FINAL OPTIMIZATION PLAN FOR SS062 AOC 9 WEAPONS STORAGE AREA LANDFILL CHLORINATED PLUME FORMER GRIFFISS AFB, NEW YORK

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFRL/RSS	Air Force Research Laboratory/Rome Research Site
AHA	Activity Hazard Analysis
AOC	Area of Concern
AR	Administrative Record
bgs	Below ground surface
Bhate	Bhate Environmental Associates, Inc.
BRAC	Base Realignment and Closure
BSOP	Bhate Standard Operating Procedure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
cis-1,2-DCE	cis-1,2-Dichloroethene
COC	Contaminant of concern
CSP	Certified Safety Professional
DO	Dissolved oxygen
DPT	Direct push technology
E&E	Ecology & Environment
EEEPC	Ecology and Environment Engineering, PC
ESI	Expanded Site Investigation
FFA	Federal Facilities Agreement
FOM	Field Operations Manager
GLDC	Griffiss Local Development Corporation
HSM	Health and Safety Manager
IC	Institutional Control
ISCO	In-Situ Chemical Oxidation
LCC	Life Cycle Cost
LTM	Long-term monitoring
LUC	Land Use Control
µg/L	Micrograms per liter

MNA	Monitored Natural Attenuation
MW	Monitoring Well
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
OBC®	Oxygen BioChem®
OES	Optimized Exit Strategy
OPS	Operating properly and successfully
OP	Optimization Plan
ORP	Oxidation reduction potential
Parsons	Parsons Government Services, Inc.
PBR	Performance-Based Remediation
PID	Photoionization detector
PM	Project Manager
POTW	Publically owned treatment works
ppm	Parts per million
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAO	Remedial action objective
RC	Response Complete
REM	Registered Environmental Manager
ROD	Record of Decision
SAC	Strategic Air Command
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SW	Solid Waste
TCE	Trichloroethene
UFP	Uniform Federal Policy
UIC	Underground Injection Control
U.S.	United States
USAF	U.S. Air Force
USEPA	U.S. Environmental Protection Agency
VOCs	Volatile Organic Compounds
WSA	Weapons Storage Area

1 INTRODUCTION

Bhate Environmental Associates, Inc. (Bhate) has been contracted by the Air Force Civil Engineer Center (AFCEC) to prepare this Optimization Plan (OP) for the SS062 Area of Concern (AOC) 9 Weapons Storage Area (WSA) Landfill chlorinated plume site located at the former Griffiss Air Force Base (AFB), in Rome, New York (see **Figure 1**). The work discussed in this OP will be conducted under Performance-Based Remediation (PBR) contract number FA8903-16-F-0012. This OP addresses the tasks required to achieve the goals of the Optimized Exit Strategy (OES) outlined in the *2016 Opening Phase Project Management Plan, Former Griffiss Air Force Base, Rome, New York* (Bhate, September 2016a).

Work conducted at this site will be performed in accordance with the *2016 Update Uniform Federal Policy* [UFP] – *Quality Assurance Project Plan* [QAPP] *for Long-Term Management, Former Griffiss Air Force Base, Rome, New York* (Bhate, September 2016b). Section 2 of this OP provides a site description, a summary of historical remediation activities, long-term site management, and the proposed outcome for AOC 9. Section 3 describes the OP technical approach to achieve the proposed outcome. Section 4 outlines project management responsibilities, and Section 5 describes the optimization reporting process. Work plans, technical memorandums, and optimization documents for AOC 9 will be provided separately from the OP.

1.1 Griffiss AFB Operational History

The mission of the former Griffiss AFB varied over the years. The base was activated on February 1, 1942, as Rome Air Depot, with the mission of storage, maintenance, and shipment of material for the United States (U.S.) Army Air Corps. Upon creation of the Air Force in 1947, the depot was renamed Griffiss AFB. The base became an electronics center in 1950, with the transfer of Watson Laboratory Complex (later Rome Air Development Center [1951], Air Force Research Laboratory/Rome Research Site [AFRL/RRS]), and then the Information Directorate at RRS was established with the mission of applied research, development, and testing of electronic air-ground systems. The headquarters of the Ground Electronics Engineering Installations Agency was established in June 1958 to engineer and install ground communication equipment throughout the world. The 49th Fighter Interceptor Squadron served at Griffiss AFB from 1959 until its inactivation in 1987. On July 1, 1970, the 416th Bombardment Wing of the Strategic Air Command (SAC) was activated with the mission of maintenance and implementation of both effective air refueling operations and long-range bombardment capability. Griffiss AFB was designated for realignment under the Base Realignment and Closure Act (BRAC) in 1993, resulting in deactivation of the 416th Bombardment Wing in September 1995.

1.2 Environmental Background

As a result of the various national defense missions carried out at the former Griffiss AFB since 1942, hazardous and toxic substances were used, and hazardous wastes were generated, stored, or disposed of at various sites on the installation. The defense missions involved were, among others: the procurement, storage, maintenance, and shipment of war material; research and development; and aircraft operations and maintenance.

Pursuant to Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Griffiss AFB was included on the National Priorities List (NPL) on July 15, 1987. On August 21, 1990, the U.S. Air Force (USAF), the U.S. 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. On March 20, 2009, 2,897.2 of the 3,552 acres were deleted from the NPL; however, the AOC 9 site remains on the NPL.

1.3 Standards Criteria and Guidance and Remedial Action Objectives

Contaminants of concern (COCs) associated with AOC 9 consist of chlorobenzene, trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE). However, since chlorobenzene is the most prevalent COC, exceeding 100 micrograms per liter (µg/L) over 50-percent of the groundwater plume at AOC 9, this constituent will be the driver for optimization activities. Any groundwater samples collected from the site will be analyzed in accordance with the 2016 Update to the UFP-QAPP (Bhate, September 2016b). The groundwater results will be compared to the NYSDEC Class GA Standards and Guidance Values included in *NYSDEC Technical and Operational Guidance Series 1.1.1* (NYSDEC, June 1998).

The primary remedial action objective (RAO) for AOC 9 is to reduce current chlorobenzene concentrations in RAO target wells, AOC9-MW15 and AOC9-MW17, to 10 µg/L or less by the year 2020, and to allow for achievement of a Response Complete (RC) chlorobenzene concentration of 5 µg/L (the NYSDEC Class GA groundwater standard), through monitored natural attenuation (MNA) by the year 2024. The secondary goal of the OP is to reduce the long-term monitoring (LTM) requirements from the current nine groundwater monitoring wells to seven groundwater monitoring wells until the RAOs are achieved.

2 AOC 9 WSA LANDFILL CHLORINATED PLUME

2.1 Site Description

The following AOC 9 description contains paraphrased excerpts from the document entitled *Draft-Final Demonstration of Remedial Actions Operating Properly and Successfully at AOC 9, Former Griffiss Air Force Base, Rome, New York* (Ecology and Environment Engineering, PC [EEEPC] and Parsons Government Services, Inc. [Parsons], April 2016).

AOC 9 is a grass-covered area approximately 1,500 feet long and 650 feet wide, located in the southwest portion of the inactive WSA (see **Figure 2**). The site is located northwest of the runway and extends into the WSA to the northeast. Perimeter Road runs through the approximate center of the site and Six Mile Creek extends through the southwestern portion of the site.

The area comprising AOC 9 was originally farmland in the 1930s, before the base was constructed. In the 1940s and 1950s, the first landfill for the base was established beneath the northern portion of the WSA extending south between Perimeter Road and Six Mile Creek. Aerial photographs show that the landfill was active between 1943 and 1957, but no later than 1960. The type of material buried at this site is unknown; however, it is reported that large quantities of the landfill material were removed during construction of the WSA in the 1950s.

Two munitions storage bunkers were erected between Perimeter Road and Six Mile Creek in the early 1950s. One of the bunkers (also referred to as igloos) was removed in the late 1970s or early 1980s (before 1981), and the other bunker was removed in 1992. Although the bunkers were initially used for munitions storage, they were later used to store hazardous materials.

The site's status was changed from "Area of Interest" to "Area of Concern" in 1998 when groundwater samples collected during an Expanded Site Investigation (ESI) (Ecology & Environment [E&E], 1998) were found to contain chlorinated solvents at concentrations exceeding NYSDEC Class GA standards and USEPA Maximum Contaminant Levels (USEPA, 2006; NYSDEC, June 1998).

The AOC 9 site is currently inactive and access is somewhat restricted by Perimeter Road Gates 4 and 11. The southern portion of this area is expected to remain vacant in the future, acting as a buffer zone between the runway and future development in adjacent areas. The northern portion of the site extends into the former WSA and is expected to be zoned as a nonresidential, industrial area.

