, confirmed that low level plume concentrations are likely the result of back diffusion from fine grained silty clay material at the site (Parsons, September 2015). Thirty-six soil samples and three groundwater samples were collected on 11 and 12 August 2015 as a SI Addendum, which effectively delineated CVOCs in the area to the northwest of Building 817. Samples were collected from 8 to 25 ft bgs. The highest CVOCs were detected in samples collected northwest of Building 817, adjacent to BH-1-10 and the suspected source area. Concentrations decrease up gradient and side gradient away from the building. The groundwater at Site SD052-05 varies significantly, but is generally neutral pH with low DOs (less than 4 mg/L).

The ROD for Site SD052-05 was signed on 6 March 2009. The RAOs for SD052-05 outlined in the ROD are as follows:

- Achieve the cleanup goals for COCs PCE and TCE, which is 5 µg/L.
- Prevent human exposure to groundwater through groundwater use restrictions until cleanup goals are achieved.

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- Prevent contaminated groundwater from the site from adversely impacting surface water (in SMC), which is defined as surface water concentrations above performance indicators (NYSDEC Class GA Groundwater Quality Standard of 2 µg/L for vinyl chloride and 5 µg/L for DCE).
- Prevent development and use of the property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.

The selected remedy (Alternative 7) for the Building 817/WSA OBGW site consists of a two-step groundwater remediation approach that includes enhanced bioremediation followed by air sparging to both volatilize and aerobically degrade DCE and vinyl chloride residuals, as needed. As listed in the final RAWP (Parsons, July 2008), this process is intended to increase biodegradation of the groundwater contaminants by injecting a vegetable oil emulsion into the ground. The vegetable oil emulsion increases the biological breakdown of the chemicals by providing the appropriate strains of Dehalococcoides (DHC), a naturally occurring anaerobic bacteria, with an appropriate carbon electron donor that releases hydrogen atoms to replace the chlorine atoms in the CVOCs. The DHC strips the chlorine atoms replacing it with the hydrogen atom from the vegetable oil emulsion; thereby reducing the concentration of contaminants. The secondary step of air sparging would primarily be implemented to prevent groundwater from reaching the Six Mile Creek; however, this additional step has not been necessary to date based upon sampling data.

## 2 TECHNICAL APPROACH TO ACHIEVING PROPOSED OUTCOME

The primary approach for each of the four on-base groundwater AOCs is to implement ERD to treat the CVOCs. Sites SD052-01, SD052-04, and SD052-05 will focus on reduction of CVOCs in Remedial Action – Operation (RA-O) target wells. These sites will also include a secondary goal to optimize the monitoring network. Site SD052-02 will use ERD to reduce CVOCs to less than the NYSDEC Class GA groundwater standards by 2021 to achieve RC. The following outlines the optimization approaches and rationale for each of the sites.

### 2.1 SD052-01 Apron 2 Chlorinated Plume Site Optimization

Given the size and presence of the chlorinated plume under existing buildings and Apron 2, reducing the CVOCs to less than NYSDEC Class GA groundwater standards by 2021 within the 5-year period of performance (POP) cannot occur without expending large amounts of money and at a high risk to the Air Force. Therefore, optimization using in-situ bioremediation will be used to implement a sustainable remediation for the lowest cost. Per the ROD:

*“A contingency alternative, such as a horizontal air sparging barrier (or other action agreed upon by the Air Force, USEPA, and NYSDEC) will be implemented if surface water samples from SMC contain elevated concentrations of VC (NYSDEC Class GA Groundwater Quality Standard of 2 µg/L).”*

While this contingent action has not been triggered because VC is not being detected in the surface water, it is clear that VC is building up and indigenous bacteria is unable to further degrade this COC. The existing aquifer is generally anaerobic due to upgradient and side gradient petroleum releases that have occurred but have largely been remediated in the recent years.

Though the implementation of a contingent action is allowed under the ROD, a ROD amendment or ESD is likely to be required. To further evaluate the remedy of ERD, initial treatment of the aquifer will be completed as a pilot study. If that action is successful, then the ROD may be revised through an amendment or ESD as determined through partnering and discussions with the Air Force and Regulators.

#### 2.1.1 Optimization Rationale

Two monitoring wells (782VMW-81 and 782VMW-105B) at SD052-01 had TCE detected above 5 µg/L in August 2014. All remaining exceedances are associated with daughter products DCE and VC. The current plume is primarily VC with the potential to impact SMC. Given VC plume concentrations over time, degradation of the VC is not occurring or VC is continuing to be

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generated through degradation of the DCE. Regardless, optimization of SD052-01 requires treatment of TCE, DCE, and VC at the head of plumes in the vicinity of Building 785 to reduce Air Force risk of the plume entering SMC and to reduce the time to achieve site closure. The placement of the injection points in proximity to the monitoring wells at Building 785 is designed to take advantage of the natural groundwater flow gradient as well as to inject into the highly transmissible gravel zone underneath Apron 1. The pilot study injection point locations should promote significant down gradient treatment of the remaining VOCs in the vicinity of Building 785.

### 2.1.2 Pilot Study Design

Implementation of the ERD pilot study at Site SD052-01 will involve injections of EVO, an inoculum of DHC culture, and nutrients into the groundwater via 7 direct-push technology (DPT) injection locations. The injection points are proposed to be in close proximity to 782VMW-80, 782VMW-81, and 782VMW-105B. **Figure 6** illustrates the injection point locations at SD052-01 where the ERD pilot study will be performed. The injection points will be advanced by DPT probe rod equipped with expendable points. Once the probe rod reaches the target injection depth the tool string will be retracted deploying the expendable point, thus allowing the injectant to be pumped through the probe rod and applied to the target depth interval.

Each injection point will receive 2,000 pounds of EVO; 750 gallons deoxygenated water; and 3.5 liters of DHC. Sodium bicarbonate will be added on an as needed basis. In total approximately 14,000 pounds of EVO; 5,250 gallons deoxygenated water; and 24.5 liters of DHC cultures will be injected into the groundwater via 7 DPT points to treat the chlorinated solvent groundwater contamination. Additional design assumptions are as follows: the saturated horizon is 15 ft, spanning an area of 9,200 square ft, with the assumed total and effective porosity at 0.35 and 0.3, respectively. The soil bulk density of 1.65 grams per cubic centimeter ( $\text{gm}/\text{cm}^3$ ) and soil fraction organic carbon content (foc) of 0.002, equates to a Treatment Zone Total Pore Volume (total volume X total porosity) of 1,367,856 liters and the Treatment Zone Effective Pore Volume of 1,172,448 liters, therefore, Bhate will adjust the target horizons to 0.77 grams (gms) EVO/liter to stimulate ERD.

The USEPA is the regulatory authority administering the Underground Injection Control (UIC) Program in New York. The Inventory of Injection Wells, USEPA Form 7520-16, will be submitted 30 days prior to commencement of injection, if conducted, unless otherwise indicated by the UIC Program Director.

### 2.1.3 Performance Model for SD052-01

No performance model is provided at this time as the action at SD052-01 is considered a pilot study to assess ERD effectiveness. The metric will focus on verifying growth of DHC and maintaining reducing conditions. Performance will initially be evaluated via quarterly sampling of performance monitoring wells identified on **Figure 6**. Following assessment of pilot study results, a performance model will be prepared if ERD is effective at reducing the COCs at Site SD052-01.

### 2.1.4 Contingencies for SD052-01

If the pilot study does not demonstrate ERD effectiveness, then evaluation of aerobic metabolism for the DCE and VC will be evaluated. While much of the aquifer is anaerobic, the significant reduction on carbon substrates from historical spills will eventually result in a more aerobic aquifer beneficial to aerobic VC degradation and to a lesser extent DCE degradation. Therefore, if ERD cannot be maintained at SD052-01, addition of dissolved oxygen via injection of an oxygen releasing compound or passive bioventing will be evaluated.

## 2.2 SD052-02 Building 775 Technical Approach to Achieving RC

To achieve RC, the RAOs within the ROD need be achieved, which requires reducing TCE to 5 µg/L throughout the site. The current selected remedy is extraction of groundwater for discharge to the sanitary sewer for offsite treatment. Despite approval of operating properly and successfully (OPS) of this remedy, TCE detections are not reducing significantly since the system came online in 2008. Further, there appears to be a dissection of the plume in the deeper aquifer south of Perimeter Road. Therefore, a step-wise evaluation to select an alternative remedy will be completed. Two pilot tests are anticipated to be completed at Site SD052-02. Pilot Study Area 1 is located within the upgradient, aerobic portion of the plume. Pilot Study Area 2 is located within the anaerobic, downgradient end of the plume. The step-wise process for each of these areas is outlined below.

**Pilot Study Area 1:** As presented in Section 2.2.3, the groundwater at SD052-02 will be tested using in-situ Bio-Trap® samplers to evaluate the remedial action effectiveness in stimulating microbial growth and creating a conducive environment to promote the growth of DHC. A soil sample collected using DPT from Pilot Study Area 1 near 775MW-06 will be sent to ReSolution Partners of Madison, WI for analysis using permanganate for a soil oxidant demand evaluation. Upon receipt of this data, a pilot study for Area 1 will be developed and presented in a technical memorandum. The data will be used to determine which remedy to further assess as follows:

- If the oxidant demand is greater than 1 mg/kg, then ERD treatment will be implemented. Sampling results, design rationale, injection point locations, estimated injection volume/quantity, and design calculation spreadsheets will be provided in a

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technical memorandum at a later date if it is determined that ERD will be used in Pilot Study Area 1 at SD052-02. The general injection procedures appear in Section 3.5 of this report.

- If the oxidant demand is below 1 milligrams per kilogram (mg/kg), then in-situ chemical oxidation (ISCO) will be evaluated within Pilot Study Area 1 based on its short timeframe to reduce residual VOC mass, ability to work in an aerobic environment and the limited infrastructure needed to implement the remedy. Sampling results, radius of influence determination, design rationale, injection point locations, estimated injection volume/quantity, and design calculation spreadsheets will be provided in a technical memorandum at a later date if it is determined that permanganate will be used in Pilot Study Area 1 at SD052-02. The general injection procedures appear in Section 3.6 of this report.

**Pilot Study Area 2:** To maintain consistency with the selected remedy for downgradient Site Landfill 6 AOC, ERD treatment will be evaluated in the deeper aquifer south of Perimeter Road. Additionally, this deeper aquifer has the lowest dissolved oxygen (DO) of the entire site such that ERD has the highest potential for success in this area. Given the depth of the contamination south of Perimeter Road, Bhate proposes to install two injection wells to complete the pilot study, as presented on **Figure 7**. During advancement of the injection wells, soil samples will be collected from approximately 70 bgs. The soil samples for Pilot Study Area 2 will be sent to ReSolution Partners of Madison, WI for analysis using permanganate for oxidant demand evaluation.

### 2.2.1 Optimization Rationale

The current selected remedy will not achieve site closure the ROD RAOs for at least 10 years based upon current trends. Addition of more extraction wells would follow the current selected remedy and optimize the removal of TCE; however, ROD RAOs will not be achieved within the 5-year contract. Therefore, additional in-situ treatment is necessary to reduce TCE to 5 µg/L throughout the plume and achieve the ROD RAOs within this contract POP.

### 2.2.2 Pilot Study Area 1

Prior to deploying the full scale remedial system in the upgradient, shallow portion of the plume, the groundwater at SD052-02 will be tested using in-situ Bio-Trap® samplers to evaluate the remedial action effectiveness in stimulating microbial growth and creating a conducive environment to promote the growth of DHC. The In-Situ Bio-Trap® samplers will be deployed in monitoring wells 775VMW-5 and 775MW-20.

The in-situ Bio-Trap® sampler studies serve as cost-effective, in-situ microcosms providing microbial, chemical, and geochemical evidence to screen remedial alternatives and evaluate

biodegradation as a treatment mechanism. Each in-situ Bio-Trap® sampler assembly consists of two to three units and are deployed in a monitoring well for 30 to 60 days and recovered for analysis. Each unit corresponds to a treatment approach (Control-MNA, Treatment A, and Treatment B). Treatment A and Treatment B are the exact same approach but is used to determine that optimal amount of injectate loading that will be required to promote ERD. Therefore, Treatment A is usually half the amount of the EVO as compared to Treatment B. Baffles are used to physically isolate each unit to eliminate vertical transport or “cross-talk” and establish each unit as an individual in-situ microcosm. Each unit contains passive diffusion samplers to determine COC concentrations and geochemical parameters. Each unit is a micro sampler for characterization of the microbial community. The assembly will also contain an amendment supplier corresponding to the type of treatment being investigated. Following 60 days of incubation in the target monitoring well, each assembly is retrieved and shipped to Microbial Insights located in Knoxville, Tennessee.

The data is analyzed as follows: The purpose of the Control-MNA Unit is to provide the baseline for comparison. Lower contaminant concentrations and increased daughter product formation in the Treatment Unit COC samplers would provide the first line of evidence that the treatments would be effective. Comparison of the geochemical parameters would be used to determine whether the treatments promoted redox conditions conducive to the desired biodegradation process. Finally, CENSUS analysis of the Bio-trap® samplers is used to determine whether the treatments stimulated growth of organisms capable of biodegradation of the COCs. The same comparisons would then be used to evaluate Treatment A versus Treatment B. Overall, a typical Bio-Trap® in situ microcosm study will provide three lines of complementary evidence to:

- Assess the feasibility of MNA
- Evaluate enhanced bioremediation as a treatment approach
- Screen enhanced bioremediation options

During the deployment of the Bio-Trap® sampler, a soil sample will be collected using DPT from 74 ft bgs and 20 feet hydraulically upgradient of 775MW-06. This soil sample will be sent to ReSolution Partners of Madison, WI for analysis using permanganate for soil oxidant demand evaluation. Pilot Study Area 2

As part of the remedial action planned for SD052-02, two injection wells will be installed by Bhate during the pilot study (**Figure 7**). Both injection wells will be placed hydraulically upgradient of their respective target wells. The first injection well will be to the northwest of monitoring well 775VMW-10 and the other will be placed northwest of monitoring well 775MW-20. During advancement of the injection wells, soil samples will be collected from approximately 70 ft bgs. These soil samples will be sent to ReSolution Partners of Madison, WI for analysis using permanganate for soil oxidant demand evaluation.

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Total depths of the injection wells will be determined through observation of the transition zone between the mixed silty sands and the underlying till. Placement of the screened interval will be above the till layers. The target injection well depths are approximately 110 ft bgs.

The injection wells will be constructed with ¾-inch diameter flush-threaded Schedule 40 polyvinyl chloride (PVC) riser and screened at varying depths with 0.020-inch factory slotted PVC screen. Washed, bagged, and rounded 8/20 or 10/20 mesh sand pack material will be placed in the annular space around the well assembly by tremie pipe, approximately 1 to 2 ft above the top of the well screen followed by fine grained 30/65 mesh silica sand (choke sand) and a casing seal consisting of Type II Portland cement grout to the ground surface. Each well will then be completed as a permanent flush mount. Upon completion of the well installations, a New York-registered professional land surveyor will perform vertical and horizontal surveying at each well.

### 2.2.3 Pilot Study Area 2

Implementation of the ERD pilot study at Site SD052-02, Area 2 will involve injections of EVO, an inoculum of DHC culture, and nutrients into the groundwater via the two injection wells presented above. Each injection well, shown on **Figure 7**, will receive 2,571 pounds of EVO; 750 gallons deoxygenated water; and 4 liters of DHC. Sodium bicarbonate will be added on an as needed basis. In total approximately 5,143 pounds of EVO; 1,500 gallons deoxygenated water; and 8 liters of DHC cultures will be injected into the deep aquifer. Additional design assumptions are as follows: the saturated horizon is 15 ft, spanning an area of 11,134 square ft (combined area for 775IW-01 and 775IW-02), with the assumed total and effective porosity at 0.35 and 0.3, respectively. The soil bulk density of 1.65 gm/cm<sup>3</sup> and soil foc of 0.002, equates to a Treatment Zone Total Pore Volume (total volume X total porosity) of 1,655,403 liters and the Treatment Zone Effective Pore Volume of 1,418,917 liters, therefore, Bhate will adjust the target horizons to 1.64 gms EVO/liter to stimulate ERD.

The USEPA is the regulatory authority administering the UIC Program in New York. . The Inventory of Injection Wells, USEPA Form 7520-16, will be submitted 30 days prior to commencement of injection, if conducted, unless otherwise indicated by the UIC Program Director.

### 2.2.4 Performance Model for SD052-02

No performance model is required as this site will achieve the RAOs within the contracted period of performance. Two pilot studies will be implemented to assist in revising the remedy. Performance will initially be evaluated via quarterly sampling of performance monitoring wells identified in **Figure 7**.

### 2.2.5 Contingencies for SD052-02

The systematic evaluation of site remedies for SD052-02 provides for sufficient evaluation of potential remedies. Contingent actions are not specifically required for SD052-02 at this time.

## 2.3 SD052-04 Landfill 6 TCE Site Optimization

Based upon the SI Addendum activities completed in 2015, the existing injection wells will be used to again inject into the aquifer. As observed in the sampling events from 2010 to 2014, the additional injections have not resulted in complete degradation of the TCE such that total CVOCs remains similar in total concentration as before the injections commenced. Therefore, bioaugmentation is planned to ensure proper and sufficient microbes are present. **Figure 8** presents the location of the five existing injection wells (LF6IW-01, -02, -03, -04, and -06) that will be used. This allows for the optimal injection approach using the existing injection wells that target the known hotspot at and around LF6MW-12 and LF6MW-16.

### 2.3.1 Optimization Rationale

Optimization of the selected remedy using existing injection wells in an area with the highest CVOC detections provides a reduction in life cycle cost and time to achieve site closure. Bioaugmentation will ensure sufficient and proper microbes are present within the treated area and allow for continued treatment of the plume.

### 2.3.2 Treatment System Design

Based on the April 2014 sampling event, TCE, DCE, and VC exceeded their regulatory action limits in the hot spot that encompasses LF6MW-16, LF6MW-17, and LF6MW-20. To treat this hot spot, ERD will be implemented. Implementation of the ERD treatment at Site SD052-04 will involve injections of EVO, an inoculum of DHC culture, and nutrients into the groundwater via 5 existing injection locations. The injection points that will be used to deliver the amendment to the subsurface at SD052-04 are LF6IW-01, LF6IW-02, LF6IW-03, LF6IW-04, and LF6IW-06. These injection wells are hydraulically upgradient of LF6MW-16, LF6MW-17, and LF6MW-20. Amendment will be pumped through the existing injection wells to the target depth interval. **Figure 8** illustrates the injection point locations at SD052-04 where ERD treatment will be performed.

Each injection well will receive 2,000 pounds of EVO; 750 gallons deoxygenated water; and 3.5 liters of DHC. Sodium bicarbonate will be added on an as needed basis. In total approximately 10,000 pounds of EVO; 3,750 gallons deoxygenated water; and 17.5 liters of DHC cultures will be injected into the groundwater via five existing injection wells to treat the chlorinated solvent groundwater contamination. Additional design assumptions are as follows: the saturated horizon is 15 ft, spanning an area of 10,000 square ft, with the assumed total and effective

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porosity at 0.35 and 0.3, respectively. The soil bulk density of  $1.65 \text{ gm/cm}^3$  and soil foc of 0.002, equates to a Treatment Zone Total Pore Volume (total volume X total porosity) of 1,486,800 liters and the Treatment Zone Effective Pore Volume of 1,274,400 liters, therefore, Bhate will adjust the target horizons to 3.56 gms EVO/liter to stimulate ERD.

The USEPA is the regulatory authority administering the UIC Program in New York. The Inventory of Injection Wells, USEPA Form 7520-16, will be submitted 30 days prior to commencement of injection, if conducted, unless otherwise indicated by the UIC Program Director.

### 2.3.3 Performance Model for SD052-04

A performance model was prepared to assess the ERD treatment over time. Historical groundwater data were compiled between November 2006 and June 2015 to further evaluate the site and develop the performance model. The plume concentrations appear to be seasonally influenced; therefore, this observed oscillation has been incorporated into the out-year predictions of the performance model. The concentration data were then plotted against its associated sampling date and an attenuation rate constant of  $0.0002 \text{ per day (d}^{-1}\text{)}$  was used to determine the degradation of the total CVOCs over time. The methodology for developing a rate constant is described in Calculations and the Use of First Order Rate Constant for Monitored Natural Attenuation Studies Charles J Newell, et. al, November 2002, EPA/540/S-02/500. Development of a corresponding biodegradation rate constant to predict what the out-year concentration will be post-injection operations is difficult because ERD systems are seldom in a state of equilibrium. Traditional analytical methods that assume steady state conditions exist are generally not appropriate for ERD systems. The addition of an organic substrate causes significant changes in the geochemical conditions and biological activity of the aquifer, which rarely stabilize over the treatment duration. Based on experience, if biodegradation has been stimulated by substrate addition and bioaugmented (ERD system), an increase in the biodegradation rates of three times is possible as compared to the natural attenuation rate constant prior to injection.

The performance model is based on the average of the total CVOCs (TCE, cis-DCE, and VC) at LF6MW-12, LF6MW-16, LF6MW-17, and LF6MW-20. These four wells historically have had the highest CVOC detections at LF-6. Development of a single performance model based on these four wells provides the best indicator of the progress toward OES at LF-6. Therefore, a pseudo-biodegradation rate constant of  $0.0005 \text{ d}^{-1}$  was used for total CVOCs, and incorporated the seasonal fluctuations to estimate the concentration at LF6MW-12, LF6MW-16, LF6MW-17, and LF6MW-20 between April 2015 (last data point) and June 2021. **Appendix A** presents the performance model for SD052-04 Landfill 6 TCE plume. Performance will initially be evaluated via quarterly sampling of performance monitoring wells identified in **Figure 8**.

### **2.3.4 Contingencies for SD052-04**

SD052-04 has demonstrated that ERD will treat the CVOCs present. Should rebounding occur, then an additional injection will be completed that will be augmented with zero valent iron (ZVI) in hot spot areas to assist in degradation of the solvents via abiotic chemical reduction.

## **2.4 SD052-05 Building 817/WSA Site Optimization**

Based upon the SI and SI Addendum activities completed in 2014 and 2015, site optimization will focus on treatment of the former source area. In addition, treatment downgradient of the former source area is recommended because the highest CVOCs are present in soil up and downgradient of monitoring well WSA-MW16. DCE and VC were not detected in any samples collected during the 2015 sampling event indicating that bioremediation, if occurring, is limited to the area previously treated. Based upon the soil and groundwater data from the SI and SI Addendum, the injections will follow the groundwater gradient as presented on **Figure 9**. This approach is the most effective manner to optimize the existing remedy.

### **2.4.1 Optimization Rationale**

Based upon the SI and SI Addendum, CVOCs are present outside of the previous treatment zone located immediately south of Building 817. Therefore, treatment along the centerline of the plume that was further defined by the SI activities provides for reduction in time to achieve site closure. Use of ERD is consistent with the ROD and provides a low cost remedy to advancing towards the RAOs.

### **2.4.2 Treatment Design**

Based on the April 2014 sampling event, only one monitoring well (WSA-MW16) at SD052-05 contained PCE and TCE exceeding their regulatory action limits. No other daughter products were detected. Note: The April 2014 sampling event was limited to WSA-MW09 and WSA-MW16.

Implementation of the ERD treatment at Site SD052-05 will involve injections of EVO, an inoculum of DHC culture, and nutrients into the groundwater via eight DPT injection locations along the centerline of the plume. The injection points are designed to focus treatment on the hot spot in the vicinity of WSA-MW18 and WSA-MW16. The injection points will be advanced by DPT probe rod equipped with expendable points. Once the probe rod reaches the target injection depth the tool string will be retracted deploying the expendable point, thus allowing the injectant to be pumped through the probe rod and applied to the target depth interval. **Figure 9** illustrates the injection point locations at SD052-05 where ERD treatment will be performed.

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Each injection point will receive 2,000 pounds of EVO; 750 gallons deoxygenated water; and 3.5 liters of DHC. Sodium bicarbonate will be added on an as needed basis. In total approximately 16,000 pounds of EVO; 6,000 gallons deoxygenated water; and 28 liters of DHC cultures will be injected into the groundwater via 8 DPT points to treat the chlorinated solvent groundwater contamination. Additional design assumptions are as follows: the saturated horizon is 15 ft, spanning an area of 23,400 square ft, with the assumed total and effective porosity at 0.35 and 0.3, respectively, soil bulk density of 1.65 gm/cm<sup>3</sup> and soil foc of 0.002, equates to a Treatment Zone Total Pore Volume (total volume X total porosity) of 2,899,260 liters and the Treatment Zone Effective Pore Volume of 2,485,080 liters, therefore, Bhate will adjust the target horizons to 2.92 gms EVO/liter to stimulate ERD.

The USEPA is the regulatory authority administering the UIC Program in New York. . The Inventory of Injection Wells, USEPA Form 7520-16, will be submitted 30 days prior to commencement of injection, if conducted, unless otherwise indicated by the UIC Program Director.

### **2.4.3 Performance Model for SD052-05**

A performance model was prepared to assess the ERD treatment. The performance model for SD052-05 is based upon reduction of total CVOCs along the centerline of the plume. To assess and predict the TCE and PCE concentrations at site SD052-05, historical groundwater data were compiled between October 2006 and December 2015. The plume concentrations at this site appear to be to be seasonally influenced over the same time frame; therefore, this concentration oscillation has been incorporated into the out-year predictions of the performance model. The concentration data were then plotted against its associated sampling date and an attenuation rate constant of 0.0001 d<sup>-1</sup> and 6.0E-05 d<sup>-1</sup> were determined for TCE and PCE, respectively. The methodology for developing a rate constant is described in Calculations and the Use of First Order Rate Constant for Monitored Natural Attenuation Studies Charles J Newell, et. al, November 2002, EPA/540/S-02/500. Development of a corresponding biodegradation rate constant to predict what the out-year concentration will be post-injection operations is difficult because ERD systems are seldom in a state of equilibrium. Traditional analytical methods that assume steady state conditions exist are generally not appropriate for ERD systems. The addition of an organic substrate causes significant changes in the geochemical conditions and biological activity of the aquifer, which rarely stabilize over the treatment duration. Based on experience, if biodegradation has been stimulated by substrate addition and bioaugmented (ERD system), an increase in the biodegradation rates of three times is possible as compared to the natural attenuation rate constant prior to injection. The performance model is based on the total concentration of TCE and PCE at monitoring wells WSA-MW16, WSA-MW18, and WSA-MW19 that have been averaged. These three wells historically have had the highest VOC detections at SD052-05 and define the core of the plume. Development of a single performance model based on these three wells provides the best

indicator of the progress toward OES at SD052-05. Therefore, a pseudo-biodegradation rate constant of  $0.0003 \text{ d}^{-1}$  was developed and incorporated the seasonal fluctuations to estimate the concentration at WSA-MW16, WSA-MW18, and WSA-MW19 between March 2015 (last data point) and June 2021. **Appendix A** contains the SD052-05 Building 817 performance model. Performance will initially be evaluated via quarterly sampling of performance monitoring wells identified on **Figure 9**.

#### 2.4.4 Contingencies for SD052-05

SD052-05 has demonstrated the ERD will treat the CVOCs present. Should rebounding occur, then an additional injection will be completed that will be augmented with ZVI in hot spot areas to assist in degradation of the solvents via abiotic chemical reduction.

### 2.5 Long-Term Groundwater Monitoring Optimization

As the optimizations presented herein are implemented, LTM optimization will be possible due to reductions in CVOC levels. LTM optimization will occur through 2021 as the optimizations are implemented and reductions in monitoring wells is observed. LTM optimization will be initially accomplished by reducing the number of wells present at each site to reduce Air Force liabilities. Each site has numerous wells that are not included in the on-going performance monitoring. LTM optimization will then focus on reducing the sampling frequency and or sample locations based upon the proposed groundwater treatment optimization. Per the Project Management Plan (PMP), the following reductions are proposed for each site (Bhate, September 2016a).

- SD052-01: Reduce annual samples by at least 47%
  - This reduction will be accomplished by reducing both groundwater and surface water sample locations from the current total of 16 to one surface water location and 8 monitoring wells annually.
- SD052-04: Reduce annual samples by at least 43%
  - This reduction will be accomplished by eliminating the sampling of the 5 temporary wells and reducing groundwater sampling to annually within the POP, which will result in an approximate 67% reduction in sample locations annually.
- SD052-05: Reduce annual samples by at least 40%
  - This reduction will be accomplished by moving the wells and sample locations that are currently analyzed semi-annually to annually. Elimination of 2 surface water samples as well as 4 monitoring well locations is also planned, which would result in an approximate 50% reduction in sample locations annually.

Performance monitoring reports will identify the monitoring wells proposed for elimination from the monitoring well network based upon two consecutive sampling events where the COCs do not exceed the RAOs.

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### **2.5.1 Annual LUC/IC Inspections**

The LUC/IC site inspections will be maintained at an annual frequency.

### **2.5.2 Five-Year Review**

The Five-Year Review will be maintained at a 5-year frequency.

## **2.6 Reporting Requirements**

During the POP, the following deliverables are anticipated at these four sites:

- Annual LTM Reports
- Five-Year Review (2020)
- Remedial Action Implementation Report

In addition, a ROD Amendment or ESD may be required at Site SD052-01 and SD052-02. Optimized Exit Strategy Reports or Technical Memorandums will be required for Sites SD052-01, SD052-04, and SD052-05 because the proposed end state under the current contract is OES. Site SD052-02 will achieve RC within the contract.

### **3 GENERAL FIELD IMPLEMENTATION**

#### **3.1 Dig Permit/Utility Clearances**

Prior to submittal of any required digging permit(s)/utility clearance requests, the locations will be clearly delineated with marker flags, stakes, or paint, as appropriate, on the surface material. Utility clearance approvals will be completed by the appropriate utility office (e.g., telephone, sewer, water, natural gas, etc.) and/or airport facility engineering. The following organizations will be contacted:

- Griffiss International Airport flight line personnel or other applicable personnel will be informed in advance of the number of workers and types of equipment that will be needed to perform site activities if work is conducted inside the airfield fence. Dates and hours of activities will be conveyed to flight line personnel, which may be required to be present during the performance of the work.
- Griffiss Local Development Corporation (GLDC), the current owner of the property for SD052-01, -02, -04, and -05.
- Dig Safely New York will be contacted not less than 2-days but no more than 10 days ahead of any drilling and/or injection activities.

All intrusive work will be coordinated with AFCEC personnel to identify any other potential privately owned utilities prior to the start of work.

#### **3.2 Security**

At a minimum, an exclusion zone surrounding the work area will be demarcated with caution tape. The size of the exclusion zone will be determined by the size of the drilling rig and support equipment.

#### **3.3 Underground Injection Permitting**

The USEPA is the regulatory authority in New York and administers the UIC Program. The Inventory of Injection Wells, USEPA Form 7520-16, will be submitted 30 days prior to commencement of injection, if conducted, unless otherwise indicated by the UIC Program Director.

### **3.4 Mobilization**

Mobilization will begin upon receipt of all required permits and authorizations as described above, as well as approval of this RO Work Plan. Mobilization will consist of the following tasks:

- Review of project-wide Site Safety and Health Plan (SSHP) as well as project specific Activity Hazard Analyses (AHAs) by all Bhatte personnel and subcontractor personnel involved with the project.
- Mobilization of selected drilling/injection contractor.
- Utility clearance confirmation.
- Site access coordination.
- Delivery of injection materials, equipment, and personnel travel.

Injection water will be obtained from on-site sources. Water hydrant use and metering will be coordinated with the City Water Department and/or the airport.

### **3.5 Injection Well Installation, Construction, and Development**

The injection wells at sites SD052-02 will be constructed with ¾-inch diameter flush-threaded Schedule 40 PVC riser and screened at varying depths with 0.020-inch factory slotted PVC screen. Washed, bagged, and rounded 8/20 or 10/20 mesh sand pack material will be placed in the annular space around the well assembly by tremie pipe, approximately 1 to 2 ft above the top of the well screen followed by fine grained 30/65 mesh silica sand (choke sand) and a casing seal consisting of Type II Portland cement grout to the ground surface. Each well will then be completed as a permanent flush mount. Upon completion of the well installations, a New York-registered professional land surveyor will perform vertical and horizontal surveying at each well.

### **3.6 Decontamination**

All down-hole equipment will be decontaminated after use. All drilling and sampling materials that come into contact with subsurface soil and groundwater will be washed after each well is installed using a high pressure washer and a wiper. Potable water will used for decontamination will come from an onsite potable water source free of contamination.

### 3.7 Investigation Derived Waste Disposal

Bhate will containerize and profile all investigation derived waste (IDW). Containerized IDW will be stored on site in sealed drums until proper disposal. Waste disposal will follow applicable regulations.

### 3.8 Baseline Sampling

Baseline (pre-injection) samples will be collected from the injection well, dose response wells, and performance monitoring wells to understand the subsurface conditions present at the Site prior to the pilot injection. Groundwater samples will be collected using a low flow/low stress sampling method and submitted for analysis to TestAmerica, Denver for VOC analysis using USEPA SW-8260. Field parameters (pH, DO, ORP, specific conductivity, temperature, and color) and groundwater elevations will also be collected during the baseline sampling event.

### 3.9 Enhanced Reductive Dechlorination Injection

ERD injection will be performed in a two-step process at each site. The first step involves deoxygenating and mixing the injectate and the second step is the injection into the substrate. All mixing and injection activities will be supervised and documented by Bhate personnel and performed in accordance with the SSHP located in **Appendix B**.

#### Step 1: Deoxygenation and Mixing

All materials will be delivered to the site and staged at an approved, pre-determined lay-down area/decontamination pad. The EVO will be shipped to the site in 330 gallon totes. Potable water will be obtained from a nearby fire hydrant. Potable water will serve as a dispersant for the soybean oil-in-water emulsion as well as a carrier for the pH product. Depending on the location, water may have to be transported to the site via a water truck. Deoxygenation of bulk water will be accomplished using a large (6,000 gallon) pillow tank. Water will be transferred using a fire hose from a fire hydrant to the high volume storage tank. A commercial grade meter will be used to monitor the volume of water that is transferred to the storage tank. During filling operations, sugar and yeast solution will be added to the high volume storage tank which deoxygenates the bulk water within 24 hours to a dissolved oxygen level of less than 2 µg/L. Sugar and yeast are added to the high volume storage tank at a ratio of 100 pounds per 1,000 gallons and 16 ounces per 1,000 gallons of water to deoxygenate, respectively. EVO can be used to supplement sugar as a carbon source. To the extent possible, the sugar and yeast solution will be mixed with the bulk water. Typically, deoxygenation will occur faster in the warmer summer months. If injection operations are planned during fall or winter months, sodium sulfite may be used as an alternate deoxygenating agent. Sodium sulfite, widely known as an oxygen scavenger, can be used to chemically remove dissolved oxygen by binding

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elemental oxygen and producing a soluble salt. Mixing the sugar and yeast in the 330 gallon tote and transferring to the high volume tank will be achieved using a centrifugal trash pump with 2-inch suction and discharge lines.

Typically, depending on the site, each injection point will receive 2,000 pounds of EVO; 750 gallons of deoxygenated water; and 3.5 liters of DHC. Sodium bicarbonate will be added on an as needed basis. To achieve the correct mixture ratio, injectate will be initially combined in batches just prior to injection, which will be transferred from the large mixing tank on the injection trailer which is equipped with a transfer pump.

The design estimated injection volume/quantity calculation spreadsheets for each site are included within **Appendix C**. Actual volumes may be adjusted based on additional aquifer information, product availability, and/or field conditions. Actual injection volumes will be documented by Bhate in the field logbook.

#### Step 2: Injection

Either permanent injection wells (SD052-02 and SD052-04) or DPT drilling rig (SD052-01 or SD052-05) will be used to advance drill rods from ground surface to the bottom of the target injection level will be used to deliver the injectate to the subsurface. See the design estimated injection volume/quantity calculation spreadsheets for the planned injection intervals for each site in **Appendix C**.

For permanent injection wells, a 2-inch transfer line will be attached from the transfer pump on the injection trailer to the well head. For DPT drilling rig injections at SD052-01 or SD052-05, upon reaching the bottom of the target injection zone, the drill rod will be pulled up 5 ft exposing a temporary well screen. Plastic tubing or hose will be connected from the larger final mixing tank to the drill rod. The injectate will then be pumped through the drill rod well screen into the formation using a pneumatic diaphragm pump. After the injection in the deepest interval has been completed, the injection process will be repeated at higher injection intervals, in 5-ft increments, until all injection intervals have been completed at the injection site. It is anticipated that the top of the injection interval will coincide with the water table at each injection site. This process will then be repeated until all injection activities have been completed.

As described in Bhate Standard Operating Procedure 12 (Bhate, September 2016b), upon completion of injection activities, each borehole will be filled with Portland cement with 3% powdered grout to approximately 6 to 24-inches bgs. The material will be allowed to settle over a minimum period of 24-hours. Additional grout may be added to the borehole, as necessary, if settling occurs. The remainder of the borehole will be backfilled with sand and top soil to ground surface. Though not anticipated, boreholes located in asphalt or concrete will be patched with appropriate material.

RO activities will be supervised and documented by Bhate field personnel. Detailed field notes will be taken describing major activities performed, daily quantities used/injected, any project delays, and any other pertinent information. Upon completion of injection activities, all materials and equipment used during injection activities will be removed and the site will be restored to its original condition.

### **3.10 Potassium Permanganate Injection**

A potassium permanganate dose response injection will be performed as detailed in the following sections at Pilot Study Area 1 at SD052-02. The test will provide necessary information to perform a full-scale pilot study design, including determining appropriate injection well/point spacing and determining appropriate injection flow rates for liquid. The dose response test will also determine injection parameters required to estimate full-scale remediation costs. These parameters include oxidant concentrations, injection rates, temperature, pressures, radius of influence, and injection volumes. A dose response test can also be used to confirm complex subsurface geologic formations and to determine treatment effectiveness for COCs.

As indicated above, a full-scale pilot study design will be provided in a technical memorandum at a later date if it is determined that permanganate will be used in Pilot Study Area 1 at SD052-02. If potassium permanganate is selected for a pilot test, then the SSHP (Appendix B) will be revised at that time also. The following describes the general field activities that will be required to conduct a potassium permanganate dose response injection at SD052-02 Dose Response Test

The injection volume required to distribute the oxidant solution to the full design radius of influence (ROI) is calculated based upon the aquifer mobile porosity and treated aquifer thickness. The estimated target injection volume for the injection event is 2,000 gallons with a ROI of 15 ft. The actual volume required to reach the target ROI, however, can vary significantly due to the variability of site-specific mobile porosity and thickness of the surficial aquifer, therefore the actual required injected volume will be verified during the injection event using the dose response wells, and modified as necessary.