2.2 Historical and Current Long-Term Management

From approximately 1997 through 2007, numerous environmental investigations were conducted at AOC 9 for which reports have been prepared on behalf of the USAF. These have included soil and groundwater investigations, bedrock groundwater and surficial aquifer studies, supplemental investigations, and pre-design investigations. These activities are detailed in reports contained in the Air Force Administrative Record (AR).

A Final Record of Decision (ROD) for AOC 9, dated July 2010 (EEPC, July 2010), was issued by the USAF and signed by the USEPA in September 2010. The selected remedy for AOC 9 included the following:

- Removal of the suspected source area through excavation of contaminated soil
- Polishing with oxidant on the floor of the resulting excavation
- Treatment of contaminated groundwater using an oxidant injection via persulfate

Details of the remedial design are presented in the *Final Remedial Design Work Plan and Construction Drawings for Area of Concern (AOC) 9 Former Griffiss Air Force Base, Rome New York* (EEEPC, 2010a) and the remedial actions are detailed in the *Remedial Action Work Plan Addendum, Area of Concern 9, Former Griffiss Air Force Base, Rome New York* (Parsons, September 2013). Excerpts describing the remedial action construction elements undertaken by Parsons to execute the remedy were obtained from the above documents and are detailed below in the following sections.

2.2.1 Source Excavation

In 2010, Parsons excavated a total area of 22,500 square-feet within areas identified as Cell 1 and Cell 2 on the site (**Figure 3**). All soils within the cells that exhibited evidence of contamination (staining/odors) or produced photoionization detector (PID) responses exceeding 50 parts per million (ppm), were removed and disposed off-site. Between the two cells, a total of 10,072 tons of soil and a 200-foot section of 14-inch diameter sewer line were disposed at the Oneida Herkimer Solid Waste Authority. Contaminated water captured from excavation dewatering activities, was disposed off-site in the City of Rome publically owned treatment works (POTW). In addition, it was reported that several 55-gallon drums were removed from the excavation and disposed offsite.

2.2.2 Excavation Floor Polishing

Prior to backfilling the excavation, a sodium persulfate oxidant with an iron chelate activator was applied to the bottom of the excavation to oxidize low-level residual contamination. AOC 9 was then backfilled with overburden soils followed by grading and hydro seeding.

2.2.3 Dissolved Phase Groundwater Remediation

In November 2013, 53 injection points were placed in the southwestern portion of the excavation area, immediately downgradient of the former source area, between AOC9-MW14 and AOC9- MW19, using a standard Geoprobe drilling rig. In order to supplement the groundwater with oxygen and enhance aerobic bioremediation of the contaminated groundwater plume, approximately 10,000 pounds of PermeOx® Plus was mixed with approximately 6,000 gallons of water, and injected into the formation via the 53 injection points.

2.2.4 Groundwater Monitoring Activities

Groundwater/surface water monitoring at AOC 9 has consisted of three phases, two of which have already been completed (EEEPC and Parsons, April 2016). Groundwater/surface water sampling locations are shown on **Figure 2**. The first phase of monitoring was conducted in July 2010 and consisted of baseline sampling of eight groundwater monitoring wells (AOC9-MW01, AOC9-MW02, AOC9-MW05, AOC9-MW06, AOC9-MW14, AOC9-MW15, AOC9-MW17, and AOC9- MW18), and three surface water locations (AOC9-SW01, AOC9-SW02 and AOC9-SW03) within Six-Mile Creek.

The second phase consisted of performance monitoring of five groundwater monitoring wells (AOC9-MW06, AOC9-MW14, AOC9-MW15, AOC9-MW17, and AOC9-MW19) and three surface water locations (AOC9-SW01, AOC9-SW02, and AOC9-SW03) to evaluate the short-term effectiveness of the remediation efforts described above. Performance monitoring entailed a total of four sampling events spanning a time-frame of 2 years (May 2011, October 2011, April 2012, and September 2012).

The long-term effectiveness of the remedial efforts was monitored during annual sampling events (April 2013, April 2014, and April 2015) of nine wells (AOC9-MW01, AOC9-MW02, AOC9-MW05, AOC9-MW06, AOC9-MW14, AOC9-MW15, AOC9-MW17, AOC9-MW18, and AOC9-MW19) and three surface water locations (AOC9-SW01, AOC9-SW02, and AOC9-SW03). Following the April 2015 sampling event, the schedule for LTM was modified from annual to biennial with the next event scheduled for April 2017.

These documented groundwater monitoring events have demonstrated that groundwater beneath the site flows in a southwesterly direction toward Six Mile Creek and the limits of the associated chlorinated plume in groundwater are well defined and exist wholly within the confines of the site (**Figure 3**). Analysis of surface water samples collected from Six Mile Creek, bordering AOC 9 to the southwest, have not indicated impact from site groundwater contaminants. Chlorobenzene concentrations have reduced significantly due to source area excavation and groundwater oxidant treatment. Mann-Kendall statistical analysis, using data through April 2015, has demonstrated an overall downward trend of chlorobenzene concentrations (EEEPC and Parsons, April 2016).

2.2.5 Assessment of Remedial Actions

In April 2016, EEEPC in conjunction with Parsons, produced the document entitled *Draft-Final Demonstration of Remedial Actions Operating Properly and Successfully at AOC 9, Former Griffiss Air Force Base, Rome, New York*. The purpose of this document was to demonstrate that the remedy put in place per the July 2010 Final ROD, which included source removal, oxidant treatment of residual contaminants in soil, and oxidant treatment of the dissolved groundwater contaminant plume is operating properly and successfully (OPS) at AOC 9. It is stated in the document that OPS is demonstrated by groundwater monitoring information through April 2015 that has shown reduced contaminant concentrations, surface water monitoring information showing that Six-Mile Creek, located to the southwest, has not been adversely impacted by the groundwater plume, and the use of enforceable Land Use Controls and Institutional Controls (LUC/ICs) which are in place at AOC 9. The Final version of the OPS document has been submitted to the NYSDEC for review.

Bhate has reviewed the OPS document and the most current April 2015 site data, which is contained in the document entitled *Final April 2015 Long-Term Monitoring Data Summary Report, AOC 9 (SD-62), Former Griffiss Air Force Base, Rome, New York* (EEEPC, December 2015), to verify chlorobenzene trends. Based on the trend analysis contained in the OPS document and Bhate's chlorobenzene trend assessment, it appears that chlorobenzene is trending downward and/or stable in RAO target wells AOC9-MW15 and AOC9-MW17. However, in upgradient well AOC9-MW14, the April 2015 data indicated an uptick in the chlorobenzene concentration compared to the April 2014 data. Though backdiffusion of constituent concentrations in groundwater commonly follow an injection event, Bhate will take a proactive approach upon approval of the OP document and collect groundwater samples from RAO target wells AOC9-MW15 and AOC9-MW-17, and upgradient well AOC9-MW14 to assess the most current site conditions, as described in Section 3 of this Plan.

2.3 Regulatory Drivers

AOC 9 is regulated by NYSDEC under the New York State Superfund Sites Program. Therefore, AOC 9 site activities are conducted under the supervision and recommendations of NYSDEC. Groundwater sample results are compared to New York State's, Class GA Groundwater Standards and Guidance Values included in *NYSDEC Technical and Operational Guidance Series 1.1.1* (NYSDEC, June 1998).

2.4 Proposed Outcome

The proposed outcome for AOC 9 is to reduce current chlorobenzene concentrations in RAO target wells, AOC9-MW15 and AOC9-MW17, to 10 µg/L or less by the year 2020, and to allow for achievement of a RC chlorobenzene concentration of 5 µg/L (NYSDEC Class GA groundwater

standard), through MNA by the year 2024. The secondary goal of the OP is to reduce the LTM requirements from the current nine groundwater monitoring wells to seven groundwater monitoring wells until the RAOs are achieved.

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3 TECHNICAL APPROACH FOR ACHIEVING PROPOSED OUTCOME

The primary OP goal for this site is to further enhance chlorobenzene reductions achieved as a result of the previous remediation efforts described in Section 2.2. Specifically the goal is to reduce current chlorobenzene concentrations in RAO target wells AOC9-MW15 and AOC9-MW17 to 10 µg/L or less by the year 2020, and to allow for achievement of a RC chlorobenzene concentration of 5 µg/L (the NYSDEC Class GA groundwater standard), through MNA by the year 2024. The secondary goal of the OP is to reduce the LTM requirements from sampling nine groundwater monitoring wells to seven groundwater monitoring wells until the RAOs are achieved in groundwater.

Based on review of historical laboratory data collected from remedial performance monitoring and LTM events through April 2015, it appears that the current remedy is working to reduce the dissolved groundwater contaminant plume across the site. In RAO target well, AOC9-MW15, the latest LTM event conducted in April 2015 indicated a 55-percent reduction in chlorobenzene in comparison with the April 2014 LTM event, and a 13-percent reduction in RAO target well AOC9-MW17. Mann-Kendall trend analysis also confirms a downward trending chlorobenzene concentration using historical site data (EEEPC and Parsons, April 2016). However, in AOC9-MW14, which is located directly upgradient from these two wells, and immediately downgradient from the former source area excavation, the chlorobenzene concentration spiked from 31 µg/L in April 2014 to 150 µg/L in April 2015. This increase could potentially be due to backdiffusion of contaminants in groundwater within the former soil removal area, which is common following injection activities. Based on this data, Bhate will implement the following 2-step approach to meet the OP objectives:

1. Collect groundwater samples to determine the current status of chlorobenzene concentrations in key groundwater monitoring wells across the site.

2. Evaluate current groundwater results and trends to either allow the current remedy to continue and monitor its on-going effectiveness through the LTM program, and/or perform additional oxidant injections in the vicinity of the removed source area with the intention of reducing downgradient chlorobenzene concentrations in RAO target wells AOC9-MW15 and AOC9-MW17.

Task descriptions to accomplish the optimization goal are summarized in the following sections.

3.1 Groundwater Sampling

The most current groundwater data for AOC 9 is over a year old, and Bhate understands that the next LTM event at AOC 9 will take place in April 2017. Given the recent inconsistency of

chlorobenzene concentrations in AOC9-MW14, and the dynamics of groundwater flow at the site, which has been reported to be approximately 8 feet per day, more current groundwater data is needed to make informed decisions regarding a path forward to achieve the objectives within the proposed time frame.

Groundwater samples will be collected from AOC9-MW14, AOC9-MW15, and AOC9-MW17 using low flow sampling techniques. These three wells were selected for sampling because they exhibit the highest concentrations of chlorobenzene along the axis of the plume. Primarily, these wells represent chlorobenzene concentrations at the head of the plume (AOC9-MW14, immediately downgradient of the removed source area), within the center of the plume (AOC9-MW15) and at the terminus of the plume (AOC9-MW17). As such, these three monitoring wells have been determined to be optimal for representing current plume conditions as well as for monitoring on-going remediation efforts. Groundwater samples will be submitted to the laboratory for analysis of Volatile Organic Compounds (VOCs) using USEPA Solid Waste (SW) Method 8260B. Additionally, general water quality parameters will be collected in the field using a hand-held multi-meter. These parameters include pH, temperature, conductivity, dissolved oxygen (DO), turbidity, and oxidation reduction potential (ORP), at the time of sample collection.

If VOC analyses yields chlorobenzene results that demonstrate this constituent is remaining on a downward trend in RAO target wells, AOC9-MW15 and AOC9-MW17, and the chlorobenzene concentration in the upgradient well, AOC9-MW14, is stable or consistent with the April 2015 results, then optimization would consist of allowing the current remedy to work and monitoring its on-going effectiveness through LTM events to determine if future site remedy modification is warranted.

If VOC analyses yields chlorobenzene results that demonstrate this constituent is no longer trending downward in the RAO target wells or if there is further elevation in the upgradient well, AOC9-MW14, then optimization would potentially consist of oxidant treatment of groundwater at an upgradient location of the RAO target wells. This is also described in Section 3.6, Contingency Planning.

The current groundwater LTM schedule for the site covering this period of performance provides for biennial sampling events of 9 wells, including AOC9-MW14, AOC9-MW15 and AOC9-MW17, occurring in April 2017 and again in April 2019. Regardless of which optimization step is used, the dynamics of site groundwater flow and the performance period time-frame warrant more immediate groundwater data and at a higher frequency during the performance period evaluation in order to make timely adjustments to the remedy, if needed. For this reason, Bhate plans to modify the current LTM schedule for wells AOC9-MW-14, AOC9-MW15, and AOC9-MW17 to include quarterly sampling events during the first year, semi-annual events during the second year, and annual events during years three and four.

3.2 Oxidant Treatment of Groundwater

As per Alternative 3 of the ROD (EEEPC, July 2010), focused optimization activities would involve the injection of Oxygen BioChem (OBC®), which is a formulated mixture of sodium persulfate and calcium peroxide, through eight injection points in the immediate vicinity of the removed source area and upgradient of AOC9-MW14 (**Figure 3**). The effectiveness of the injections will be assessed by sampling a number of groundwater monitoring wells during scheduled LTM events, as outlined in the 2016 Update UFP-QAPP (Bhate, September 2016b). Additionally, as part of the LTM, surface water samples will be collected from Six Mile Creek, which extends through the southwestern portion of AOC 9 and immediately downgradient of AOC9-MW15 and AOC9-MW17. The following sections detail the activities associated with the planning and implementation of the optimization work.

3.2.1 Dig Permit/Utility Clearances

If it is determined that subsurface work is required, then prior to submittal of digging permit(s)/utility clearance requests, the subsurface work areas and/or injection locations will be clearly delineated with marker flags, stakes or paint, as appropriate on the ground 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 occupied by AOC 9.

- 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.

3.2.2 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 work area containing the drilling rig and support equipment.

3.2.3 Underground Injection Permitting

The USEPA administers the Underground Injection Control (UIC) Program. Injection of chemical oxidants, if used, into the site substrate is subject to 40 Code of Federal Regulations (CFR) §144.21 - §144.28 because the injection points fall under the definition of "any dug hole or well that is deeper than its largest surface dimension, where the principal function of the hole is the emplacement of fluids" (40 CFR §144.1[g][1][ii]). Injection wells are classified as Class V wells, which are authorized by the rule contingent upon provision of basic operator information and notification of planned injection activities, as described in 40 CFR §144.24. A notification to the USEPA will be filed prior to injection activities.

The Inventory of Injection Wells, USEPA Form 7520-16, will be submitted 90 days prior to commencement of injection, if conducted, unless otherwise indicated by the UIC Program Director.

3.2.4 Mobilization

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

- Review of the Site Safety and Health Plan (SSHP) as well as project specific Activity Hazard Analysis (AHA) sheets (**Appendix A**) by all Bhate personnel and subcontractor personnel involved with the project.
- Mobilization of selected drilling/injection contractor.
- Utility clearance confirmation.
- Site access coordination.
- Delivery of injection materials and equipment and personnel travel.
- Obtain Injection water from on-site sources. Coordinate water hydrant use and metering with the City Water Department and/or the airport.

3.2.5 Oxidant Injection

Oxidant injection will be performed in a two-step process. The first step involves 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.

3.2.5.1 Step 1: Mixing

All materials will be delivered to the site and staged at an approved, pre-determined lay-down area/decontamination pad. The OBC® will be shipped in dry form contained in 50-pound bags, which will be stored on wooden pallets wrapped with polyethylene plastic sheeting. Potable water will be obtained from the nearest hydrant. Depending on the location, water may have

to be transported to the site via a water truck from a source to be determined. The makeup water will be added to the mixing tank first to prevent the OBC® from creating an exothermic reaction in the tank. Only about 75 to 80 percent of the required volume of the makeup water will be initially added since OBC® will add to the volume in the tank. Once the OBC® is introduced and thoroughly mixed, additional makeup water will be added until the target volume is reached.

Each injection site will receive a mixture of approximately 200 pounds of OBC® powder and 400 gallons of injectate. To achieve the correct mixture ratio, injectate will be initially combined in batches, which will then be stored in a larger final mixing tank equipped with a pump to recirculate the mixture and provide adequate mixing since a portion of the calcium peroxide will not totally dissolve and settle out of solution. Using these mixing ratios, it is anticipated that a total of 1,600 pounds of OBC® and 3,200 gallons of injectate will be introduced into the substrate.

The estimated injection volume/quantity calculation spreadsheets are included within **Appendix B**. 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.

3.2.5.2 Step 2: Injection

Eight injection sites will be advanced in the immediate vicinity of the former source removal excavation area (**Figure 3**), to further address chlorobenzene concentrations in this area as well as downgradient in the RAO target wells. A direct push technology (DPT) drilling rig will be used to advance drill rods from ground surface to the bottom of the target injection level which is anticipated to be top of the Utica Shale, a weathered bedrock, ranging in depth from 13-feet and 19-feet below ground surface (bgs) across the site. Previous sampling of bedrock wells at this site, as documented in *AOC 9 Bedrock Groundwater Study Former Griffiss Air Force Base, Rome, New York* (E&E, Inc., August 2002), has indicated that chlorinated solvents are not anticipated to be found below the top of bedrock.