The permanganate oxidant concentration in the injection solution has been selected to provide thorough treatment of the VOCs in the target area. Typical injection concentrations for potassium permanganate range from 2% to 10%. Based on the low concentrations of VOCs in groundwater and the limited potential for density driven flow (i.e., denser than water oxidant solution to sink below the target treatment interval), a 3% solution will be utilized for the pilot injection.

Injection and post-injection monitoring will evaluate the horizontal migration of the injection solution as well as the treatment within the injection well ROI and downgradient. It is expected that the oxidant will persist at a high enough concentration to provide treatment 10-20 feet

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horizontally and downgradient from the injection well. Information gathered regarding oxidant solution migration, oxidant persistence, and oxidant solution effectiveness will all be used to further optimize the solution strength during full scale implementation.

### **3.10.1 Injection Procedures**

Injection activities will begin with the mixing and injection of a potassium permanganate solution into the injection well. A potassium permanganate solution will be diluted with potable water to a concentration of approximately 3%. Injection into the well or point will continue until the permanganate solution arrival is confirmed (as indicated by purple color and/or increase in conductivity) at dose response well. The volume injected will be based on the volume required to reach a 15 foot ROI for the injection well, and confirmed at the dose response well. In the event that the target injection volume is taking significantly longer than anticipated to reach the 15 foot ROI, the dose response well 7.5 feet side-gradient from the injection point will be used and the injection will be terminated once the 7.5 foot ROI is reached.

The injection well will be fitted with a bleed valve and pressure gauge to ensure that minimal wellhead pressure is applied. Over-pressurization of the well could result in failure of the well and/or fracture of the subsurface formation, which could create preferential pathways away from the target treatment interval or cause surfacing of the injection solution. If the injection rate is too fast, injection solution will discharge out of the bleed valve providing a visual indication that the pumping rate should be reduced. A 5-gallon bucket (or equivalent) will be placed at the injection well to contain any discharges from the bleed valve. If possible, injections will be completed under gravity feed, although an injection pump may be added to offset frictional losses in the injection lines and manifolds and to increase flow to the well. The anticipated injection flow rate is approximately 1 gallon per minute. The injection manifold will be equipped with a flow meter, pressure gauge, and flow control valve to monitor and control the injection flow to the well.

### **3.10.2 Injection Monitoring**

Immediately prior to starting injection activities, field parameter readings (specific conductance, pH, and temperature) and water levels will be collected from the injection well, dose response well and the two nested performance monitoring wells. Additionally, the injection batch solutions will be periodically monitored for specific conductance, pH, and temperature. Dose-response monitoring will be conducted during the injection activities. The dose response well and 775MW-06 will be monitored for specific conductance, temperature, and water level using a dedicated water quality data logger placed at mid-screen and set to record measurements on a 1-minute frequency. A minimum of 30 minutes of background data will be collected prior to the start of the injection. Approximately once per hour, vertical

profiling will be conducted during the injection to check for preferential flow paths and a bailer grab sample will be collected from the groundwater in the well column. The water quality data logger will be raised or lowered in one-foot increments across the screened interval of the dose response well. The data logger will be positioned in the interval of highest conductivity after vertical profiling is completed. When the conductivity increases or when a purple color is noted in the dose response well, a field test for measurement of potassium permanganate will be used to confirm arrival of the injected solution. Field measurement of the potassium permanganate concentration will be conducted using the HACH DR/890 kit by Method 8034, Manganese High Range. If the sample concentration is out of range for the kit, the sample will be diluted with distilled water and reanalyzed. Manual water levels at the dose response well and 775MW-06 will be checked approximately once per hour to ensure that there are no substantial changes in the water table elevation during the injection. To monitor the progress of the injection, the following parameters will be recorded approximately once per hour during the entire duration of the injection event:

- Flow totalizer readings,
- Injection flow rate at the well, and
- Wellhead pressure.

Parameters will be recorded in dedicated field logs. A field book will also be maintained to record the time on site for field personnel and any notable events that occur during injection activities.

### **3.10.3 Post-Injection Monitoring**

The permanganate ion will react with a variety of organic constituents in the aquifer as it travels through the subsurface. As the oxidant continues to react, its concentration and capacity to degrade the target constituents will gradually decline. Groundwater samples will be collected following completion of the injection activities to track the movement of the potassium permanganate through the aquifer during the pilot test. Groundwater samples will be collected from 775MW-06. Groundwater samples will also be inspected visually for a purple color that is indicative of the presence or absence of the oxidant. Groundwater samples will be analyzed for VOCs.

Post-injection sampling will commence only after the oxidant concentration has decreased to a level that will not effectively degrade the target constituents further. The initial post-injection sampling event will be timed as soon as possible after a return to baseline conditions to ensure that the full effectiveness of the pilot test can be was quantified. Additional VOC sampling will follow approximately 1 month and 2 months after the initial post-injection sampling to monitor for constituent rebound in the target treatment area. The data will be used in the full scale design to maximize both treatment of the Site constituents and the distribution of the oxidant solution in the subsurface. Injection point locations and design estimated injection

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volume/quantity calculation spreadsheets will be provided in a follow-on technical memorandum at a later date if it is determined that permanganate will be used to treat Study Area 1 at SD052-02.

## 4 SUMMARY OF OPTIMIZATION AT THE ON-BASE GROUNDWATER AOCs

The purpose of optimizing the on-base groundwater sites is to reduce plume concentrations that will ultimately reduce Air Force life-cycle cost by allowing reduction in LTM duration and level of effort. LTM Optimization is not planned for Site SD052-02 because the site will achieve RAOs within the contracted POP.

**Table 2. LTM Optimization Summary**

Site ID	Current LTM Activities	OES during POP
SD052-01 Apron 2	<ul style="list-style-type: none"> <li>• Annual performance monitoring of groundwater at 13 monitoring wells and 3 surface water locations</li> <li>• Annual LUC inspection</li> <li>• Five-Year Review</li> </ul>	<ul style="list-style-type: none"> <li>• Initially increase performance monitoring to quarterly but continue annual LTM</li> <li>• Reduce overall sampling by 2021 to 8 monitoring wells and 1 surface water location</li> <li>• Abandonment of unused monitoring well locations</li> <li>• Reduce total VOC concentrations in LTM monitoring wells by 50% using the November 2016 VOC analytical data as the baseline concentrations</li> <li>• Continue annual LUC inspections</li> <li>• Continue Five Year Review cycle</li> </ul>
SD052-04 Landfill 6	<ul style="list-style-type: none"> <li>• Annual performance monitoring of groundwater at 8 monitoring wells, 5 direct push temporary wells, and 1 surface water location (FPM, February 2016)</li> <li>• Annual LUC inspection</li> <li>• Five-Year Review</li> </ul>	<ul style="list-style-type: none"> <li>• Initially increase performance monitoring to quarterly but continue annual LTM</li> <li>• Reduce overall sampling by 2021 to 8 permanent monitoring wells and 1 surface water location</li> <li>• Abandonment of unused monitoring well locations</li> <li>• Reduce total VOC concentrations in LTM monitoring wells by 50% using the April 2015 VOC analytical data as the baseline concentrations</li> <li>• Continue annual LUC inspections</li> <li>• Continue Five Year Review cycle</li> </ul>
SD052-05 Building 817/WSA	<ul style="list-style-type: none"> <li>• Semi-annual LTM of groundwater at 9 monitoring wells, 3 surface water locations, and 3 manholes</li> <li>• Annual LTM at 3 monitoring wells</li> <li>• Annual LUC inspection</li> <li>• Five-Year Review</li> </ul>	<ul style="list-style-type: none"> <li>• Initially increase performance monitoring to quarterly but continue annual LTM</li> <li>• Reduce overall sampling by 2021 to 8 monitoring wells and 1 manhole location</li> <li>• Abandonment of unused monitoring well locations</li> <li>• Reduce total VOC concentrations in LTM monitoring wells by 50% using the March 2015 VOC analytical data as the baseline concentrations</li> <li>• Continue annual LUC inspections</li> <li>• Continue Five Year Review cycle</li> </ul>

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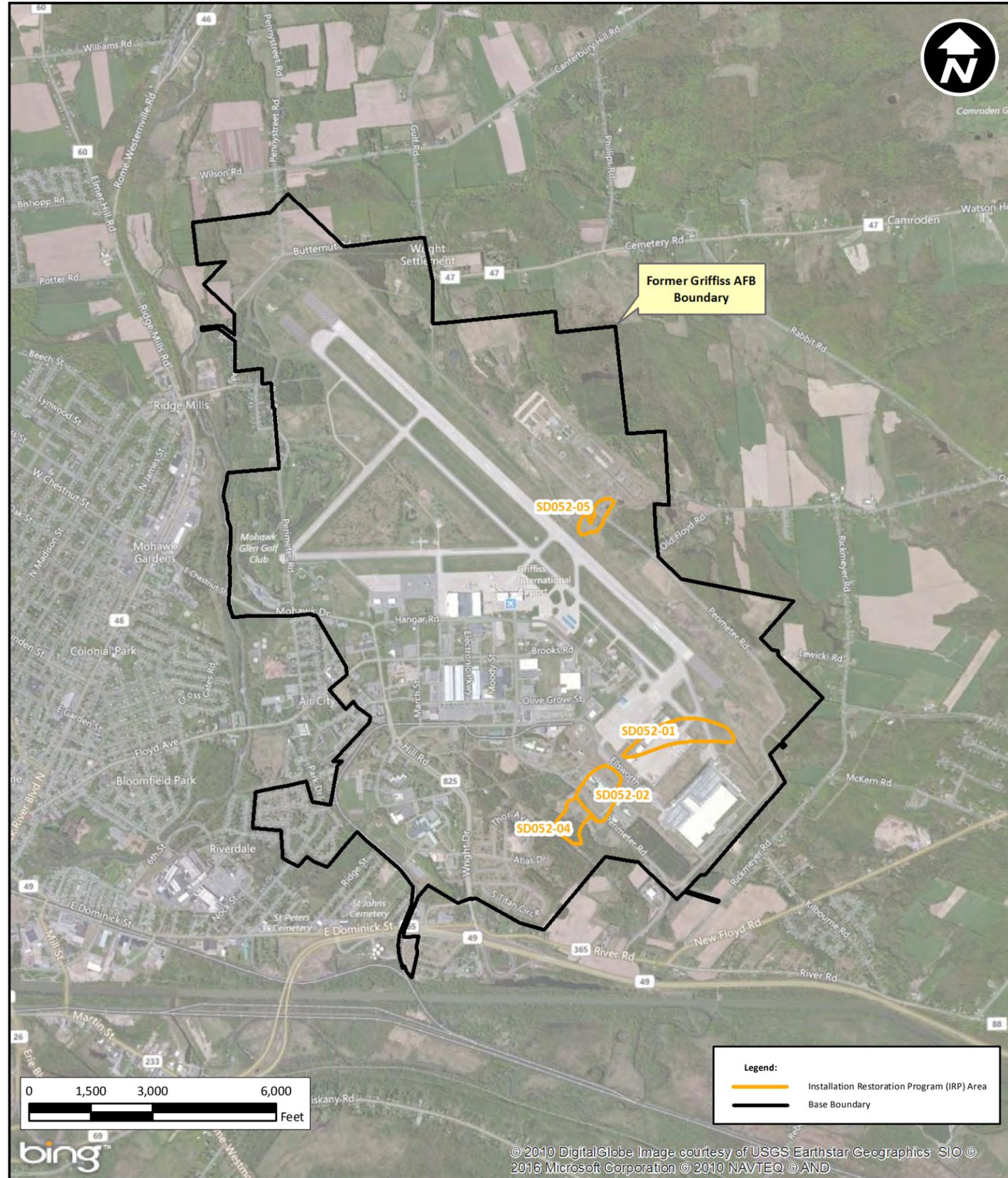
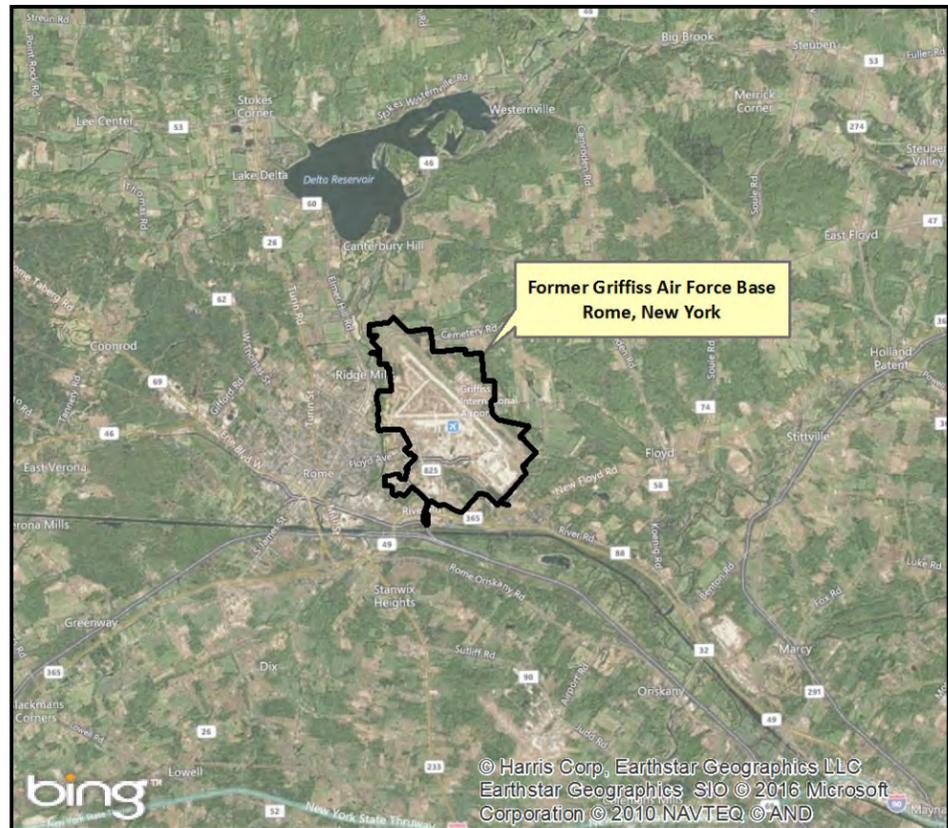
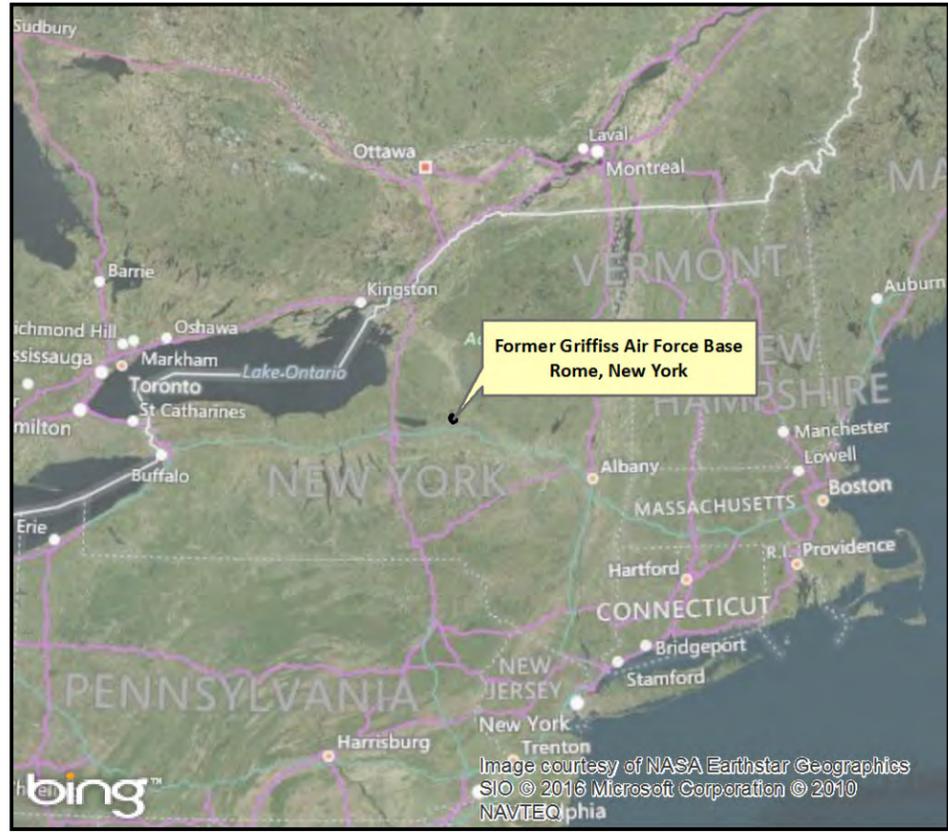
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**FIGURES**



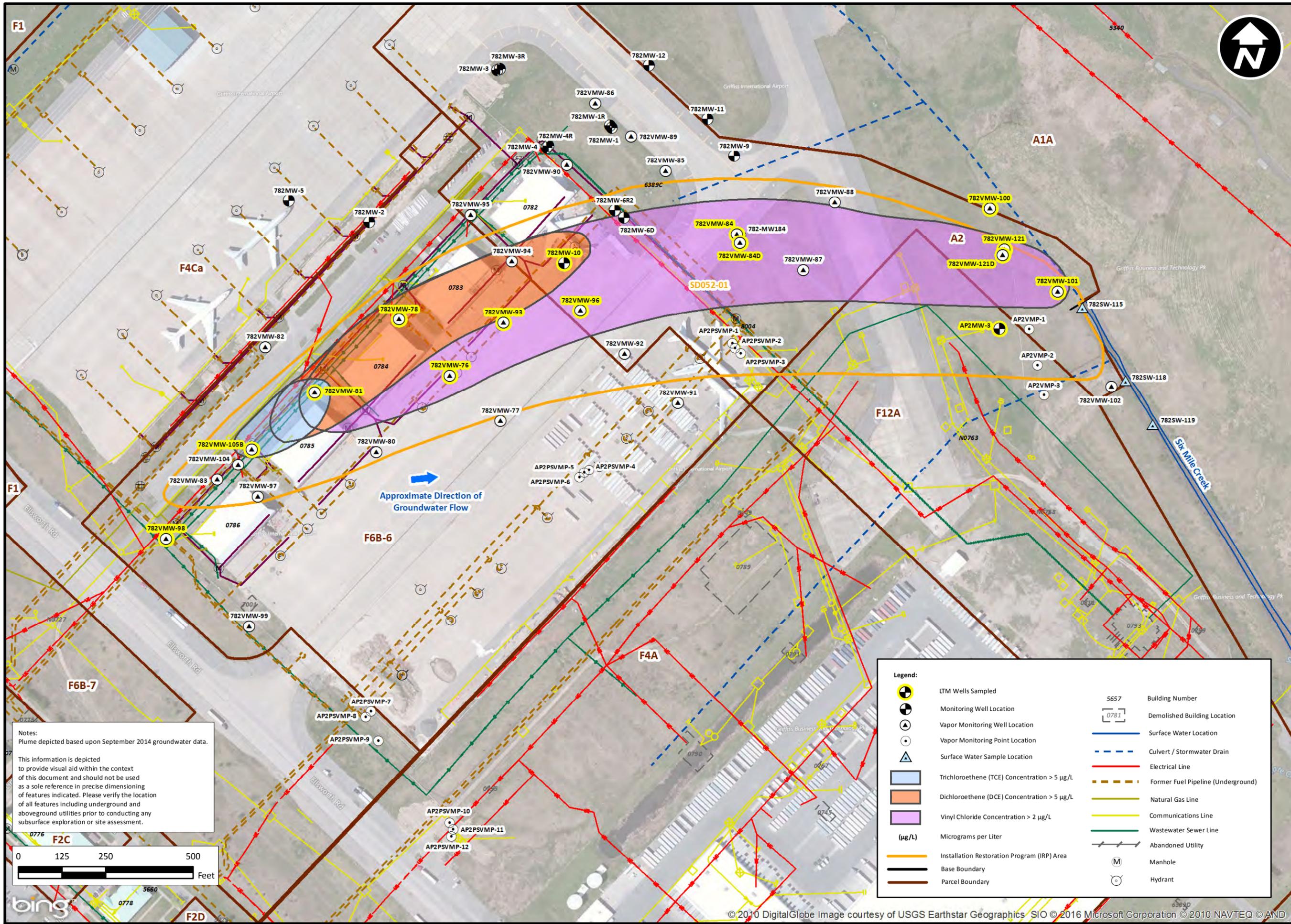
Site Location Map

Figure 1

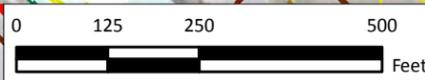
Remedial Optimization Work Plan  
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Notes:  
 Plume depicted based upon September 2014 groundwater data.  
 This information is depicted to provide visual aid within the context of this document and should not be used as a sole reference in precise dimensioning of features indicated. Please verify the location of all features including underground and aboveground utilities prior to conducting any subsurface exploration or site assessment.



**Legend:**

	LTM Wells Sampled		5657	Building Number
	Monitoring Well Location			Demolished Building Location
	Vapor Monitoring Well Location			Surface Water Location
	Vapor Monitoring Point Location			Culvert / Stormwater Drain
	Surface Water Sample Location			Electrical Line
	Trichloroethene (TCE) Concentration > 5 µg/L			Former Fuel Pipeline (Underground)
	Dichloroethene (DCE) Concentration > 5 µg/L			Natural Gas Line
	Vinyl Chloride Concentration > 2 µg/L			Communications Line
(µg/L)	Micrograms per Liter			Wastewater Sewer Line
	Installation Restoration Program (IRP) Area			Abandoned Utility
	Base Boundary			Manhole
	Parcel Boundary			Hydrant

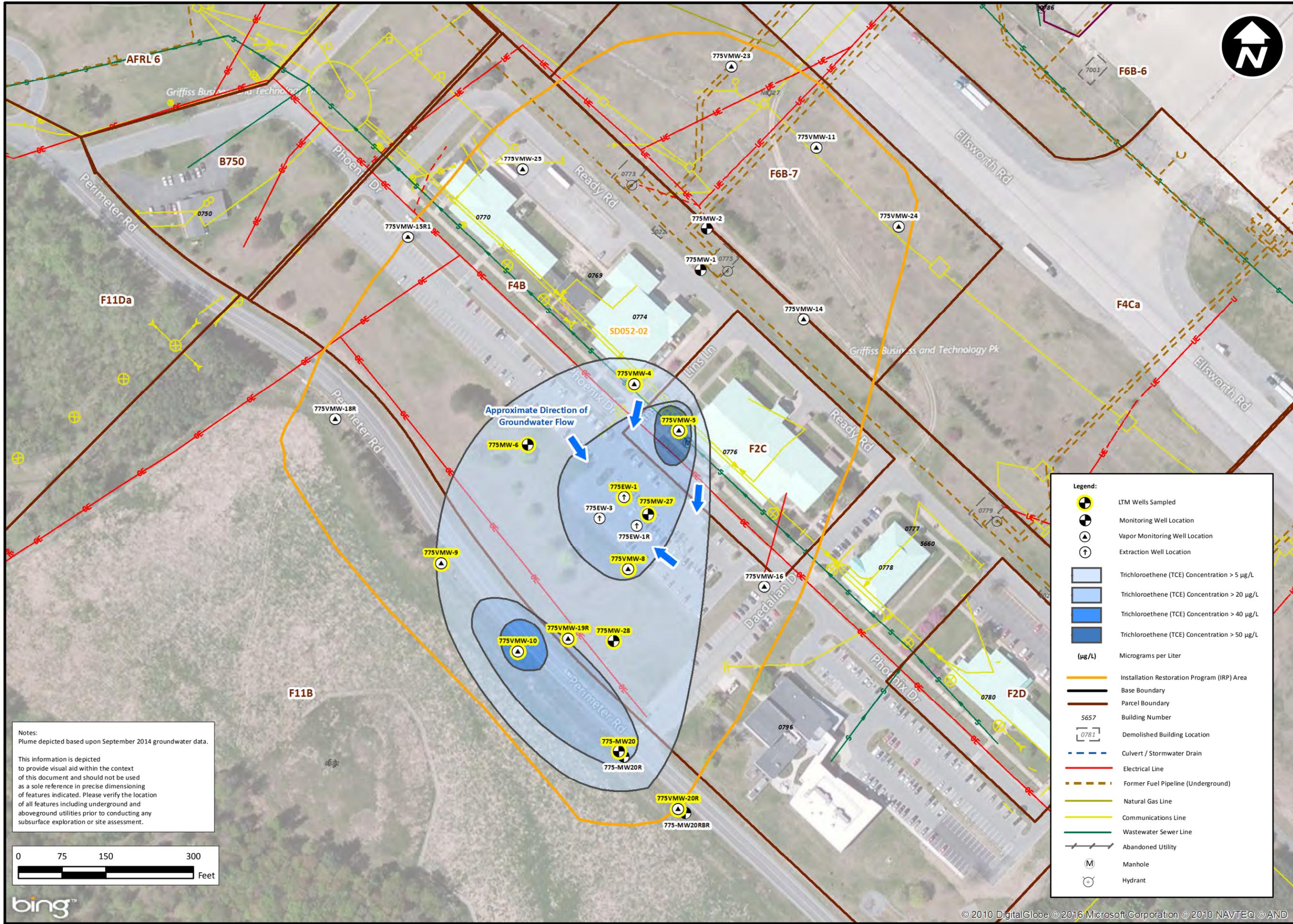
**Figure 2**

**SD052-01 (Apron 2 Chlorinated Plume)**  
 Site Location, Plume and Sampling Plan Map

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 On-Base Groundwater Areas of Concern  
 Former Griffiss Air Force Base, Rome, New York

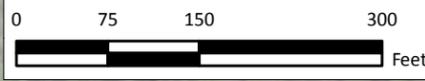
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Notes:  
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**Legend:**

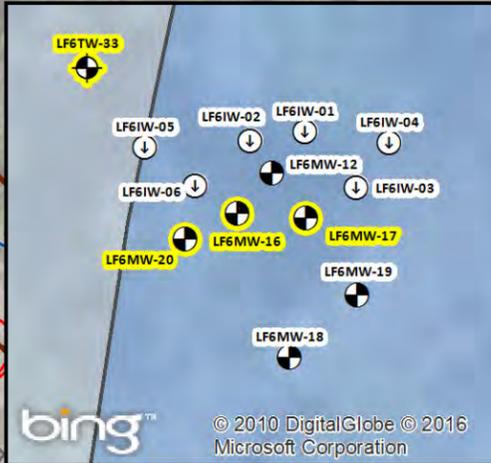
- LTM Wells Sampled
- Monitoring Well Location
- Vapor Monitoring Well Location
- Extraction Well Location
- Trichloroethene (TCE) Concentration > 5 µg/L
- Trichloroethene (TCE) Concentration > 20 µg/L
- Trichloroethene (TCE) Concentration > 40 µg/L
- Trichloroethene (TCE) Concentration > 50 µg/L
- (µg/L)** Micrograms per Liter
- Installation Restoration Program (IRP) Area
- Base Boundary
- Parcel Boundary
- Building Number
- Demolished Building Location
- Culvert / Stormwater Drain
- Electrical Line
- Former Fuel Pipeline (Underground)
- Natural Gas Line
- Communications Line
- Wastewater Sewer Line
- Abandoned Utility
- Manhole
- Hydrant

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**SD052-02 (Building 775 Site)**  
 Site Location, Plume and Sampling Plan Map

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**Figure 3**



**Legend:**

- LTM Wells Sampled
- Monitoring Well Location
- Temporary Monitoring Well Location
- Vapor Monitoring Well Location
- Injection Well Location
- Surface Water Sample Location
- Installation Restoration Program (IRP) Area
- Base Boundary
- Parcel Boundary
- Trichloroethene (TCE) Concentration > 5 µg/L
- Trichloroethene (TCE) Concentration > 200 µg/L
- (µg/L) Micrograms per Liter
- 5657 Building Number
- [0781] Demolished Building Location
- Surface Water Location
- Culvert / Stormwater Drain
- Electrical Line
- Former Fuel Pipeline (Underground)
- Natural Gas Line
- Communications Line
- Wastewater Sewer Line
- Abandoned Utility
- Manhole

**Notes:**  
 Plume depicted based upon June 2014 groundwater data.

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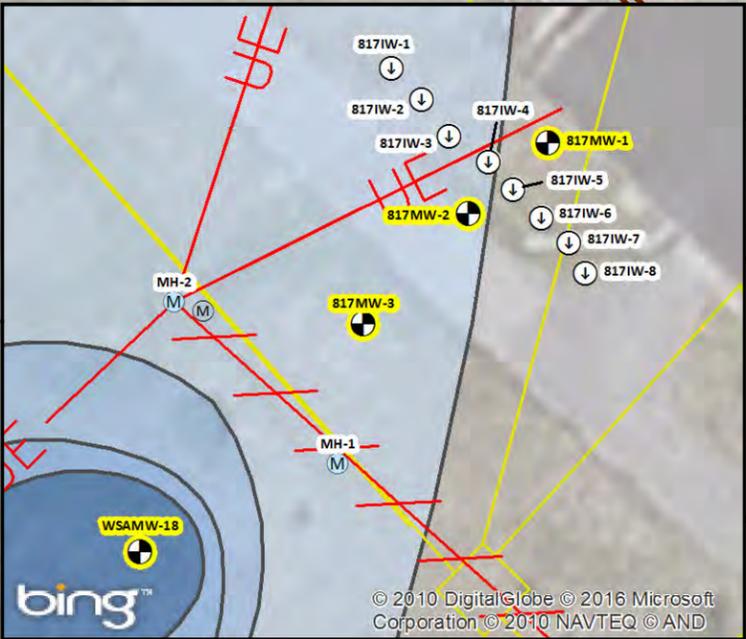
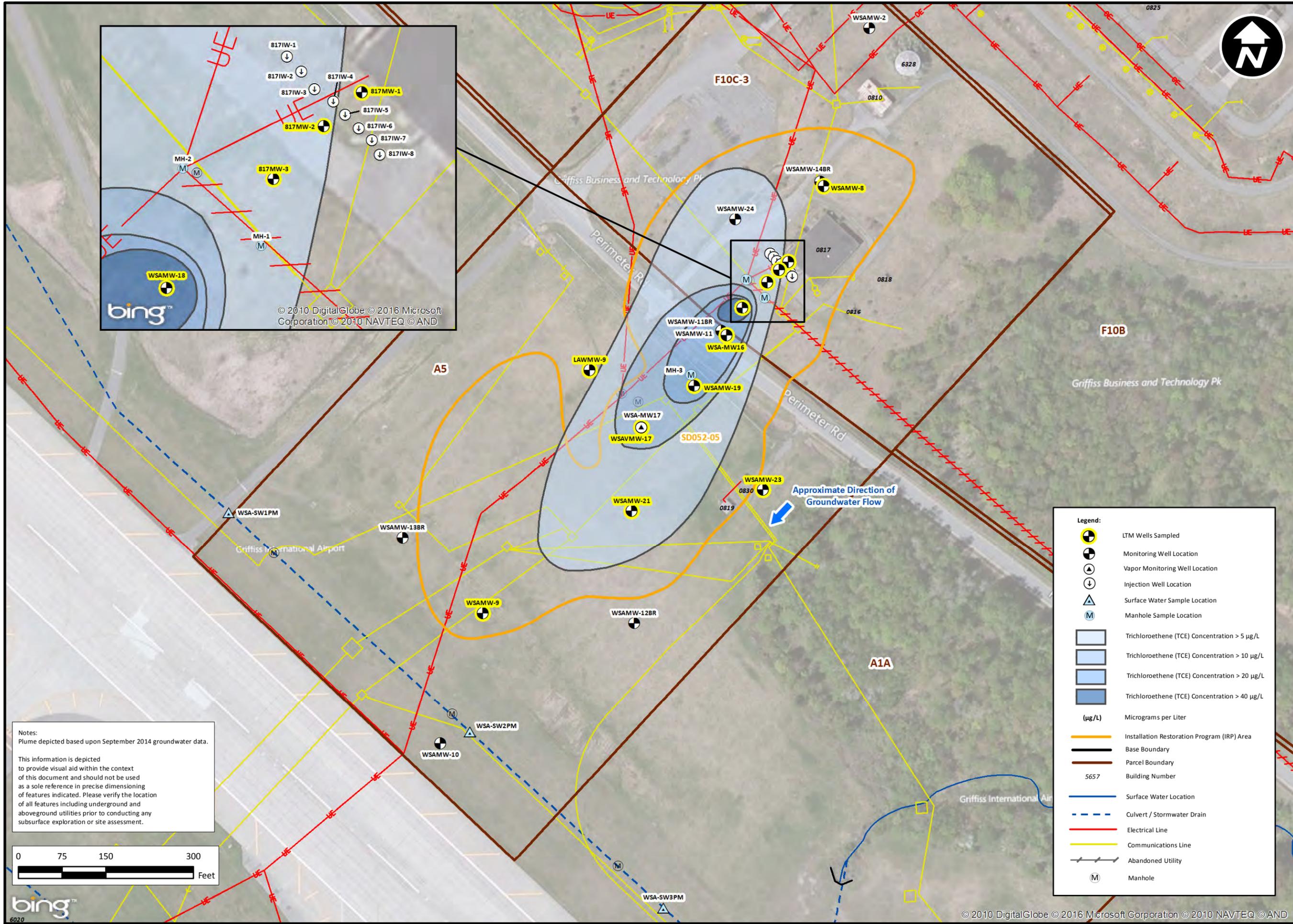
SD052-04 (Landfill 6 TCE Site)  
 Site Location, Plume and Sampling Plan Map

Figure 4

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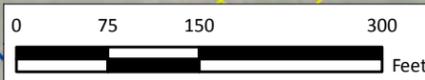




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Notes:  
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**Legend:**

- LTM Wells Sampled
- Monitoring Well Location
- Vapor Monitoring Well Location
- Injection Well Location
- Surface Water Sample Location
- Manhole Sample Location
- Trichloroethene (TCE) Concentration > 5 µg/L
- Trichloroethene (TCE) Concentration > 10 µg/L
- Trichloroethene (TCE) Concentration > 20 µg/L
- Trichloroethene (TCE) Concentration > 40 µg/L
- (µg/L) Micrograms per Liter
- Installation Restoration Program (IRP) Area
- Base Boundary
- Parcel Boundary
- 5657 Building Number
- Surface Water Location
- Culvert / Stormwater Drain
- Electrical Line
- Communications Line
- Abandoned Utility
- Manhole

SD052-05 (Building 812/WSA)  
 Site Location, Plume and Sampling Plan Map

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 On-Base Groundwater Areas of Concern  
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PROJECT NO: AFGSA3.0012.00AA

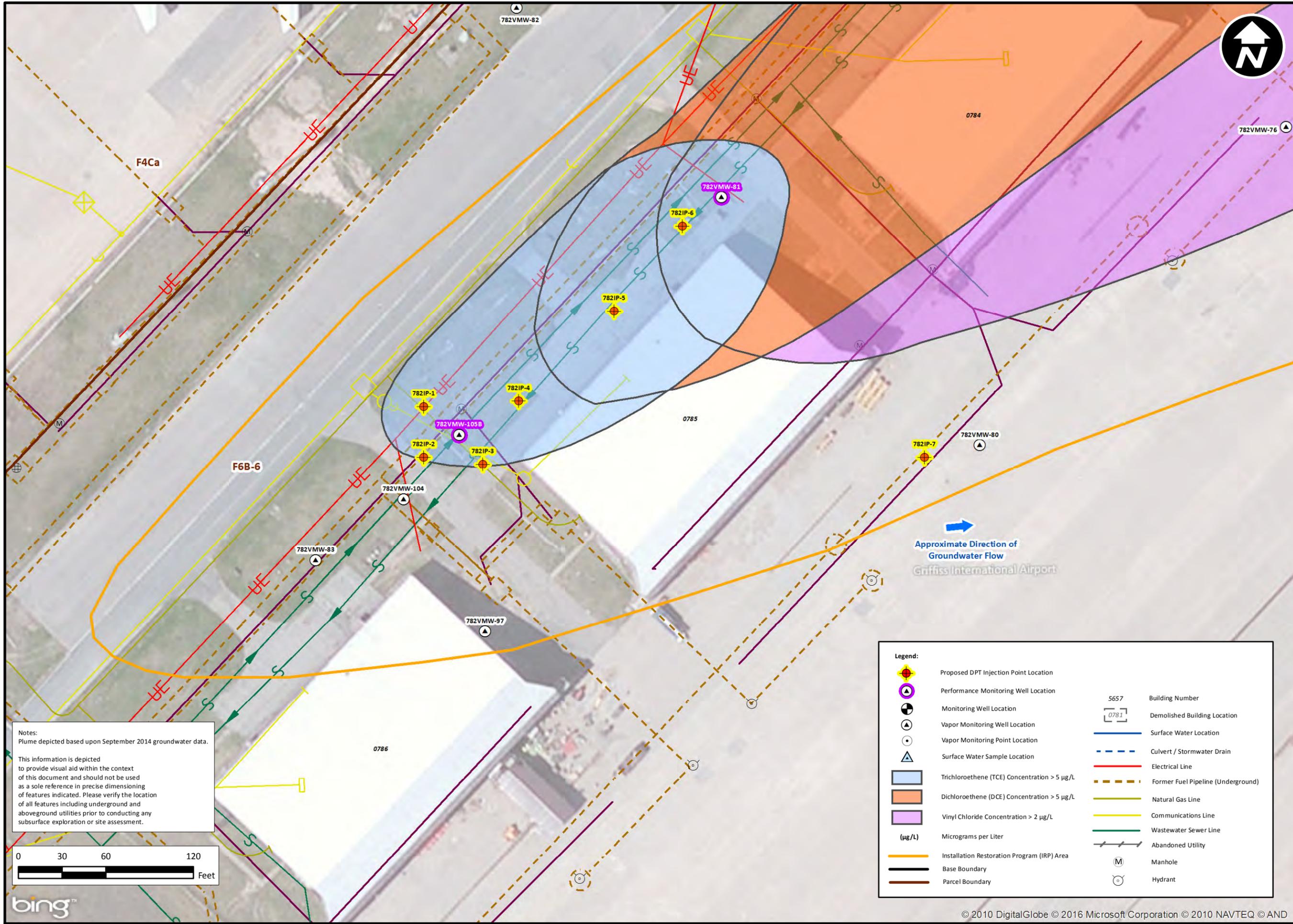
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DATE: 10/28/2016

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Figure 5

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Notes:  
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 This information is depicted to provide visual aid within the context of this document and should not be used as a sole reference in precise dimensioning of features indicated. Please verify the location of all features including underground and aboveground utilities prior to conducting any subsurface exploration or site assessment.

**Legend:**

	Proposed DPT Injection Point Location		Monitoring Well Location		Vapor Monitoring Well Location		Vapor Monitoring Point Location		Surface Water Sample Location		Trichloroethene (TCE) Concentration > 5 µg/L		Dichloroethene (DCE) Concentration > 5 µg/L		Vinyl Chloride Concentration > 2 µg/L		(µg/L)	Micrograms per Liter		Installation Restoration Program (IRP) Area		Base Boundary		Parcel Boundary		Manhole		Hydrant
	5657	Building Number		0781	Demolished Building Location		Surface Water Location		Culvert / Stormwater Drain		Electrical Line		Former Fuel Pipeline (Underground)		Natural Gas Line		Communications Line		Wastewater Sewer Line		Abandoned Utility							

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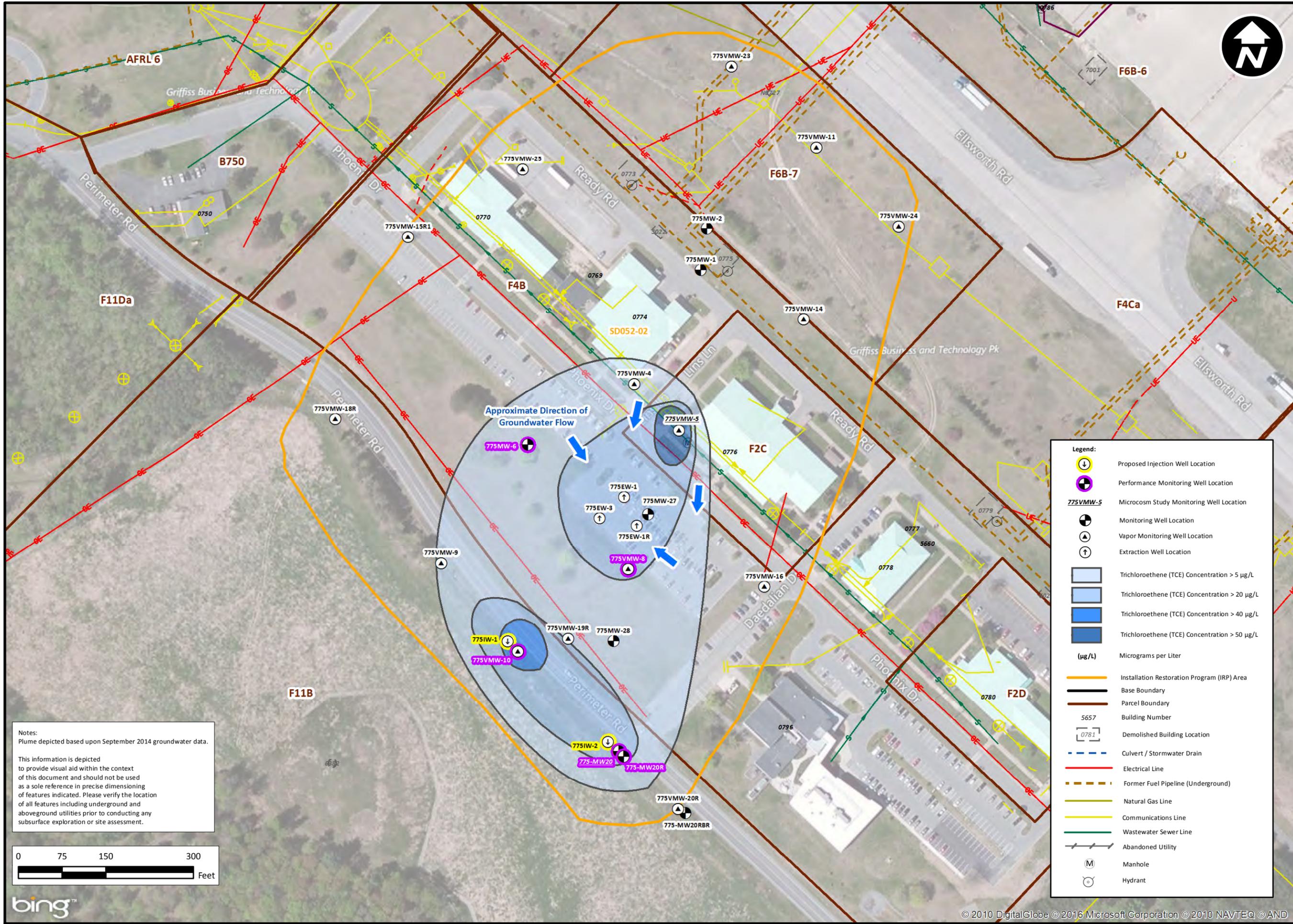
**SD052-01 (Apron 2 Chlorinated Plume)**  
**Pilot Study Plan Location Map**

**Figure 6**

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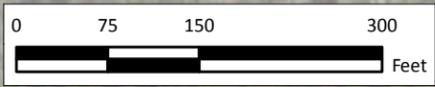
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Notes:  
 Plume depicted based upon September 2014 groundwater data.

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**Legend:**

- Proposed Injection Well Location
- Performance Monitoring Well Location
- 775VMW-5 Microcosm Study Monitoring Well Location
- Monitoring Well Location
- Vapor Monitoring Well Location
- Extraction Well Location
- Trichloroethene (TCE) Concentration > 5 µg/L
- Trichloroethene (TCE) Concentration > 20 µg/L
- Trichloroethene (TCE) Concentration > 40 µg/L
- Trichloroethene (TCE) Concentration > 50 µg/L
- (µg/L) Micrograms per Liter
- Installation Restoration Program (IRP) Area
- Base Boundary
- Parcel Boundary
- 5657 Building Number
- Demolished Building Location
- Culvert / Stormwater Drain
- Electrical Line
- Former Fuel Pipeline (Underground)
- Natural Gas Line
- Communications Line
- Wastewater Sewer Line
- Abandoned Utility
- Manhole
- Hydrant

SD052-02 (Building 775 Site)  
 Pilot Test Plan Location Map

Remedial Optimization Work Plan  
 On-Base Groundwater Areas of Concern  
 Former Griffiss Air Force Base, Rome, New York

PROJECT NO:  
 AFCGSA3,  
 0012.00AA

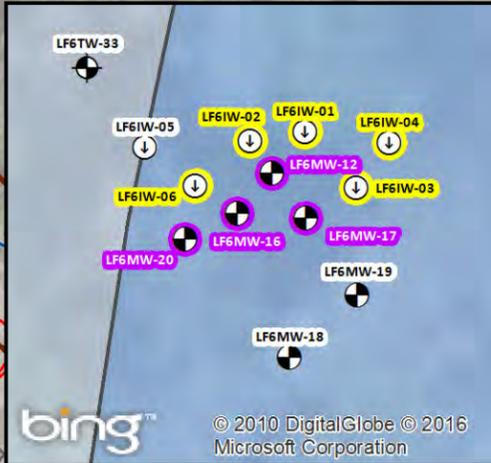
SCALE:  
 As Shown

DATE:  
 10/28/2016

DRAWN BY:  
 MRM

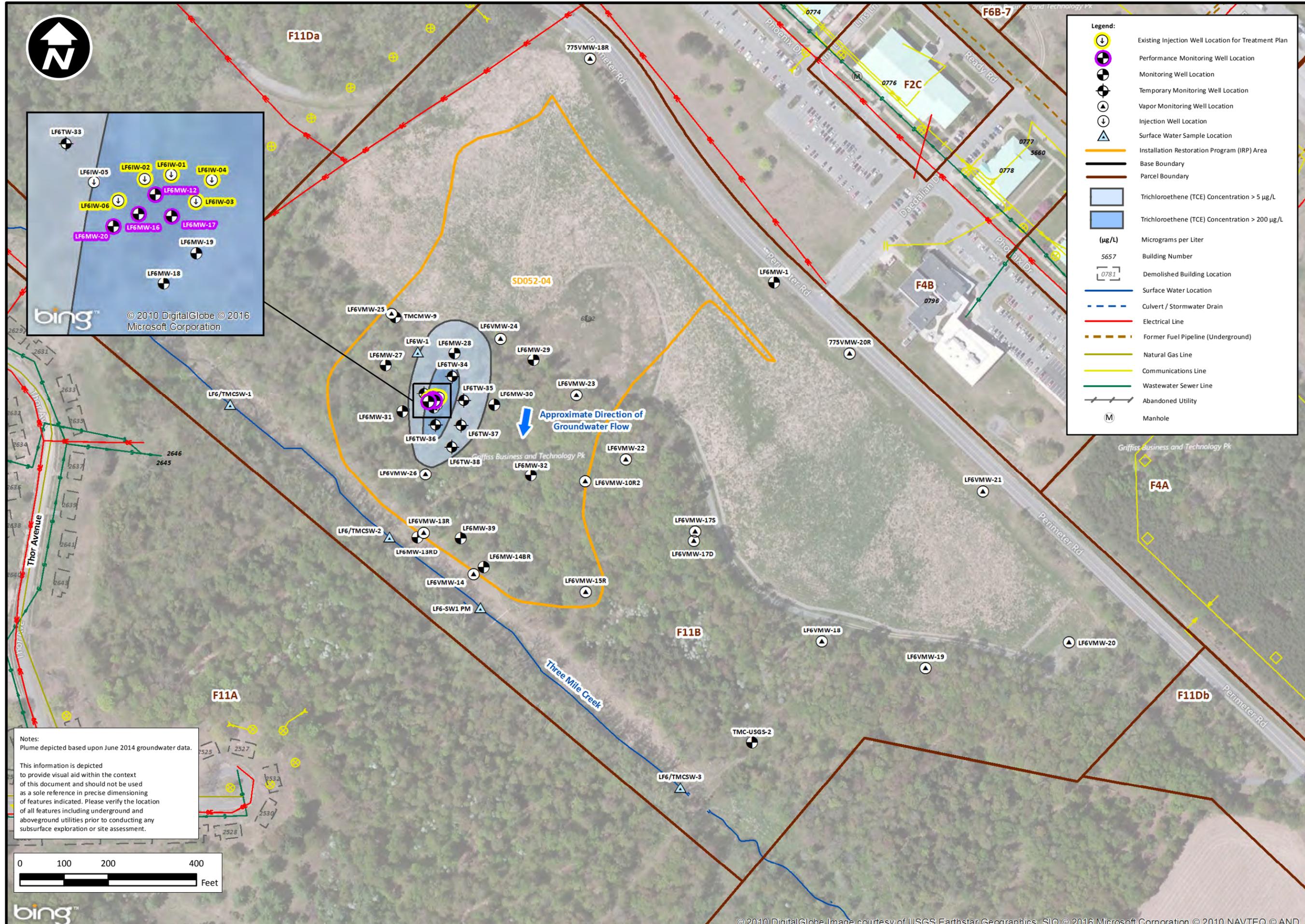


Figure 7



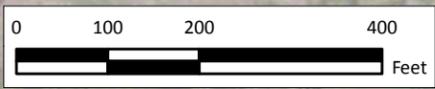
- Legend:**
- Existing Injection Well Location for Treatment Plan
  - Performance Monitoring Well Location
  - Monitoring Well Location
  - Temporary Monitoring Well Location
  - Vapor Monitoring Well Location
  - Injection Well Location
  - Surface Water Sample Location
  - Installation Restoration Program (IRP) Area
  - Base Boundary
  - Parcel Boundary
  - Trichloroethene (TCE) Concentration > 5 µg/L
  - Trichloroethene (TCE) Concentration > 200 µg/L
  - (µg/L)

 Micrograms per Liter
  - 5657 Building Number
  - Demolished Building Location
  - Surface Water Location
  - Culvert / Stormwater Drain
  - Electrical Line
  - Former Fuel Pipeline (Underground)
  - Natural Gas Line
  - Communications Line
  - Wastewater Sewer Line
  - Abandoned Utility
  - Manhole



Notes:  
 Plume depicted based upon June 2014 groundwater data.

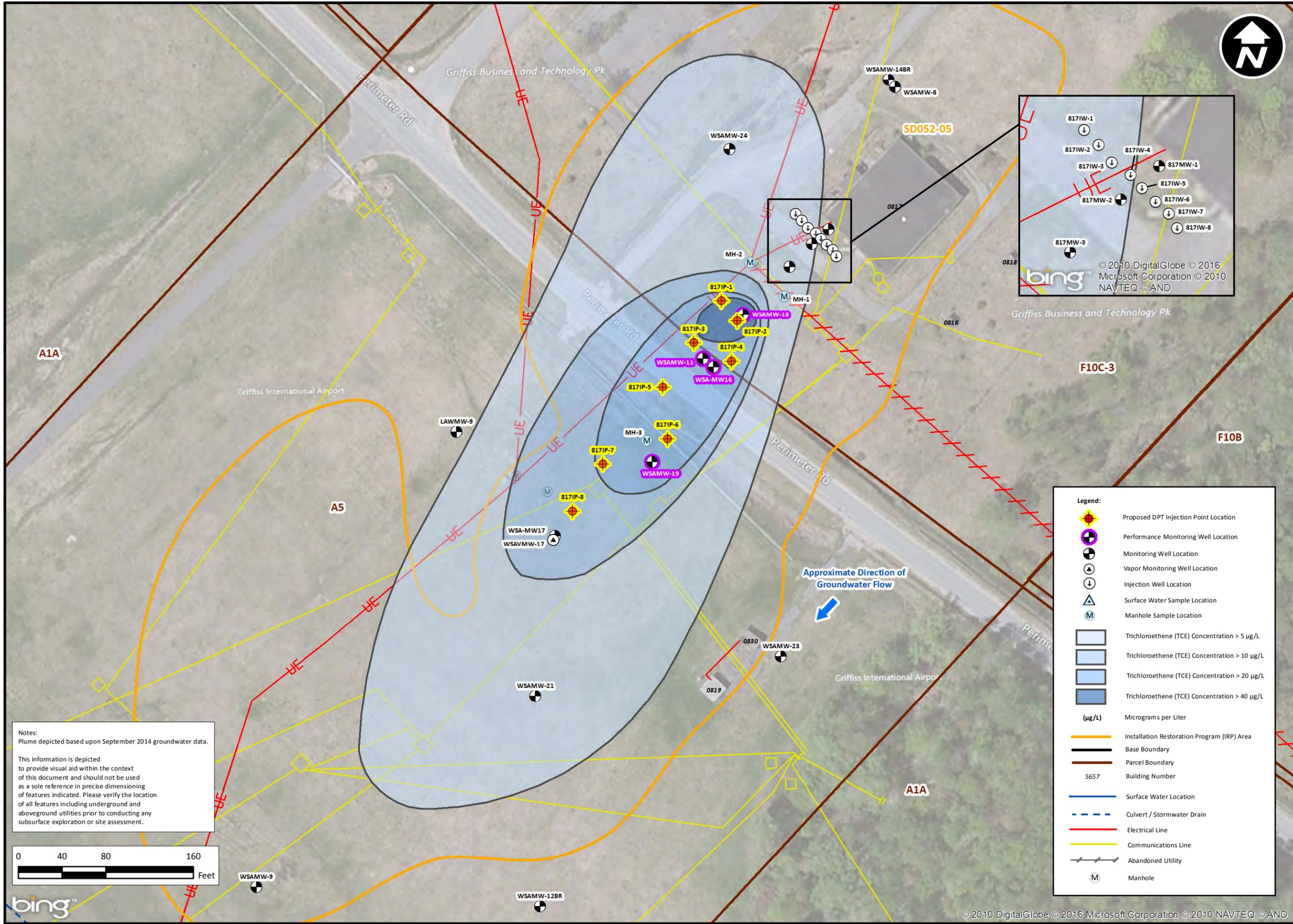
This information is depicted to provide visual aid within the context of this document and should not be used as a sole reference in precise dimensioning of features indicated. Please verify the location of all features including underground and aboveground utilities prior to conducting any subsurface exploration or site assessment.



SD052-04 (Landfill 6 TCE Site)  
 ERD Treatment Plan Location Map

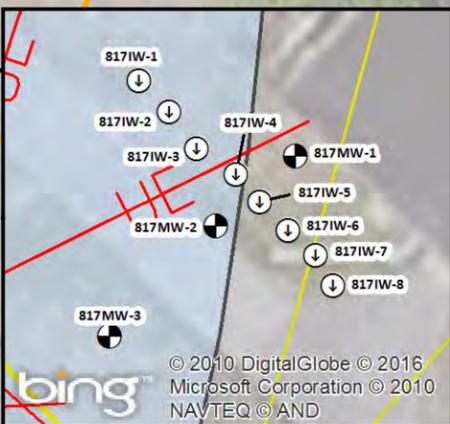
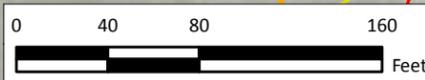
Remedial Optimization Work Plan On-Base Groundwater Areas of Concern Former Griffiss Air Force Base, Rome, New York	PROJECT NO: AFCGSA3, 0012.00AA	SCALE: As Shown	DRAWN BY: MRM
		DATE: 10/28/2016	





Notes:  
 Plume depicted based upon September 2014 groundwater data.

This information is depicted to provide visual aid within the context of this document and should not be used as a sole reference in precise dimensioning of features indicated. Please verify the location of all features including underground and aboveground utilities prior to conducting any subsurface exploration or site assessment.



**Legend:**

- Proposed DPT Injection Point Location
- Performance Monitoring Well Location
- Monitoring Well Location
- Vapor Monitoring Well Location
- Injection Well Location
- Surface Water Sample Location
- Manhole Sample Location
- Trichloroethene (TCE) Concentration > 5 µg/L
- Trichloroethene (TCE) Concentration > 10 µg/L
- Trichloroethene (TCE) Concentration > 20 µg/L
- Trichloroethene (TCE) Concentration > 40 µg/L
- Micrograms per Liter
- Installation Restoration Program (IRP) Area
- Base Boundary
- Parcel Boundary
- Building Number
- Surface Water Location
- Culvert / Stormwater Drain
- Electrical Line
- Communications Line
- Abandoned Utility
- Manhole

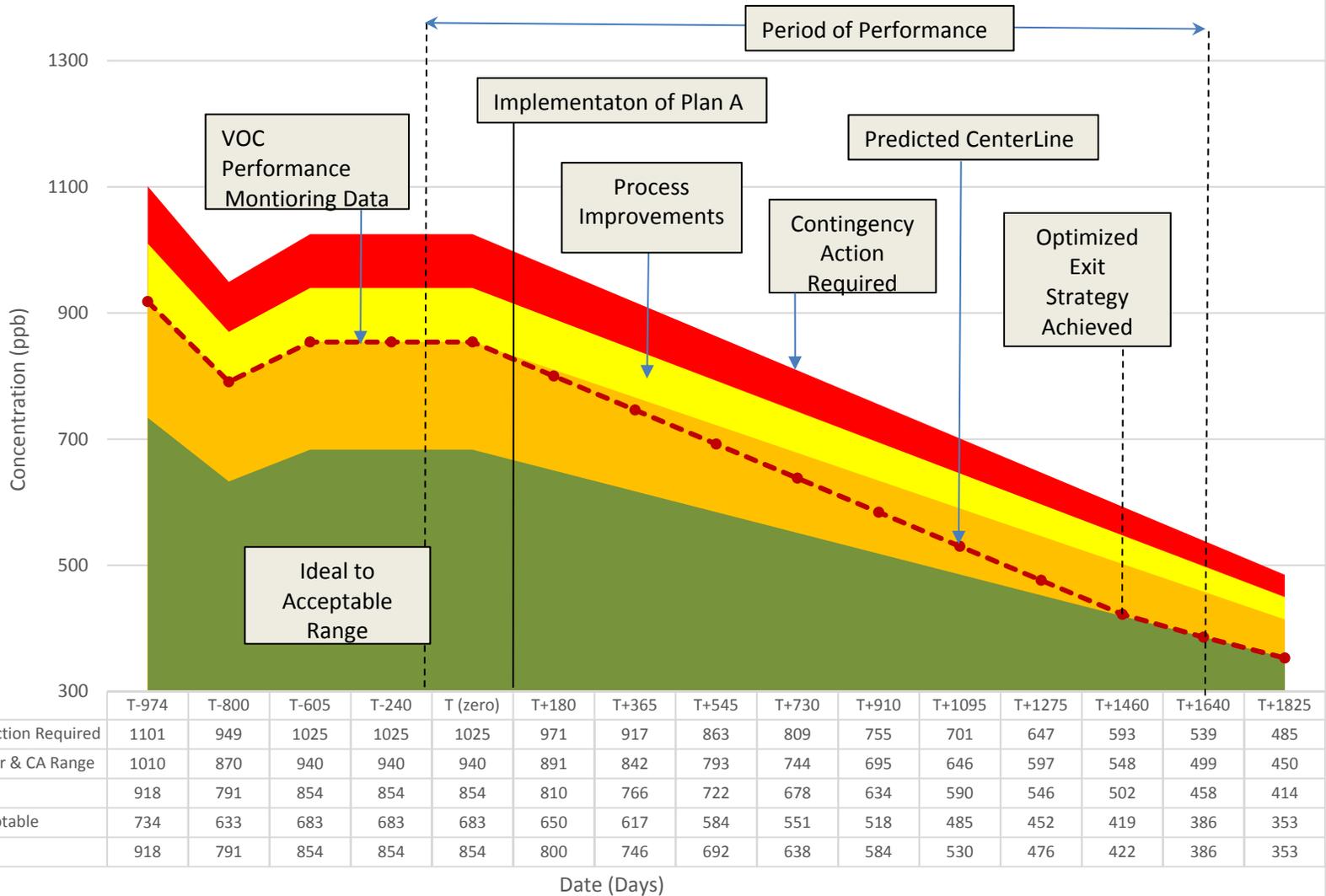
**SD052-05 (Building 812/WSA)  
 ERD Treatment Plan Location Map**

**Figure 9**

Remedial Optimization Work Plan On-Base Groundwater Areas of Concern Former Griffiss Air Force Base, Rome, New York	SCALE:	AS SHOWN
	DATE:	10/28/2016
PROJECT NO: AFCGSA3. 0012.00AA	DRAWN BY:	MRM

**APPENDIX A**  
**PERFORMANCE MODELS**

## SD052-04 Landfill 6 OES Performance Model



Date (Days)

Performance model is based on the average concentrations TCE, cis-DCE and VC concentrations at LF6MW-12, LF6MW-16, LF6MW-17 and LF6MW-20. These four wells historical have had the highest VOC detections at LF-6. Development of a single performance model based on these 4 wells would provide the best indicator of the progress toward OES at LF-6. Initial concentrations were calculated from April 2015 analytical results and represents the anticipated VOC reductions over time

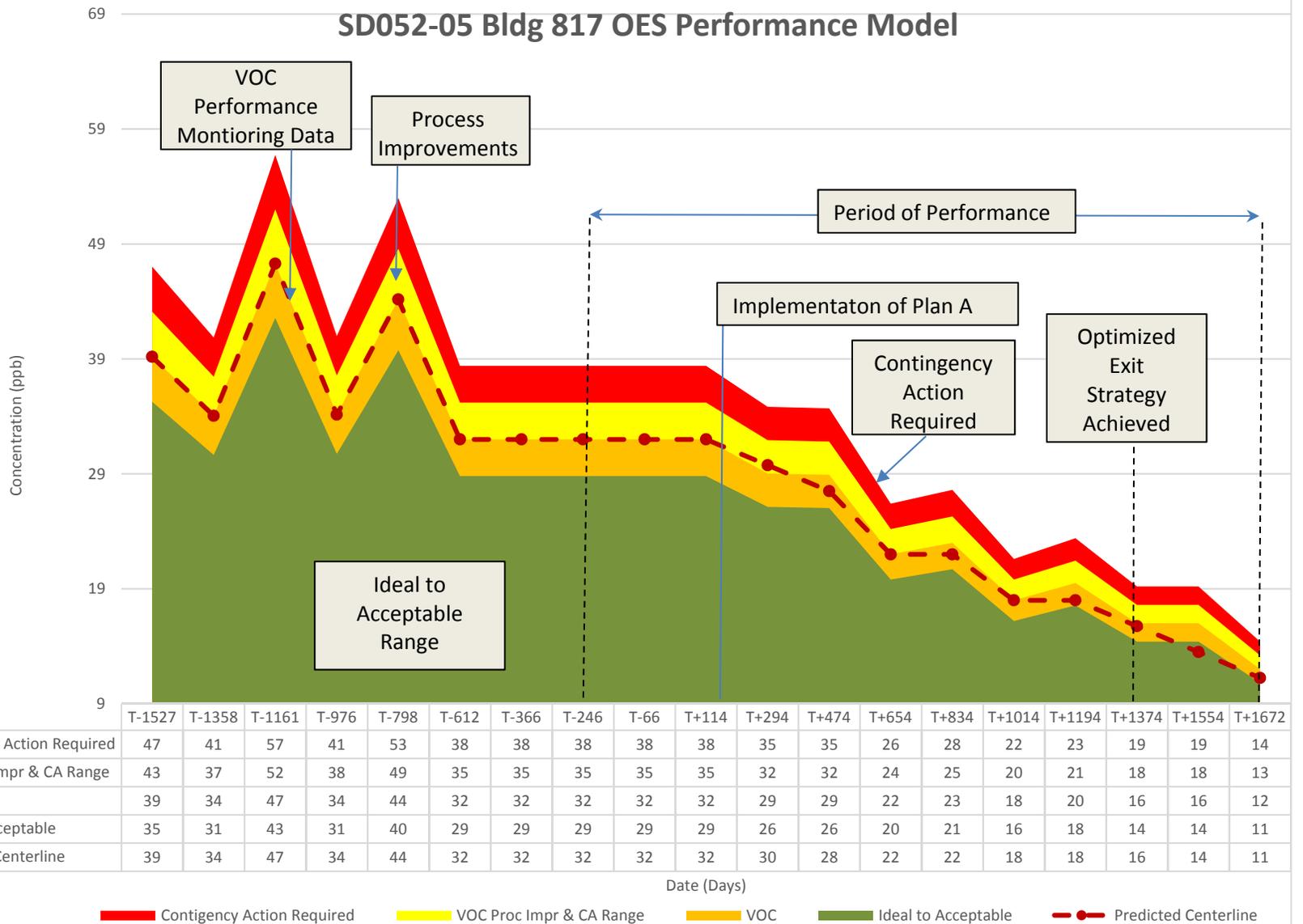
Performance Model Zones  
For SD052-04

Performance Model Zones	T-240	T (zero)	T+180	T+365	T+545	T+730	T+910
Contingency Action Required (20% above Predicted Curve)	1025	1025	971	917	863	809	755
Contingency Action Required (Lower Limit)	940	940	891	842	793	744	695
VOC Proc Impr & CA Range (Upper Limit)	940	940	891	842	793	744	695
VOC Proc Impr & CA Range (Lower Limit)	854	854	810	766	722	678	634
VOC (Predicted Curve Upper Limit)	854	854	810	766	722	678	634
VOC (Predicted Curve Lower Limit)	683	683	650	617	584	551	518
Ideal to Acceptable (20% below Predicted Curve)	683	683	650	617	584	551	518
Predicted Centerline	854	854	800	746	692	638	584

Performance Model Zones  
For SD052-04

Performance Model Zones	T+1095	T+1275	T+1460	T+1640	T+1825
Contingency Action Required (20% above Predicted Curve)	701	647	593	539	485
Contingency Action Required (Lower Limit)	646	597	548	499	450
VOC Proc Impr & CA Range (Upper Limit)	646	597	548	499	450
VOC Proc Impr & CA Range (Lower Limit)	590	546	502	458	414
VOC (Predicted Curve Upper Limit)	590	546	502	458	414
VOC (Predicted Curve Lower Limit)	485	452	419	386	353
Ideal to Acceptable (20% below Predicted Curve)	485	452	419	386	353
Predicted Centerline	530	476	422	386	353

## SD052-05 Bldg 817 OES Performance Model



Performance model is based on the average concentration of TCE and PCE at monitoring wells WSA-MW16, WSA-MW18 and WSA-MW19. These three wells historical have had the highest VOC detections at SD052-05 Bldg 817 and define the core of the plume. Development of a single performance model based on these 3 wells would provide the best indicator of the progress toward OES at SD052-05 Bldg 817. Initial average concentrations were calculated from March 2015 analytical results and represents the anticipated VOC reductions over time.

Performance Model Zones  
for SD052-05

<b>Performance Model Zones</b>	<b>T-246</b>	<b>T-66</b>	<b>T+114</b>	<b>T+294</b>
<b>Contingency Action Required (20% above Predicted Curve)</b>	38	38	38	35
<b>Contingency Action Required (Lower Limit)</b>	35	35	35	32
<b>VOC Proc Impr &amp; CA Range (Upper Limit)</b>	35	35	35	32
<b>VOC Proc Impr &amp; CA Range (Lower Limit)</b>	32	32	32	29
<b>VOC (Predicted Curve Upper Limit)</b>	32	32	32	29
<b>VOC (Predicted Curve Lower Limit)</b>	29	29	29	26
<b>Ideal to Acceptable (20% below Predicted Curve)</b>	29	29	29	26
<b>Predicted Centerline</b>	32	32	32	30

Performance Model Zones  
for SD052-05

<b>Performance Model Zones</b>	<b>T+474</b>	<b>T+654</b>	<b>T+834</b>	<b>T+1014</b>
<b>Contingency Action Required (20% above Predicted Curve)</b>	35	26	28	22
<b>Contingency Action Required (Lower Limit)</b>	32	24	25	20
<b>VOC Proc Impr &amp; CA Range (Upper Limit)</b>	32	24	25	20
<b>VOC Proc Impr &amp; CA Range (Lower Limit)</b>	29	22	23	18
<b>VOC (Predicted Curve Upper Limit)</b>	29	22	23	18
<b>VOC (Predicted Curve Lower Limit)</b>	26	20	21	16
<b>Ideal to Acceptable (20% below Predicted Curve)</b>	26	20	21	16
<b>Predicted Centerline</b>	28	22	22	18

Performance Model Zones  
for SD052-05

<b>Performance Model Zones</b>	<b>T+1194</b>	<b>T+1374</b>	<b>T+1554</b>	<b>T+1672</b>
<b>Contingency Action Required (20% above Predicted Curve)</b>	23	19	19	14
<b>Contingency Action Required (Lower Limit)</b>	21	18	18	13
<b>VOC Proc Impr &amp; CA Range (Upper Limit)</b>	21	18	18	13
<b>VOC Proc Impr &amp; CA Range (Lower Limit)</b>	20	16	16	12
<b>VOC (Predicted Curve Upper Limit)</b>	20	16	16	12
<b>VOC (Predicted Curve Lower Limit)</b>	18	14	14	11
<b>Ideal to Acceptable (20% below Predicted Curve)</b>	18	14	14	11
<b>Predicted Centerline</b>	18	16	14	11

**APPENDIX B**  
**SITE SAFETY AND HEALTH PLAN**

### A. Project Information and Approvals

		<b>Project Numbers: AFCGSA3.0012.00AA.2010.0001-.0003</b>			
<b>Client Information: (Name, Address, Contact, etc.)</b> Air Force Civil Engineer Center (AFCEC) 8 Colorado Street, Suite 121 Plattsburgh NY, 12903 ATTN: David Farnsworth Cell: (518) 420-2179	<b>Bhate Project SSHP Approvals (minimum)</b>				
	<b>Title</b>	<b>Name</b>	<b>Signature</b>	<b>Date</b>	
	Project Manager (PM)	Kim Nemmers			
<b>Project Information: (Facility Name, Address, etc.)</b> Remedial Optimization Work Plan On-Base Groundwater AOCs Former Griffiss AFB, Rome, New York  <b>CONTRACT/TASK ORDER NO:</b> FA8903-16-F-0012	Health and Safety Manager (HSM)	Sally S. Smith, CIH, CSP ,CHMM, CPEA			
	Field Operation Manager (FOM) and Site Safety and Health Officer (SSHO)	TBD			
<b>Project Safety Coordination:</b>					
A FOM/SSHO will be onsite during invasive field work to implement and enforce the health and safety procedures outlined in this Site Safety and Health Plan (SSHP) and the Griffiss Program Health and Safety Plan (Griffiss Program HASP). Bhate will enforce the requirements of this SSHP and Griffiss Program HASP for both site contractor and subcontractor personnel. The Bhate HSM is responsible for the development and oversight of Bhate’s Corporate HASP, the Griffiss Program HASP, and this SSHP. Should any project health and safety issues arise that are not adequately covered by this SSHP, the PM must contact the HSM and request guidance. The FOM/SSHO has the authority to stop work if a serious hazard warrants the action.					
<b>Description of field work to be performed:</b>					
This SSHP addresses the potential health and safety hazards associated with field activities at SD052 at the former Griffiss Air Force Base (AFB) in Rome, New York.  The following project tasks are addressed in this SSHP for the injection of chemical oxidants at four injection sites: <ul style="list-style-type: none"> <li>• Mobilization and delivery of injection compounds</li> <li>• Injection well installation, groundwater sampling, and implementation of the remedial action (injections).</li> </ul> Each injection point will receive 2,000 pounds (lbs) of emulsified vegetable oil (EVO); 750 gallons deoxygenated water; and 3.5 liters of Dehalococcoides ethenogenes (DHC) cultures. The only exception to this is at Site SD052-02, where slightly more EVO will be injected (2,571 lbs per point). Sodium bicarbonate will be added on an as needed basis to treat the chlorinated solvent groundwater contamination.					

### B. Hazard(s) Assessment

Hazard Categories	Hazard Potential [High, Moderate, or Low]	Description of Potential Hazards
General Safety	• Moderate	<ul style="list-style-type: none"> <li>• Slips, trips, and falls</li> <li>• Traffic and heavy equipment</li> <li>• Materials handling</li> </ul>
Traffic	• Moderate	<ul style="list-style-type: none"> <li>• Contact with or disruption of traffic when mobilizing and/or drilling</li> </ul>
Utilities	• Moderate	<ul style="list-style-type: none"> <li>• Buried and aboveground utilities</li> </ul> <p style="color: red;">Beware: Dig Safe will <b>not</b> be able to locate the abandoned utilities at the sites</p>
Chemical	• Moderate	<ul style="list-style-type: none"> <li>• EVO</li> <li>• DHC cultures</li> <li>• Sodium bicarbonate (if needed)</li> <li>• Sodium sulfite (if needed)</li> </ul>

Hazard Categories	Hazard Potential [High, Moderate, or Low]	Description of Potential Hazards
		<ul style="list-style-type: none"> <li>Sugar</li> <li>Yeast</li> <li>Gasoline</li> <li>Diesel</li> <li>Motor Oil</li> <li>Groundwater potentially contaminated with chlorinated volatile organic compounds (CVOCs) [Tetrachloroethene (PCE), Trichloroethene (TCE)]</li> <li>Silica dust when mixing grout, as needed</li> <li>Bentonite</li> <li>Portland cement/Concrete</li> </ul>
Physical	<ul style="list-style-type: none"> <li>Moderate</li> </ul>	<ul style="list-style-type: none"> <li>Thermal Stressors - Heat</li> <li>Sun Exposure</li> <li>Equipment noise</li> <li>Vibration when drilling in concrete or asphalt (walkway, road), if needed</li> </ul>
Biological	<ul style="list-style-type: none"> <li>Moderate</li> </ul>	<ul style="list-style-type: none"> <li>Insects, snakes, and other wildlife, ticks</li> </ul>

The Activity Hazard Analysis (AHA) identifies potential safety, health, and environmental hazards, and provides for the protection of personnel, the community, and the environment. Because conditions may be constantly changing during the course of a project, supervisors must be aware of conditions that may harm site personnel, the community, or the environment. The FOM/SSHO must monitor these changing conditions and discuss them with the HSM. If conditions change or if new tasks and/or hazards present themselves, the SSHO must notify the HSM and the HSM will write or approve the change or addition to the AHAs. AHAs for the field activities are provided in Attachment 1 of this SSHP addendum.

### C. Training Requirements

The required training for site personnel will be consistent with the requirements of 29 Code of Federal Regulations (CFR) Part 1926 and 29 CFR §1910.120(e). Employees will be instructed on the requirements of the SSHP, review and location of Safety Data Sheets (SDSs) and/or Material Safety Data Sheets (MSDSs), hospital route maps, emergency procedures, and any additional safety or health concerns, such as required personal protective equipment (PPE). Field personnel will attend informal daily tailgate safety briefings lead by the SSHO/FOM each morning prior to beginning fieldwork to discuss the proposed activities scheduled for the day as well as hazards and control measures required. There will be a formal weekly safety meeting. Personnel attendance at daily safety briefings, any site specific training, and an employee endorsement of the provisions of the SSHP will be documented and maintained by the SSHO. (See form for Review of SSHP and the form for Daily/Weekly Safety Meeting in Attachment 2 of the Griffiss Program HASP). There will be at least two individuals onsite at all times who have First Aid/Cardiopulmonary Resuscitation (CPR) training and Blood-borne Pathogen Training. The names of the designated First Aid/CPR personnel will be announced and posted.

### D. Personal Protective Equipment

Minimum Personal Protective Equipment by Activity					
Activity	Head/Face/Ears <sup>1</sup>	Foot	Hands	Respiratory <sup>3, 4</sup>	Clothing
General Site Activities	Hard hat, safety glasses with rigid side shields, face shields as needed for splashing, hearing protection while operating noisy equipment (> 85 decibels A-weighted [dBA])	Steel toed boots	Leather gloves, as needed	None	Minimum of long pants and shirts with a minimum 4-inch sleeve, ANSI Class II reflective safety vest (for traffic areas)

Minimum Personal Protective Equipment by Activity					
Activity	Head/Face/Ears <sup>1</sup>	Foot	Hands	Respiratory <sup>3, 4</sup>	Clothing
Soil or Groundwater Sampling	Hard Hat, Safety Glasses with rigid side shields Hearing protection when working near drill rigs	Steel toed boots	Nitrile inner and outer chemical resistant gloves	None	Minimum of long pants and shirts with a minimum 4-inch sleeve ANSI Class II reflective safety vests when working around heavy equipment or traffic areas
Operation of: -Forklift for "off loading" injection compounds  -Direct push technology (DPT) drill rig when injecting	Hard hat, safety glasses with rigid side shields, face shields as needed for splashing, hearing protection while operating noisy equipment (> 85 dBA)	Steel toed boots and chemically - resistant boot covers, as needed	Leather gloves	None	Minimum of long pants and shirts with a minimum 4-inch sleeve ANSI Class II reflective safety vests when working around heavy equipment or traffic areas
Installation of Injection Wells, as needed	Hard hat, safety glasses with rigid side shields, face shields as needed for splashing, hearing protection while operating noisy equipment (> 85 dBA)	Steel toed boots and chemically - resistant boot covers, as needed	Nitrile inner and outer chemical resistant gloves	Only if site conditions warrant it, full face, air purifying respirator with combination Organic Vapor/HEPA (P100) cartridges <sup>2</sup>	Minimum of long pants and shirts with a minimum 4-inch sleeve, ANSI Class II reflective safety vest (for traffic areas)

**Notes:**

<sup>1</sup> Safety Glasses with rigid side shields approved by American National Standards Institute (ANSI) Z-87 required at all times. Hard hats are not required inside fully enclosed equipment cabs.