Upon reaching the bottom of the target injection zone, the drill rod will be pulled up 5 feet 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-foot 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 (14.0 feet to 18.0 feet-bgs) at each injection site. This process will then be repeated until all injection activities have been completed.

As described in Bhate Standard Operating Procedure (BSOP) 12 (presented in the 2016 Update UFP-QAPP, 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 at AOC 9, boreholes located in asphalt or concrete will be patched with like appropriate material. It is anticipated that injection activities will take a total of 2 days to complete.

All OP activities will be supervised and documented by Bhate field personnel. Detailed field notes will be recorded 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.

3.3 Long-Term Groundwater Monitoring Optimization

Currently nine groundwater monitoring wells are included in the annual LTM sampling schedule for AOC 9. Three annual events, beginning in 2013, have taken place with the latest event being in April 2015. After the 2015 event, the LTM schedule was modified to biennial, so the next event is scheduled for April 2017. However, as described in Section 3.1, Bhate plans to modify the current LTM schedule to include quarterly sampling events during the first year, semi-annual events during the second year, and annual events during years three and four of the period of performance. In order to optimize the LTM program, historical groundwater analytical data was evaluated to identify two groundwater monitoring wells for proposed elimination from the LTM program. Based on this evaluation, AOC9-MW05, which is one of two wells located south of Six-Mile Creek is proposed for elimination. Historically, no VOCs were detected in sampling events conducted in 2000, 2004, 2006, baseline sampling conducted in 2010, and the first two events of the LTM program. Low levels of carbon disulfide (0.51 µg/L) and cis-1,2-DCE (0.84 µg/L) were detected below their respective NYSDEC Class GA Groundwater Standards during the third annual LTM event conducted in April 2015. Carbon disulfide currently does not have a groundwater standard and the groundwater standard for cis-1,2-DCE is 5 µg/L.

The second well proposed for elimination from the LTM program is AOC-MW18, which is the most upgradient well on the site. Baseline sampling in 2010 indicated the presence of 1,2-dichlorobenzene (0.20 µg/L) and chlorobenzene (3.0 µg/L). Through the first three annual LTM sampling events, 1,2-dichlorobenzene was not detected. Chlorobenzene was not detected during the first two annual LTM events; however, a low level concentration of chlorobenzene was detected at 0.25 µg/L during the third annual LTM event in April 2015. The NYSDEC Class GA Groundwater Standard for chlorobenzene is 5 µg/L. Since neither of these wells have

exceedances of NYSDEC Class GA Groundwater Standards, they will be proposed for abandonment pending approval from the NYSDEC.

The remaining 11 wells at AOC 9, not including the 3 wells proposed for optimization sampling (AOC9-MW14, AOC9-MW-15, and AOC9-MW17), and the 2 wells proposed for LTM removal, described above, include 3 bedrock aquifer wells (AOC9MW-9BR, AOC9MW-10BR, and AOC9MW-11BR), and 8 surficial aquifer wells (AOC9-MW03, AOC9-MW04, AOC9-MW07, AOC9-MW08, AOC9-MW12, AOC9-MW13, AOC9-MW16, and WSAMW-4). The bedrock aquifer wells are not proposed for sampling due to their depth and screened interval and the eight surficial aquifer wells are not proposed for sampling due to their proximity relative to the existing plume. Many of these wells are close together and would provide duplicative information, which would increase the USAF's life-cycle costs (LCC) for this site in the long run.

The proposed LTM optimization groundwater monitoring well locations are presented on **Figure 4**.

3.4 Performance Model

A performance model was prepared to assess the initial and subsequent In-Situ Chemical Oxidation (ISCO) injection events at AOC 9. The performance model is based upon the sampling results of the two monitoring wells with the highest detections of chlorobenzene. Following the planned injection event in the immediate vicinity of the removed source area and upgradient of AOC9-MW14, the effectiveness of the injections will be assessed by monitoring the change in the chlorobenzene groundwater concentration at AOC9-MW15 and AOC9-MW17 during scheduled performance monitoring indicated in this OP and LTM events, as outlined in the 2016 Update UFP-QAPP (Bhate, September 2016b). The performance model is presented in **Appendix C** and is initially based on the baseline concentrations of wells AOC9-MW14, AOC9-MW15, and AOC9-MW17, which were determined from April 2015 groundwater analytical results. Please note that due to the upcoming winter months, an optimization plan remedial design sampling event is anticipated to occur in early spring 2017 to obtain up-to-date baseline values for AOC9-MW15 and AOC9-MW17. Therefore, the present performance model curve should be considered "temporary" and a revised performance model, showing remediation beginning point concentrations, will be developed following the OP remedial design sampling event.

3.5 Optimization Rationale

This OP is designed to provide an upfront two-step evaluation of the current remedy, which has appeared to be effective in reducing the groundwater chlorinated plume since its implementation in 2013. However, in order to provide optimization, Bhate plans to collect groundwater samples for laboratory analysis from key wells (AOC9-MW14 [upgradient], AOC9-MW15, and AOC9-MW17 [RAO target wells]) to evaluate the status of chlorobenzene

concentrations and determine current site-wide trends for this constituent. If the chlorobenzene trend continues to decrease in RAO target wells (AOC9-MW15 and AOC9-MW17), and remains stable and/or decreasing in the upgradient monitoring well, AOC9-MW14, then the current remedy will be allowed to continue. Its effectiveness will be monitored using the LTM program throughout the period of performance to determine if remedy modification is warranted.

If the evaluation indicates that chlorobenzene is on an increasing trend in the RAO target wells and/or near the source area, then an additional oxidant treatment will be applied at the head of the plume, near the removed source area. Though the ROD specifies a persulfate oxidant (PermeOx®) for in-situ treatment of groundwater, Bhate proposes the use of OBC® to enhance biodegradation at the site. Unlike PermeOx®, which was previously used, OBC® is a combination of sodium persulfate and calcium peroxide, which provides direct chemical oxidation as well as enhanced long-term biologic oxidation both aerobically (long-term oxygen release) and anaerobically (oxidation by sulfate reduction).

The goal of this OP is to identify the approach for evaluating and optimizing the effectiveness of the ISCO treatment activities occurring at AOC 9 and to present performance metrics and models to be used for describing how remediation is expected to progress. Additionally, the OP presents an approach for evaluating and optimizing the monitoring well network by eliminating excess monitoring wells. Bhate's OP is in the best interest of the USAF because optimization of the ROD remedies provides the USAF with the lowest LCC and liabilities, while ensuring compliance with the RAOs and protectiveness of human and ecological receptors.

3.6 Contingency Planning

This OP takes into consideration several variables that will be evaluated to achieve optimization at this site. As such, contingencies to counter these variables have been put in place to ensure the project continues to move forward in the best interest of the USAF. These contingencies are listed below:

- Subsurface Work
    - If it is determined that subsurface work is required to complete any necessary field work, then the appropriate utility and permit approvals will be obtained and appropriate contacts and notifications will be made, as described in Sections 3.2.1 and 3.2.3 of this OP.
    - If it is necessary to penetrate concrete and/or asphalt ground surface covers to complete subsurface work, i.e., drilling and injection sites, then those locations will be repaired/patched with like-kind material, as described in Section 3.2.5.2.

- Water Source

  - If a water use permit is unattainable and/or if a fire hydrant is not in close proximity to the site, then a water truck will be used to transport water to the site from a source to be determined, as described in Section 3.2.5.1.

- Groundwater Optimization Sampling

  - Groundwater samples will be collected from AOC9-MW14 (upgradient well), AOC9-MW15, and AOC9-MW17 (RAO target wells) to obtain current VOC groundwater data. If laboratory analysis indicates that chlorobenzene concentrations are no longer trending downward, then optimization would potentially consist of oxidant treatment of groundwater at an upgradient location of the RAO target wells, as described in Section 3.1.

- Contaminant rebound following injection

  - If oxidant injection into the subsurface is conducted as part of the site optimization, it is possible to observe contaminant concentration spikes or "rebound" in groundwater wells immediately following the injection. If this occurs, the quarterly LTM sampling will be extended to monitor the concentrations and verify that it is in fact contaminant rebound that is occurring. If chlorobenzene concentrations do not decrease or continue to go up over time in specific locations, then a second, more focused injection will be conducted. For the second injection, the oxidant will be changed from OBC® to persulfate.

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4 PROJECT MANAGEMENT

4.1 Project Management and Field Supervision

The Bhate project management approach is to work closely with AFCEC to accomplish project objectives and ensure continuous client satisfaction with the work. Therefore, the Project Manager (PM) will have overall responsibility for project schedule, costs, and resources. Resource requirements will be addressed with Bhate's full support during the course of the work.