<sup>2</sup> All Bhatte personnel required to wear a respirator during any phase of site activities must comply with the requirements of the Bhatte Respiratory Protection Program. Respiratory protection users must participate in a medical monitoring program and be physically capable of performing the required work activities, received training in the use of and be fit tested for the respiratory protection selected. HEPA = High-Efficiency Particulate Air

<sup>3</sup> Voluntary use of respirators is authorized for comfort from nuisance dusts and odors, provided they are issued and used in accordance with established respiratory protection program procedures.

<sup>4</sup> Cartridge change out will occur at the following conditions:

- Damage to cartridge
- Cartridge is wet, restriction in breathing, unusual odors
- Cartridge is visibly clogged with dust, restriction in breathing
- Each day of use with no continuous exposures over the established Permissible Exposure Limits (PELs) as per manufacturer's cartridge change out recommendations/calculations
- Changes that may be otherwise identified in 29 CFR §1910.120.

These minimum PPE requirements must be adhered to at all times on the job site. Any downgrades/changes in PPE requirements must be approved by the HSM prior to implementation.

The following qualified person certifies that the selection of PPE is based on best available information about the work requirements and anticipated hazards.

<b>Printed Name:</b> Sally S. Smith, MHS, CIH, CSP, CHMM, CPEA Bhatte Director of Health and Safety	<b>Signature:</b>  	<b>Date:</b>  
---	---------------------------	----------------------

Although not anticipated, when air monitoring levels indicate use of respirators is needed, then the SSHO will confer with HSM to implement use of respiratory protection. If required, respirators will be specified according to the hazard. All Bhate personnel and subcontractors who may be required to wear a respirator during any phase of site activities must comply with the requirements of the Bhate Respiratory Protection Program and the subcontractor's respiratory protection program, whose ever is more stringent. Respiratory protection users must participate in a medical monitoring program and be physically capable of performing the required work activities; they must have received training in the use of, and have been fit tested for the respiratory protection selected.

**E. Medical Surveillance Requirements**

A medical surveillance program established for hazardous waste work will be followed for all onsite workers where applicable. Personnel working on any hazardous waste site will have had a pre-employment and current annual/biennial physical examination in accordance with 29 CFR §1910.120(f) / 29 CFR §1926.65(f) conducted by an occupational health physician and, on the basis of this examination, will have been certified as being fit for duty on potentially hazardous sites.

All Bhate personnel who may be required to wear a respirator during any phase of site activities must comply with the requirements of the Bhate Respiratory Protection Program. Respiratory protection users must participate in a medical monitoring program and be physically capable of performing the required work activities, they must have received training in the use of, and have been fit tested for the respiratory protection selected.

**F. Air Monitoring**

The majority of exposure monitoring will be conducted using direct-reading instruments in the workers' breathing zone or area to conduct negative exposure assessments and to verify the effectiveness of controls. Monitoring results will be recorded on an Air Monitoring Data Sheet (Attachment 2) or in a field logbook maintained by the SSHO. Readings of breathing zones (unless location is otherwise specified) will be taken periodically during all activities. The following site monitoring parameters and action levels are applicable for direct reading exposure monitoring.

Air monitoring for organic vapors with real-time direct-reading instruments will be used at both locations during performance of their tasks to: (1) determine the appropriate PPE requirements for individual tasks, (2) determine the need for upgrading and downgrading of PPE, and (3) confirm that air contaminants are being contained within the boundaries of the project. Monitoring with direct-reading instruments will be conducted to provide the FOM/SSHO with real-time and trending data to assess the effectiveness of control measures.

**Exposure Monitoring Action Levels**

Activity(s)	Compound / Instrument	Action Level(s) and Frequency	Actions
Intrusive activities such as groundwater sampling and injection	Total CVOCs / Photoionization Detector (PID)	0 - 5 parts per million (ppm) Every 15 minutes during intrusive activities	Continue work in required PPE and continue monitoring.
		> 5 ppm to < 10 ppm (Sustained for more than 5 minutes)	Ensure personnel are upwind; notify the PM. SSHO will upgrade PPE to Level C respiratory protection with organic vapor and HEPA cartridge (P100), as necessary. Implement appropriate controls such as ventilation. <b>Monitor for benzene and implement actions listed below.</b>
		> 10 ppm (Sustained for more than 5 minutes)	Stop work, ensure employees are upwind. Notify PM and HSM for additional control measures.
	Benzene / By colorimetric tube or similar (where indicated by PID readings) [not expected]	No detection up to 0.2 ppm	Continue work activities in required protective equipment. Perform integrated personal exposure monitoring using Organic Vapor badge or charcoal tubes with calibrated pump per National Institute for Occupational Safety and Health (NIOSH) or Occupational Safety and Health Administration (OSHA) method (consult HSM as needed).
> 0.2 ppm		Cease work, exit the area to upwind location and notify the Site Manager.	

Activity(s)	Compound / Instrument	Action Level(s) and Frequency	Actions
Injection Well installation, as needed	Lower Explosive Limit (LEL)	<10% LEL	Continue work in required PPE and continue monitoring.
		>10% LEL	Cease work and ensure personnel are upwind, notify the Site Manager. Ensure all sources of ignition are kept >50 feet away.
All site activities	Noise	< 85 dBA	Continue work in required PPE and continue monitoring.
		> 85 dBA to < 110 dBA (noise levels are in this range if have to shout when talking next to one another.)	a.) Ear plugs or ear muffs must be worn with a Noise Reduction Rating (NRR) of at least 26 dBA. b.) Must be worn when DPT activities are occurring
		> 110 dBA to < 130 dBA	Ear plugs and ear muffs must be worn together each with a NRR of at least 26 dBA.
		> 130 dBA	Cease work and ensure personnel leave work area. Notify the PM.
<b>Note:</b> All Bhatte personnel and subcontractors who may be required to wear a respirator during any phase of site activities must comply with the requirements of the Bhatte Respiratory Protection Program. Respiratory protection users must participate in a medical monitoring program and be physically capable of performing the required work activities, they must have received training in the use of, and have been fit tested for the respiratory protection selected.			

### G. Site Control

Access will be coordinated with the FOM. Access will be made via a specified route. The SSOH will be responsible for the accountability for all onsite personnel using appropriate sign in / sign out procedures as needed. The SSOH shall be responsible for maintaining adequate site control in order to limit hazards to site workers and site visitors. To the extent feasible, immediate work areas shall be cordoned off through the use of devices such as traffic cones, caution tape, or construction fencing along with appropriate signage such as “Hard Hat, Safety Glasses, and Safety Boots Required in this Area” (see example signs in Attachment 2). Work Areas will be clearly marked and cordoned. Highly visible vests will be worn in high traffic area and/or where heavy equipment is being operated to improve visibility. All site workers shall be aware of surroundings and prevent unauthorized personnel as well as vehicle traffic from entering the work area. In areas where traffic control is required, all traffic control devices and methodologies will comply with the U.S. Department of Transportation (DOT) Manual on Uniform Traffic Control Devices (MUTCD, <http://mutcd.fhwa.dot.gov>) including the use of appropriate roadway markings, highly visible safety vests, and flagmen as needed.

Site control in potentially contaminated areas is described in the following table.

**Site Control for Potentially Contaminated Area(s)**

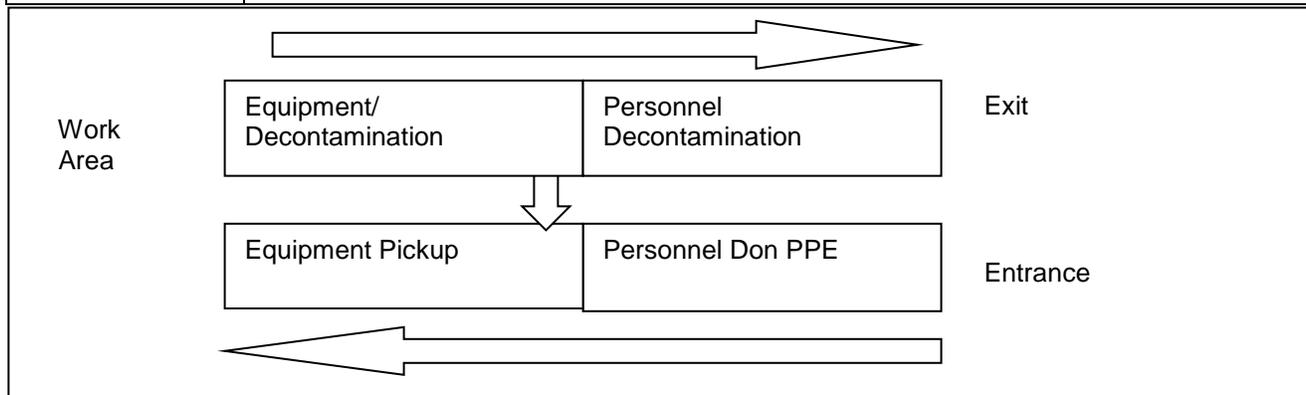
Location	Site Control Procedure (discuss important elements such as signs, barricades, briefings, qualifications, required supplies and equipment, sign-in/out logs, etc.)
Support Zone (SZ)	Located outside of contaminated areas, access will be from clean areas or from the Exclusion Zone through the Contamination Reduction Zone.
Contamination Reduction Zone (CRZ)	The Contamination Reduction Zone will be demarcated with caution tape or temporary construction fencing. Decontamination stations will be located here.
Exclusion Zone (EZ)	Exclusion Zone work areas will be clearly demarcated with caution tape or temporary construction fencing. All access to this area will require the use of a sign-in/out log.

### H. Decontamination

Decontamination procedures are described in the following table. The drawing below depicts a typical decontamination sequence.

**Decontamination Procedures by Location**

Type of Decontamination	Decontamination Methods
Personnel decontamination	<p>Personal hygiene will be the responsibility of each individual worker. Eating, drinking, chewing tobacco or gum, smoking, and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the work area. Personnel will be required to thoroughly wash hands and face prior to eating, drinking, or smoking. Any disposable PPE used will be collected following use in the work area for proper disposal. All disposable PPE will be removed and disposed of in a labeled, pre-designated receptacle prior to leaving the work area to prevent the spread of contaminants. Upon return, new and/or cleaned PPE will be provided for use. In the case of excessive soiling or splattering, the PPE shall be changed out more frequently to reduce the spread of contamination and reduce the potential for contaminant breakthrough. Reusable PPE shall be cleaned with soap and water after each use. Respirator filter cartridges (if used) shall be changed out at least on a daily basis.</p> <p>The decontamination (decon) area will be divided into two general areas (equipment decon area and personnel decontamination area). When exiting the work area, workers will leave all equipment in the equipment decon area. Workers will then remove disposable PPE. Outer gloves will be turned inside out so as to not come into contact with potentially contaminated material. A small wash area will be provided so workers can then wash their face and hands. Clean paper towels and/or rags will be used to dry hands and face. Spent PPE and towels/rags will then be placed in a labeled 55-gallon drum for proper disposal at the end of the project. If PPE is upgraded to require wearing respirators, then a respirator wash and rinse station needs to be added to the personnel decon area. The respirator will be removed and set aside for cleaning before removing inner gloves. Clean gloves will be donned to wash the masks. Cartridges can be reused for a week or until warning properties are detected, whichever comes first.</p>
Equipment decontamination	<p>Work efforts will be made to minimize equipment contact with contaminated materials. Prior to leaving the work area, equipment (tires, drill rig tools, hand tools) will be dry decontaminated. Soils from the dry decontamination process will be disposed with other investigation derived waste (IDW) generated. Decontamination tools may include brooms and shovels.</p>



**I. Hazard Communication**

The SDSs/MSDSs for all chemicals brought on site must be submitted to the FOM and the HSM. A copy of all SDSs/MSDSs must be kept on site as well as in the Corporate Office. (See Attachment 3 of this SSHP for SDSs/MSDSs provided.) All employees on site must review the SDS/MSDS for all chemicals used. All containers must be labeled at a minimum with the identity of the chemical contents and the associated hazards. The National Fire Protection Association (NFPA) diamond label shall be used for all temporary or transfer containers used on site. The appropriate rating will be filled in for each hazard category based on the SDS/MSDS. Red = Fire Hazards, Blue = Health Hazards, Yellow = Reactivity Hazards, and White = other hazards (i.e. water reactive or oxidizer). All subcontractors are responsible for submitting a SDS/MSDS for all chemical products brought on site. A copy of the written hazard communication program is found in the Corporate Health and Safety Plan. A review has been performed for the primary contaminants of concern (PCOC) (i.e. TCE, PCE, etc.) using the NIOSH Pocket Guide to Chemical Hazards and International Chemical Safety Cards (see Table of PCOC in Attachment 4 of this SSHP).

**J. Emergency Action and Response / Communications**

Cellular telephones will be available to summon emergency services as required. Refer to the table below for site specific guidance on emergency situations and appropriate actions. Site communication amongst workers shall be a combination of verbal and line of sight hand communications. Visual signals include:

1. Hand gripping throat = Can't breathe,
2. Grip partner's wrist or both hands at waist = Leave area immediately,
3. Hands on top of head = Need assistance,
4. Thumbs up = OK, I'm all right, I understand,
5. Thumbs down = No, Negative

**Cellular telephone use is not permitted while operating equipment.** However, in the event of an emergency, the support zone may contact operators of heavy equipment with hand held radios or cellular phones. Emergency situations and appropriate response actions are described in the following table.

**Emergency Situations and Response Actions**

In Case of	Response Actions
Injury or illness	Treat injury with applicable First Aid. All work related injuries beyond first aid will result in notification of Emergency Services and notification of the employee supervisor. All injuries must be reported to the FOM, PM, and HSM.
Chemical exposure	First Aid shall be provided such as but not limited to: move victim to fresh air, remove contaminated clothing, flush affected skin with water for at least 15 minutes, and seek medical attention.
Fire or explosion	Notify emergency services immediately. All personnel shall evacuate the immediate area of the fire and move to an upwind location.
Adverse weather	Tornados, lightning, or other threatening weather conditions will result in an immediate shut down of operations and evacuation of personnel. If take shelter situation is required personnel will proceed to the pre-designated take shelter location onsite.
Material spill or release	Vehicles and equipment will be maintained and inspected so as to prevent fluid leaks. Spill kits will be available to facilitate prompt containment and clean-up of spills.

In the event of an emergency, local sources of assistance will be used. Cellular telephones or other means of communication must be available at all times on site to summon emergency services as needed while work is being conducted. The functionality of the means of communication must be verified at the work site during the tailgate safety meeting. Prior to the commencement of the work, the SSHO will familiarize the field team with the locations of the closest hospital (see hospital maps with directions in Attachment 5 of this SSHP). Phone numbers and facilities for emergency use are provided for the work site. **Rome Fire Department does not transport victims so private ambulance (AmCare) needs to be called. See phone number in Emergency contact List. Mohawk Glen Urgent Care is only for non-emergency conditions.**

After initial contacts have been made and the situation has stabilized, the FOM/SSHO will notify the PM, Base Realignment and Closure Environmental Coordinator (BEC)/Contracting Officer's Representative (COR) and HSM, as appropriate. An Incident Report form must be completed within 24 hours of the incident and the Incident Investigation Form must be completed within 5 days of the incident.

**Emergency Contacts**  
 (Also see Table 9-1 of Griffiss AFB Program HASP)

<b>Rome Fire Department</b> 158 Black River Blvd N Rome, NY 13440	911 (Emergency) 315-339-7733 (Non-Emergency)
<b>Rome Police Department</b> 301 N James St #1 Rome, NY 13440	911 (Emergency) 315-339-7780 (Non-Emergency)
<b>Rome Memorial Hospital</b> 1500 N. James Street Rome, NY 13440	911 (Emergency) 315-338-7000 (Administrative) (see maps and directions in Attachment 5)
<b>Ambulance (private) – Am Care</b> <b>(Rome Fire Dept. does not transport victims)</b>	315-339-5600
<b>Mohawk Glen Urgent Care</b> <b>(on base - not a hospital)</b> 91 Perimeter Road Suite 100 Rome, NY 13441	911 (Emergency) 315-337-2156 (Administrative) (see maps and directions in Attachment 5)
<b>Site Safety and Health Officer (SSHO) –</b> Dustin McNeil	720-463-3904 Office 303-589-4564 Cell
<b>Griffiss AFB BEC/COR -</b> David Farnsworth	518-563-2871 office
<b>Project Manager</b> Kim Nemmers	303-550-9239 cell
<b>Bhate Health and Safety Manager</b> Sally S. Smith, CIH, CSP, CHMM, CPEA	205-918-4032 office 205-983-4150 cell

## **SSHP ATTACHMENTS**

SSHP Attachment 1 – Activity Hazard Analyses (AHAs)

SSHP Attachment 2 – Common Safety Signs and Field Safety Forms

SSHP Attachment 3 – Safety Data Sheets (SDSs)/Material Safety Data Sheets (MSDSs)

SSHP Attachment 4 – Properties of Primary Contaminants of Concern Table

SSHP Attachment 5 – Hospital Maps and Directions

### **(ALSO SEE GRIFFISS PROGRAM HASP ATTACHMENTS)**

Griffiss Program HASP Attachment 2 – Health and Safety Field Forms

# **SSHP ATTACHMENT 1**

## **ACTIVITY HAZARD ANALYSES (AHAs)**

**Activity Hazard Analysis – 01**

<b>Task:</b> General Site Activities; Site Mobilization; Traffic Control, as needed; Demobilization; and Management of IDW		<b>Project:</b> Former Griffiss AFB	<b>AHA Reviewed by:</b> Sally S. Smith, CIH, CSP, CHMM, CPEA
<b>Minimum Personal Protective Equipment (PPE):</b> Level D (Hard Hat, Safety Glasses with rigid side shields, steel toe work boots, leather gloves, disposable Tyvek suit, as needed)		<b>Location:</b> Rome, New York	<b>AHA Reviewed date:</b> December 2016
Activity	Potential Hazard(s)	Control Measures	
General Site Activities; Site Mobilization; Traffic Control, as needed; Demobilization; and Management of IDW  [NOTE: The hazards and control measures presented in AHA-01 are applicable to all phases of the project]	Slips, trips, or falls on walking and working surfaces	<ul style="list-style-type: none"> <li>• Be alert for uneven terrain and steep slopes</li> <li>• Keep work area free of dirt, grease, slippery materials, debris, and tools; practice good housekeeping</li> <li>• Provide adequate lighting in all work areas</li> <li>• Keep all stairways and walkways clear of debris/tools to prevent trips</li> <li>• Inspect all tools; take damaged tools out of service and tag – “damaged – do not use”</li> </ul>	
	Potential for non-work personnel to be injured or contaminated	<ul style="list-style-type: none"> <li>• In areas where traffic control is required, all traffic control devices and methodologies will comply with the U.S. Department of Transportation (DOT) Manual on Uniform Traffic Control Devices (MUTCD, <a href="http://mutcd.fhwa.dot.gov">http://mutcd.fhwa.dot.gov</a>) including the use of appropriate roadway markings, highly visible safety vests, and flagmen as needed.</li> <li>• Be aware of potential vehicle traffic while on site</li> <li>• Follow posted warnings and rules for travel around site</li> <li>• All onsite personnel must wear highly reflective ANSI Class 2 safety vests in traffic areas and/or when working around heavy equipment</li> </ul>	
	Exposure to high noise from heavy equipment and power tools	<ul style="list-style-type: none"> <li>• Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs)</li> <li>• Hearing protection will be worn when operating the DPT.</li> <li>• SSHO/FOM will determine the need for hearing protection</li> <li>• All equipment will be equipped with manufacturer's required mufflers</li> </ul>	
	Eye injury	<ul style="list-style-type: none"> <li>• Use ANSI approved safety glasses with rigid side shields</li> </ul>	
	Overhead hazards	<ul style="list-style-type: none"> <li>• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1 in any construction areas, and areas with overhead hazards</li> </ul>	
	Dropped objects	<ul style="list-style-type: none"> <li>• Steel toe boots meeting ANSI Standard Z41 shall be worn</li> </ul>	

AHA – 01 (continued)

Activity	Potential Hazard(s)	Control Measures
General Site Activities; Site Mobilization; Traffic Control, as needed; Demobilization; and Management of IDW (continued)  [NOTE: The hazards and control measures presented in AHA 01 are applicable to all phases of the project]	Back injury from lifting heavy loads	<ul style="list-style-type: none"> <li>• Site personnel will be instructed on proper lifting techniques – bend with the knees and not with the back; avoid twisting at the waist, use your feet to turn</li> <li>• Mechanical devices should be used to reduce manual handling of materials</li> <li>• Team lifting should be used if mechanical devices are not available. [50 pound maximum lifting restriction for one person]</li> </ul>
	Inclement weather (Thunderstorms and tornadoes)	<ul style="list-style-type: none"> <li>• Halt activities immediately and take cover during thunderstorm or tornado warnings, shelter in a building if possible, stay away from windows</li> <li>• If outdoors, stay close to the ground</li> <li>• Listen to radio or television announcements for pending weather information</li> <li>• Do not try to outrun a tornado on foot or in a vehicle</li> </ul>
	Biological hazards (spiders, snakes, ticks etc.)	<ul style="list-style-type: none"> <li>• Workers will inspect the work area carefully and avoid placing hands and feet into concealed areas</li> <li>• Look in direction of travel for biological hazards to avoid</li> <li>• Wear insect repellent as needed</li> </ul>
	Thermal Stressors and other hazards (i.e. heat stress, cold stress)	<ul style="list-style-type: none"> <li>• Employees will have appropriate clothing for variable weather</li> <li>• Wear long sleeves and long pants and sunscreen with a high sun protection factor (SPF) on exposed skin</li> <li>• Employees will take breaks and drink plenty of fluids, as necessary, to prevent heat stress alternating between water and Gatorade-type drinks</li> <li>• Take periodic warming breaks and drink warm sweet liquids when working in cold weather</li> <li>• Protect skin from becoming wet in cold weather; replace clothing that becomes wet as soon as possible</li> <li>• Wear insect repellent as needed</li> <li>• Refer to the Griffiss Program HASP for detailed information on heat and cold stress</li> </ul>
	Overhead/buried utilities	<ul style="list-style-type: none"> <li>• Conduct a utility locate to identify the location of underground utilities in locations where drilling activities will occur</li> <li>• <b>Beware: Dig Safe will not be able to locate the abandoned utilities at the sites</b></li> <li>• Overhead utilities should be considered live until determined otherwise</li> <li>• Maintain a minimum distance of &gt; 25 feet from overhead utilities</li> <li>• All underground utilities must be clearly marked before beginning work</li> <li>• No intrusive work shall be conducted within a 4 foot “Buffer Zone” of any underground utility marking</li> </ul>

**AHA – 01 (continued)**

Activity	Potential Hazard(s)	Control Measures
General Site Activities; Site Mobilization; Traffic Control, as needed; Demobilization; and Management of IDW (continued)  [NOTE: The hazards and control measures presented in AHA 01 are applicable to all phases of the project]	Spills/Fire	<ul style="list-style-type: none"> <li>• Fuel cans will be NFPA approved and equipped with pouring spout or funnel</li> <li>• Spill and absorbent materials will be readily available</li> <li>• Smoking and open flames are not permitted in fueling/greasing areas or in the work area</li> <li>• All heavy equipment will be equipped with a ABC type fire extinguishers which will be inspected weekly and documented</li> <li>• Provide fire extinguishers near all welding, soldering, or other sources of ignition</li> <li>• Keep fire extinguishers easy to see and reach in case of an emergency</li> <li>• Store gasoline and other flammable liquids in a safety can with flame arrestor outdoors or in an approved flammable cabinet</li> <li>• Ensure that leaks or spills of flammable or combustible materials are cleaned up promptly</li> <li>• Oily or solvent soaked rags must be disposed of in a metal self closing safety can and must be emptied and properly disposed of on a daily basis</li> </ul>
	Sharp objects, if encountered	<ul style="list-style-type: none"> <li>• All exposed sharp objects that could cut or impale someone must be protected (i.e. rebar caps - mushroom type is not acceptable for impalement protection)</li> <li>• All exposed nails must be bent over or removed; all loose nails must be kept off the ground</li> <li>• Wear leather or Kevlar gloves while handling sharp objects to prevent lacerations</li> </ul>
	Electrical, when used	<ul style="list-style-type: none"> <li>• Ensure ground fault circuit interrupters (GFCI) are used in all outdoor environments, in any areas subject to moisture, and for all temporary power</li> <li>• Ensure all cords and electrical tools are in good repair. Do not attempt to repair a cord with tape; discard damaged cords immediately. Ensure ground prong is in place and insulation is not damaged on all extension cords/equipment.</li> <li>• Ensure breaker boxes, electrical boxes, junction boxes, outlets, have covers in place. Ensure there are no openings where someone can come in contact with live electricals; all knockout holes are covered with proper plugs.</li> <li>• Keep cords and electrical tools out of traffic areas where they may be damaged</li> <li>• Prohibit work on new and existing energized (hot) electrical circuits until all power is shut off and a positive Lockout/Tagout System is in place. <b>ONLY TRAINED ELECTRICIANS ARE PERMITTED TO WORK ON ELECTRICAL CIRCUITRY.</b></li> <li>• <b>VIOLATION OF A LOCKOUT/TAGOUT REQUIREMENT CAN RESULT IN IMMEDIATE REMOVAL FROM THE JOB SITE AND TERMINATION FROM THE COMPANY AND/OR BAN ON FUTURE BUSINESS FOR SUBCONTRACTORS</b></li> </ul>

**AHA – 01 (continued)**

Activity	Potential Hazard(s)	Control Measures	
General Site Activities; Site Mobilization; Traffic Control, as needed; Demobilization; and Management of IDW (continued)  [NOTE: The hazards and control measures presented in AHA 01 are applicable to all phases of the project]	Ergonomics	<ul style="list-style-type: none"> <li>• Avoid awkward postures</li> <li>• Avoid repetitive motions; switch hands and take rest breaks to give your affected body parts time to rest</li> <li>• Avoid excessive contact stress; provide padding if contact with a fixed object is prolonged such as the floor or a wall</li> </ul>	
	Vehicular traffic in work area and heavy equipment operation	<ul style="list-style-type: none"> <li>• Wear ANSI Class II reflective traffic vest and cordon off work area</li> <li>• Maintain awareness of vehicle movement in work area and exercise caution when approaching heavy equipment exercise caution when approaching heavy equipment</li> <li>• Equipment will be equipped with functioning back-up alarms, signal lamps, lights, and alerting horns</li> <li>• Operators are required to use seat belts at all times</li> <li>• Only qualified / licensed operators will operate mobile equipment</li> <li>• All equipment must be inspected using the appropriate forms prior to use on each day of use</li> </ul>	
	Exposure to potential contaminants during management of IDW	<ul style="list-style-type: none"> <li>• Wear appropriate PPE including chemical resistant gloves (nitrile inner and neoprene outer) and Tyvek coveralls to minimize potential contact with groundwater, as appropriate</li> <li>• Conduct work activities in a manner that minimizes potential contact with groundwater</li> <li>• Collect all PPE and disposable sampling equipment and place in properly labeled DOT container for proper disposal</li> <li>• Wash hands and face prior to eating, drinking, or smoking</li> </ul>	
Equipment Used	Inspection Requirements	Training Requirements	
Level D PPE Fire Extinguishers First Aid Kits Eyewash	Employees inspect their own PPE. Weekly inspections will be performed on fire extinguishers. Weekly inspections will be performed on first aid kits and eyewash. Informal daily inspections are to be conducted by the SSHO. Formal weekly safety inspections are to be conducted and documented on field inspection form by the SSHO.	All personnel attend safety orientation and have read and understand the SSHP, hospital route map, SDSs/MSDSs, and AHAs  At least two designated individuals onsite will have current CPR and First Aid training	

**AHA - 02**

<b>Task:</b> Injection well installation, groundwater sampling, and implementation of the Remedial Optimization (RO)		<b>Project:</b> Former Griffiss AFB	<b>AHA Reviewed by:</b> Sally S. Smith, CIH, CSP, CHMM, CPEA
<b>Minimum Personal Protective Equipment (PPE):</b> Modified Level D PPE - hard hats, steel toed boots, safety glasses with rigid side shields and face shield when mixing RO chemicals, and as needed, hearing protection. [NOTE: Upgrade to Level C based on air monitoring with PID.]		<b>Location:</b> Rome, New York	<b>AHA Reviewed date:</b> December 2016
Activity	Potential Hazard(s)	Control Measures	
<p>NOTE: Hazards and recommended controls from AHA-01 - Mobilization/Demobilization/Site Preparation apply]</p> <p><u>Step 1: Mixing Process</u> - Compounds delivered to the site and staged in designated secured area With forklift or hand dolly -Prepare injectate</p> <p><u>Step 2: Injection into substrate</u> - Each injection point will receive ~2,000 lbs of EVO; 750 gallons deoxygenated water; and 3.5 liters of DHC cultures. Sodium bicarbonate will be added on an as needed basis.</p> <p><u>Step 3: Filling bore hole</u> After 24 hours, fill each bore hole with Portland cement and grout.</p>	Fork Lift and Drill Rig Hazards	<ul style="list-style-type: none"> <li>Fork lifts and Drill rig are to be operated and maintained by qualified operators only</li> <li>A Drill Rig Inspection Checklist (Griffiss Program HASP Attachment 2) should be completed to ensure that the rig is operating properly (the inspection will include fittings, cables, pins, connections, lubrication points, controls, emergency stops, etc.)</li> <li>To the extent possible, the terrain should be level and the condition of the ground such that unexpected movement of the rig is unlikely</li> <li>Stabilize the rig prior to boring in accordance with manufacturer’s recommendations</li> <li>Wear required PPE (hard hat, safety glasses, work gloves, ear muffs or plugs, steel toe work boots), ensure loose clothing is secured</li> <li>Maintain good housekeeping on and around drill rig</li> <li>Keep hands, fingers, and other body parts clear of all moving machinery; ensure machine guards are in place while in operation</li> </ul>	

AHA – 02 (continued)

Activity	Potential Hazard(s)	Control Measures																		
<p><u>Step 1: Mixing Process</u> - Compounds delivered to the site and staged in designated secured area With forklift or hand dolly -Prepare injectate</p> <p><u>Step 2: Injection into substrate</u> - Each injection point will receive ~2,000 lbs of EVO; 750 gallons deoxygenated water; and 3.5 liters of DHC cultures. Sodium bicarbonate will be added on an as needed basis.</p> <p><u>Step 3: Filling bore hole</u> After 24 hours, fill each bore hole with Portland cement and grout.</p>	<p>Overhead/buried utilities</p>	<ul style="list-style-type: none"> <li>• Work activity adjacent to overhead electric power lines will not be initiated until a survey has been conducted to ascertain the safe clearance distance from energized lines.</li> <li>• <b>Beware: Dig Safe will not be able to locate the abandoned utilities at the sites</b></li> <li>• Refer to the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM 385-1-1, 2008) for a complete description of procedures required when working at a location adjacent to overhead power lines.</li> <li>• The minimum required clearance distances from energized overhead electric lines are provided below.                     <table border="1" data-bbox="1045 529 1776 841"> <thead> <tr> <th>Nominal System Voltage</th> <th>Minimum Rated Clearance</th> </tr> </thead> <tbody> <tr> <td>0 to 50 kilovolts (kV)</td> <td>10 feet (ft) (3 meters [m])</td> </tr> <tr> <td>51 to 200 kV</td> <td>15 ft (4.6 m)</td> </tr> <tr> <td>201 to 350 kV</td> <td>20 ft (6 m)</td> </tr> <tr> <td>351 to 500 kV</td> <td>25 ft (7.6 m)</td> </tr> <tr> <td>501 to 650 kV</td> <td>30 ft (9.1 m)</td> </tr> <tr> <td>651 to 800 kV</td> <td>35 ft (10.7 m)</td> </tr> <tr> <td>801 to 950 kV</td> <td>40 ft (12.2 m)</td> </tr> <tr> <td>951 to 1,100 kV</td> <td>45 ft (13.7 m)</td> </tr> </tbody> </table> </li> <li>• For other overhead or in-workplace utilities, workers must be instructed to use care in working under or around utilities to avoid hot surfaces, pressurized gases or air, leaking pipelines, and discharging steam or hot liquids, and must work to prevent accidental contact or damage.</li> <li>• Overhead utilities should be considered live until determined otherwise</li> <li>• All underground utilities must be clearly marked before beginning work</li> <li>• No borings shall be made within a 4 foot “Buffer Zone” of any utility marking</li> </ul>	Nominal System Voltage	Minimum Rated Clearance	0 to 50 kilovolts (kV)	10 feet (ft) (3 meters [m])	51 to 200 kV	15 ft (4.6 m)	201 to 350 kV	20 ft (6 m)	351 to 500 kV	25 ft (7.6 m)	501 to 650 kV	30 ft (9.1 m)	651 to 800 kV	35 ft (10.7 m)	801 to 950 kV	40 ft (12.2 m)	951 to 1,100 kV	45 ft (13.7 m)
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AHA – 02 (continued)

Activity	Potential Hazard(s)	Control Measures
<p><u>Step 1: Mixing Process</u> - Compounds delivered to the site and staged in designated secured area With forklift or hand dolly -Prepare injectate</p> <p><u>Step 2: Injection into substrate</u> - Each injection point will receive ~2,000 lbs of EVO; 750 gallons deoxygenated water; and 3.5 liters of DHC cultures. Sodium bicarbonate will be added on an as needed basis.</p> <p><u>Step 3: Filling bore hole</u> After 24 hours, fill each bore hole with Portland cement and grout.</p>	<p>Chemical exposure during preparing injectate</p>	<ul style="list-style-type: none"> <li>• Wear Modified Level D PPE with face shield and safety glasses to avoid splash and exposure including chemical resistant gloves (nitrile inner and neoprene outer) and Tyvek coveralls to minimize potential contact with chemicals, as appropriate</li> <li>• Wear ANSI Class II reflective safety vest and cordon off work area</li> <li>• Use proper lifting techniques and material handling devices to move chemicals from storage</li> <li>• Position body upwind to minimize dust exposure</li> <li>• When delivering and removing mixer. moving Equipment will be equipped with functioning back-up alarms, signal lamps, lights, and alerting horns</li> <li>• When delivering and removing mixer, operators are required to use seat belts at all times</li> <li>• Only qualified / licensed operators will operate mixing tank and mobile equipment</li> <li>• All equipment must be inspected using the appropriate forms prior to use on each day of use</li> <li>• Lock-out/Tag-out procedures required if mixing tank needs repairs</li> <li>• Conduct work activities in a manner that minimizes potential contact with chemicals</li> <li>• Collect all PPE and disposable equipment and dispose of properly</li> <li>• Wash hands and face prior to eating, drinking, or smoking</li> </ul>
	<p>Exposure to contaminants</p>	<ul style="list-style-type: none"> <li>• To the extent feasible, limit contact with subsurface materials</li> <li>• Wear chemical resistant gloves (nitrile inner and outer) when handling soil and groundwater samples</li> <li>• SSHO shall conduct breathing zone monitoring for chlorinated volatile organic compounds (CVOCs) with a photoionization detector (PID)/flame ionization detector (FID) if any odors or visible soil staining are encountered (SSHO may require an upgrade in PPE or modification to work based on monitoring results)</li> <li>• Wash hands and face prior to eating, drinking, or smoking after handling potentially contaminated materials</li> </ul>
	<p>Spills/residue material</p>	<ul style="list-style-type: none"> <li>• Have absorbent materials available to control possible spills or leaks</li> </ul>

AHA – 02 (continued)

Activity	Potential Hazard(s)	Control Measures
<p><u>Step 1: Mixing Process</u> - Compounds delivered to the site and staged in designated secured area With forklift or hand dolly -Prepare injectate</p> <p><u>Step 2: Injection into substrate</u> - Each injection point will receive ~2,000 lbs of EVO; 750 gallons deoxygenated water; and 3.5 liters of DHC cultures. Sodium bicarbonate will be added on an as needed basis.</p> <p><u>Step 3: Filling bore hole</u> After 24 hours, fill each bore hole with Portland cement and grout.</p>	Heavy lifting (sample shipping containers)	<ul style="list-style-type: none"> <li>• Use proper lifting techniques</li> </ul>
	Electrical Hazards (Extension cords, electrical equipment, temporary lighting, building electricity) if encountered	<ul style="list-style-type: none"> <li>• Equipment must be inspected prior to use and must be in good condition</li> <li>• The use of extension cords or other portable electrical connections or devices that are not rated for use in wet environments is strictly prohibited</li> <li>• Only ground fault circuit interrupter outlets may be used</li> </ul>
	Noise	<ul style="list-style-type: none"> <li>• Drill Rig operation may result in high noise levels</li> <li>• Appropriate hearing protection with a NRR &gt;26 shall be worn while operating the drill rig</li> </ul>
	Pinch points	<ul style="list-style-type: none"> <li>• Use appropriate PPE (leather gloves) when handling well casings and tools</li> </ul>
	Dust	<ul style="list-style-type: none"> <li>• Use care when installing well materials (sand, bentonite, Portland cement) into injection well to prevent dust generation. Use dust respirator during any mixing using Portland cement.</li> <li>• Position body in an upwind location from materials while installing</li> <li>• Use wet methods to prevent dust generation</li> </ul>
	Cut hazards	<ul style="list-style-type: none"> <li>• Use care when handling glassware</li> <li>• Do not reach “blindly” into sample container cooler</li> </ul>
Exposure to high noise from mixer and power tools	<ul style="list-style-type: none"> <li>• Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs – NRR of 26 dBA)</li> <li>• SSHO/Site Field Operations Manager will determine the need for hearing protection</li> <li>• All equipment will be equipped with manufacturer's required mufflers</li> </ul>	

**AHA – 02 (continued)**

Activity	Potential Hazard(s)	Control Measures
<p><u>Step 1: Mixing Process</u> - Compounds delivered to the site and staged in designated secured area With forklift or hand dolly -Prepare injectate</p> <p><u>Step 2: Injection into substrate</u> - Each injection point will receive 2,000 lbs of EVO; 750 gallons deoxygenated water; and 3.5 liters of DHC cultures. Sodium bicarbonate will be added on an as needed basis.</p> <p><u>Step 3: Filling bore hole</u> After 24 hours, fill each bore hole with Portland cement and grout.</p>	<p>Exposure to high noise from mixer and power tools</p> <p>Hazards from forklift operation:</p> <ul style="list-style-type: none"> <li>• Vehicular Accidents</li> <li>• injuries</li> <li>• Dropping of loads</li> <li>• Falling off vehicle</li> </ul>	<ul style="list-style-type: none"> <li>• Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs – NRR of 26 dBA)</li> <li>• SSHO/Field Operations Manager will determine the need for hearing protection</li> <li>• All equipment will be equipped with manufacturer's required mufflers</li> <li>• Only qualified personnel will operate the forklift.</li> <li>• Confirm OSHA-required forklift training of operators (Forklift Operator Training is required to operate a forklift)</li> <li>• Watch Out, Be Alert For Traffic</li> <li>• Drive defensively, report violations, follow all traffic rules</li> <li>• Secure unsteady or unbalanced loads in vehicles or on forklifts</li> <li>• Wear ANSI Class II reflective safety vest</li> <li>• Maintain awareness of vehicle movement in work area and exercise caution</li> <li>• Moving equipment will be equipped with functioning back-up alarms, signal lamps, lights and alerting horns</li> <li>• Operators are required to use seat belts at all times</li> </ul>
<p>Preparing shipping container after sampling, as needed</p>	<p>Heavy lifting (heavy from ice in sample shipping containers)</p>	<ul style="list-style-type: none"> <li>• Do not overload shipping containers with ice and with samples</li> <li>• Use proper lifting techniques</li> <li>• Wear disposable gloves to avoid contact</li> </ul>

**AHA – 02 (continued)**

Equipment Used	Inspection Requirements	Training Requirements
Modified Level D PPE (Level C, if SSHO determines needed) (Face shield when preparing injectate chemicals or Portland cement) First Aid Kits Eyewash Hand wash station (not hand sanitizer) when RO chemicals are present on site Portland cement Fire Extinguishers Peristaltic pump , if needed Hollow Stem Auger, if needed Direct Push Technology (DPT) rig Forklift(s) Poly tanks for EVO Mixing tank(s) Pneumatic diaphragm pump	Employees inspect their own PPE. Daily inspection of drill rig by operator Weekly inspections will be performed on fire extinguishers. Weekly inspections will be performed on first aid kits and eyewash. Informal daily inspections are to be conducted by the SSHO. Formal weekly safety inspections are to be conducted and documented on field inspection form by the SSHO.	Personnel have read and understand the SSHP, hospital route map, SDSs/MSDSs, and AHAs At least two designated individuals onsite will have current CPR and First Aid training Fork Lift Operator must have certification card showing he has completed OSHA required training

## **SSHP ATTACHMENT 2**

### **COMMON SAFETY SIGNS AND FIELD SAFETY FORMS**

**DANGER**

**CONSTRUCTION AREA  
KEEP OUT**

**DANGER**



**NO  
SMOKING**

**DANGER**

**CONSTRUCTION AREA  
HARD HAT AND  
SAFETY GLASSES  
REQUIRED**

**NOTICE**

**First Aid  
Kit Here**

**NOTICE**

**Fire  
Extinguisher  
Here**

# NOTICE

**Eyewash  
Solution  
Here**



**EMPLOYEE and SUBCONTRACTOR WARNING REPORT**

Employee's Name \_\_\_\_\_

Date of Warning: \_\_\_\_\_

Job Number: \_\_\_\_\_

Type of Violation:  Attendance     Carelessness     Disobedience    Violation Date: \_\_\_\_\_  
 Safety     Tardiness     Work Quality    Violation Time: \_\_\_\_\_  
 Other(Describe Below)    Location Violation Occurred: \_\_\_\_\_  
(area on job site, bldg #, floor etc.)

**BHATE STATEMENT**

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**EMPLOYEE STATEMENT**

Check paper box:  
 I concur with Bhate's Company Statement  
 I disagree with Bhate's Company Statement for the following reasons:  
 \_\_\_\_\_  
 \_\_\_\_\_  
 My signature confirms that I have checked off the appropriate box and/or entered my statement of the above matter:  
 \_\_\_\_\_  
 Employee's Signature \_\_\_\_\_ Date \_\_\_\_\_

**CORRECTIVE ACTION TAKEN**

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Approved by: \_\_\_\_\_  

Name
Title
Date

**LIST ALL PREVIOUS WARNINGS (BELOW)**

When warned (Date) and by Whom:  
 Previous Warning: (1<sup>st</sup> Warning)  
 Date: \_\_\_\_\_ By Whom: \_\_\_\_\_  
 Verbal  
 Written

Previous Warning : (2<sup>nd</sup> Warning)  
 Date: \_\_\_\_\_ By Whom: \_\_\_\_\_  
 Verbal  
 Written

Previous Warning: (3<sup>rd</sup> Warning)  
 Date: \_\_\_\_\_ By Whom: \_\_\_\_\_  
 Verbal  
 Written

I Have read this "warning decision" and understand it.  
 \_\_\_\_\_  
 Employee's Signature \_\_\_\_\_ Date \_\_\_\_\_  
 \_\_\_\_\_  
 Signature of person warning \_\_\_\_\_ Date \_\_\_\_\_  
 \_\_\_\_\_  
 Supervisor's Signature \_\_\_\_\_ Date \_\_\_\_\_

Copy Distribution: Employee  
 Safety Records Binder  
 Employee File  
 Monthly Safety Report

**All Signatures are required Original copy shall be filed @ the job site in Safety Records Binder.**

## INSTRUCTIONS FOR EMPLOYEE and SUBCONTRACTOR WARNING REPORT

1. The **“Location Violation Occurred”** should note the general location (i.e...Sears, Mall,4<sup>th</sup> Floor, NE Stairwell.
2. For **“Bhate’s Company statement,”** write in clear and specific language. Describe the violation and be specific about job site location. If possible, quote the subpart or numeric code from your safety manual (29 CFR 1910 or 1926, i.e...Subpart M, Fall Protection, etc....)
3. For **“Employee Statement,” ALWAYS** have the Employee check one of the boxes as to whether they concur or disagree with the “Company Statement.” If the Employee disagrees, have them state their reasons why. This section must be signed by the Employee. If they refuse, contact your Safety Director and/or Regional Superintendent and their refusal on the form.
4. For **“Corrective Action Taken,”** clearly describe the corrective action being taken, by whom, and when. (should be immediately)
5. Make sure that you take the time to complete “List All Previous Warnings” (if any have occurred) so that a pattern can be clearly reported and necessary follow-up action taken.
6. A **SIGNATURE** of all parties involved in the recording of the violation will be required in the last section of the warning report. Remember that the EMPLOYEE will have two places to sign on the report, one in the **“Employee Statement”** and another under the section titled **“I have read this warning decision and understand it”** and another under the section titled **“I have read this warning decision and understand it”** It is very important that both signature are obtained.



## Confined Space Pre-Entry Briefing Checklist

<b>Project Location (Address, City, State, Site Description):</b>	<b>Date:</b>	<b>Time:</b>	<b>Project Number:</b>
<b>Checklist Completed By:</b>	<b>Attendee(s):</b>		

- Hazard Communication (including the signs, symptoms, and modalities of chemical overexposure)
- Physical hazards present
- All hazard controls
- Acceptable entry conditions
- Emergency procedures
- Rescue procedures
- Duties of entrants and attendants during routine and emergency operations
- Frequency and Types of Monitoring
- Communications system backup to be used
- Review of work to be accomplished during entry
- Decontamination procedures (if necessary)
- PPE disposal
- Potential emergencies that may occur outside the confined space



**Confined Space Entry Permit**

Page 1 of 2

Permit Valid for one shift only. All Permit copies to remain at project site until completion of the project.

<b>Project Location (Address, City, State, Site Description):</b>		<b>Date:</b>	<b>Time:</b>	<b>Project Number:</b>
<b>Supervisor on Duty:</b>	<b>Supervisor Phone Number:</b>	<b>Purpose of Entry:</b>		
<b>Communication Procedures:</b>				
<b>Rescue Procedures and Phone Numbers:</b>				

Requirements Completed					
	Date	Time		Date	Time
Breathing Apparatus			Line(s) Broken-Capped Blank		
Emergency Escape/Fall Retrieval Equipment			Lighting (Explosive Proof)		
Full Body Harness w/ "D" Ring			Fire Extinguishers		
Lifelines			Secure Area (Post and Flag)		
Protective Clothing			Ventilation		
Respiratory Protection			Purge-Flush and Vent		
Standby Safety Personnel					

**Note: For items that do not apply, enter N/A in the blank.**

Instrumentation
<b>Manufacturer:</b>
<b>Model:</b>
<b>Serial #:</b>
<b>Date of Last Factory Calibration:</b>

Pre-Entry Calibration Data			
Date and Time			
Gas Type	Concentration	Instrument Reading	

Post-Entry Calibration Data			
Date and Time			
Gas Type	Concentration	Instrument Reading	

Air Monitoring							
Record Monitoring Results At Least Every ¼ Hour							
Parameters	Permissible Entry Level	Times					
Percent Oxygen	19.5% - 22.0%						
Lower Flammable Level	< 10%						

Entry Participants		
Name	Signature	Duty (Supervisor, Entrant, Attendant)

<b>Remarks:</b>

Entry Authorization	
Supervisor has reviewed the permit and verified the confined space conditions	
Supervisor Signature:	Date/Time:



## Construction Equipment Inspection Checklist

<b>Project Name:</b>	<b>Date /Time:</b>
<b>Type of Inspection:</b> Incoming _____ Outgoing _____ (Please check the inspection type) Daily _____	<b>S M T W Th F S</b> (Please circle the day)
<b>Equipment Make/Description:</b>	<b>Equipment Model Number:</b>
<b>Equipment ID/Plate Number:</b>	

**Inspected By: (Name and Signature):**

Equipment	Acceptable	Not Acceptable	NA	Comments and Actions Taken
Operation/Owners Manual				
Brakes				
Brake Lights				
Reverse Signal Alarm				
Horn/Air Horn				
Tires/Tracks				
Steering				
Seat Belt				
Operating Controls				
Fire Extinguisher				
Lights				
Defroster				
Mirrors				
Instruments				
Coupling Devices				
Bed/Cargo Area				
Tailgate and Latch				
Tarps/covers				
Windshield/Window Glass				
Windshield Wipers				
Mudflaps/Rock Guards				
Exhaust Systems				
Hitches and Safety Cables				
Hydraulic Lines and Air Hoses				
Engine Oil				
Hydraulic Fluid				
Rollover Equipment				
Cleanliness				

**Comments:**

<b>Project Name:</b>	<b>Location:</b>	<b>Date:</b>
<b>Supervisor on Duty:</b>	<b>Supervisor Phone Number:</b>	<b>Scheduled Date of Lift:</b>

**Load Description:**

**Sketches Attached:**       **Lift Layout**                       **Rigging Configuration**

Assigned Personnel	Name	Signature
Site Safety and Health Officer		
Lift Supervisor		
Project Engineer (or designee)		
Crane Operator 1		
Crane Operator 2 (if required)		
Rigger		
Signalperson 1		
Signalperson 2 (if required)		

**Review and Approvals**

Name	Title	Signature	Date

Weight Calculations	Weight (lbs)	Comments
Weight of Object Empty		
Weight of Contents		
Weight of Block		
Weight of Spreader Bar		
Weight of Jib (stored or erect)		
Weight of Rigging		
Weight of Jib Headache Ball		
Weight of Boom Extension		
Weight of Rope Below Sheaves		
Other		
Total Weight		
Crane/Lift Data	Data	Comments
Manufacturer		
Model Number		
Boom Length		
Boom Radius		
Boom Angle		
Hoisting from Main-Aux-Jib		
Crane Capacity		
Rated Capacity for Lift Over Front		
Rated Capacity for Lift Over Rear		
Distance from Center Pin to Center of Load		
Percent of Crane's Capacity		
Cable Capacity		
Number of Parts		
Size of Rigging		
Rigging Arrangement		
Communications		

Lift Checklist (see additional comments below)					
	Yes	No		Yes	No
Obstacles to lift or swing			Swing area checked and marked		
Electrical hazards			Maximum counterweights		
Operational hazards			Load chart in crane		
Outriggers fully extended			Taglines used		
Outriggers stabilized			Crane in good working condition		
Wind conditions checked			Operator's aids functional		
Crane solid, stable, level			Maintenance records checked		
Foundation support checked			Preparatory inspections complete		
Center of gravity determined					
Checklist Comments					
Lift Sequence (attach additional sheets if necessary)					

**Daily Excavation Inspection Checklist**  
 (To Be Completed by a "Competent Person")  
 Page 1 of 2

<b>Project Location (Address, City, State, Site Description):</b>	<b>Date:</b>	<b>Time:</b>	<b>Project Number:</b>
	<b>Weather Conditions:</b>		
<b>Competent Person:</b>	<b>Soils Type:</b>		<b>Soil Classification</b>
			<b>Type A</b>
	<b>Excavation Dimensions:</b>		<b>Type B</b>
	<b>Depth:</b>	<b>Width:</b>	<b>Type C</b>
<b>Length:</b>			
<b>Type of Protective System Used:</b>			
<b>General Inspection of Job Site</b>	<b>Yes</b>	<b>No</b>	<b>Not Applicable (N/A)</b>
Surface encumbrances removed or supported			
Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation			
Hard hats worn by all employees			
Spoils, materials, and equipment set back at least 2 feet from the edge of the excavation			
Barriers provided at all remotely located excavations, wells, pits, shafts, etc.			
Walkways and bridges over excavations 4 feet or more in depth are equipped with standard guardrails			
Warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic			
Warning system established and utilized when mobile equipment is operated near the edge of the excavation			
Employees prohibited from working on the faces of sloped or benched excavations above other employees			
<b>Utilities</b>			
Utility companies contacted and/or utilities located			
Exact location of utilities marked when approaching the utilities			
Underground installations protected, supported or removed when excavation is open			
<b>Means of Access and Egress</b>			
Lateral travel to means of egress no greater than 25 feet in excavations 4 feet or more in depth			
Ladders used in excavations secured and extended 3 feet above the edge of the trench			
Structural ramps used by employees designed by a competent person			
Structural ramps used for equipment designed by a registered professional engineer (RPE)			
Ramps constructed of materials of uniform thickness, cleated together on the bottom, equipped with a no-slip surface			
Employees protected from cave-ins when entering or exiting the excavation			

<b>Wet Conditions</b>	<b>Yes</b>	<b>No</b>	<b>Not Applicable (N/A)</b>
Precautions taken to protect employees from the accumulation of water			
Water removal equipment monitored by a competent person			
Surface water or runoff diverted or controlled to prevent accumulation in the excavation			
Inspections made after every rainstorm or other hazard increasing occurrence			
<b>Hazardous Atmospheres</b>			
Atmosphere within the excavation tested when there is a possibility of an oxygen deficiency, combustible or other harmful contaminant exposing employees to a hazard			
Ventilation			
Testing conducted often to ensure that the atmosphere remains safe			
Emergency equipment, such as breathing apparatus, safety harness and line, and basket stretcher readily available where hazardous atmospheres could or do exist			
Safety harness and life line used and individually attended when entering deep confined excavations			
<b>Support Systems</b>			
Materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads			
Materials and equipment used for protective systems inspected and in good condition			
Materials and equipment not in good condition have been removed from service			
Damaged materials and equipment used for protective systems inspected by a RPE after repairs and before being placed back into service			
Protective systems installed without exposing employees to the hazards of cave-ins, collapses or from being struck by materials or equipment			
Members of support system securely fastened to prevent failure			
Support systems provided to insure stability of adjacent structures, buildings, roadways, sidewalks, walls, etc.			
Excavations below the level of the base or footing approved by an RPE			
Removal of support systems progresses from the bottom and members are released slowly as to note any indication of possible failure			
Backfilling progresses with removal of support system			
Excavation of material to a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth			
Shield system placed to prevent lateral movement			
Employees are prohibited from remaining in shield system during vertical movement			
<b>Comments</b>			



**DAILY SITE SAFETY MEETING**

**Project:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Project/Phase Number:** \_\_\_\_\_ **Time:** \_\_\_\_\_

**Meeting Conducted By:** \_\_\_\_\_

*Print Name*

*Signature*

**1. AWARENESS (e.g., special EHS concerns, pollution prevention, recent incidents, etc.):**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**2. OTHER ISSUES (HASP changes, new AHAs, attendee comments, etc.):**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**3. DISCUSSION OF DAILY ACTIVITIES/TASKS AND SAFETY MEASURES TO BE USED:**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**4. ATTENDEES (Print Name):**

1.	2.
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.
13.	14.
15.	16.
17.	18.
19.	20.
21.	22.
23.	24.
25.	26.
27.	28.
29.	30.

This Site Safety Meeting Log documents the safety briefing conducted in accordance with 29 CFR 1910.120 *Hazardous Waste Operations and Emergency Response* as well as other applicable regulatory requirements. Personnel who perform work operations onsite are required to attend each safety briefing and acknowledge receipt of such briefings daily.



Date:	Equipment/Model Type:
Project/Phase No.:	Serial/License No.:
Location:	Owner/Operator:

Place an X in the “Yes” column if the requirement has been met. If a “No” is encountered, equipment must be removed from operation until the deficiency has been corrected. Use the Comment column to note any additional information needed to certify the equipment.

Inspection Item	Requirement	Yes	No	Comments/Corrections
Hydraulic systems controls and levers	No leaks from fittings or connections Levers are in good operating condition Fluid levels are full			
Fuel, oil, water, and coolant lines	No leaks			
Hoses	No leaks in hoses or connections No signs of excessive wear, kinked or bent hoses			
Gauges	Operational and visible to operator			
Emergency kill switch and life line	Operational and accessible to operator			
Shear pins	In place			
Drive chains	No signs of excessive wear, broken, or defective links			
Parking brakes	Set and operational			
Outriggers	No leaks Set on pads (as necessary to avoid damage)			
Windshield wipers	Operational			
Lights (head, brake, signal, and running lights)	Operational without cracked lenses			
Back-up alarm	Operational, spotter used			
Cables and ropes	No fraying, birdnesting, flattening, stretching Must be braided or properly clamped at connections			
Pulleys, drums, and spools	No excessive wear or cracking			
Derrick/mast	Locked in position Frame is not cracked or bent			
Hoists	Properly spooled cable, rated to lift loads			
Safety Equipment	Safety harnesses, fire extinguisher, flares, safety reflectors, first aid kit, grounding wire for fueling, and spill response equipment (for fueling and repairs)			
Guards	Power take-offs (PTOs) and all rotating parts designed with guards are present Guards must have warning levels			
Miscellaneous (as applicable)	Diverter systems, auger and head seals, cyclones, grout plant guards Other:			

Inspection Conducted and Certified by  
Owner/Operator:

\_\_\_\_\_

Printed Name
Signature
Date



**Excavation Soils Analysis Form**  
 (To Be Completed by a "Competent Person")  
 Page 1 of 2

This checklist must be completed when soil analysis is made to determine the soil type(s) present in the excavation. A separate analysis must be performed on each layer of soil in excavation walls or if the length of the excavation is in different soil types.

<b>Project Location (Address, City, State, Site Description):</b>	<b>Date:</b>	<b>Time:</b>	<b>Project Number:</b>
	<b>Weather Conditions:</b>		
<b>Competent Person:</b>	<b>Excavation Dimensions:</b>		
	<b>Depth</b>	<b>Width</b>	<b>Length</b>
<b>Location Where Soil Sample Obtained:</b>			

Visual Observations				
Particle type:	_____ Fine Grained (cohesive)		_____ Course grained (sand or gravel)	
Water conditions:	_____ Wet	_____ Dry	_____ Surface water present	_____ Submerged
Previously disturbed soils?	_____ Yes		_____ No	
Underground utilities?	_____ Yes		_____ No	
Layered soils?	_____ Yes		_____ No	
Layered soil dipping into excavation?	_____ Yes		_____ No	
Excavation exposed to vibrations?	_____ Yes		_____ No	
Crack-like openings or spallings observed?	_____ Yes		_____ No	
Conditions that may create a hazardous atmosphere? If yes, identify condition and source in comments.	_____ Yes		_____ No	
Surface encumbrances?	_____ Yes		_____ No	
Work to be performed near public vehicular traffic?	_____ Yes		_____ No	
Possible confined space exposure?	_____ Yes		_____ No	

Manual Tests		
Plasticity:	_____ Cohesive	_____ Non-cohesive
Dry Strength:	_____ Granular (crumbles easily)	_____ Cohesive (broken with difficulty)
<b>NOTE: The following unconfined compressive strength tests should be performed on undisturbed soils.</b>		
<b>Thumb Test</b> (used to estimate unconfined compressive strength of cohesive soil)		
Test performed: _____ Yes _____ No		
_____ Type A (soil indented by thumb with very great effort) _____ Type B (soil indented by thumb with some effort) _____ Type C (soil easily penetrated several inches by thumb with little or no effort). If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.		
<b>Penetrometer or Shearvane</b> (used to estimate unconfined compressive strength of cohesive soils)		
Test performed: _____ Yes _____ No		
_____ Type A (soil with unconfined compressive strength of 1.5 tons per square foot (tsf) or greater) _____ Type B (soil with unconfined compressive strength of 0.5 tsf to 1.5 tsf) _____ Type C (soil with unconfined compressive strength of 1.5 tsf or less). If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.		
<b>Wet Shaking Test</b> (used to determine percentage of granular and cohesive materials). Compare results to soil textural classification chart to determine soil type.		
Test performed: _____ Yes _____ No		
_____ Type A (clay, silty clay, sandy clay, clay loam, and in some cases silty clay, loam and sandy clay loam) _____ Type B (angular gravel [similar to crushed rock], silt, silt loam, sandy loam, silty clay loam and sandy clay loam) _____ Type C (granular soil including gravel, sand, and loamy sand) _____ % granular _____ % cohesive _____ % silt		
<b>NOTE: Although OSHA will accept the above tests in most cases, some states will not. Check your state safety requirements for trenching regulations.</b>		
<b>Soil Classification</b>		
_____ Type A	_____ Type B	_____ Type C
<b>Selection of Protective System</b>		
_____ Sloping, Specify angle: _____	_____ Aluminum Hydraulic Shoring	_____ Timber Shoring
<b>Comments</b>		







### Forklift/Palletjack Operator's Daily Inspection Checklist

<b>Project Name:</b>			<b>Date /Time:</b>	
			S M T W Th F S (Please circle the day)	
<b>Inspected By (Name and Signature):</b>		<b>Equipment Make/Description:</b>		
		<b>Equipment Model Number:</b>		
		<b>Equipment ID/Plate Number:</b>		
Equipment	Acceptable	Not Acceptable	NA	Comments and Actions Taken
<b>Forklift</b>				
Operation/Owners Manual				
Brakes and Brake Lights				
Lights				
Reverse Signal Alarm				
Horn/Air Horn				
Tires				
Steering and Operating Controls				
Seat Belt				
Fire Extinguisher				
Load Backrest/Headache Rack Mounted Securely				
Mirrors				
Instruments				
Exhaust Systems				
Hydraulic Lines and Air Hoses				
Engine Oil and Hydraulic Fluid				
Rollover Equipment				
Cleanliness				
<b>Palletjack</b>				
Brakes				
Steering and Operating Controls				
Horn/Air Horn				
Wheels				
Equipment Properly Charged				
Forks				
<b>Comments:</b>				

**IF REPAIR IS NEEDED – DO NOT OPERATE, TAG INOPERATIVE, AND NOTIFY SUPERVISOR**







## Heat Stress Monitoring Data Sheet

Project Location (Address, City, State, Site Description):	Page ____ of ____	Date:	Project Number:
	Weather Conditions:		
Personal Protective Equipment Used:			

**Monitoring Instructions**

1. Take and record measurement of temperature and pulse at the following times:
  - a. before beginning shift
  - b. at each break
  - c. at the end of the day
2. Shorten the work cycle if measurements exceed:
  - Pulse – 110 beats per minute
  - Temperature – 99.6 °F
3. Never continue work if your body temperature is more than 100.4 °F, or you are experiencing sudden and severe fatigue, nausea, dizziness, or lightheadedness.

<b>1. Employee Name:</b>				<b>Body Weight (lbs.)</b>			
				Pre-work:		Post-work:	
Time							
Temp (°F)							
Pulse							

<b>2. Employee Name:</b>				<b>Body Weight (lbs.)</b>			
				Pre-work:		Post-work:	
Time							
Temp (°F)							
Pulse							

<b>3. Employee Name:</b>				<b>Body Weight (lbs.)</b>			
				Pre-work:		Post-work:	
Time							
Temp (°F)							
Pulse							

<b>4. Employee Name:</b>				<b>Body Weight (lbs.)</b>			
				Pre-work:		Post-work:	
Time							
Temp (°F)							
Pulse							



## Hot Work Permit

Project Location (Address, City, State, Site Description):	Permit Issuance Date:	Permit Issuance Time:	Project Number:
	Permit Expiration Date:	Permit Expiration Time:	
Describe the Hot Work to be completed:			

Safety Zone for work established by (check all that apply)				
___ Cones	___ Caution Tape	___ Natural Barrier	___ Welding Screen	___ Building
Other, explain:				
Safety Equipment (check all that apply)				
___ Respirator	___ Welders Mask	___ Burning Goggles	___ Face Shield	
Other, explain:				
Safety Requirements				
Fire Extinguisher properly rated	___ Yes	___ No		
Fire watch present	___ Yes	___ No		
Combustibles covered or removed within 50 feet	___ Yes	___ No		
Work area clean	___ Yes	___ No		
Cables, hose lines, regulators, cylinders, electric sources checked	___ Yes	___ No		
Are special fire protection procedures being implemented? If so, explain				

Air Monitoring Requirements, as specified by the SSHO							
Instrumentation	Background	Times					
FID/PID							
Oxygen Level							
Combustible Gas Indicator							

Hot Work Authorization	
Supervisor Signature:	Date/Time:
SSHO Signature:	Date/Time:
Fire Watch Signature:	Date/Time:



## INCIDENT INVESTIGATION

Bhate Report No: \_\_\_\_\_

1. GENERAL INFORMATION				
COMPANY:	DATE OF INCIDENT:	DATE OF INVESTIGATION REPORT:		
INCIDENT COST:	ESTIMATED: \$	ACTUAL: \$		
OSHA RECORDABLE: <input type="checkbox"/> YES <input type="checkbox"/> NO	# RESTRICTED DAYS:	# DAYS AWAY FROM WORK:		
WAS THE ACTIVITY ADDRESSED IN AN AHA?: <input type="checkbox"/> YES (Attach a copy) <input type="checkbox"/> NO				
2. CAUSE ANALYSIS				
<b>IMMEDIATE CAUSES</b> – WHAT ACTIONS AND CONDITIONS CONTRIBUTED TO THIS EVENT? (SEE EXAMPLES NEXT PAGE)				
<b>BASIC CAUSES</b> - WHAT SPECIFIC PERSONAL OR JOB FACTORS CONTRIBUTED TO THIS EVENT? (SEE EXAMPLES NEXT PAGE)				
3. ACTION PLAN				
<b>REMEDIAL ACTIONS</b> - WHAT HAS BEEN AND/OR SHOULD BE DONE TO CONTROL THE CAUSES LISTED? INCLUDE MANAGEMENT PROGRAMS (SEE ATTACHED LIST) FOR CONTROL OF INCIDENTS IF APPLICABLE.				
ACTION	PERSON RESPONSIBLE	TARGET DATE	DATE COMPLETE	VERIFIED BY
4. PERSONNEL PERFORMING INVESTIGATION				
NAME: (PRINT)	SIGN:	DATE:		
NAME: (PRINT)	SIGN:	DATE:		
NAME: (PRINT)	SIGN:	DATE:		
5. MANAGEMENT REVIEW				
Project Manager (PRINT)	SIGN:	DATE:		
COMMENTS:				
Bhate Health and Safety Manager (PRINT)	SIGN:	DATE:		
COMMENTS:				
<b>NOTE: Attach additional information as necessary. Site Manager to forward copy of Investigation Report to the Bhate Health and Safety Manager as soon as possible, but no later than 72 hours after the incident.</b>				



**INCIDENT INVESTIGATION (Continued)**

**EXAMPLES OF IMMEDIATE CAUSES**

<u>SUBSTANDARD ACTIONS</u>	<u>SUBSTANDARD CONDITIONS</u>
<ol style="list-style-type: none"> <li>1. Operating Equipment without Authority</li> <li>2. Failure to Warn</li> <li>3. Failure to Secure</li> <li>4. Operating at Improper Speed</li> <li>5. Making Safety Devices Inoperable</li> <li>6. Using Defective Equipment</li> <li>7. Failure to Use PPE Properly</li> <li>8. Improper Loading</li> <li>9. Improper Placement</li> <li>10. Improper Lifting</li> <li>11. Improper Position for Task</li> <li>12. Servicing Equipment in Operation</li> <li>13. Horseplay</li> <li>14. Under Influence of Alcohol/Drugs</li> <li>15. Using Equipment Improperly</li> <li>16. Failure to Follow Procedure</li> </ol>	<ol style="list-style-type: none"> <li>1. Inadequate Guards or Barriers</li> <li>2. Inadequate or Improper Protective Equipment</li> <li>3. Defective Tools, Equipment, or Materials</li> <li>4. Congestion or Restricted Action</li> <li>5. Inadequate Warning System</li> <li>6. Fire and Explosion Hazards</li> <li>7. Poor Housekeeping/Disorder</li> <li>8. Noise Exposure</li> <li>9. Exposure to Radiation/Hazardous Materials</li> <li>10. Exposure to Temperature Extremes</li> <li>11. Inadequate Illumination</li> <li>12. Inadequate Ventilation</li> <li>13. Hazardous Environmental Conditions</li> </ol>

**EXAMPLES OF BASIC CAUSES**

<u>PERSONAL FACTORS</u>	<u>JOB FACTORS</u>
<ol style="list-style-type: none"> <li>1. Inadequate Physical/Physiological Capability</li> <li>2. Inadequate Mental/Psychological Capability Knowledge</li> <li>3. Physical or Psychological Stress</li> <li>4. Mental or Psychological Stress</li> <li>5. Lack of Knowledge</li> <li>6. Lack of Skill</li> <li>7. Improper Motivation</li> </ol>	<ol style="list-style-type: none"> <li>1. Inadequate Leadership/Supervision</li> <li>2. Inadequate Engineering</li> <li>3. Inadequate Purchasing</li> <li>4. Inadequate Maintenance</li> <li>5. Inadequate Tools/Equipment</li> <li>6. Inadequate Work Standards</li> <li>7. Excessive Wear and Tear</li> <li>8. Abuse or Misuse</li> </ol>

**MANAGEMENT PROGRAMS FOR CONTROL OF INCIDENTS**

<ol style="list-style-type: none"> <li>1. Leadership and Administration</li> <li>2. Management Training</li> <li>3. Planned Inspections and Maintenance</li> <li>4. Task Analysis and Procedures</li> <li>5. Task Observation</li> <li>6. Emergency Preparedness</li> <li>7. Rules and Work Permits</li> <li>8. Accident/Incident Analysis</li> <li>9. Personal Protective Equipment</li> </ol>	<ol style="list-style-type: none"> <li>10. Health Control</li> <li>11. Program Audits</li> <li>12. Engineering and Change Management</li> <li>13. Personal Communications</li> <li>14. Group Communications</li> <li>15. General Promotion/Awareness</li> <li>16. Hiring and Placement</li> <li>17. Purchasing Controls</li> <li>18. Off-the-Job Safety</li> </ol>
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**NOTIFICATION REMINDER**

Fatalities or hospitalization (admittance) of three or more individuals requires notification to OSHA within 8 hours. Contact the Bhate Operations Manager to make the notification. If unavailable, the senior operations person on site should make the notification.



## INCIDENT INVESTIGATION INSTRUCTIONS

**Report No.:** This is the same as the incident report number assigned by the Bhate Health and Safety Manager

**Date of Investigation Report:** This date should be within 72 hours of the incident. In cases where the investigation is not completed until a later date, submit the incomplete report within the 72 hours, and a revised report should be submitted when the missing information is obtained.

**Incident Cost:** For all vehicle/equipment or property damage cases, an estimated or actual loss value must be entered. If an estimated value is entered, the report must be revised when the actual costs are known.

**OSHA Recordable:** This section should be completed in consultation with the Health and Safety Manager.

**No. of Restricted Days:** This relates to days of restricted work activity, not restrictions on motion or physical capability. If the employee is capable of doing his normal job the day after the injury and thereafter, there are no restricted days, even if the physician indicates a physical restriction. It does not include the day of the injury.

**No. of Days Away from Work:** The number of days after the day of the injury that the employee was scheduled to work but could not due to an occupational injury. If the treating physician releases an employee to return to work, but the employee chooses not to come to work, do not count those days. In this case the Health and Safety Manager should be consulted.

### Cause Analysis

**Immediate Causes:** Determine the immediate causes, using the examples on page 2 of the Incident Investigation form. If one or more of the examples fits the circumstance, use those words in the cause description. However, do not confine your cause determination to the guide words.

**Basic Causes:** Like the Immediate Causes, use the guide words in the attachment whenever appropriate and explain. For example, improper motivation may be because the correct way takes more time or effort; short cutting standard procedure is tolerated or positively reinforced; or the person thinks there is no personal benefit to always doing the job correctly.

**Remedial Actions:** Include all actions taken or those that should be taken to prevent recurrence. Be sure that actions address the causes. For example, training (safety meetings) may be a necessary response for lack of knowledge, but may be inadequate for improper motivation. If completion dates are not verified prior to submitting the report, a revised report must be submitted or verification of closeout noted on the original report.

**Personnel Performing Investigation:** The primary investigator is the Supervisor in charge of the work where the incident occurred. Others participating in the investigation should also sign the report.

**Management Review:** The Bhate Project Manager and the Bhate Health and Safety Manager must sign the report indicating their satisfaction with the thoroughness of the investigation and the report, and their concurrence that the action items address the identified causes.



## INCIDENT REPORT

Date of Report: \_\_\_\_\_

Bhate Report No: \_\_\_\_\_  
(To be assigned by the HSM)

TYPE OF INCIDENT (check all that apply)			
<input type="checkbox"/> INJURY/ILLNESS	<input type="checkbox"/> VEHICLE DAMAGE	<input type="checkbox"/> HIGH LOSS POTENTIAL (NEAR MISS)	<input type="checkbox"/> FIRE
<input type="checkbox"/> SPILL/RELEASE	<input type="checkbox"/> PROPERTY LOSS/DAMAGE	<input type="checkbox"/> PERMIT OR EQUIV. EXCEEDANCE	<input type="checkbox"/> OTHER
GENERAL INFORMATION			
PROJECT:		TASK:	
COMPANY OR SUBCONTRACTOR NAME(S):			
DATE OF INCIDENT:	DAY OF WEEK:	MILITARY TIME:	
SUPERVISOR ON DUTY:	PHONE:	SUPV ON SCENE? <input type="checkbox"/> YES <input type="checkbox"/> NO	
LOCATION OF INCIDENT:			
WEATHER/LIGHTING CONDITIONS:			
DESCRIBE WHAT HAPPENED (step by step, use additional pages if necessary)			
1. What was the employee doing, or what was happening, just before the incident occurred? Describe the activity, as well as the equipment, tools, or materials in use. <i>Be specific, e.g. "climbing a ladder while carrying tools" or "driving westbound on Main St."</i>			
2. What happened? What was the contact or event and how did it occur? e.g. "When the ladder slipped on the wet floor, employee fell 20 feet" or "was distracted by bee, swerved off right side of road and struck the stop sign"			
IMMEDIATE CORRECTIVE ACTIONS (use additional pages if necessary)			
AFFECTED EMPLOYEE INFORMATION (Include injured person or employees whose activities resulted in incident)			<input type="checkbox"/> N/A
NAME:	<input type="checkbox"/> MALE <input type="checkbox"/> FEMALE	COMPANY:	
HOME ADDRESS:			
SOCIAL SECURITY OR EMPLOYEE #:		HOME PHONE #:	
JOB CLASSIFICATION:		YEARS IN JOB CLASSIFICATION:	
TIME EMPLOYEE BEGAN WORK:	DATE OF HIRE:	AGE:	
DID INCIDENT RELATE TO ROUTINE TASK FOR JOB CLASSIFICATION?:			<input type="checkbox"/> YES <input type="checkbox"/> NO
INJURY/ILLNESS INFORMATION			<input type="checkbox"/> N/A
NATURE OF INJURY OR ILLNESS (Body part affected and how it was affected, e.g. strained back):			
OBJECT/EQUIPMENT/SUBSTANCE CAUSING HARM:			
FIRST AID PROVIDED: <input type="checkbox"/> YES <input type="checkbox"/> NO		IF YES, WHERE: <input type="checkbox"/> ON SITE <input type="checkbox"/> OFF SITE	
IF YES, WHO PROVIDED FIRST AID?:			
WILL THE INJURY/ILLNESS RESULT IN:		<input type="checkbox"/> RESTRICTED DUTY	<input type="checkbox"/> LOST TIME <input type="checkbox"/> UNKNOWN



## INCIDENT REPORT (Continued)

TREATMENT OR EVALUATION INFORMATION (Attach Provider's Report/Statement) <span style="float: right;"><input type="checkbox"/> N/A</span>		
WAS TREATMENT OR EVALUATION PROVIDED? <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> FIRST AID <input type="checkbox"/> EVALUATION <input type="checkbox"/> MEDICAL TREATMENT		
IF YES, WHERE? <input type="checkbox"/> ON SITE <input type="checkbox"/> DR'S OFFICE <input type="checkbox"/> HOSPITAL <input type="checkbox"/> OTHER:		
NAME OF PERSON(S) PROVIDING TREATMENT OR EVALUATION:		
ADDRESS WHERE TREATMENT OR EVALUATION WAS PROVIDED:		
TYPE OF TREATMENT OR EVALUATION:		
PROPERTY LOSS OR DAMAGE INFORMATION <span style="float: right;"><input type="checkbox"/> N/A</span>		
PROPERTY OR VEHICLE INVOLVED:		
DESCRIPTION OF LOSS OR DAMAGE:		ESTIMATED \$ LOST:
SPILL OR RELEASE INFORMATION <span style="float: right;"><input type="checkbox"/> N/A</span>		
SUBSTANCE SPILLED OR RELEASED:	FROM WHERE:	TO WHERE:
ESTIMATED QUANTITY/DURATION:		
REPORTABLE QUANTITY (RQ):	RQ EXCEEDED? <input type="checkbox"/> YES <input type="checkbox"/> NO	
RELEASED TO WATERS OF STATE? <input type="checkbox"/> YES <input type="checkbox"/> NO	CERCLA HAZARDOUS SUBSTANCE? <input type="checkbox"/> YES <input type="checkbox"/> NO	
RESPONSE ACTIONS TAKEN:		
PERMIT OR EQUIVALENT EXCEEDANCE <span style="float: right;"><input type="checkbox"/> N/A</span>		
TYPE OF PERMIT:	PERMIT #:	
DATE OF EXCEEDANCE:	DATE FIRST KNOWLEDGE OF EXCEEDANCE:	
PERMITTED LEVEL OR CRITERIA (e.g., Water quality, Air Quality):		
EXCEEDANCE LEVEL OR CRITERIA:	EXCEEDANCE DURATION:	
RESPONSE ACTIONS TAKEN:		
PERSONS PREPARING REPORT (Employee and Supervisor to Complete Report)		
EMPLOYEE'S NAME (PRINT):	SIGN:	DATE:
EMPLOYEE'S NAME (PRINT):	SIGN:	DATE:
SUPERVISOR'S NAME (PRINT):	SIGN:	DATE:
PERSONNEL NOTIFIED (check all that apply)		
ORGANIZATION	NAME(S)	DATE/TIME
<input type="checkbox"/> Bhate Site Safety and Health Officer		
<input type="checkbox"/> Bhate Site Manager		
<input type="checkbox"/> Site Emergency Services		
<input type="checkbox"/> Other Organizations Notified		
RECEIVED BY Bhate Health and Safety Manager		Date:



## INCIDENT REPORT INSTRUCTIONS

**General:** The incident report (2 pages) must be completed within 24 hours of the incident. If any information is unknown, it can be provided later as the information is available. Complete all applicable sections of the form. If a section does not apply, indicate this by using "N/A". Names, dates, and signatures should be complete.