4.2 Personnel - Duties and Responsibilities

4.2.1 Overall Responsibilities

Bhate will:

- Initiate and maintain a thorough and proactive safety program during the performance of the project.
- Maintain copies of specifications, addenda, written amendments, change orders, work directive changes, and written interpretations and clarifications.
- Manage all resources to meet the project schedule in a cost-effective manner.
- Effectively communicate project-related information with AFCEC points of contact.

4.2.2 Responsibilities of the Project Management Team

As mentioned above, the PM will have overall responsibility for technical, schedule, and budget issues. The Task Manager and other support personnel (as needed) have day-to-day responsibility for project implementation, in accordance with the contract. The Task Manager will support the PM.

4.2.3 Project Manager

The PM, Kimberly Nemmers, is the single Point of Contact for AFCEC and is responsible for programmatic execution and reporting. Our PM resides in Bhate's Lakewood, Colorado office.

4.2.4 Field Operations Manager and Site Safety and Health Officer

The Field Operations Manager (FOM) and Site Safety and Health Officer (SSHO) will be Dustin McNeil. This dual hat position will be responsible for the day-to-day activities, as well as dissemination of information, and policies/procedures. As SSHO, this position is responsible for implementing the SSHP to satisfy federal, State, and local regulations and ensuring that the plan

is consistent with site conditions. The SSHO may take actions to stop work, if required, to address safety concerns. The SSHO is responsible for conformance of all site work with requirements and procedures identified in the SSHP.

The FOM reports to the PM, but also coordinates directly with the Corporate Health and Safety Manager (HSM) and the Corporate Quality Control (QC) Manager.

4.2.5 Corporate QC Manager

The Corporate QC Manager for this project will be Ms. Corey Green, Registered Environmental Manager (REM). The QC Manager will have the responsibility for the overall management of QC and have the authority to stop work if QC assurances are not followed. The QC Manager will also ensure compliance with contract documents and specifications, and implementation/verification of all approved corrective actions.

4.2.6 Corporate Health and Safety Manager

The Corporate HSM, Ms. Sally Smith, Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP), and Certified Hazardous Materials Manager (CHMM), is responsible for the development, implementation, oversight, and enforcement of the SSHP.

5 OPTIMIZATION PLAN REPORTING PROCESS

During the implementation of the OP program, the following deliverables are anticipated:

- Quarterly and Annual LTM Reports
- LUC/IC Inspection Reports (Annual)
- Optimization Work Plan
- Optimization Plan Implementation Report
- 5-Year Review

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6 REFERENCES

Bhate. September 2016a. *Working Copy 2016 Opening Phase Project Management Plan Former Griffiss Air Force Base Rome, New York.*

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CERCLA. 1980. Comprehensive Environmental Response, Compensation, and Liability Act – Section 105 - National Priorities List.

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E&E. 1998. *Draft Report for Expanded Site Investigation and Confirmatory Sampling of Areas of Interest and Drywell/Wastewater-Related Systems, Former Griffiss Air Force Base, Rome, New York.*

EEEPC. July 2010. *Final Record of Decision for Area of Concern 9 (SD-62) at the Former Griffiss Air Force Base, Rome, New York.*

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EEEPC. December 2015. *Final April 2015 Long-Term Monitoring Data Summary Report, AOC 9 (SD-62), Former Griffiss Air Force Base, Rome, New York.*

EEEPC and Parsons. April 2016. *Draft-Final Demonstration of Remedial Actions Operating Properly and Successfully at AOC 9, Former Griffiss Air Force Base, Rome, New York.*

NYSDEC. June 1998. *Technical and Operational Guidance Series 1.1.1.*

Parsons. September 2013. *Remedial Action Work Plan Addendum, Area of Concern 9, Former Griffiss Air Force Base, Rome, New York.*

USEPA. 40 CFR §144.21-§144.28, Underground Injection Control.

USEPA. Form 7520-16, Owner or Operator Form for Inventory of Injection Wells.

USEPA. January 23, 2006. National Primary Drinking Water Standards.

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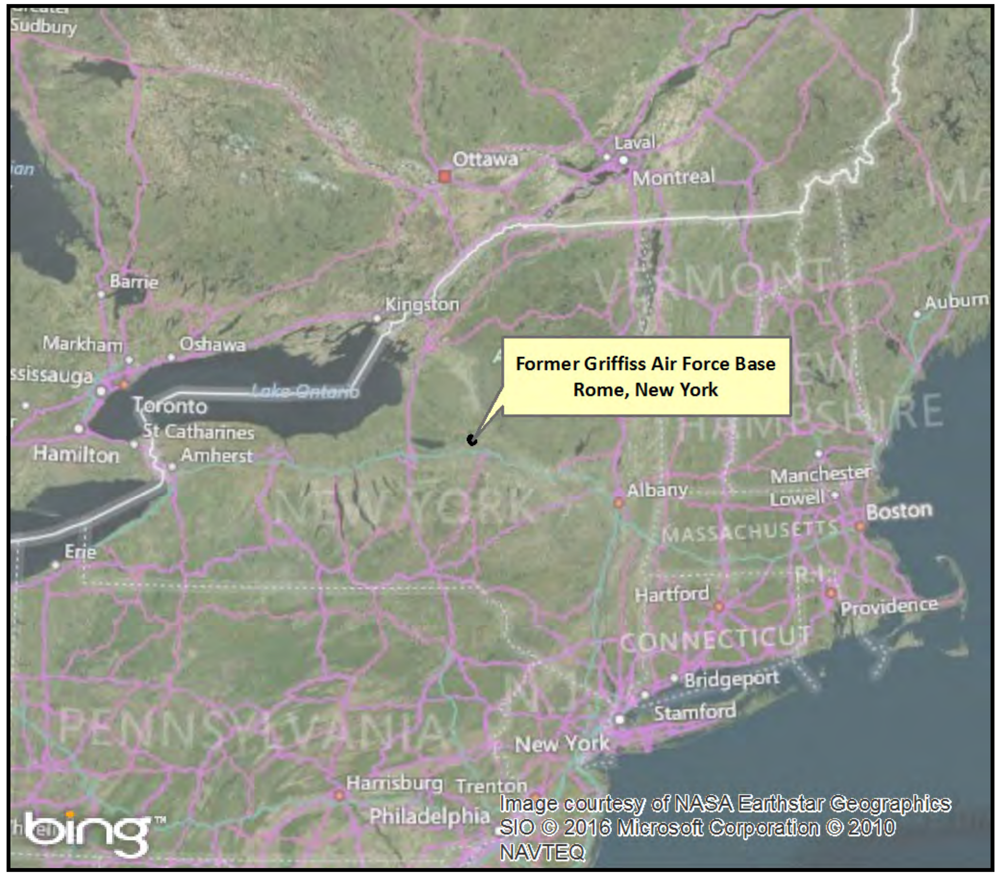
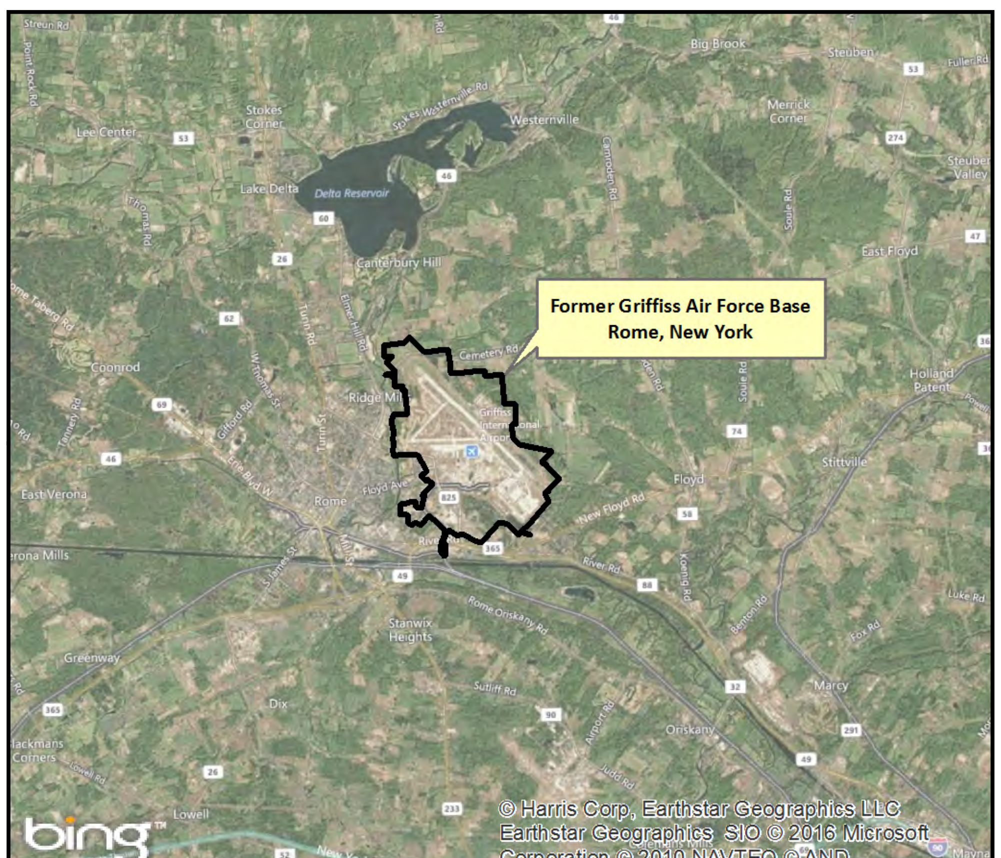
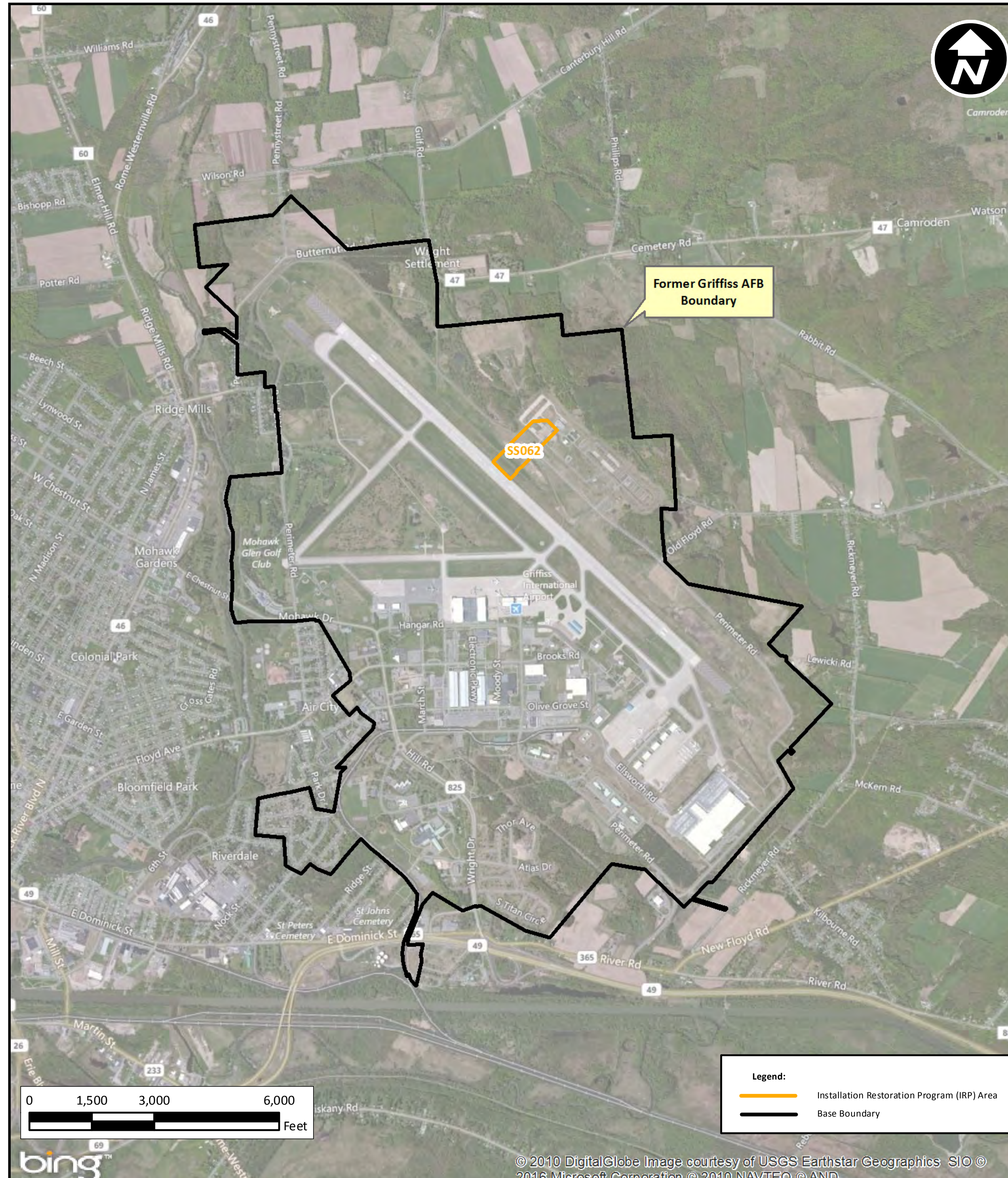
FIGURES