**Type of Incident:** Check all that apply. A Near Miss (High Loss Potential) incident is one that does not result in loss, but under slightly different circumstances, could have resulted in an OSHA Recordable injury, spill, release, permit exceedance, fire, or vehicle/property damage in excess of \$500. All Near Miss (High Loss Potential) incidents are to be investigated.

### General Information

**Project/Task:** Give the Project Name and task being performed.

**Supervisor on Duty:** The Supervisor on Duty responsible for the work effort involving the incident.

**Location of Incident:** The specific location on the project (a street address or facility building numbers)

**Weather/Lighting Conditions:** Temperature, precipitation, approximate wind speed and direction, lighting conditions, cloud cover, relative humidity. This information may be included in the description section, and must be given in detail whenever it is a factor in the cause or impact, e.g., spill, release, heat stress, windblown material.

**Describe What Happened:** This section must be completed in sufficient detail to describe the events and conditions leading up to and resulting from the incident. Try to answer the questions who, what, where, when, and how. This information is then used to determine why (cause). Provide details such as work objective, procedure being used, body position, and PPE. Include diagrams or sketches for all incidents involving vehicles/equipment and other incidents where they aid in providing detail or perspective. Consider attaching photographs.

### Immediate Corrective Actions

List what corrective actions were taken immediately as a result of the incident such as containing spills, first aid, temporary barriers, work stoppage, and similar actions.

### Affected Employee Information

**Employee:** Direct hire, whether professional, administrative, or craft; full-time or part-time; permanent or temporary and/or Subcontractor employee.

**Hours Worked on Shift Prior to the Incident:** Only include the amount of time the employee worked that shift or day prior to the incident.

**Years with the Company:** Give the number of years employed with the current company in years and/or months.

### Injury/Illness Information

**Nature of Injury or Illness:** Give a brief description of the body part affected and type of injury or illness, as applicable.

**First Aid Provided:** First Aid is any treatment that does not have to be provided by a health care professional. A clinic may provide first aid depending on the severity of the injury.

**Will the Injury Result In:** Do not delay the report if this information is unknown.

### Medical Treatment Information

**Was Medical Treatment Provided?** Medical treatment is that treatment that must be provided by a licensed medical practitioner.

**Type of Treatment:** This information is important in determining OSHA recordability. Attach a copy of the treating professional's statement/work release.

### Property Loss or Damage Information

**Property or Vehicle Involved:** For vehicles, indicate VIN and vehicle ownership.

**Description of Loss or Damage:** Be specific as to the identity of damaged part, location, and extent.

**Estimated \$ Lost:** Estimate the monetary amount of loss or damage.

### Spill or Release Information

**Substance Spilled or Released:** For pure substances, list materials by common name/chemical. For wastes, indicate waste code. For mixtures or contaminated media, provide contaminant name, CAS No., concentration.

**RQ Exceeded?** Specify the Reportable Quantity for the material.

**Response Action Taken:** Describe the mitigation efforts, as well as any reports made, beyond initial notification.

### Permit or Equivalent Exceedance

**Type of Permit:** List name of permit or equivalent including the agency name where applicable (e.g., NPDES, NESHAP, etc.).

**Date of Exceedance:** Specify date exceedance occurred (e.g., date discharge in excess of permit limits occurred).

**Date First Knowledge of Exceedance:** Specify date when first knew there was an exceedance (i.e., date analytical received). This date may be different from the date of the exceedance listed above.

**Permitted Level or Criteria:** List discharge or emission limit or narrative criteria specified in the permit.

**Exceedance Level or Criteria:** Specify an actual discharge/emission limit or narrative criterion which was exceeded.

**Exceedance Duration:** Specify time frame by date and hours (using military time) during which exceedance occurred.

See "**Spill or Release Information**" (above) for description of remaining questions.

### Persons Preparing Report

**Employee's Name:** The affected employee described on page 1 should review the report and sign here, as well as any other employees witnessing or involved in the incident.

**Supervisor's Name:** The Supervisor must review and sign the report indicating agreement. The Supervisor should be involved in conducting the investigation.

## Air Monitoring Data Sheet (Integrated Air Monitoring)

Project Location (Address, City, State, Site Description):		Page ____ of ____	Date:	Project Number:
		Weather Conditions:		
Employee Name:	Employee Number:	Job Title/Job Classification:		Sample Type:
				Personal
				Area
				Blank
Personal Protective Equipment Used:				

Notes, Job Description, Task description, Ventilation, Controls, etc.:

Analyte	Sample Media	Analytical Method	Exposure Limit (i.e. PEL, TLV)

Calibration Method	
Bubble	Base Unit No.
	Cell Unit No.
Precision Rotameter	Unit No.
Notes: (elevation and/or elevation changes)	

Pre-Sample Calibration Data	
Date and Time	
	Flow Rate
Trial 1	
Trial 2	
Trial 3	
Average	

Post-Sample Calibration Data	
Date and Time	
	Flow Rate
Trial 1	
Trial 2	
Trial 3	
Average	

Sample Data				
Sample No.				
Pump No.				
Start Time				
Stop Time				
Total Time (min.)				
Flow Rate				
Total Volume (L)				
Sample Quantity				
Concentration				
8-Hour TWA				

Data Review		
Sampler:	Sampler Signature:	Date:
Data Reviewed by:	Reviewer Signature:	Date:

## Lockout/Tagout Permit

Section A			
<b>Project Location (Address, City, State, Site Description):</b>	<b>Date:</b>	<b>Time:</b>	<b>Project Number:</b>
<b>Equipment Description and Location:</b>	<b>Reason for Lockout/Tagout:</b>		
<b>Lockout Locations:</b>	<b>Supervisor on Duty:</b>	<b>Authorized Employee:</b>	

Section B	
<b>Requestor:</b>	
<b>Notifier:</b>	
<b>Shut Down By:</b>	
<b>Isolator:</b>	
<b>Verifier:</b>	
<b>Approved By:</b>	

Section C			Section D				Section E		
Device Description	Location	Isolation Position	Applied By	Lock #	Date	Time	Removed By	Date	Time

<b>Special Instructions for Removal or Releasing Stored Energy:</b>

## Noise Dosimetry Data Sheet

<b>Project Location (Address, City, State, Site Description):</b>	<b>Page</b> ____ <b>of</b> ____	<b>Date:</b>	<b>Project Number:</b>
<b>Employee Name:</b>	<b>Employee Number:</b>	<b>Job Title/Job Classification:</b>	<b>HPDs? Yes</b> <input type="checkbox"/> <b>No</b> <input type="checkbox"/> <b>Type: Muff or Plug</b> <b>NRR:</b>

Instrumentation	Model	Serial No.	Microphone	Date of Last Factory Calibration
Calibrator			NA	
Sound Level Meter				

Calibration	Date/Time	Calibration Level (dB)	
		94 dB	114 dB
Pre-survey			
Post-survey			
<b>Note adjustments as needed:</b>			

SLM Settings		
	Pre-set	Actual
<b>Threshold (dB)</b>	80	
<b>Weighting</b>	A-scale	
<b>Response (Fast/Slow)</b>	Slow	
<b>Criterion (dB)</b>	90	
<b>Exchange Rate (dB)</b>	5	

Noise Monitoring Data								
Start Time	Stop Time	Total Time	Dose %	Proj. Dose %	TWA	L <sub>EQ</sub> (dB)	L <sub>MAX</sub> (dB)	Max L <sub>PEAK</sub> (dB)

**Notes, Job description, Task description, Exceedances, etc:**

Data Review		
<b>Surveyor:</b>	<b>Surveyor Signature:</b>	<b>Date:</b>
<b>Data Reviewed by:</b>	<b>Reviewer Signature:</b>	<b>Date:</b>

## Noise Survey Data Sheet

Project Location (Address, City, State, Site Description):	Page ____ of ____	Date:	Project Number:
--	-------------------	-------	-----------------

Instrumentation	Model	Serial No.	Microphone	Date of Last Factory Calibration
Calibrator				
Sound Level Meter				

Calibration	Date/Time	Calibration Level (dB)	
		94 dB	114 dB
Pre-survey			
Post-survey			
Note adjustments as needed:			

SLM Settings		
	Pre-set	Actual
Threshold (dB)	80	
Weighting	A-scale	
Response (Fast/Slow)	Slow	
Criterion (dB)	90	
Exchange Rate (dB)	5	

Diagram, Notes, Equipment, Distances, Exceedances, etc.:

↑  
N

Sound Level Data								
Location (indicate on diagram 1, 2, etc.)								
Distance (feet)								
SPL (dBA)								

Octave Band Analysis								
Frequency	Hz							
SPL (dBA)								

Data Review		
Surveyor:	Surveyor Signature:	Date:
Data Reviewed by:	Reviewer Signature:	Date:





# Safety Observation Form



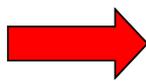
Observer \_\_\_\_\_  
 Employee(s) \_\_\_\_\_  
 (Subcontractor or RMA) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 Employee(s) Co. \_\_\_\_\_

Date \_\_\_\_\_  
 Time \_\_\_\_\_  
 Task \_\_\_\_\_  
 Location \_\_\_\_\_

Focused Observation?  
 (Lockout, PPE Usage, Hot Work, Tools, Heavy Equipment, Procedures, Scaffolds, Excavations, etc.)  
 Yes  
 No  
 Primary Focus \_\_\_\_\_

## Observation

Working Safely  
 Basic Training Required  
 Retraining Required  
 Retraining  
 Unsafe Condition/Actions



Employee Commended  
 Basic Training Given Date \_\_\_\_\_  
 Retraining Given Date \_\_\_\_\_  
 Retraining Scheduled Date \_\_\_\_\_  
 Corrected or Referred (see comments below)

Type of Observation  
 Planned  Impromptu  
 Follow-up

Copy Given to the Employee  
 Yes Date \_\_\_\_\_  
 No

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Signatures  
 Observer \_\_\_\_\_ Employee # \_\_\_\_\_ Employee(s) \_\_\_\_\_ Employee # \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

*Please return all completed forms to the Bhate Health and Safety Manager no later than the 5th of the following month*

<b>Project Location (Address, City, State, Site Description):</b>	<b>Date:</b>	<b>Project Number:</b>
<b>Type of Inspection:</b> <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly		
<b>Tasks or Activities Observed:</b>		

<b>Personnel Participating in Inspection:</b>			
Name	Organization	Name	Organization

<b>General Workplace Conditions:</b>		
Category	Observations (N/A if Not Applicable)	Action required - Yes or No
Walking/Working Surfaces		
Aisles and Passageways		
Platforms/Scaffolding		
Ladders		
Stairs		
Exits/Egress		
Roadways		
Excavations/Trenches		
Ventilation		
Lighting		
Noise Exposure		
Ergonomics		
Potable Water		
Sanitation Facilities		
Temperature Extremes		

<b>Hazardous Materials Use &amp; Storage:</b>		
Category	Observations (N/A if Not Applicable)	Action required - Yes or No
MSDSs Available		
Material Labeling		
Storage Conditions		
Storage Containers Condition		
Chemical Storage Compatibility		
Compressed Gas Storage & Use		
Waste Storage/Disposal		

<b>Motor Vehicles &amp; Power Equipment:</b>		
Category	Observations (N/A if Not Applicable)	Action required - Yes or No
Seatbelts & Back-up Alarms		
Dozer Equipment		
Scraper Equipment		
Road Grader Equipment		
Water Trucks		
Front End Loader/Backhoe Equipment		
Cranes/ Hoists & Rigging		
Forklifts		
Other Heavy Equipment		
Loads Secure on Vehicles		
Wheels Chocked		
<b>Hazard Controls:</b>		
Category	Observations (N/A if Not Applicable)	Action required - Yes or No
General Site Controls		
Work Zone Delineation		
Lockout/Tagout Systems		
Accident Prevention Signs and Tags		
Barricades		
Hole Covers		
Electrical Grounding & GFCI Use		
<b>Emergency Systems:</b>		
Category	Observations (N/A if Not Applicable)	Action required - Yes or No
Emergency Instructions/Postings		
Fire Protection		
Eye Wash and Showers		
First Aid Kits/Stations		
Emergency Rescue Equipment		
<b>Personal Protective Equipment:</b>		
Category	Observations (N/A if Not Applicable)	Action required - Yes or No
Eye Protection		
Ear Protection		
Respiratory Protection		
Head Protection		
Hand Protection		
Foot Protection		
Body Protection		
Fall Protection		





## **SSHP ATTACHMENT 3**

# **SAFETY DATA SHEETS (SDS)/ MATERIAL SAFETY DATA SHEETS (MSDS)**

### SECTION 1: Identification of the substance/mixture and of the company/undertaking

#### 1.1. Product identifier

Product form : Substance  
 Substance name : Sodium Sulfite, Anhydrous  
 CAS No : 7757-83-7  
 Product code : LC24930  
 Formula : Na<sub>2</sub>SO<sub>3</sub>

#### 1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

#### 1.3. Details of the supplier of the safety data sheet

LabChem Inc  
 Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court  
 Zelenople, PA 16063 - USA  
 T 412-826-5230 - F 724-473-0647  
[info@labchem.com](mailto:info@labchem.com) - [www.labchem.com](http://www.labchem.com)

#### 1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

### SECTION 2: Hazards identification

#### 2.1. Classification of the substance or mixture

##### GHS-US classification

Skin Irrit. 2 H315  
 Eye Irrit. 2A H319

#### 2.2. Label elements

##### GHS-US labelling

Hazard pictograms (GHS-US) :



GHS07

Signal word (GHS-US) :

Warning

Hazard statements (GHS-US) :

H315 - Causes skin irritation  
 H319 - Causes serious eye irritation

Precautionary statements (GHS-US) :

P264 - Wash exposed skin thoroughly after handling  
 P280 - Wear protective gloves, eye protection  
 P302+P352 - IF ON SKIN: Wash with plenty of soap and water  
 P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing  
 P332+P313 - If skin irritation occurs: Get medical advice/attention  
 P337+P313 - If eye irritation persists: Get medical advice/attention  
 P362 - Take off contaminated clothing

#### 2.3. Other hazards

Other hazards not contributing to the classification

: None.

#### 2.4. Unknown acute toxicity (GHS-US)

No data available

### SECTION 3: Composition/information on ingredients

#### 3.1. Substances

Substance type : Mono-constituent

Name	Product identifier	%	GHS-US classification
Sodium Sulfite, Anhydrous (Main constituent)	(CAS No) 7757-83-7	100	Skin Irrit. 2, H315 Eye Irrit. 2A, H319

Full text of H-phrases: see section 16

#### 3.2. Mixture

Not applicable

# Sodium Sulfit, Anhydrous

## Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

### SECTION 4: First aid measures

#### 4.1. Description of first aid measures

First-aid measures general	: Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).
First-aid measures after inhalation	: Assure fresh air breathing. Allow the victim to rest.
First-aid measures after skin contact	: Wash with plenty of soap and water. Wash contaminated clothing before reuse. If skin irritation occurs: Get medical advice/attention.
First-aid measures after eye contact	: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
First-aid measures after ingestion	: Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

#### 4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation	: May cause respiratory irritation.
Symptoms/injuries after skin contact	: Causes skin irritation.
Symptoms/injuries after eye contact	: Causes serious eye irritation.
Symptoms/injuries after ingestion	: Central nervous system depression. Diarrhoea. Nausea. Vomiting.

#### 4.3. Indication of any immediate medical attention and special treatment needed

Obtain medical assistance.

### SECTION 5: Firefighting measures

#### 5.1. Extinguishing media

Suitable extinguishing media	: Foam. Dry powder. Carbon dioxide. Water spray. Sand.
Unsuitable extinguishing media	: Do not use a heavy water stream.

#### 5.2. Special hazards arising from the substance or mixture

Fire hazard	: Not flammable.
Explosion hazard	: Not applicable.

#### 5.3. Advice for firefighters

Firefighting instructions	: Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Avoid (reject) fire-fighting water to enter environment.
Protection during firefighting	: Do not enter fire area without proper protective equipment, including respiratory protection.

### SECTION 6: Accidental release measures

#### 6.1. Personal precautions, protective equipment and emergency procedures

##### 6.1.1. For non-emergency personnel

Protective equipment	: Gloves. Safety glasses.
Emergency procedures	: Evacuate unnecessary personnel.

##### 6.1.2. For emergency responders

Protective equipment	: Equip cleanup crew with proper protection.
Emergency procedures	: Ventilate area.

#### 6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

#### 6.3. Methods and material for containment and cleaning up

Methods for cleaning up	: On land, sweep or shovel into suitable containers. Minimize generation of dust. Store away from other materials.
-------------------------	--

#### 6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

### SECTION 7: Handling and storage

#### 7.1. Precautions for safe handling

Precautions for safe handling	: Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapour.
Hygiene measures	: Wash exposed skin thoroughly after handling.

#### 7.2. Conditions for safe storage, including any incompatibilities

Storage conditions	: Keep container closed when not in use.
Incompatible products	: Strong acids.
Incompatible materials	: Moisture.

#### 7.3. Specific end use(s)

No additional information available

# Sodium Sulfite, Anhydrous

## Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

### SECTION 8: Exposure controls/personal protection

#### 8.1. Control parameters

#### 8.2. Exposure controls

Appropriate engineering controls	: Provide adequate general and local exhaust ventilation.
Personal protective equipment	: Avoid all unnecessary exposure.
Hand protection	: Wear protective gloves.
Eye protection	: Chemical goggles or safety glasses.
Skin and body protection	: Wear suitable protective clothing.
Respiratory protection	: Wear appropriate mask.
Other information	: Do not eat, drink or smoke during use.

### SECTION 9: Physical and chemical properties

#### 9.1. Information on basic physical and chemical properties

Physical state	: Solid
Molecular mass	: 126.04 g/mol
Colour	: white.
Odour	: Odourless.
Odour threshold	: No data available
pH	: No data available
pH solution	: 5 (8.5 - 10) %
Relative evaporation rate (butylacetate=1)	: No data available
Melting point	: > 500 °C
Freezing point	: No data available
Boiling point	: No data available
Flash point	: No data available
Self ignition temperature	: No data available
Decomposition temperature	: > 500 °C
Flammability (solid, gas)	: No data available
Vapour pressure	: No data available
Relative vapour density at 20 °C	: No data available
Relative density	: No data available
Density	: 2.63 g/cm <sup>3</sup>
Solubility	: Moderately soluble in water.
Log Pow	: No data available
Log Kow	: No data available
Viscosity, kinematic	: No data available
Viscosity, dynamic	: No data available
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: No data available

#### 9.2. Other information

No additional information available

### SECTION 10: Stability and reactivity

#### 10.1. Reactivity

No additional information available

#### 10.2. Chemical stability

Hygroscopic.

#### 10.3. Possibility of hazardous reactions

Not established.

#### 10.4. Conditions to avoid

Air contact. Heat. Moisture. Incompatible materials.

#### 10.5. Incompatible materials

Strong acids. Strong oxidizers.

# Sodium Sulfit, Anhydrous

## Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

### 10.6. Hazardous decomposition products

Sodium oxide. Sulfur compounds.

## SECTION 11: Toxicological information

### 11.1. Information on toxicological effects

Acute toxicity : Not classified

Sodium Sulfit, Anhydrous ( f )7757-83-7	
LD50 oral rat	2610 mg/kg
LC50 inhalation rat (mg/l)	> 5.5 mg/l/4h

Skin corrosion/irritation : Causes skin irritation.

Serious eye damage/irritation : Causes serious eye irritation.

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Sodium Sulfit, Anhydrous (7757-83-7)	
IARC group	3

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Potential Adverse human health effects and symptoms : Based on available data, the classification criteria are not met.

Symptoms/injuries after inhalation : May cause respiratory irritation.

Symptoms/injuries after skin contact : Causes skin irritation.

Symptoms/injuries after eye contact : Causes serious eye irritation.

Symptoms/injuries after ingestion : Central nervous system depression. Diarrhoea. Nausea. Vomiting.

## SECTION 12: Ecological information

### 12.1. Toxicity

Sodium Sulfit, Anhydrous (7757-83-7)	
LC50 fishes 1	220 - 460 mg/l

### 12.2. Persistence and degradability

Sodium Sulfit, Anhydrous (7757-83-7)	
Persistence and degradability	Not established.

### 12.3. Bioaccumulative potential

Sodium Sulfit, Anhydrous (7757-83-7)	
Bioaccumulative potential	Not established.

### 12.4. Mobility in soil

No additional information available

### 12.5. Other adverse effects

Other information : Avoid release to the environment.

## SECTION 13: Disposal considerations

### 13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.

Ecology - waste materials : Avoid release to the environment.

## SECTION 14: Transport information

In accordance with DOT

### 14.1. UN number

No dangerous good in sense of transport regulations

### 14.2. UN proper shipping name

Not applicable

# Sodium Sulfit, Anhydrous

## Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

### 14.3. Additional information

Other information : No supplementary information available.

#### Overland transport

No additional information available

#### Transport by sea

No additional information available

#### Air transport

No additional information available

## SECTION 15: Regulatory information

### 15.1. US Federal regulations

#### Sodium Sulfit, Anhydrous (7757-83-7)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

### 15.2. International regulations

#### CANADA

#### Sodium Sulfit, Anhydrous (7757-83-7)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification : Class D Division 2 Subdivision B - Toxic material causing other toxic effects

#### EU-Regulations

No additional information available

#### Classification according to Regulation (EC) No. 1272/2008 [CLP]

Not classified

#### Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

#### 15.2.2. National regulations

#### Sodium Sulfit, Anhydrous (7757-83-7)

Not listed on the Canadian Ingredient Disclosure List

### 15.3. US State regulations

No additional information available

## SECTION 16: Other information

Other information : None.

Full text of H-phrases: see section 16:

Eye Irrit. 2A	Serious eye damage/eye irritation, Category 2A
Skin Irrit. 2	Skin corrosion/irritation, Category 2
H315	Causes skin irritation
H319	Causes serious eye irritation

NFPA health hazard

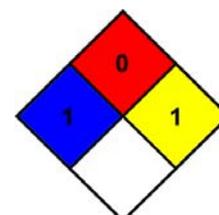
: 1 - Exposure could cause irritation but only minor residual injury even if no treatment is given.

NFPA fire hazard

: 0 - Materials that will not burn.

NFPA reactivity

: 1 - Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.



# Sodium Sulfite, Anhydrous

## Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

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### HMIS III Rating

Health : 1 Slight Hazard - Irritation or minor reversible injury possible  
Flammability : 0 Minimal Hazard  
Physical : 1 Slight Hazard  
Personal Protection : B

SDS US (GHS HazCom 2012)

*Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.*

# Safety Data Sheet

**Shaw Environmental, Inc.**  
**17 PRINCESS ROAD**  
**LAWRENCEVILLE, N.J. 08648**  
**(609) 895-5340**

## SECTION 1 - MATERIAL IDENTIFICATION AND INFORMATION

Material Name: DHC microbial consortium (RTB-1 SDC-9) MSDS #: ENV 1033

Date Prepared: 10/06/2003 CAS #: N/A (Not Applicable)

Prepared By: Simon Vainberg Formula #: N/A

Material Description: Non-hazardous, naturally occurring non-altered anaerobic microbes and enzymes in a water-based medium.

**24 HOUR EMERGENCY RESPONSE PHONE NUMBER (800)424-9300**

## SECTION 2 - INGREDIENTS

Components	%	OSHA PEL	ACGIH TLV	OTHER LIMITS
Non-Hazardous Ingredients	100	N/A	N/A	N/A

## SECTION 3 - PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: 100° C (water) Specific Gravity (H<sub>2</sub>O = 1): 0.9 - 1.1

Vapor Pressure @ 25° C: 24 mm Hg (water) Melting Point: 0° C (water)

Vapor Density: N/A Evaporation Rate (H<sub>2</sub>O = 1): 0.9 - 1.1

Solubility in Water: Soluble Water Reactive: No

pH: 6.0 - 8.0

Appearance and Odor: Murky, yellow water. Musty odor.

#### **SECTION 4 - FIRE AND EXPLOSION HAZARD DATA**

Flash Point: N/A

Flammable Limits: N/A

Extinguishing Media: Foam, carbon dioxide, water

Special Fire Fighting Procedures: None

Unusual Fire and Explosion Hazards: None

#### **SECTION 5 - REACTIVITY DATA**

Stability: Stable

Conditions to Avoid: None

Incompatibility (Materials to Avoid): Water-reactive materials

Hazardous Decomposition Byproducts: None

#### **SECTION 6 - HEALTH HAZARD DATA**

##### HEALTH EFFECTS

The effects of exposure to this material have not been determined. Safe handling of this material on a long-term basis will avoid any possible effect from repetitive acute exposures. Below are possible health effects based on information from similar materials. Individuals hyper allergic to enzymes or other related proteins should not handle.

Ingestion: Ingestion of large quantities may result in abdominal discomfort including nausea, vomiting, cramps, diarrhea, and fever.

Inhalation: Hypersensitive individuals may experience breathing difficulties after inhalation of aerosols.

Skin Absorption: N/A

MATERIAL SAFETY DATA SHEET FOR DHC consortium (RTB-1)

PAGE 3 OF 4

October 6, 2003

Skin Contact: May cause skin irritation. Hypersensitive individuals may experience allergic reactions to enzymes.

Eye Contact: May cause eye irritation.

FIRST AID

Ingestion: Get medical attention if allergic symptoms develop (observe for 48 hours). Never give anything by mouth to an unconscious or convulsing person.

Inhalation: Get medical attention if allergic symptoms develop.

Skin Absorption: N/A

Skin Contact: Wash affected area with soap and water. Get medical attention if allergic symptoms develop.

Eye Contact: Flush eyes with plenty of water for at least 15 minutes using an eyewash fountain, if available. Get medical attention if irritation occurs.

**NOTE TO PHYSICIANS:** All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this material may have occurred.

**SECTION 7 - SPILL AND LEAK PROCEDURES**

Reportable quantities (in lbs of EPA Hazardous Substances): N/A

Steps to be taken in case of spill or release: No emergency results from spillage. However, spills should be cleaned up promptly. All personnel involved in the cleanup must wear protective clothing and avoid skin contact. Absorb spilled material or vacuum into a container. After clean-up, disinfect all cleaning materials and storage containers that come in contact with the spilled liquid.

Waste Disposal Method: No special disposal methods are required. The material may be sewerred, and is compatible with all known biological treatment methods. To reduce odors and permanently inactivate microorganisms, mix 100 parts (by volume) of DHC consortium with 1 part (by volume) of bleach. Dispose of in accordance with local, state and federal regulations.

MATERIAL SAFETY DATA SHEET FOR DHC consortium (RTB-1)  
PAGE 4 OF 4  
October 6, 2003

## **SECTION 8 - HANDLING AND STORAGE**

Hand Protection: Rubber gloves.

Eye Protection: Safety goggles with side splash shields.

Protective Clothing: Use adequate clothing to prevent skin contact.

Respiratory Protection: Surgical mask.

Ventilation: Provide adequate ventilation to remove odors.

Storage & Handling:

Material may be stored for up to 3 weeks at 2-4° C without aeration.

Other Precautions: An eyewash station in the work area is recommended.

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While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Shaw Environmental, Inc. MAKES NO WARRANTY WITH RESPECT HERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

# **SAFETY DATA SHEET**

## **Anaerobic BioChem (ABC)**

### **ABC-Ole`**

## **1. PRODUCT AND COMPANY IDENTIFICATION**

**PRODUCT NAME:** ABC-Ole`  
**GENERAL USE:** Bioremediation of halogenated organics and metals

**MANUFACTURER:**

**Redox Tech, LLC**  
200 Quade Drive  
Cary, NC 27513  
919-678-0140

**EMERGENCY TELEPHONE:**

Within USA and Canada: 1-800-424-9300  
+1 703-527-3887 (collect calls accepted)

## **2. HAZARDS IDENTIFICATION**

**EMERGENCY OVERVIEW:** Product is generally recognized as safe. May cause irritation exposure to eyes. Long term contact to skin may cause some drying and minor irritation.

## **3. COMPOSITION INFORMATION ON INGREDIENTS**

Proprietary mixture of fatty acids, glycerol, vegetable oil and emulsifying agent.

## **4. FIRST AID MEASURES**

**EYES:** Immediately flush with water for up to 15 minutes. If irritation persists, seek medical attention.

**SKIN:** Rinse with water. Irritation is unlikely, but if irritation occurs or persists, seek medical attention.

**INGESTION:** Generally safe to ingest but not recommended.

**INHALATION:** No first aid required.

## **5. FIRE FIGHTING MEASURES**

**EXTINGUISHING MEDIA:** Deluge with water

**FIRE/EXPLOSION HAZARDS:** Product is combustible only at temperatures above 600C

**FIRE FIGHTING PROCEDURES:** Use flooding with plenty of water, carbon dioxide or other inert gasses. Wear full protective clothing and self-contained breathing apparatus. Deluging with water is the best method to control combustion of the product.

**FLAMMABILITY LIMITS:** non-combustible

**SENSITIVITY TO IMPACT:** non-sensitive

**SENSITIVITY TO STATIC DISCHARGE:** non-sensitive

## 6. ACCIDENTAL RELEASE MEASURES

Confine and collect spill. Transfer to an approved DOT container and properly dispose. Do not dispose of or rinse material into sewer, stormwater or surface water. Discharge of product to surface water could result in depressed dissolved oxygen levels and subsequent biological impacts.

## 7. HANDLING AND STORAGE

**HANDLING:** Protective gloves and safety glasses are recommended.

**STORAGE:** Keep dry. Use first in, first out storage system. Keep container tightly closed when not in use. Avoid contamination of opened product. Avoid contact with reducing agents.

## 8. EXPOSURE CONTROLS – PERSONAL PROTECTION

### EXPOSURE LIMITS

Chemical Name	ACGIH	OSHA	Supplier
ABC	NA	NA	NA

**ENGINEERING CONTROLS:** None are required

### PERSONAL PROTECTIVE EQUIPMENT

**EYES and FACE:** Safety glasses recommended

**RESPIRATOR:** none necessary

**PROTECTIVE CLOTHING:** None necessary

**GLOVES:** rubber, latex or neoprene recommended but not required

## 9. PHYSICAL AND CHEMICAL PROPERTIES

Odor:	none to mild pleasant organic odor
Appearance:	milky
Auto-ignition Temperature	Non-combustible
Boiling Point	>600 C

Melting Point	NA
Density	0.90 gram/cc
Solubility	infinite
pH	7-9

## 10. STABILITY AND REACTIVITY

**CONDITIONS TO AVOID:** Do not contact with strong oxidizers

**STABILITY:** product is stable

**POLYMERIZATION:** will not occur

**INCOMPATIBLE MATERIALS:** strong oxidizers

**HAZARDOUS DECOMPOSITION PRODUCTS:**

## 11. TOXICOLOGICAL INFORMATION

### Acute Toxicity

A: General Product Information

Acute exposure may cause mild skin and eye irritation.

B: Component Analysis - LD50/LC50

No information available.

B: Component Analysis - TDLo/LDLo

TDLo (Oral-Man) none

### Carcinogenicity

A: General Product Information

No information available.

B: Component Carcinogenicity

Product is not listed by ACGIH, IARC, OSHA, NIOSH, or NTP.

### Epidemiology

No information available.

### Neurotoxicity

No information available.

## 12. ECOLOGICAL INFORMATION

### Ecotoxicity

Discharge to water may cause depressed dissolved oxygen and subsequent ecological stresses

### Environmental Fate

No potential for food chain concentration

## 13. DISPOSAL CONSIDERATIONS

**DISPOSAL METHOD:** Material is not considered hazardous, but consult with local, state and federal agencies prior to disposal to ensure all applicable laws are met.

## 14. TRANSPORT INFORMATION

NOTE: The shipping classification information in this section (Section 14) is meant as a guide to the overall classification of the product. However, transportation classifications may be subject to change with changes in package size. Consult shipper requirements under I.M.O., I.C.A.O. (I.A.T.A.) and 49 CFR to assure regulatory compliance.

### US DOT Information

Shipping Name: Not Regulated

Hazard Class: Not Classified

UN/NA #: Not Classified

Packing Group: None

Required Label(s): None

### 50<sup>th</sup> Edition International Air Transport Association (IATA):

Not hazardous and not regulated

### INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG)

Material is not regulated under IMDG

## 15. REGULATORY INFORMATION

### UNITED STATES

#### SARA TITLE III

SECTION 311 No Hazard for Immediate health Hazard

SECTION 312 No Threshold Quantity

SECTION 313 Not listed

**CERCLA** NOT REGULATED UNDER CERCLA

**TSCA** NOT REGULATED UNDER TSCA

**CANADA (WHIMS):** NOT REGULATED

## 16. OTHER INFORMATION

HMIS:

Health	0
Flammability	0
Physical Hazard	0
Personal Protection	E

E: Safety Glasses, gloves

# FLINN SCIENTIFIC, INC.

## Safety Data Sheet (SDS)

SDS #: 855.00

Revision Date: January 16, 2014

### SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

#### Yeast

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261

CHEMTREC Emergency Phone Number: (800) 424-9300

Signal Word N/A

Pictograms

### SECTION 2 — HAZARDS IDENTIFICATION

This chemical is considered nonhazardous according to GHS classifications for the Hazard Communication Standard. Treat all laboratory chemicals with caution.

Although this material is considered to be nonhazardous, unpredictable reactions among chemicals are always possible. Prudent laboratory practices should be observed.

Product should be treated as a chemical and is not for consumption as it has been stored with other nonfood-grade chemicals.

### SECTION 3 — COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
Yeast	None established	Unspecified	Unspecified	

### SECTION 4 — FIRST AID MEASURES

Call a POISON CENTER or physician if you feel unwell.

**If inhaled:** Remove victim to fresh air and keep at rest in a position comfortable for breathing.

**If in eyes:** Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing.

**If on skin:** Wash with plenty of water.

**If swallowed:** Rinse mouth. Call a POISON CENTER or physician if you feel unwell.

### SECTION 5 — FIRE FIGHTING MEASURES

Nonflammable solid.

When heated to decomposition, may emit toxic fumes.

**In case of fire:** Use a tri-class dry chemical fire extinguisher.

**NFPA CODE**  
None  
established

### SECTION 6 — ACCIDENTAL RELEASE MEASURES

Sweep up, place in sealed bag or container and dispose. Wash spill site after material pickup is complete. See Sections 8 and 13 for further information.

---

**SECTION 7 — HANDLING AND STORAGE**

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Flinn Suggested Chemical Storage Pattern: Organic Miscellaneous.

---

**SECTION 8 — EXPOSURE CONTROLS, PERSONAL PROTECTION**

---

Wear protective gloves, protective clothing, and eye protection. Wash hands thoroughly after handling.

---

**SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES**

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Light tan fine powder granules. Faint odor of beer.

Not for human consumption.

Soluble: Slightly in water.

Brewers yeast is nonviable, and Bakers yeast is freeze-dried, viable for baking, culturing.

---

**SECTION 10 — STABILITY AND REACTIVITY**

---

Shelf life: Fair, will expire.

---

**SECTION 11 — TOXICOLOGICAL INFORMATION**

---

Acute effects: N.A.

ORL-RAT LD<sub>50</sub>: N.A.

Chronic effects: N.A.

IHL-RAT LC<sub>50</sub>: N.A.

Target organs: N.A.

SKN-RBT LD<sub>50</sub>: N.A.

N.A. = Not available, not all health aspects of this substance have been fully investigated.

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**SECTION 12 — ECOLOGICAL INFORMATION**

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Data not yet available.

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**SECTION 13 — DISPOSAL CONSIDERATIONS**

---

Please review all federal, state and local regulations that may apply before proceeding.

Flinn Suggested Disposal Method #26a is one option.

---

**SECTION 14 — TRANSPORT INFORMATION**

---

Shipping name: Not regulated. Hazard class: N/A. UN number: N/A.

N/A = Not applicable

---

**SECTION 15 — REGULATORY INFORMATION**

---

Not listed.

---

**SECTION 16 — OTHER INFORMATION**

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This Safety Data Sheet (SDS) is for guidance and is based upon information and tests believed to be reliable. Flinn Scientific, Inc. makes no guarantee of the accuracy or completeness of the data and shall not be liable for any damages relating thereto. The data is offered solely for your consideration, investigation, and verification. The data should not be confused with local, state, federal or insurance mandates, regulations, or requirements and CONSTITUTE NO WARRANTY. Any use of this data and information must be determined by the science instructor to be in accordance with applicable local, state or federal laws and regulations. The conditions or methods of handling, storage, use and disposal of the product(s) described are beyond the control of Flinn Scientific, Inc. and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THIS PRODUCT(S).

Consult your copy of the *Flinn Science Catalog/Reference Manual* for additional information about laboratory chemicals.

Revision Date: January 16, 2014

# Material Safety Data Sheet

Sucrose

ACC# 22174

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Sucrose

**Catalog Numbers:** AC220900000, AC220900010, AC220900025, AC419770000, AC419775000, AC424500000, AC424500010, S71203, S71204, S93389, BP220-1, BP220-10, BP220-212, NC9492621, S2-12, S2-212, S2-50, S2-500, S2-500GM, S3-12, S3-212, S3-500, S3SAM1, S3SAM2, S3SAM3, S5-12, S5-3, S5-500, S6-12, S6-212, S6-50, S6-500, S6SAM1, S6SAM2, S6SAM3, XXS54-5KG

**Synonyms:** Beet sugar; cane sugar; saccharose; table sugar.

**Company Identification:**

Fisher Scientific  
1 Reagent Lane  
Fair Lawn, NJ 07410

**For information, call:** 201-796-7100

**Emergency Number:** 201-796-7100

**For CHEMTREC assistance, call:** 800-424-9300

**For International CHEMTREC assistance, call:** 703-527-3887

## Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
57-50-1	Sucrose	100	200-334-9

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: white solid.

**Caution!** May cause eye and skin irritation. May cause respiratory tract irritation. This is expected to be a low hazard for usual industrial handling.

**Target Organs:** Lungs.

#### Potential Health Effects

**Eye:** Dust may cause mechanical irritation.

**Skin:** May cause skin irritation. Low hazard for usual industrial handling.

**Ingestion:** Low hazard for usual industrial handling. Hydrolysis of sucrose yields invert sugar composed of equal parts fructose and glucose. Sugar is an important source of metabolic energy in foods and its formation in plants is an essential factor in the life process.

**Inhalation:** Excessive inhalation may cause minor respiratory irritation.

**Chronic:** Chronic inhalation of fine dusts may cause lung damage.

## Section 4 - First Aid Measures

**Eyes:** Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

**Skin:** Get medical aid if irritation develops or persists. Flush skin with plenty of soap and water.

**Ingestion:** Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid if irritation or symptoms occur.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** Wear appropriate protective clothing to prevent contact with skin and eyes. Wear a self-contained breathing apparatus (SCBA) to prevent contact with thermal decomposition products. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.

**Extinguishing Media:** Use extinguishing media most appropriate for the surrounding fire.

**Flash Point:** Not applicable.

**Autoignition Temperature:** Not applicable.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 1; Flammability: 1; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Avoid generating dusty conditions. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Use with adequate ventilation. Minimize dust generation and accumulation.

**Storage:** Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Use adequate ventilation to keep airborne concentrations low.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Sucrose	10 mg/m <sup>3</sup> TWA	10 mg/m <sup>3</sup> TWA (total dust); 5 mg/m <sup>3</sup> TWA (respirable dust)	15 mg/m <sup>3</sup> TWA (total dust); 5 mg/m <sup>3</sup> TWA (respirable fraction)

**OSHA Vacated PELs:** Sucrose: 15 mg/m<sup>3</sup> TWA (total dust); 5 mg/m<sup>3</sup> TWA (respirable fraction)

### Personal Protective Equipment

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to minimize contact with skin.

**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid

**Appearance:** white

**Odor:** odorless

**pH:** Not available.

**Vapor Pressure:** Not available.

**Vapor Density:** Not available.

**Evaporation Rate:** Not available.

**Viscosity:** Not available.

**Boiling Point:** Not available.

**Freezing/Melting Point:** 190 - 192 deg C

**Decomposition Temperature:**190 - 192 deg C

**Solubility:** 1970 G/L WATER (15°C)

**Specific Gravity/Density:**Not available.

**Molecular Formula:**C12H22O11

**Molecular Weight:**342.29

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable.

**Conditions to Avoid:** Dust generation, excess heat.

**Incompatibilities with Other Materials:** Strong oxidizers.

**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 57-50-1: WN6500000

**LD50/LC50:**

**CAS#** 57-50-1:

Oral, rat: LD50 = 29700 mg/kg;

**Carcinogenicity:**

**CAS#** 57-50-1: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

**Epidemiology:** No information found

**Teratogenicity:** No information found

**Reproductive Effects:** No information found

**Mutagenicity:** No information found

**Neurotoxicity:** No information found

**Other Studies:**

## Section 12 - Ecological Information

**Ecotoxicity:** No data available. No information available.

**Environmental:** Dissolves completely in water.

**Physical:** No information available.

**Other:** No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:** None listed.

## Section 14 - Transport Information

	US DOT	Canada TDG
<b>Shipping Name:</b>	Not regulated as a hazardous material	No information available.
<b>Hazard Class:</b>		
<b>UN Number:</b>		
<b>Packing Group:</b>		

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 57-50-1 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

#### CERCLA Hazardous Substances and corresponding RQs

None of the chemicals in this material have an RQ.

#### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

#### SARA Codes

CAS # 57-50-1: Not controlled.

**Section 313** No chemicals are reportable under Section 313.

#### Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

**Clean Water Act:**

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**

None of the chemicals in this product are considered highly hazardous by OSHA.

**STATE**

CAS# 57-50-1 can be found on the following state right to know lists: Pennsylvania, Minnesota, Massachusetts.

**California Prop 65**

California No Significant Risk Level: None of the chemicals in this product are listed.

**European/International Regulations**

**European Labeling in Accordance with EC Directives**

**Hazard Symbols:**

Not available.

**Risk Phrases:**

**Safety Phrases:**

**WGK (Water Danger/Protection)**

CAS# 57-50-1: 0

**Canada - DSL/NDSL**

CAS# 57-50-1 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of Not controlled..

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

**Section 16 - Additional Information**

**MSDS Creation Date:** 3/05/1999

**Revision #6 Date:** 6/29/2007

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*



# 60% SMALL DROPLET SLOW RELEASE EMULSIFIED VEGETABLE OIL SUBSTRATE (SRS<sup>®</sup>-SD) SAFETY DATA SHEET

---

## 1. Product Identification

**Synonyms:** 60% Small Droplet Slow Release Substrate (SRS<sup>®</sup>-SD)  
Emulsified Vegetable Oil (EVO)

**Recommended Use:** Treatment of groundwater contaminated with chlorinated solvents and other anaerobically degradable compounds.

**Supplier:** Terra Systems, Inc.  
130 Hickman Road, Suite 1  
Claymont, Delaware 19703  
Telephone (302) 798-9553  
Fax (302) 798-9554  
[www.terrasystems.net](http://www.terrasystems.net)

---

## 2. Hazards Identification

### Emergency Overview

**Caution:** May cause eye irritation.

**Health Rating:** 1 - Slight

**Flammability Rating:** 1 - Slight

**Reactivity Rating:** 1 - Slight

**Contact Rating:** 1 - Slight

**Protective Equipment:** Goggles; Proper Gloves

**Storage Color Code:** Green (General Storage)

### Potential Health Effects

**Inhalation:** Not expected to be a health hazard. If heated, may produce vapors or mists that irritate the mucous membranes and cause irritation, dizziness, and nausea. Remove to fresh air.

**Ingestion:** Not expected to be a health hazard via ingestion. Large doses may produce abdominal spasms, diarrhea.

**Skin Contact:** No adverse effects expected. May cause irritation or sensitization in sensitive individuals.

**Eye Contact:** May cause mild irritation, possible reddening.

**Chronic Exposure:** No information found.

**Aggravation of Pre-existing Conditions:** No information found.

### 3. Composition/Information on Ingredients

Ingredient	Synonyms	CAS #	Percent	Hazardous
Soy bean oil	Soya oil	8001-22-7	60%	No
Emulsifiers and proprietary nutrient package containing nitrogen, phosphorus and vitamin B <sub>12</sub>		Mixture	5 – 15%	No
Sodium lactate	2-hydroxypropionic acid sodium salt	72-17-3	<5%	Yes
Water		7732-18-5	20 - 30%	No

The emulsifiers and nutrient package mixture is a trade secret and consists of ingredients of unknown acute toxicity.

### 4. First Aid Measures

<b>Inhalation:</b>	Not expected to require first aid measures. Remove to fresh air. Get medical attention for any breathing difficulty.
<b>Ingestion:</b>	If large amounts were swallowed, give water to drink and get medical advice.
<b>Skin Contact:</b>	Not expected to require first aid measures. Wash exposed area with soap and water. Get medical advice if irritation develops.
<b>Eye Contact:</b>	Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention if irritation persists.

### 5. Fire Fighting Measures

<b>Fire:</b>	Flash point: >200 C (>392 F). Not considered to be a fire hazard. Isolate from heat and open flame.
<b>Explosion:</b>	Not considered to be an explosion hazard. Closed containers may explode if exposed to extreme heat.
<b>Fire Extinguishing Media:</b>	Dry chemical, foam, or carbon dioxide. Water spray may be ineffective on fire, but can protect fire-fighters and cool closed containers. Use fog nozzles if water is used.
<b>Special Information:</b>	In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full face piece operated in the pressure demand or other positive pressure mode.



## 6. Accidental Release Measures

Clean-up personnel may require protective clothing. Absorb in sand, paper towels, "Oil Dry", or other inert material. Scoop up and containerize for disposal. Flush trace residues to sewer with soap and water. Containerized waste may be sent to an approved waste disposal facility.

---

## 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Containers of this material are not hazardous when empty since they do not contain vapors or harmful substances; observe all warnings and precautions listed for the product. Do not store above 49 C (120 F). Keep container tightly closed and upright when not in use to prevent leakage.

---

## 8. Exposure Controls/Personal Protection

<b>Airborne Exposure Limits:</b>	None established.
<b>Ventilation System:</b>	Not expected to require any special ventilation.
<b>Personal Respirators (NIOSH Approved):</b>	Not expected to require personal respirator usage.
<b>Skin Protection:</b>	Wear protective gloves and clean body-covering clothing.
<b>Eye Protection:</b>	Use chemical safety goggles and/or a full face shield where splashing is possible. Provide readily accessible eye wash stations and safety showers.
<b>Slips, Trips, and Falls:</b>	Material is slippery when spilled. Clean up with sand, paper towels, "Oil Dry", or other inert material.

---

## 9. Physical and Chemical Properties

<b>Appearance:</b>	White liquid.
<b>Odor:</b>	Vegetable oil.
<b>Solubility:</b>	Miscible in water.
<b>Specific Gravity (water=1):</b>	0.95-0.98. 8.09 pounds per gallon.
<b>pH:</b>	6-7 (40% aqueous solution)
<b>% Volatiles by volume @ 21C (70F):</b>	Negligible.
<b>Boiling Point:</b>	≥ 100C (≥ 212F)
<b>Melting Point:</b>	No information found.
<b>Flash Point (F):</b>	No information found.
<b>Autoignition Temperature:</b>	No information found.
<b>Decomposition Temperature:</b>	No information found.
<b>Vapor Density (Air=1):</b>	No information found.
<b>Vapor Pressure (mm Hg):</b>	< 1.0 @ 20C (68F).
<b>Evaporation Rate (BuAc=1):</b>	No information found.
<b>Viscosity @23 C (73 F):</b>	213 centipoises (1.2 centipoises diluted 1:10)
<b>Partition Coefficient (octanol/water):</b>	No information found.

---

## 10. Stability and Reactivity

<b>Stability:</b>	Stable under ordinary conditions of use and storage.
<b>Reactivity:</b>	Not reactive under ordinary conditions.
<b>Hazardous Decomposition Products:</b>	Carbon dioxide and carbon monoxide may form when heated to decomposition.
<b>Hazardous Polymerization:</b>	Will not occur.
<b>Incompatibilities:</b>	Strong oxidizers, acids.
<b>Conditions to Avoid:</b>	Incompatibles. Isolate from heat and open flame.

---

## 11. Toxicological Information

<b>Soybean Oil:</b>	No information found on toxicology. It is not a carcinogen listed by IARC, NTP, NIOSH, OSHA, or ACGIH.
<b>Emulsifier/Nutrient Mixture:</b>	No information found on toxicology. It is not a carcinogen listed by IARC, NTP, NIOSH, OSHA, or ACGIH.
<b>Sodium Lactate:</b>	Oral rat LD50: 2,000 mg/kg. 100 mg caused mild irritation to rabbit eye in Draize test. This compound is not listed as a carcinogen by IARC, NTP, NIOSH, OSHA, or ACGIH.
<b>SRS-SD:</b>	The toxicity of the mixture has not been measured.

---

## 12. Ecological Information

<b>Environmental Fate:</b>	No information found.
<b>Environmental Toxicity:</b>	No information found.
<b>Degradability:</b>	This product is completely biodegradable under both aerobic and anaerobic conditions.
<b>Soil Mobility:</b>	This compound will move with groundwater until the adsorbed onto the soil. Degradation products may be mobile.
<b>Bioaccumulation Potential:</b>	No information found.

---

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

## 14. Transport Information

Not regulated.

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## 15. Regulatory Information



**OSHA STATUS:** This product is not hazardous under the criteria of the Federal OSHA hazard Communication Standard 29 CFR 1910.1200. However, thermal processing and decomposition fumes from this product may be hazardous as noted in Section 10.

**TSCA STATUS:** No component of this product is listed on the TSCA inventory.

**CERCLA (Comprehensive Response Compensation, and Liability Act):** Not reportable.

**SARA TITLE III (Superfund Amendments and Reauthorization Act)**

Section 312 Extremely Hazardous Substances: None

Section 311/312 Hazard Categories: Non-hazardous Under Section 311/312

Section 313 Toxic Chemicals: None

**RCRA STATUS:** If discarded in its purchased form, this product would not be a hazardous waste either by listing or by characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste. (40 CFR 261.20-24)

**CALIFORNIA PROPOSITION 65:** The following statement is made in order to comply with the California safe Drinking Water and Toxic Enforcement Act of 1986. The product contains no chemicals known to the State of California to cause cancer.

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## 16. Other Information

**NFPA Ratings:**

Health: **1** Flammability: **1** Reactivity: **1**

**Date Prepared:**

January 17, 2014

**Revision Information:**

SDS Section(s) changed since last revision of document include: None.

**Disclaimer:**

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**Prepared by:**  
**Phone Number:**

Terra Systems, Inc.  
(302) 798-9553 (U.S.A.)

---

## Sodium Bicarbonate

### Section 1 - Product and Company Identification

<b>Material Name</b>	▪ <b>Sodium Bicarbonate</b>
<b>CAS Number</b>	▪ 144-55-8
<b>Chemical Category</b>	▪ Particulates not otherwise classified (PNOC)
<b>EINECS</b>	▪ 205-633-8
<b>Molecular Formula</b>	▪ NaHCO <sub>3</sub>
<b>Molecular Weight</b>	▪ 84
<b>Product Description</b>	▪ White crystalline or powdered solid with no odor.
<b>Synonyms</b>	▪ Baking Soda; Bicarbonate of Soda; Sodium Hydrogen Carbonate
<b>Manufacturer</b>	▪ Innophos PO Box 8000 259 Prospect Plains Road Cranbury, NJ 08512-8000 United States
<b>Telephone</b>	
<b>Technical</b>	▪ 609-495-2495
<u><b>Emergency</b></u>	▪ 800-424-9300 - Chemtrec
<u><b>Emergency</b></u>	▪ 615-386-7816 - Innophos Emergency Communication Team (ECT)
<u><b>Emergency</b></u>	▪ 703-527-3887 - Chemtrec - International Collect Calls
<b>Preparation Date</b>	▪ 08/22/2007
<b>Last Revision Date</b>	▪ 09/15/2010

### Section 2 - Hazards Identification

#### Emergency Overview

##### WARNING

Causes mild skin irritation. Causes eye irritation. May be harmful if swallowed.

**Prevention** Wash thoroughly after handling. Do not breathe dusts or mists.

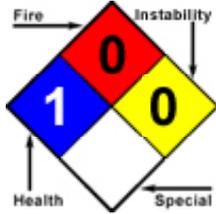
**Response** If skin irritation occurs: Get medical advice/attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. Call a POISON CENTER or doctor/physician if you feel unwell.

**Storage/Disposal** Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

<b>OSHA</b>	▪ None
<b>WHMIS</b>	▪ None

- EU GHS**
- None
  - Skin Corrosion/Irritation - Category 3, Serious Eye Damage, Eye Irritation - Category 2B, Acute Toxicity - Category 5
- Route Of Entry**
- Inhalation, Ingestion
- Medical Conditions Aggravated by Exposure**
- Disorders of the lungs, Skin

**NFPA:**



**Potential Health Effects**

**Inhalation**

- Acute (Immediate)**      ▪ May cause mild irritation.
- Chronic (Delayed)**      ▪ No data available.

**Skin**

- Acute (Immediate)**      ▪ May cause mild irritation.
- Chronic (Delayed)**      ▪ No data available.

**Eye**

- Acute (Immediate)**      ▪ May cause mild irritation.
- Chronic (Delayed)**      ▪ No data available.

**Ingestion**

- Acute (Immediate)**      ▪ Low acute oral toxicity. May cause nausea, vomiting, abdominal pain and diarrhea.
- Chronic (Delayed)**      ▪ No data available.

**Carcinogenic Effects**

- This product does not contain any ingredient designated by IARC, NTP, ACGIH or OSHA as probable or suspected human carcinogens.

See Section 12 for Ecological Information.

**Section 3 - Composition/Information on Ingredients**

Hazardous Components						
Chemical Name	CAS	%(weight)	UN;EINECS	LD50/LC50	EU Classification & R Phrases	Other
Carbonic acid sodium salt (1:1)	144-55-8	100%	205-633-8	Ingestion/Oral-Rat LD50: =4220 mg/kg	NDA	NDA

Under United States Regulations (29 CFR 1900.1200 - Hazard Communication Standard), this product is not considered hazardous. In Canada, the product mentioned above is not considered hazardous under the Workplace Hazardous Materials Information System (WHMIS). This product is not considered dangerous according to the European Directive 67/548/EEC. According to Regulation (EC) No. 1272/2008 (CLP) this material is considered hazardous. According to the Globally Harmonized Standard for Classification and Labeling (GHS) this product is considered hazardous.

See Section 11 for Toxicological Information.

**Section 4 - First Aid Measures**

- Inhalation**
  - Move victim to fresh air. If signs/symptoms continue, get medical attention.
- Skin**
  - IF ON SKIN: Wash with plenty of soap and water. Remove clothing and wash thoroughly before use. If skin irritation occurs: Get medical advice/attention.
- Eye**
  - In case of contact with substance, immediately flush eyes with running water for at least 20 minutes. If eye irritation persists: Get medical advice/attention.
- Ingestion**
  - Do not induce vomiting unless instructed to do so by a physician. If swallowed give 2-3 glasses of water if victim is conscious and alert. Do not give anything by mouth to an unconscious person. Do not leave victim unattended.
- Notes to Physician**
  - All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.
- Other Information**
  - Call 911 or emergency medical service. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

See Section 2 for Potential Health Effects.

## Section 5 - Fire Fighting Measures

- Extinguishing Media**
  - Not combustible. Use extinguishing media suitable for surrounding fire.
- Unsuitable Extinguishing Media**
  - No data available.
- Firefighting Procedures**
  - Keep unauthorized personnel away.
- Unusual Fire and Explosion Hazards**
  - Non-combustible.
- Hazardous Combustion Products**
  - Oxides of carbon.
- Protection of Firefighters**
  - Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection.

## Section 6 - Accidental Release Measures

- Personal Precautions**
  - Ventilate enclosed areas. Do not touch or walk through spilled material.
- Emergency Procedures**
  - Keep unauthorized personnel away.
- Environmental Precautions**
  - Do not flush to drain. Spills may be reportable to the National Response Center (800-424-8802) and to state and/or local agencies.
- Containment/Clean-up Measures**
  - Sweep or vacuum up and place in an appropriate closed container. Avoid generating dust. Clean up residual material by washing area with water. Collect washings for disposal.
- Prohibited Materials**
  - None known.

## Section 7 - Handling and Storage

- Handling**
  - Avoid direct or prolonged contact with skin and eyes. Avoid breathing dust.
- Storage**
  - Store in a tightly closed container. Store in a cool/low-temperature, well-ventilated, dry place.
- Special Packaging Materials**
  - No data available
- Incompatible Materials or Ignition Sources**
  - No data available

## Section 8 - Exposure Controls/Personal Protection

### Personal Protective Equipment

#### Pictograms



#### Respiratory

- For limited exposure use an N95 dust mask. For prolonged exposure use an air-

purifying respirator with high efficiency particulate air (HEPA) filters. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or symptoms are experienced.

**Eye/Face**

**Hands**

**Skin/Body**

**General Industrial Hygiene Considerations**

**Engineering Measures/Controls**

- Wear safety goggles.
- Wear appropriate gloves.
- Wear long sleeves and/or protective coveralls.
- Wash hands before eating.
- Dilution ventilation. Adequate ventilation systems as needed to control concentrations of airborne contaminants below applicable threshold limit values.

Exposure Limits/Guidelines						
	Result	ACGIH	Argentina	Canada Ontario	Canada Quebec	China
Sodium Bicarbonate	STELs	Not established	Not established	Not established	Not established	16 mg/m <sup>3</sup> STEL (free SiO <sub>2</sub> <10%, except asbestos and toxic substances. Use PC-STEL of silica When free SiO <sub>2</sub> >10%, total)  <i>as Particulates not otherwise classified</i>
	TWAs	10 mg/m <sup>3</sup> TWA (inhalable particles, recommended); 3 mg/m <sup>3</sup> TWA (respirable particles, recommended)  <i>as Particulates not otherwise classified</i>	10 mg/m <sup>3</sup> TWA (inhalable fraction, particulate matter containing no asbestos and less than 1% crystalline silica); 3 mg/m <sup>3</sup> TWA (respirable fraction, particulate matter containing no asbestos and less than 1% crystalline silica)  <i>as Particulates not otherwise classified</i>	10 mg/m <sup>3</sup> TWAEV (inhalable particulate); 3 mg/m <sup>3</sup> TWAEV (respirable particulate)  <i>as Particulates not otherwise classified</i>	10 mg/m <sup>3</sup> TWAEV (total dust, containing no asbestos and less than 1% crystalline silica)  <i>as Particulates not otherwise classified</i>	8 mg/m <sup>3</sup> TWA (free SiO <sub>2</sub> <10%, except asbestos and toxic substances. Use PC-TWA of silica When free SiO <sub>2</sub> >10%, total)  <i>as Particulates not otherwise classified</i>

**Exposure Limits/Guidelines (Con't.)**

	Result	Indonesia	Malaysia	New Zealand	OSHA	OSHA Vacated
Sodium Bicarbonate	TWAs	10 mg/m <sup>3</sup> NAB (not containing asbestos and the crystal content is <1%, inhalable particulate); 3 mg/m <sup>3</sup> NAB (not containing asbestos and the crystal content is <1%, respirable particulate)  <i>as Particulates not otherwise classified</i>	10 mg/m <sup>3</sup> TWA (particulate matter containing no asbestos and <1% crystalline silica, inhalable fraction); 3 mg/m <sup>3</sup> TWA (particulate matter containing no asbestos and <1% crystalline silica, respirable fraction)  <i>as Particulates not otherwise classified</i>	10 mg/m <sup>3</sup> TWA (inspirable dust); 3 mg/m <sup>3</sup> TWA (respirable dust)  <i>as Particulates not otherwise classified</i>	15 mg/m <sup>3</sup> TWA (total dust); 5 mg/m <sup>3</sup> TWA (respirable fraction)  <i>as Particulates not otherwise classified</i>	15 mg/m <sup>3</sup> TWA (total dust); 5 mg/m <sup>3</sup> TWA (respirable fraction)  <i>as Particulates not otherwise classified</i>

**Exposure Limits/Guidelines (Con't.)**

	Result	Singapore	United States - California
Sodium Bicarbonate	TWAs	10 mg/m3 PEL <i>as Particulates not otherwise classified</i>	10 mg/m3 PEL (total dust); 5 mg/m3 PEL (respirable fraction) <i>as Particulates not otherwise classified</i>

#### Key to abbreviations

PEL = Permissible Exposure Level determined by the Occupational Safety and Health Administration (OSHA)

STEL = Short Term Exposure Limits are based on 15-minute exposures

TWAEV = Time-Weighted Average Exposure Value

TWA = Time-Weighted Averages are based on 8h/day, 40h/week exposures

ACGIH = American Conference of Governmental Industrial Hygiene

OSHA = Occupational Safety and Health Administration

NAB = Threshold Values (Indonesia)

## Section 9 - Physical and Chemical Properties

### Physical Form

- Solid

### Appearance/Description

- White crystalline or powdered solid with no odor.

Color : White		Odor : Odorless	
Taste : NDA		Odor Threshold : NDA	
Boiling Point:	NDA	Vapor Pressure:	NDA
Melting Point:	NDA	Vapor Density:	NDA
Specific Gravity:	1.19 to 2.22	Evaporation Rate:	NDA
Density:	74.2915 to 138.5943 lb(s)/ft <sup>3</sup>	VOC (Wt.):	NDA
Bulk Density:	0.98 g/cm <sup>3</sup>	VOC (Vol.):	NDA
pH:	8.5 (@ 1 wt/wt%)	Volatiles (Wt.):	NDA
Water Solubility:	Hydrolyzes	Volatiles (Vol.):	NDA
Solvent Solubility:	NDA	Flash Point:	NDA
Viscosity:	NDA	Flash Point Test Type:	NDA
Half-Life:	NDA	UEL:	NDA
Octanol/Water Partition coefficient:	NDA	LEL:	NDA
Coefficient of water/oil distribution:	NDA	Autoignition:	NDA
Bioaccumulation Factor:	NDA	Bioconcentration Factor:	NDA
Biochemical Oxygen Demand BOD/BOD <sub>5</sub> :	NDA	Chemical Oxygen Demand:	NDA
Persistence:	NDA	Degradation:	NDA

## Section 10 - Stability and Reactivity

### Stability

- Stable under normal temperatures and pressures.

### Hazardous Polymerization

- Hazardous polymerization not indicated.

### Conditions to Avoid

- Dusting conditions. Elevated temperatures. Extreme humidity. Heat. Moisture.

### Incompatible Materials

- Strong acids, strong oxidizing agents.

### Hazardous Decomposition Products

- Oxides of carbon. Carbon dioxide.

## Section 11 - Toxicological Information

Sodium Bicarbonate				144-55-8					
Test Type	Dosage	Units	Route	Species	Duration	Results	Test Class	Target Organs	Comments
Irritation			Skin	Rabbit	NDA	NDA	Mild irritation	NDA	NDA
Acute Toxicity	> 4.74	mg/L	Inhalation	Rat	NDA	LC50	NDA	NDA	NDA
Acute Toxicity	4220	mg/kg	Ingestion/Oral	Rat	NDA	LD50	NDA	NDA	NDA
Acute Toxicity	20	mg/kg	Ingestion/Oral	Man	5 Day(s) Intermittent	TDLo	NDA	NDA	NDA
Irritation	100	mg	Eye	Rabbit	30 Second(s)	NDA	Mild irritation	NDA	NDA
Irritation	30	mg	Skin	Human	3 Day(s)	NDA	Mild irritation	NDA	NDA

### Key to abbreviations

TD = Toxic Dose

LD = Lethal Dose

LC = Lethal Concentration

## Section 12 - Ecological Information

Sodium Bicarbonate			144-55-8			
Dosage	Units	Species	Species Description	Duration	Results	Comments
7700	mg/L	Fish	Rainbow Trout	95 Hour(s)	LC50	NDA
7100	mg/L	Fish	Bluegill Sunfish	95 Hour(s)	LC50	NDA
4100	mg/L	Water Flea	Daphnia magna	48 Hour(s)	EC50	NDA

### Ecological Fate

- Product decomposes rapidly on contact with moisture to form the corresponding acid.

### Persistence/Degradability

- No data available.

### Bioaccumulation Potential

- No data available.

### Mobility in Soil

- No data available.

## Section 13 - Disposal Considerations

### Product

- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

## Section 14 - Transportation Information

The listed Transportation Classification does not address regulatory variations due to changes in package size, mode of shipment or other regulatory descriptors.

### DOT - United States - Department of Transportation

Shipping Name: Not Regulated

### TDG - Canada - Transport of Dangerous Goods

Shipping Name: Not Regulated

### IMO/IMDG - International Maritime Transport

Shipping Name: Not Regulated

**ADN - Europe Transport of Dangerous Goods by Road/Inland Waterway**

Shipping Name: Not Regulated

**IATA - International Air Transport Association**

Shipping Name: Not Regulated

**ADR - Europe Transport of Dangerous Goods by Road/Inland Waterway**

Shipping Name: Not Regulated

**RID - Europe Transport of Dangerous Goods by Railways**

Shipping Name: Not Regulated

**Section 15 - Regulatory Information**

SARA Hazard Classifications . None

State Right To Know				
Component	CAS	MA	NJ	PA
Carbonic acid sodium salt (1:1)	144-55-8	No	No	No

Inventory						
Component	CAS	Australia AICS	Canada DSL	Canada NDSL	China	EU EINECS
Carbonic acid sodium salt (1:1)	144-55-8	Yes	Yes	No	Yes	Yes

Inventory (Con't.)						
Component	CAS	EU ELNICS	Japan ENCS	Korea KECL	New Zealand	Philippines PICCS
Carbonic acid sodium salt (1:1)	144-55-8	No	Yes	Yes	Yes	Yes

Inventory (Con't.)		
Component	CAS	TSCA
Carbonic acid sodium salt (1:1)	144-55-8	Yes

## Australia

### Labor

#### Australia - Hazardous Substances - Substances Requiring Health Surveillance

None Listed

#### Australia - High Volume Industrial Chemicals List

- Sodium Bicarbonate  
(Chemical Name-Sodium bicarbonate) 144-55-8
- Carbonic acid sodium salt (1:1) 144-55-8 100%

#### Australia - List of Designated Hazardous Substances - Classification

None Listed

### Environment

#### Australia - National Pollutant Inventory (NPI) Substance List

None Listed

#### Australia - Ozone Protection Act - Scheduled Substances

None Listed

#### Australia - Priority Existing Chemical Program

None Listed

## Canada

### Labor

#### Canada - WHMIS - Classifications of Substances

- Sodium Bicarbonate  
(Chemical Name-Sodium bicarbonate) 144-55-8 Uncontrolled product according to WHMIS classification criteria
- Carbonic acid sodium salt (1:1) 144-55-8 100% Uncontrolled product according to WHMIS classification criteria

#### Canada - WHMIS - Ingredient Disclosure List

None Listed

### Environment

#### Canada - CEPA - Priority Substances List

None Listed

## Europe

### Other

#### EU - CLP (1272/2008) - Annex VI - Table 3.2 - Classification

None Listed

#### EU - CLP (1272/2008) - Annex VI - Table 3.2 - Concentration Limits

None Listed

#### EU - CLP (1272/2008) - Annex VI - Table 3.2 - Labelling

None Listed

#### EU - CLP (1272/2008) - Annex VI - Table 3.2 - Notes - Substances and Preparations

None Listed

#### EU - CLP (1272/2008) - Annex VI - Table 3.2 - Safety Phrases

None Listed

## Mexico

### Other

#### Mexico - Hazard Classifications

None Listed

#### Mexico - Regulated Substances

None Listed

## United States

### Labor

U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals

None Listed

U.S. - OSHA - Specifically Regulated Chemicals

None Listed

### Environment

U.S. - CAA (Clean Air Act) - 1990 Hazardous Air Pollutants

None Listed

## United States - California

### Environment

U.S. - California - Proposition 65 - Carcinogens List

None Listed

U.S. - California - Proposition 65 - Developmental Toxicity

None Listed

U.S. - California - Proposition 65 - Maximum Allowable Dose Levels (MADL)

None Listed

U.S. - California - Proposition 65 - No Significant Risk Levels (NSRL)

None Listed

U.S. - California - Proposition 65 - Reproductive Toxicity - Female

None Listed

U.S. - California - Proposition 65 - Reproductive Toxicity - Male

None Listed

## United States - Pennsylvania

### Labor

U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List

None Listed

U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances

None Listed

## United States - Rhode Island

### Labor

U.S. - Rhode Island - Hazardous Substance List

- Sodium Bicarbonate as Particul Toxic

## Other Information

- FDA Status: This product meets the compositional requirements of: 21 CFR 184.1736 SODIUM BICARBONATE

## Section 16 - Other Information

### Preparation Date

- 08/22/2007

### Last Revision Date

- 09/15/2010

### Disclaimer/Statement of Liability

- The information herein is given in good faith but no warranty, expressed or implied, is made.

#### Key to abbreviations

NDA = No Data Available

## **SSHP ATTACHMENT 4**

### **PROPERTIES OF PRIMARY CONTAMINANTS OF CONCERN**

Properties of the Primary Contaminants of Concern

Contaminant	PEL ppm	TLV ppm	Route(s) of Exposure	Signs and Symptoms of Exposure		Target Organs	IP (eV)	Specific Gravity	VP (mm Hg)	Flash Point (°F)	LEL %	UEL %
				Acute	Chronic							
Benzene (CAS # 71-4-32)	1 ppm STEL = 5 ppm	0.5 ppm STEL = 2.5 ppm	Inhalation Ingestion Contact Absorption	Irritation of eyes, skin, nose, and throat, headache, dizziness, nausea, staggered gait, fatigue	Cancer (leukemia), adverse reproductive effects (female fertility, birth defects)	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	9.24	0.88	75	12	1.2	7.8
Trichloroethene (TCE) (CAS # 79-01-6)	100 ppm Ceiling = 200 ppm	10 ppm STEL 25 ppm	Inhalation Absorption Ingestion Contact	Irritation of eyes, skin, nose, drowsiness, fatigue, weakness, confusion, headache, nausea, dilated pupils	Liver and kidney damage	Eyes, skin, respiratory system, Central nervous system, heart, liver, kidneys	9.45	1.46	58	unk	8.0	10.5
Tetrachloroethene (PCE) (CAS # 127-18-4)	100 ppm Ceiling = 200 ppm	25 ppm STEL = 100 ppm	Inhalation Absorption Ingestion Contact	Irritation of eyes and skin, nose, throat; dizziness, excitement, drowsiness, nausea, vomiting, irritation of bladder, etc.	Narcotic effect, Teratogen Irritation of eyes, skin, nose, throat; dizziness,, excitement, drowsiness, nausea, vomiting, irritation of bladder, etc.	Eyes, skin, resp. sys, CNS, GI tract, blood, liver, kidneys	9.32	1.62	14	25 C 82	NA	NA

- Notes: NA = Not Applicable  
 IP = Ionization Potential  
 eV = Electron volt  
 LEL = Lower Explosive Limit  
 UEL = Upper Explosive Limit  
 PEL = Permissible Exposure Limit  
 C = Ceiling Limit  
 STEL = Short-term Exposure Limit  
 TLV = Threshold Limit Value  
 mg/m<sup>3</sup> = Milligrams per cubic meter of air  
 GI = Gastrointestinal Tract  
 CNS = Central Nervous System  
 atm = atmospheres  
 mm Hg = Millimeters of mercury  
 VP = Vapor Pressure  
 unk = unknown  
 ppm = Parts per million

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# **ATTACHMENT 5**

## **HOSPITAL MAPS**

Figure 9-1A: Rome Memorial Hospital Route Map from SD052-05

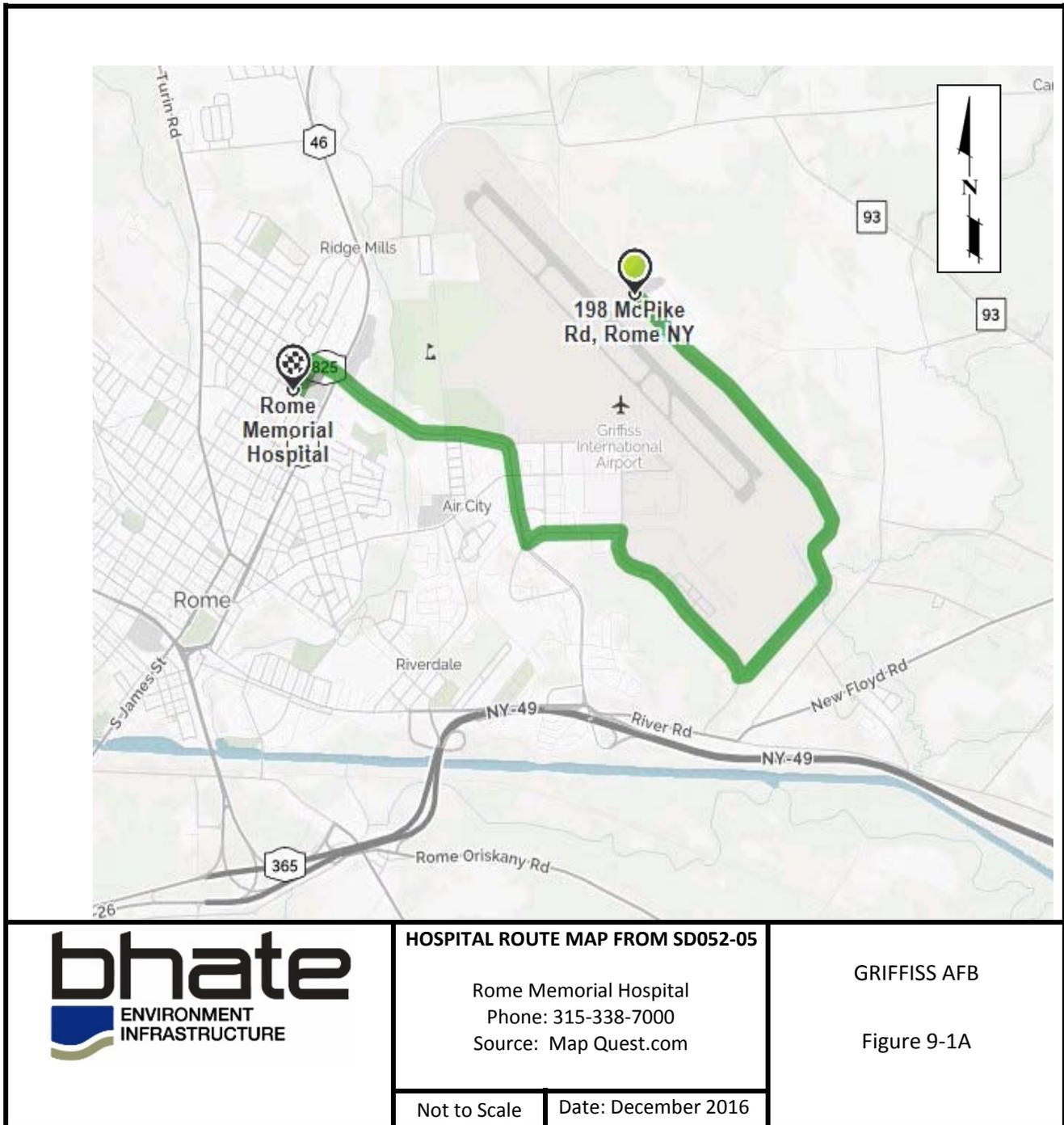
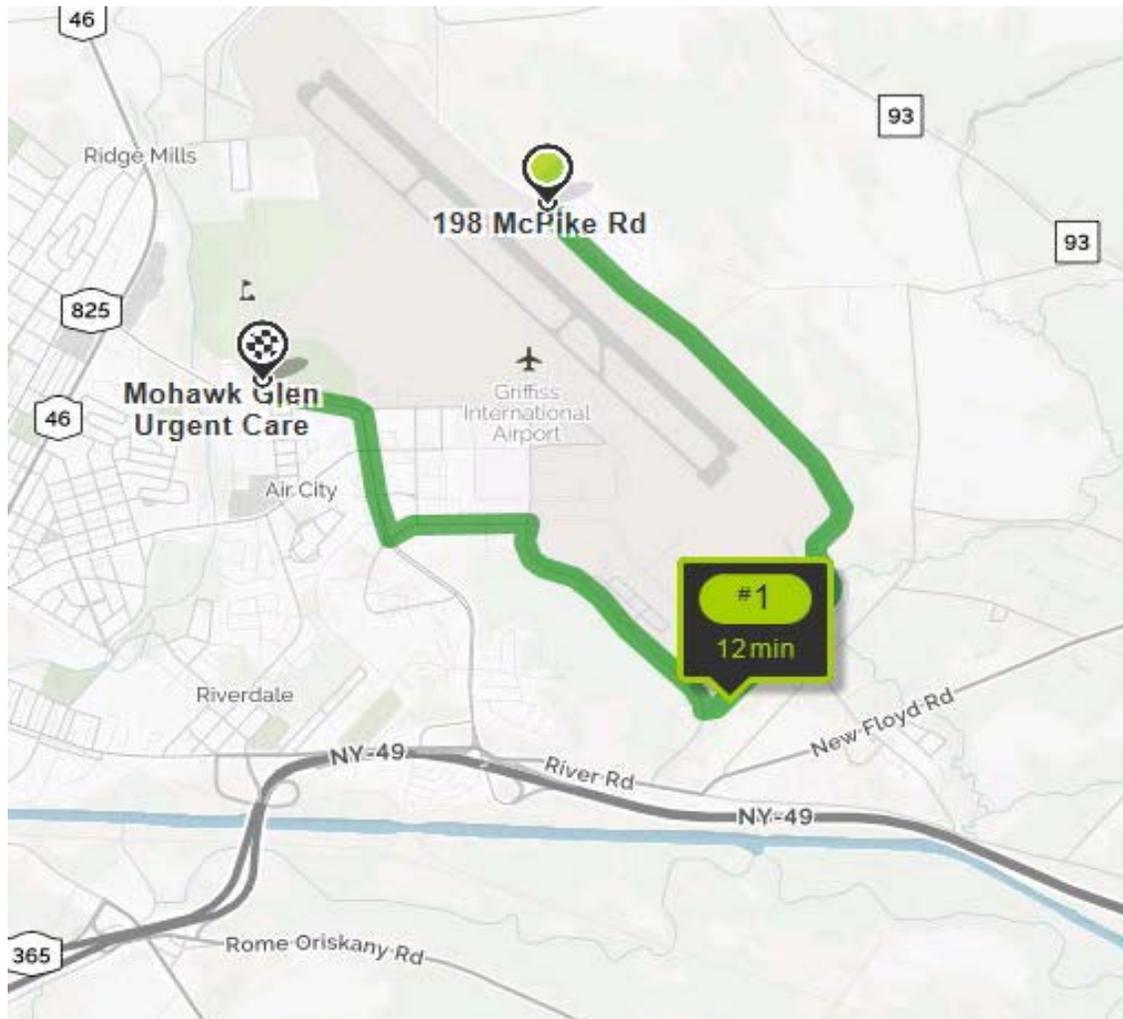