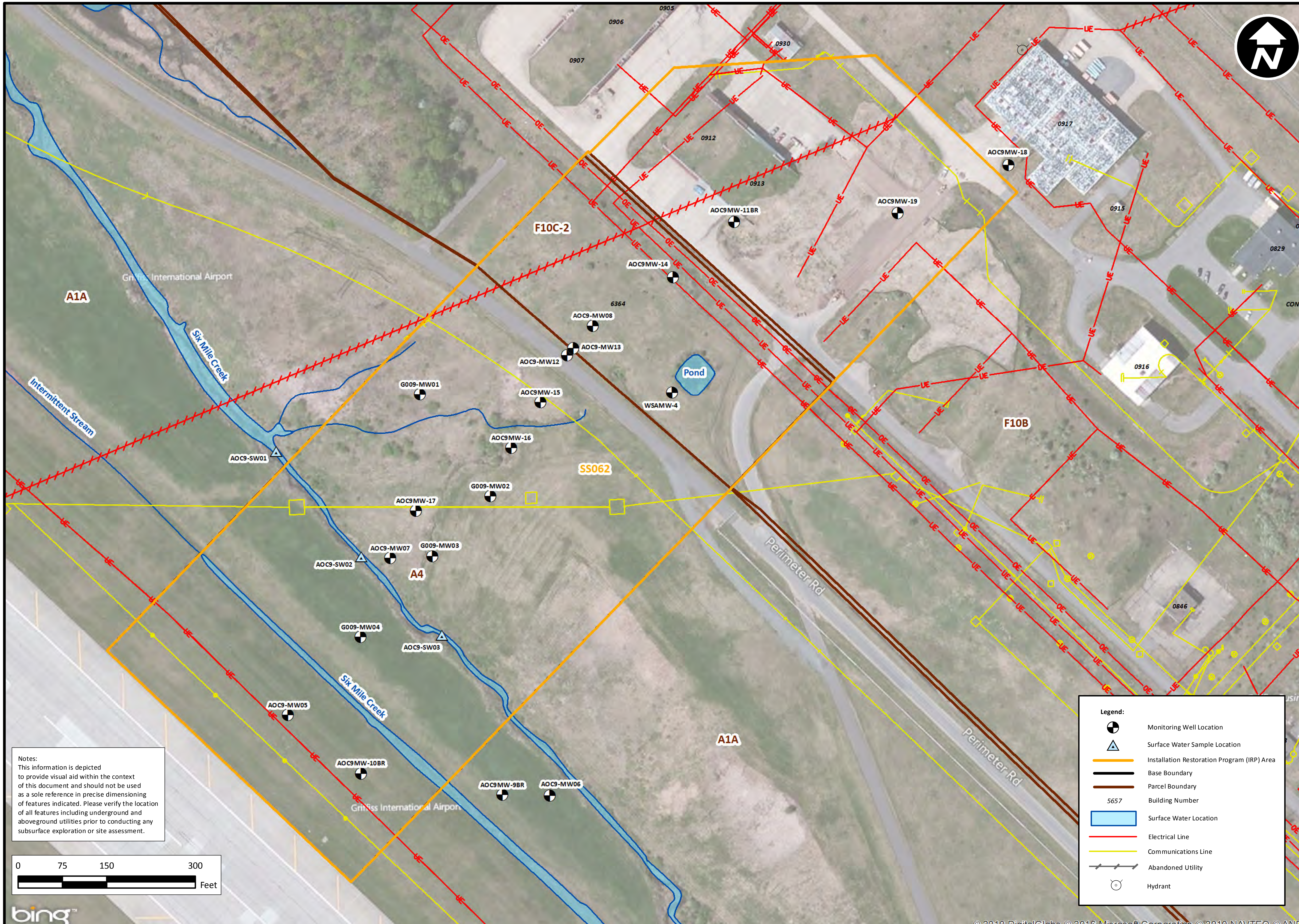


Landfill Site Location Map

Figure 1

Optimization Plan for SS062 AOC 9 Weapons Storage Area
Landfill Chlorinated Plume
Former Griffiss Air Force Base, Rome, New York