Figure 9-1B: Rome Memorial Hospital Directions From SD052-05

 Start out going <b>south</b> on McPike Rd toward Perimeter Rd. <p>----- Then 0.00 miles -----</p>  Turn <b>slight left</b> onto Perimeter Rd. <p>----- Then 2.75 miles -----</p>  Turn <b>right</b> to stay on Perimeter Rd. <p>----- Then 0.73 miles -----</p>  Perimeter Rd becomes Otis St. <p>----- Then 0.37 miles -----</p>  Turn <b>left</b> onto Ellsworth Rd. If you reach Olive Grove St you've gone a little too far. <p>----- Then 0.55 miles -----</p>  Enter next roundabout and take the 1st exit onto NY-825. <p>----- Then 1.78 miles -----</p>  Turn <b>left</b> onto N James St. Friendly's is on the corner. If you are on W Chestnut St and reach North Country National Scenic Trl you've gone a little too far. <p>----- Then 0.20 miles -----</p>  <b>1500 N JAMES ST is on the left.</b> Your destination is just past W Cedar St. If you reach E Oak St you've gone a little too far.			
	<b>HOSPITAL DIRECTIONS FROM SD052-05</b> Rome Memorial Hospital Phone: 315-338-7000 Source: MapQuest.com		GRIFFISS AFB  Figure 9-1B
	Not to Scale	Date: December 2016	

**Figure 9-2A: Mohawk Glen Urgent Care (Non-Emergency Clinic)**  
**Route Map from SD052-05**



**CLINIC ROUTE MAP FROM SD052-05**

Mohawk Glen Urgent Care  
 Phone: 315-337-2156  
 Source: MapQuest.com

GRIFFISS AFB

Figure 9-2A

Not to Scale

Date: December 2016

Figure 9-2B: Mohawk Glen Urgent Care (Non-Emergency Clinic) Directions from SD052-05

 Start out going <b>south</b> on McPike Rd toward Perimeter Rd. <p>----- Then 0.06 miles -----</p>  Turn <b>slight left</b> onto Perimeter Rd. <p>----- Then 2.75 miles -----</p>  Turn <b>right</b> to stay on Perimeter Rd. <p>----- Then 0.73 miles -----</p>  Perimeter Rd becomes Otis St. <p>----- Then 0.37 miles -----</p>  Turn <b>left</b> onto Ellsworth Rd. If you reach Olive Grove St you've gone a little too far. <p>----- Then 0.55 miles -----</p>  Enter next roundabout and take the 1st exit onto NY-825. <p>----- Then 0.90 miles -----</p>  Turn <b>right</b> onto Perimeter Rd. If you are on E Chestnut St and reach Urbandale Pkwy you've gone about 0.5 miles too far. <p>----- Then 0.05 miles -----</p>  Mohawk Glen Urgent Care, 91 PERIMETER RD is on the <b>left</b> . If you reach the end of Perimeter Rd you've gone about 0.9 miles too far.			
	<b>CLINIC ROUTE MAP FROM SD052-05</b> Mohawk Glen Urgent Care Phone: 315-337-2156 Source: MapQuest.com		GRIFFISS AFB Figure 9-2B
	Not to Scale	Date: December 2016	



**Figure 9-3B: Hospital Route Directions from SD052-02 and SD052-04  
Rome Memorial Hospital**



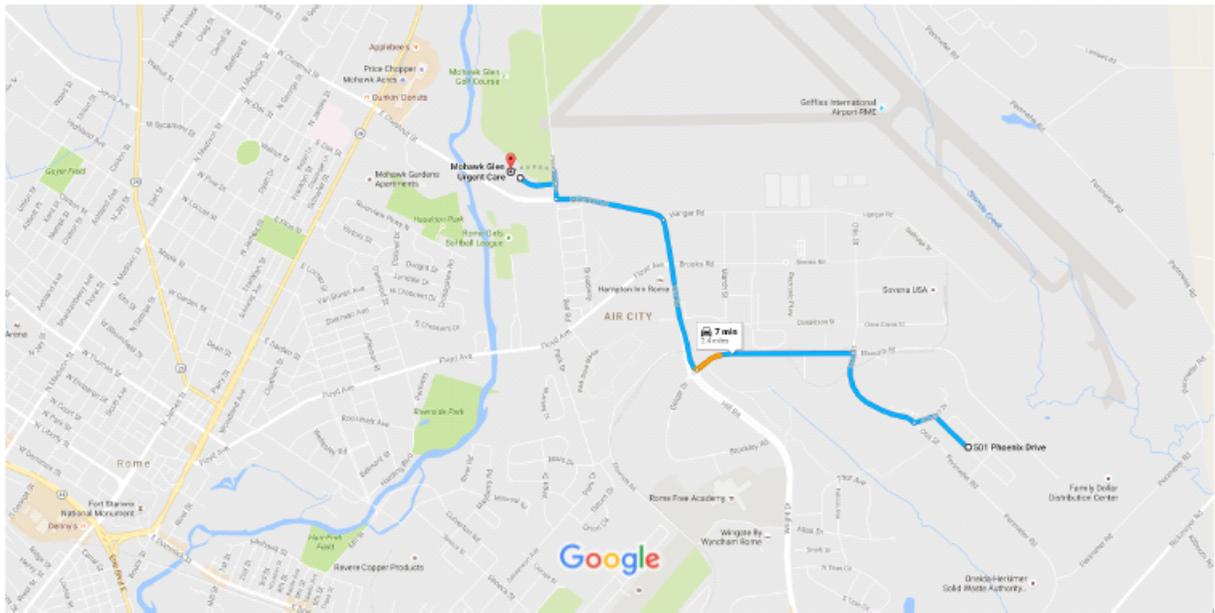
Figure 9-4A: Clinic Route Map from SD052-02 and SD052-04  
Mohawk Glen Urgent Care

9/16/2016

501 Phoenix Drive, Rome, NY 13441 to Mohawk Glen Urgent Care - Google Maps



501 Phoenix Drive, Rome, NY 13441 to Mohawk Glen Urgent Care Drive 2.4 miles, 7 min



Map data ©2016 Google 1000 ft



**CLINIC ROUTE MAP**

Mohawk Glen Urgent Care

Phone: 315-337-2156

Source: MapQuest.com

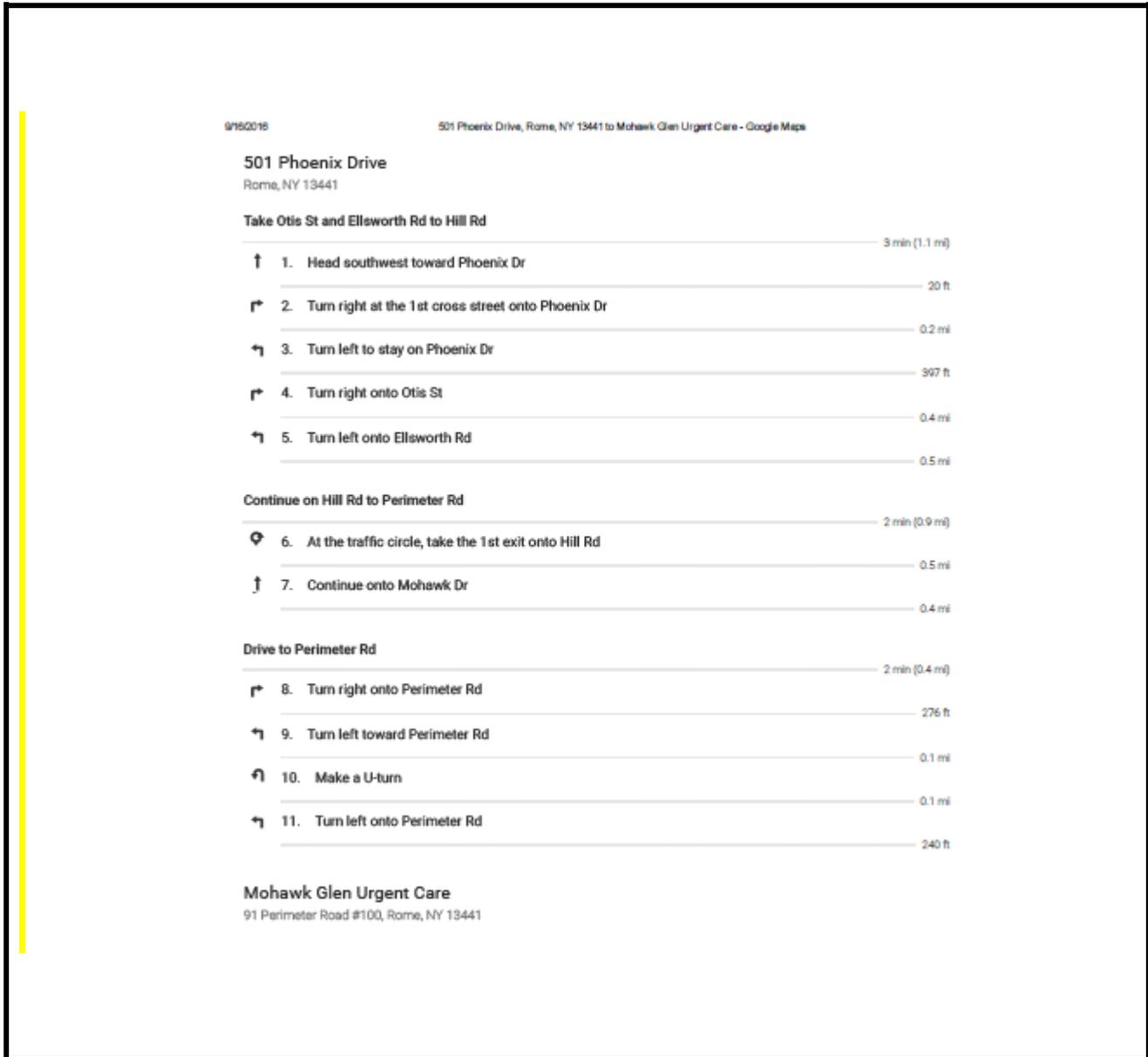
GRIFFISS AFB

Figure 9-4A

Not to Scale

Date: December 2016

Figure 9-4B: Clinic Route Directions from SD052-02 and SD052-04  
Mohawk Glen Urgent Care



**CLINIC ROUTE MAP**

Mohawk Glen Urgent Care

Phone: 315-337-2156

Source: MapQuest.com

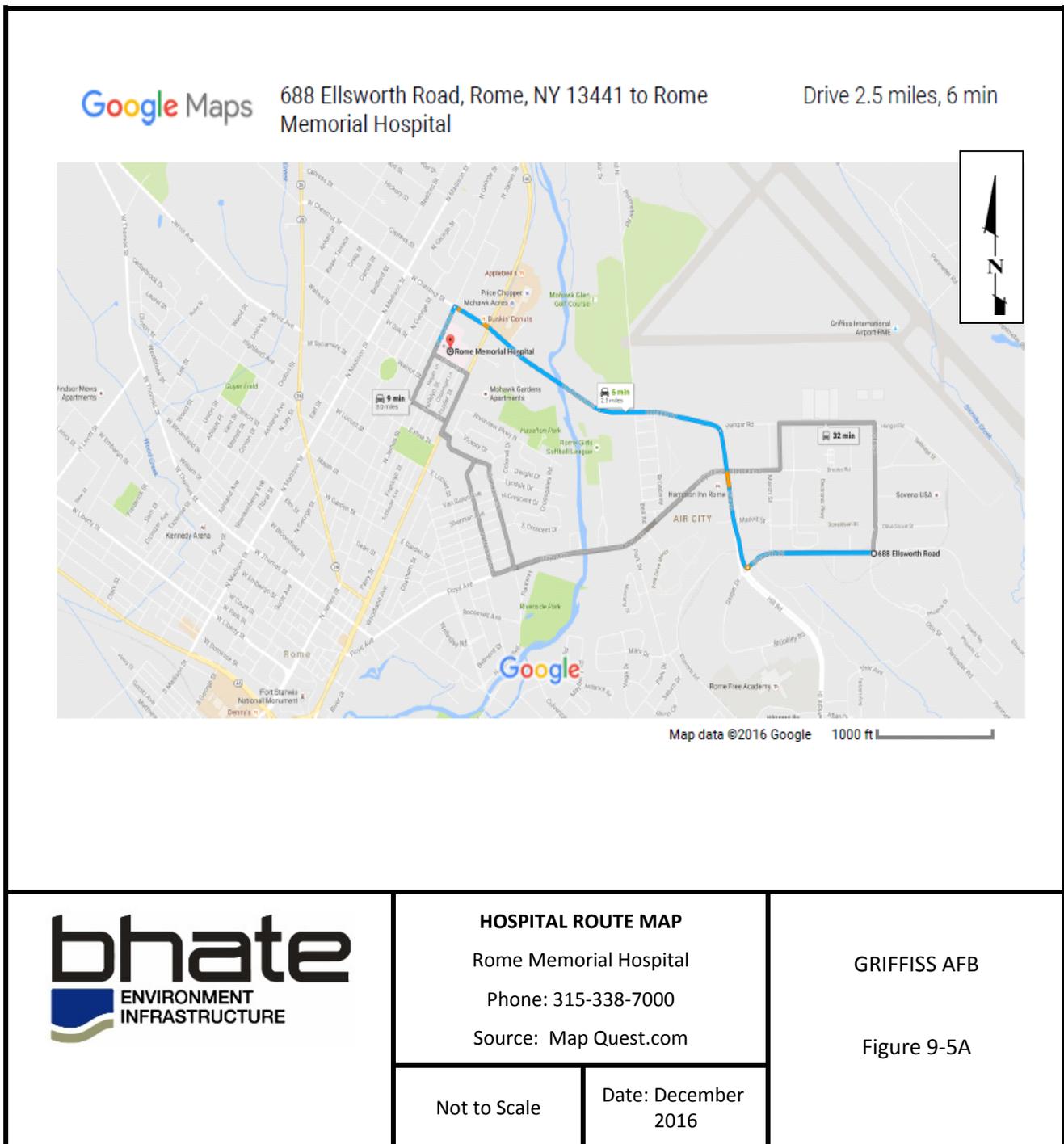
GRIFFISS AFB

Figure 9-4B

Not to Scale

Date: December  
2016

**Figure 9-5A: Hospital Route Map from SD052-01  
Rome Memorial Hospital**



**Figure 9-5B: Hospital Route Map from SD052-01**  
**Rome Memorial Hospital**

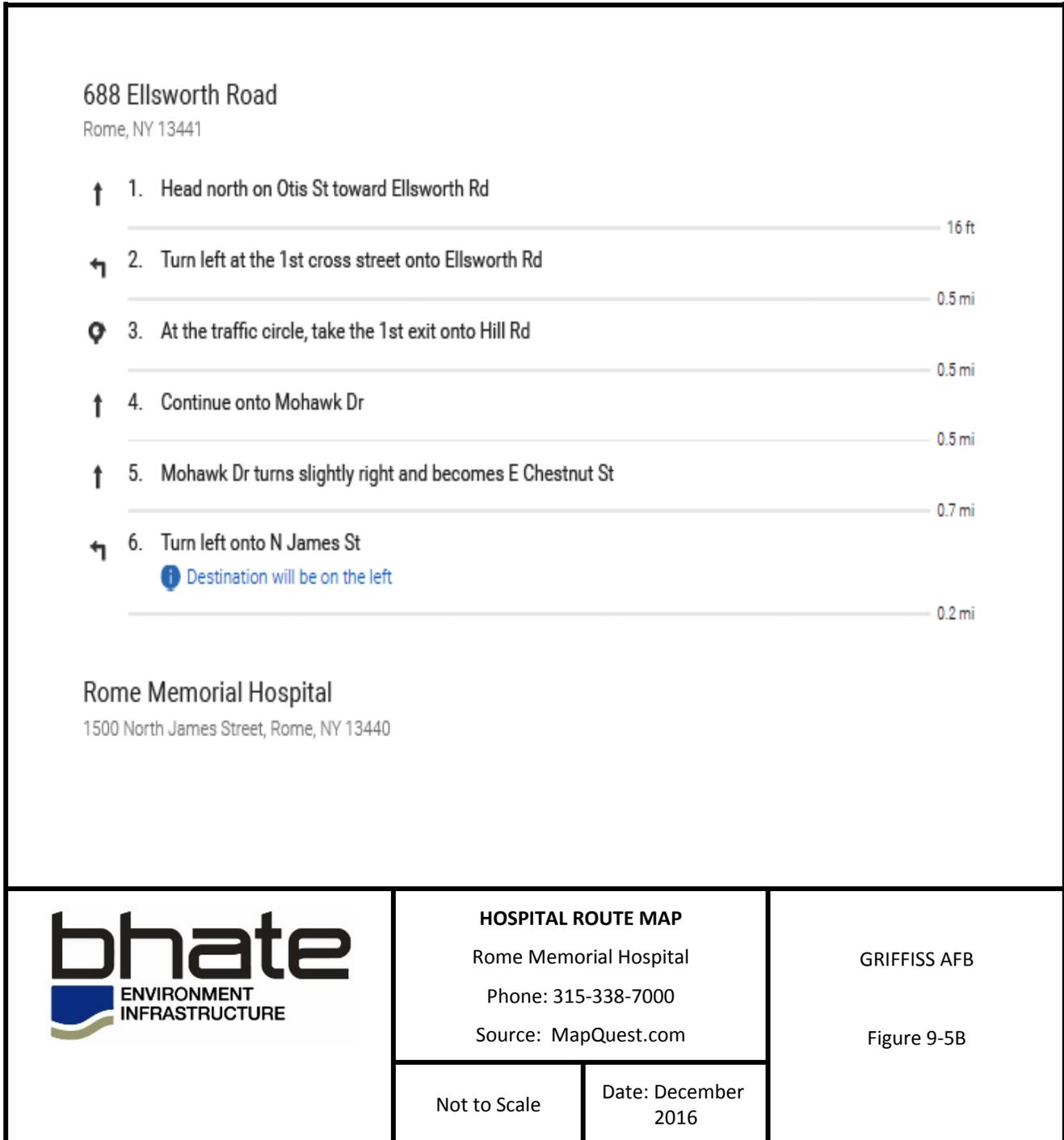
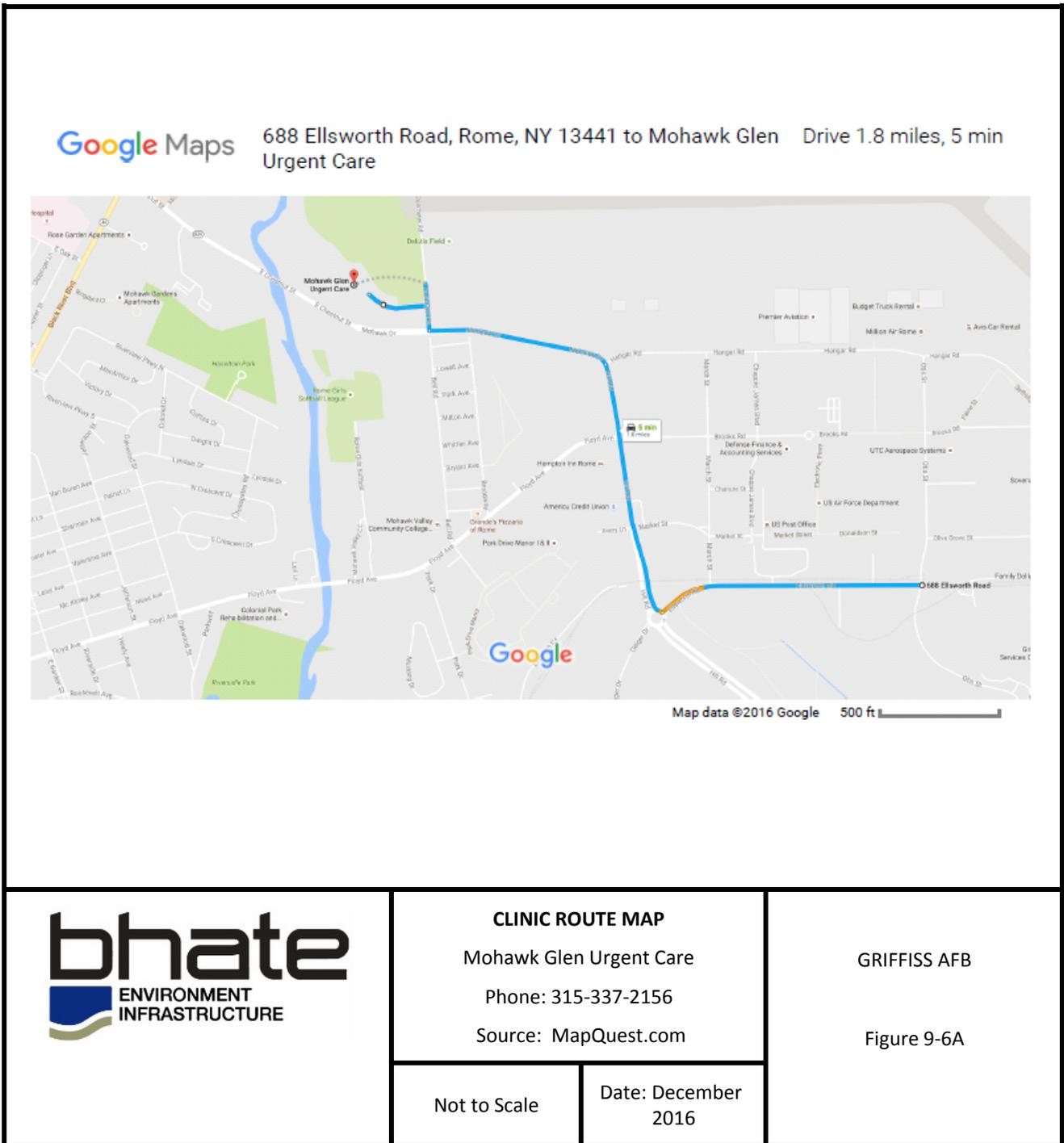
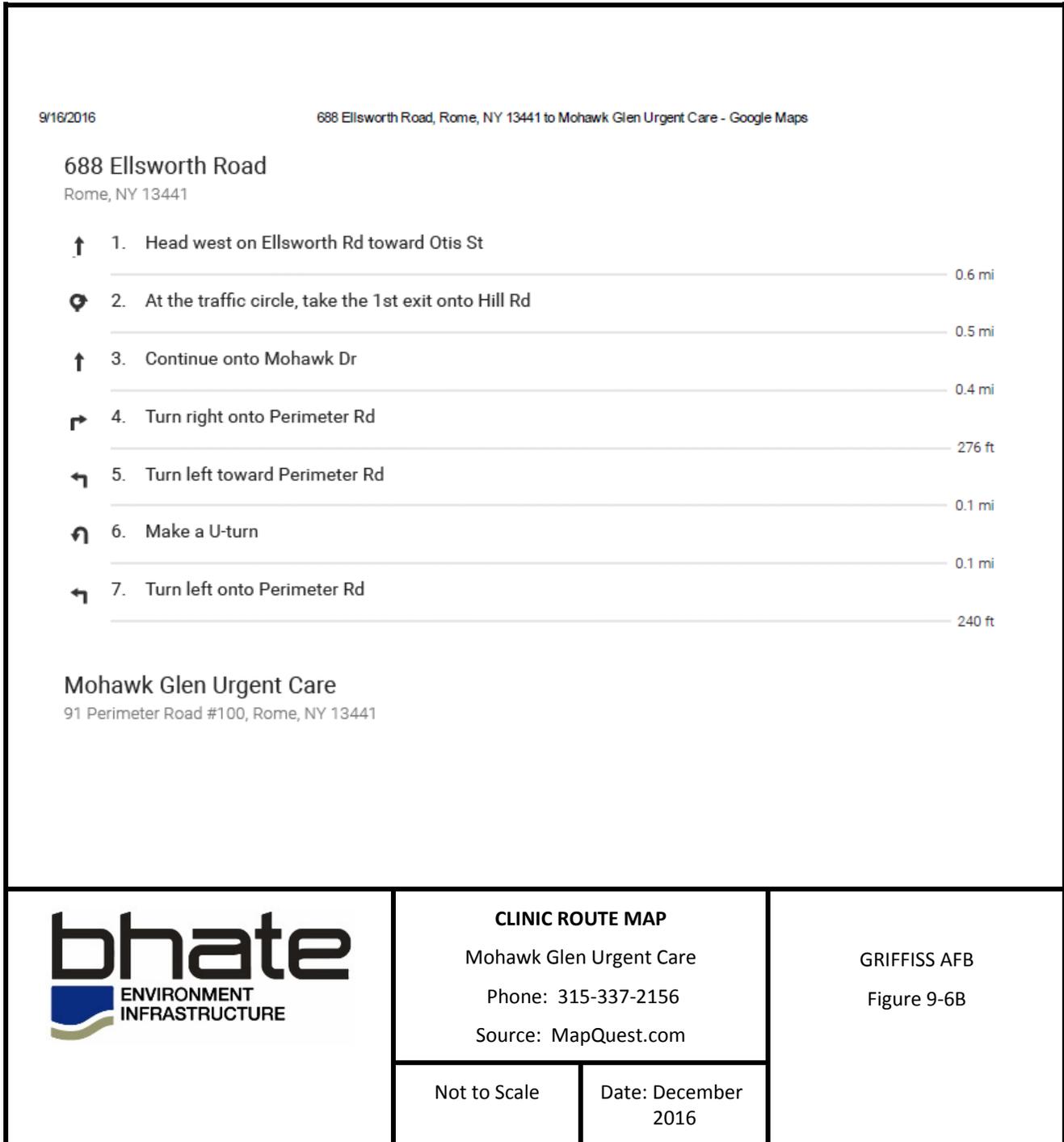


Figure 9-6A: Clinic Route Map from SD052-01  
Mohawk Glen Urgent Care



**Figure 9-6B: Clinic Route Directions from SD052-01  
Mohawk Glen Urgent Care**



**APPENDIX C**  
**ERD DESIGN CALCULATIONS**

Former Griffiss AFB Site SD052-01 Pilot Study Design

Injection Volumes and Target Intervals

Injection Point	Direct Push Technology	New/ Existing Injection Wells	Injectate Amounts								Injection Interval	
			EVO (lbs)	EVO (gal)	Deoxygenated Water (gal)	Sodium Bicarbonate (lbs)	Sodium Sulfite (lbs) (optional)	DHC (liters of 10 <sup>11</sup> cells of DHC)	Sugar (lbs)	Yeast (oz)	Beginning Depth (ft bgs)	Ending Depth (ft bgs)
782IP-1	Yes	NA	2,000	250	750	42.9	0.4	3.5	100	16	25	40
782IP-2	Yes	NA	2,000	250	750	42.9	0.4	3.5	100	16	25	40
782IP-3	Yes	NA	2,000	250	750	42.9	0.4	3.5	100	16	25	40
782IP-4	Yes	NA	2,000	250	750	42.9	0.4	3.5	100	16	25	40
782IP-5	Yes	NA	2,000	250	750	42.9	0.4	3.5	100	16	25	40
782IP-6	Yes	NA	2,000	250	750	42.9	0.4	3.5	100	16	25	40
782IP-7	Yes	NA	2,000	250	750	42.9	0.4	3.5	100	16	25	40
<b>Totals</b>			<b>14,000</b>	<b>1,750</b>	<b>5,250</b>	<b>300</b>	<b>3</b>	<b>24.5</b>	<b>700</b>	<b>112</b>		

Details and Assumptions	Quantity	Units
Injection Locations	7	
Treatment Area	9,200	ft <sup>2</sup>
Treatment Volume	138,000	ft <sup>3</sup>
Depth to Groundwater	21.26	ft
Total Porosity	0.35	
Effective Porosity	0.3	
Soil bulk density	1.65	grams/cm <sup>3</sup>
Soil fraction organic carbon content (foc)	0.002	
Hydraulic Conductivity	11.03	ft/day
Hydraulic Gradient	4.6x10 <sup>-3</sup>	ft/ft
Treatment Zone Total Pore Volume (total volume X total porosity)	1,367,856	liters (L)
Treatment Zone Effective Pore Volume	1,172,448	liters
Injection Zone between 25-40' (Saturated Horizon)	15	ft
Gallons per injection point?	1,000	gallons
Number of Horizons	3	
Gallons per Horizon	333.33	gallons
Sodium Bicarbonate	300	lbs
Sugar	700	lbs
Yeast	112	oz
Optional Sodium Sulfite	3.03	lbs
lbs EVO per Horizon	666.67	lbs
Total lbs EVO	14,000	lbs
Concentration EVO	0.77	grams/L
Total Gallons to be Injected?	7,000	gallons
Gallons per day Injection Rate for EVO	2,000	gallons
Estimated Deployment Days	3.5	days

Notes:

NA = Not Applicable

EVO = Emulsified vegetable oil

lbs = pounds

gal = gallons

DHC = Dehalococcoides

oz = ounces

ft bgs = feet below ground surface

**Former Griffiss AFB Site SD052-02 Pilot Study Area 2 Design  
Injection Volumes and Target Intervals**

Injection Point	Direct Push Technology	New/ Existing	Injectate Amounts								Injection Interval	
			EVO (lbs)	EVO (gal)	Deoxygenated Water (gal)	Sodium Bicarbonate (lbs)	Sodium Sulfite (lbs) (optional)	DHC (liters of 10 <sup>11</sup> cells of DHC)	Sugar (lbs)	Yeast (oz)	Beginning Depth (ft bgs)	Ending Depth (ft bgs)
775IW-1 (Adjacent to 775MW-10)	No	New	2,571	321	679	50	0.4	4.0	100	16	110.2	120.2
775IW-2 (Adjacent to 775MW-20)	No	New	2,571	321	679	50	0.4	4.0	100	16	88	103
			<b>5,143</b>	<b>643</b>	<b>1,357</b>	<b>100</b>	<b>0.9</b>	<b>8</b>	<b>200</b>	<b>32</b>		

<b>Details and Assumptions</b>	
Install 2, 3/4" injection wells adjacent to 775MW-10 and 775MW-20	
Treatment Area	11,134 ft <sup>2</sup>
Treatment Volume	167,010 ft <sup>3</sup>
Depth to Groundwater	60.00 ft
Total Porosity	0.35
Effective Porosity	0.3
Soil bulk density	1.65 grams/cm <sup>3</sup>
Soil fraction organic carbon content (foc)	0.002
Hydraulic Conductivity	1.55 ft/day
Hydraulic Gradient	0.005 ft/ft
Treatment Zone Total Pore Volume (total volume X total porosity)	1,655,403.12 liters (L)
Treatment Zone Effective Pore Volume	1,418,916.96 liters
Injection Zone between 105-120' (Saturated Horizon)	15 ft
Gallons per injection point?	1,000 gallons
Number of Horizons	3
Gallons per Horizon	333.33 gallons
Sodium Bicarbonate	100.00 lbs
Sugar	200 lbs
Yeast	32 oz
Optional Sodium Sulfite	0.87 lbs
lbs EVO per Horizon	1,714.29 lbs
Total lbs EVO	5,143 lbs
Concentration EVO	1.64 grams/L
Total Gallons to be Injected?	2,000 gallons
Gallons per day Injection Rate for EVO	2,000 gallons
Estimated Deployment Days	1 days

Notes:

NA = Not Applicable

EVO = Emulsified vegetable oil

lbs = pounds

gal = gallons

DHC = Dehalococcoides

oz = ounces

ft bgs = feet below ground surface

**Former Griffiss AFB Site SD052-04 Follow-on Optimization Design  
Injection Volumes and Target Intervals**

Injection Point	Direct Push Technology	New/ Existing	Injectate Amounts								Injection Interval	
			EVO (lbs)	EVO (gal)	Deoxygenated Water (gal)	Sodium Bicarbonate (lbs)	Sodium Sulfite (lbs) (optional)	DHC (liters of 10 <sup>11</sup> cells of DHC)	Sugar (lbs)	Yeast (oz)	Beginning Depth (ft bgs)	Ending Depth (ft bgs)
LF6IW-01	No	Existing	2,000	250	750	50	0.4	3.5	100	16	37	47
LF6IW-02	No	Existing	2,000	250	750	50	0.4	3.5	100	16	45	55
LF6IW-03	No	Existing	2,000	250	750	50	0.4	3.5	100	16	37	47
LF6IW-04	No	Existing	2,000	250	750	50	0.4	3.5	100	16	45	55
LF6IW-06	No	Existing	2,000	250	750	50	0.4	3.5	100	16	45	55
<b>Totals</b>			<b>10,000</b>	<b>1,250</b>	<b>3,750</b>	<b>250</b>	<b>2.2</b>	<b>17.5</b>	<b>500</b>	<b>80</b>		

<b>Details and Assumptions</b>	
Inject EVO into Existing Injection Wells IW-01, -02, -03, -04, -06	
Injection Locations	5
Treatment Area	10,000 ft <sup>2</sup>
Treatment Volume	150,000 ft <sup>3</sup>
Depth to Groundwater	19.00 ft
Total Porosity	0.35
Effective Porosity	0.3
Soil bulk density	1.65 grams/cm <sup>3</sup>
Soil fraction organic carbon content (foc)	0.002
Hydraulic Conductivity	0.283 ft/day
Hydraulic Gradient	0.005 ft/ft
Treatment Zone Total Pore Volume (total volume X total porosity)	1,486,800 liters (L)
Treatment Zone Effective Pore Volume	1,274,400 liters
Injection Zone between 40-55' (Saturated Horizon)	15 ft
Gallons per injection point?	1,000 gallons
Total lbs EVO per Injection Well	2,000 lbs
Total lbs EVO	10,000 lbs
Concentration EVO	3.56 grams/L
Sodium Bicarbonate	250 lbs
Sugar	500 lbs
Yeast	80 oz
Optional Sodium Sulfite	2.16 lbs
Total Gallons to be Injected?	5,000 gallons
Gallons per Day Injection Rate for EVO	2,000 gallons
Estimated Deployment Days	2.5 days

Notes:  
 NA = Not Applicable  
 EVO = Emulsified vegetable oil  
 lbs = pounds  
 gal = gallons  
 DHC = Dehalococcoides  
 oz = ounces  
 ft bgs = feet below ground surface

Former Griffiss AFB Site SD052-05 Follow-on Optimization Injection

Injection Volumes and Target Intervals

Injection Point	Direct Push Technology	New/ Existing	Injectate Amounts								Injection Interval	
			EVO (lbs)	EVO (gal)	Deoxygenated Water (gal)	Sodium Bicarbonate (lbs)	Sodium Sulfite (lbs) (optional)	DHC (liters of 10 <sup>11</sup> cells of DHC)	Sugar (lbs)	Yeast (oz)	Beginning Depth (ft bgs)	Ending Depth (ft bgs)
817IP-1	Yes	NA	2,000	250	750	37.5	0.4	3.5	100	16	7.5	20
817IP-2	Yes	NA	2,000	250	750	37.5	0.4	3.5	100	16	7.5	20
817IP-3	Yes	NA	2,000	250	750	37.5	0.4	3.5	100	16	7.5	20
817IP-4	Yes	NA	2,000	250	750	37.5	0.4	3.5	100	16	7.5	20
817IP-5	Yes	NA	2,000	250	750	37.5	0.4	3.5	100	16	7.5	20
817IP-6	Yes	NA	2,000	250	750	37.5	0.4	3.5	100	16	7.5	20
817IP-7	Yes	NA	2,000	250	750	37.5	0.4	3.5	100	16	7.5	20
817IP-8	Yes	NA	2,000	250	750	37.5	0.4	3.5	100	16	7.5	20
<b>Totals</b>			<b>16,000</b>	<b>2,000</b>	<b>6,000</b>	<b>300</b>	<b>3</b>	<b>28</b>	<b>800</b>	<b>128</b>		

Details and Assumptions	
Injection Locations	8
Treatment Area	23,400 ft <sup>2</sup>
Treatment Volume	292,500 ft <sup>3</sup>
Depth to Groundwater	3.60 ft
Total Porosity	0.35
Effective Porosity	0.3
Soil bulk density	1.65 grams/cm <sup>3</sup>
Soil fraction organic carbon content (foc)	0.002
Hydraulic Conductivity	0.283 ft/day
Hydraulic Gradient	0.04 ft/ft
Treatment Zone Total Pore Volume (total volume X total porosity)	2,899,260 liters (L)
Treatment Zone Effective Pore Volume	2,485,080 liters
Injection Zone between 25-40' (Saturated Horizon)	15 ft
Depths at each location from top of bedrock to water table	5 ft
Injection Zone between 7.5-20'	20 ft
Gallons per foot of depth	200 gallons
Lbs EVO per foot of depth	800 lbs
Sodium Bicarbonate	300 lbs
Sugar	400 lbs
Yeast	64 oz
Sodium Sulfite	1.73 lbs
Total lbs EVO	16,000 lbs
Concentration EVO	2.92 grams/L
Total Gallons to be Injected?	4,000 gallons
Gallons per Day Injection Rate for EVO	2,000 gallons
Estimated Deployment Days	2 days

Notes:

NA = Not Applicable

EVO = Emulsified vegetable oil

lbs = pounds

gal = gallons

DHC = Dehalococcoides

oz = ounces

ft bgs = feet below ground surface