DRAWN BY:	MRM
DATE:	9/7/2016
SCALE:	As Shown
PROJECT NO:	AFCGSA3.0012.00AA.2010.0006



Site Map with Current Groundwater/Surface Water Sample Locations

Figure 2

Optimization Plan for SS062 AOC 9 Weapons Storage Area Landfill Chlorinated Plume
Former Griffiss Air Force Base, Rome, New York

DRAWN BY:	MRM
DATE:	9/7/2016
SCALE:	As Shown
PROJECT NO:	AFCGSA3.0012.00AA.2010.0006

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Figure 3

Proposed Injection Point Locations

Optimization Plan for SS062 AOC 9 Weapons Storage Area
Landfill Chlorinated Plume
Former Griffiss Air Force Base, Rome, New York

DRAWN BY: MRM

DATE: 9/7/2016

SCALE: As Shown

PROJECT NO: AFCGSA3.0012.00AA.2010.0006

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Approximate Location of Chlorobenzene Plume (April 2015)

Approximate Location of Former Remedial Excavation Area

AOC9MW-14
AOC9MW-11BR
AOC9MW-19
AOC9MW-18
AOC9-MW08
AOC9-MW13
AOC9-MW12
AOC9MW-15
AOC9MW-16
AOC9MW-17
G009-MW01
G009-MW02
G009-MW03
G009-MW04
WSAMW-4
AOC9-SW01
AOC9-SW02
AOC9-SW03
AOC9-MW07
AOC9-MW05
AOC9MW-10BR
AOC9MW-9BR
AOC9-MW06

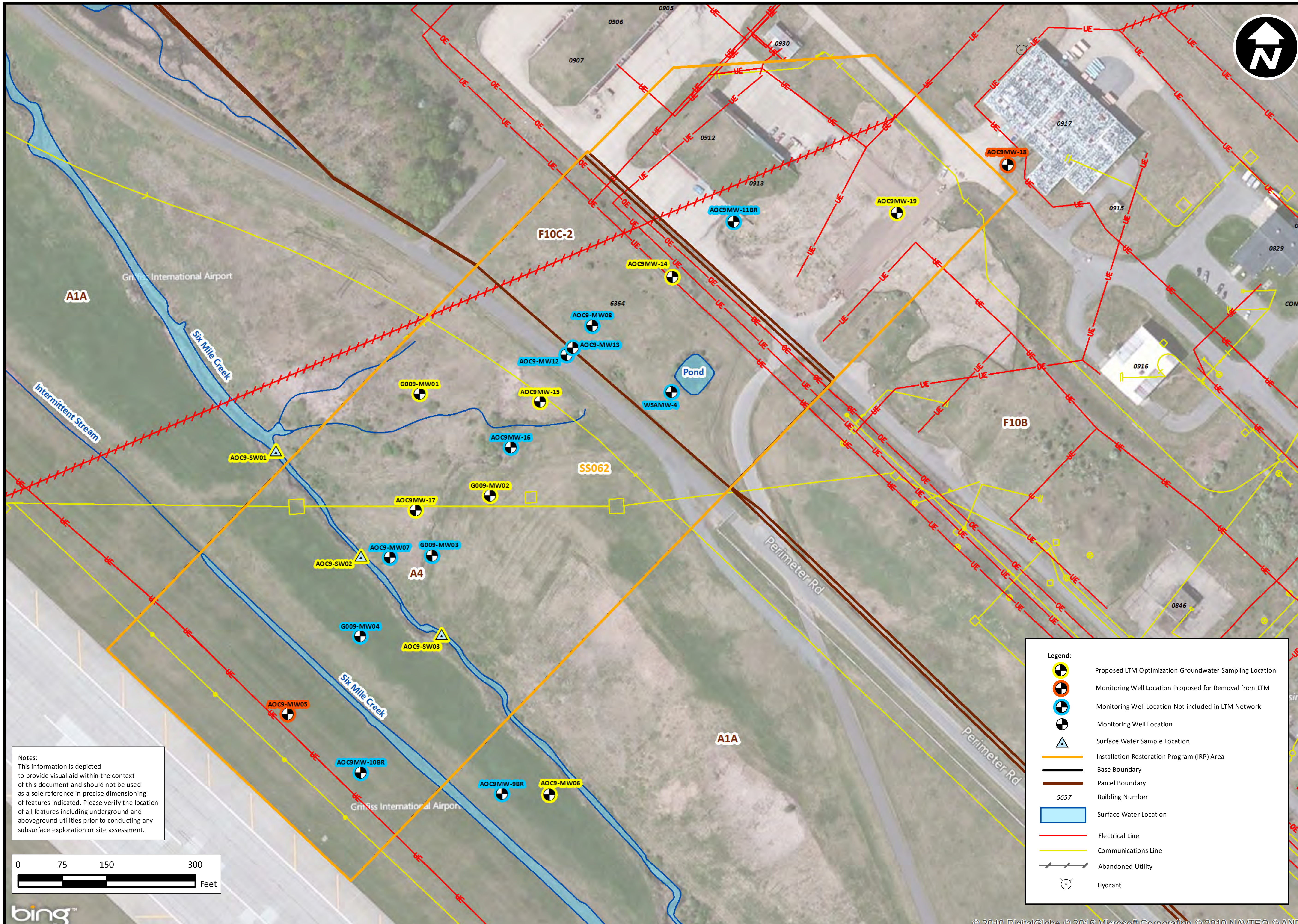
F10C-2
F10B
SS062
A1A
A4
Pond
Six Mile Creek
Intermittent Stream
Griffiss International Airport
Perimeter Rd

0905 0906 0907 0912 0913 0930 0917 0915 0916 0829 0832 0846 6364

Notes:
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.

0 75 150 300 Feet

Legend:
- Proposed Injection Point Location
- Monitoring Well Location
- Surface Water Sample Location
- Installation Restoration Program (IRP) Area
- Base Boundary
- Parcel Boundary
- 5657 Building Number
- Surface Water Location
- Electrical Line
- Communications Line
- Abandoned Utility
- Hydrant



Proposed LTM Optimization Groundwater Sampling Locations

Figure 4

Optimization Plan for SS062 AOC 9 Weapons Storage Area Landfill Chlorinated Plume
Former Griffiss Air Force Base, Rome, New York

DRAWN BY: MRM

DATE: 9/7/2016

SCALE: As Shown

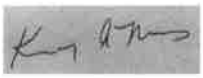
PROJECT NO: AFCGSA3.0012.00AA.2010.0006

bhate ENVIRONMENT INFRASTRUCTURE

APPENDIX A
SITE SAFETY AND HEALTH PLAN

A. Project Information and Approvals

Project Number: AFCGSA3.0012.00AA.2010.0006

Client Information: (Name, Address, Contact, etc.)	**Bhate Project SSHP Approvals (minimum)**			
	Title	**Name**	**Signature**	**Date**
Air Force Civil Engineer Center (AFCEC) Building 171 2261 Hughes Avenue, Suite 155 JBSA Lackland, TX 78236-9853 ATTN: David Farnsworth Cell: (518) 420-2179 Contract/Task Order No: FA8903-16-F-0012 Bhate Project No.: AFCGSA3.0012.00AA.2010.006	Project Manager (PM)	Kim Nemmers		11/17/16
Project Information: (Facility Name, Address, etc.) Optimization Plan for SS062 AOC 9 Weapons Storage Area Landfill Chlorinated Plume Former Griffiss AFB, New York	Health and Safety Manager (HSM)	Sally S. Smith, CIH, CSP ,CHMM, CPEA		11/17/2016
	Field Operation Manager (FOM)/ Site Safety and Health Officer (SSHO)	TBD		11/17/16

Project Safety Coordination:

A Site 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 Health and Safety Plan (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.

Description of field work to be performed:

This SSHP addresses the potential health and safety hazards associated with field activities at SS062 AOC 9 Weapons Storage Area (WSA) Landfill's Chlorinated Plume at the former Griffiss Air Force Base (AFB) in Rome, New York. The primary contaminants of concern are chlorinated solvents in groundwater.

The following project tasks are addressed in this SSHP:

- Groundwater sampling, and
- Oxidant injection - a two-step process. The first step involves mixing the injectate and the second step is the injection into the substrate using a direct push technology (DPT) drill rig. All mixing and injection activities will be supervised and documented by Bhate personnel.

B. Hazard(s) Assessment

Hazard Categories	**Hazard Potential** [High, Moderate, or Low]	**Description of Potential Hazards**
General Safety	• Moderate	• Slips, trips, and falls • Traffic and heavy equipment • Materials handling
Traffic	• Moderate	• Contact with or disruption of traffic when mobilizing and/or drilling

Hazard Categories	**Hazard Potential** [High, Moderate, or Low]	Description of Potential Hazards
Utilities	• Moderate	Buried and aboveground utilities Beware: -Dig Safe will **not** be able to locate the abandoned utilities at many of the sites
Chemical	• Moderate	• Gasoline • Diesel • Motor Oil • Oxygen Biochem® (OBC®) powder in 50 pound bags • Injectate liquid – OBC® mixed with water • Groundwater potentially contaminated with chlorinated solvents
Physical	• Moderate	• Thermal Stressors - Heat • Sun Exposure • Equipment noise – DPT drill rig
Biological	• Moderate	• Insects, snakes, and other wildlife, ticks

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 remediation 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.

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 SDSs and/or 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[1]**	**Foot**	**Hands**	**Respiratory[3, 4]**	**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[1]**	**Foot**	**Hands**	**Respiratory[3, 4]**	**Clothing**
Groundwater Sampling	Hard Hat, Safety Glasses[1] 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
Mixing of Injectate (OBC® and water)	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[2]	Splash apron, Minimum of long pants and shirts with a minimum 4-inch sleeve, ANSI Class II reflective safety vest (for traffic areas)
Operation of DPT drill rig during injection activities	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

Notes:

[1] 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.

[2] All Bhate personnel 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, received training in the use of and be fit tested for the respiratory protection selected.

[3] 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.

[4] 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.

Printed Name:	**Signature:**	**Date:**
Sally S. Smith, MHS, CIH, CSP, CHMM, CPEA **Bhate Director of Health and Safety**	Sally S. Smith	11/17/2016

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 (in Appendix 2 of Griffiss Program HASP) 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	Total VOCs / 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. **Monitor for benzene and implement actions listed below**.
		> 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 indicted 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.
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

Activity(s)	Compound / Instrument	Action Level(s) and Frequency	Actions
		> 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.
Note: 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. 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 SSHO will be responsible for the accountability for all onsite personnel using appropriate sign in / sign out procedures as needed. The SSHO 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 this SSHP 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.

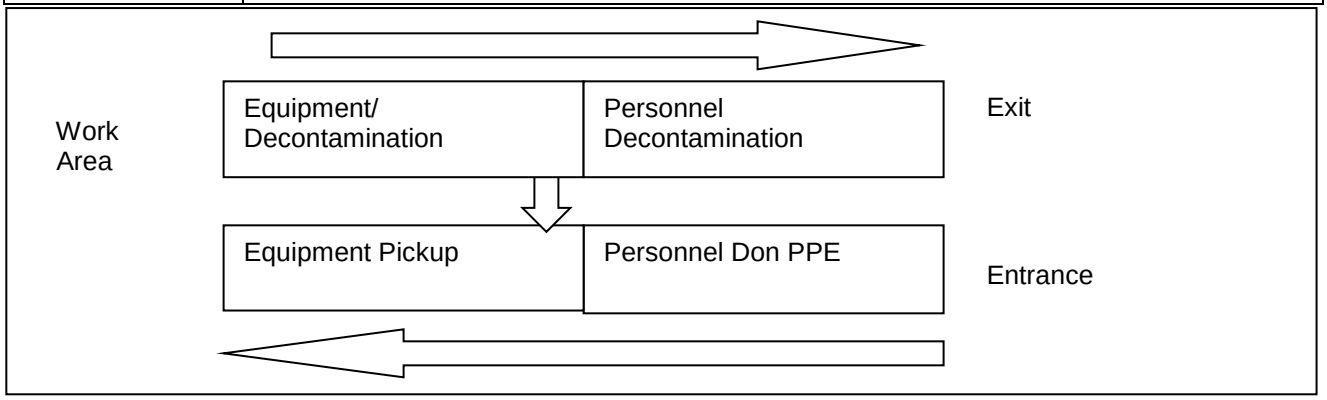
H. Decontamination

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	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.

Type of Decontamination	Decontamination Methods
	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.
Equipment decontamination	Work efforts will be made to minimize equipment contact with contaminated materials. Prior to leaving the work area following treatment of contaminated soils, 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.



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. toluene, 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). Phone numbers and facilities for emergency use are provided for the work site.
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, BEC/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)

Rome Fire Department 158 Black River Blvd N Rome, NY 13440	911 (Emergency) 315-339-7733 (Non-Emergency)
Rome Police Department 301 N James St #1 Rome, NY 13440	911 (Emergency) 315-339-7780 (Non-Emergency)
Rome Memorial Hospital 1500 N. James Street Rome, NY 13440	911 (Emergency) (315) 338-7000 (Administrative) (see Figure 9-1A and B in Attachment 5)
Mohawk Glen Urgent Care **(on base - not a hospital)** 91 Perimeter Road Suite 100 Rome, NY 13441	911 (Emergency) (315)337-2156 (Administrative) (see Figure 9-2A and B in Attachment 5)
Site Safety and Health Officer (SSHO) – TBD	TBD
Griffiss AFB BEC/COR - David Farnsworth	(518) 563-2871 office (518) 420-2179 cell
Project Manager - Kim Nemmers	(303) 550-9239 cell
Bhate Health and Safety Manager 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
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 HASP Attachment 2 – Health and Safety Field Forms

SSHP ATTACHMENT 1

ACTIVITY HAZARD ANALYSES (AHAs)

Activity Hazard Analysis – 01

Task: General Site Activities, Site Mobilization, Traffic Control, Demobilization, and Management of IDW	**Project:** SS062-AOC 9 WSA Landfill	**AHA Reviewed by:** Sally S. Smith, CIH, CSP, CHMM, CPEA
Minimum Personal Protective Equipment (PPE): Level D (Hard Hat, Safety Glasses with rigid side shields, steel toe work boots, leather gloves, disposable Tyvek suit, as needed)	**Location:** Former Griffiss AFB Rome, New York	**AHA Reviewed date:** November 2016

Activity	Potential Hazard(s)	Control Measures
General Site Activities, Site Mobilization, Traffic Control, Demobilization, Management of IDW from groundwater sampling [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	• Be alert for uneven terrain and steep slopes • Keep work area free of dirt, grease, slippery materials, debris, and tools; practice good housekeeping • Provide adequate lighting in all work areas • Keep all stairways and walkways clear of debris/tools to prevent trips • Inspect all tools; take damaged tools out of service and tag – "damaged – do not use"
	Potential for non-work personnel to be injured or contaminated	• 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. • Be aware of potential vehicle traffic while on site • Follow posted warnings and rules for travel around site • All onsite personnel must wear highly reflective ANSI Class 2 safety vests in traffic areas and/or when working around heavy equipment
	Exposure to high noise from heavy equipment and power tools	• Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs) • Hearing protection will be worn when operating the DPT. • SSHO/Site Manager will determine the need for hearing protection • All equipment will be equipped with manufacturer's required mufflers
	Eye injury	• Use ANSI approved safety glasses with rigid side shields
	Overhead hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1 in any construction areas, and areas with overhead hazards
	Dropped objects	• Steel toe boots meeting ANSI Standard Z41 shall be worn

AHA – 01 (continued)

Activity	Potential Hazard(s)	Control Measures
General Site Activities, Site Mobilization, Traffic Control, Demobilization, Management of IDW from groundwater sampling (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	• 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 • Mechanical devices should be used to reduce manual handling of materials • Team lifting should be used if mechanical devices are not available [50 pound maximum lifting restriction for one person]
	Inclement weather (Thunderstorms and tornadoes)	• Halt activities immediately and take cover during thunderstorm or tornado warnings, shelter in a building if possible, stay away from windows • If outdoors, stay close to the ground • Listen to radio or television announcements for pending weather information • Do not try to outrun a tornado on foot or in a vehicle
	Biological hazards (spiders, snakes, ticks etc.)	• Workers will inspect the work area carefully and avoid placing hands and feet into concealed areas • Look in direction of travel for biological hazards to avoid • Wear insect repellant as needed
	Thermal Stressors and other hazards (i.e. heat stress, cold stress)	• Employees will have appropriate clothing for variable weather • Wear long sleeves and long pants and sunscreen with a high sun protection factor (SPF) on exposed skin • Employees will take breaks and drink plenty of fluids, as necessary, to prevent heat stress alternating between water and Gatorade-type drinks • Take periodic warming breaks and drink warm sweet liquids when working in cold weather • Protect skin from becoming wet in cold weather; replace clothing that becomes wet as soon as possible • Wear insect repellant as needed • Refer to the Griffiss Program HASP for detailed information on heat and cold stress
	Overhead/buried utilities	• Conduct a utility locate to identify the location of underground utilities in locations where drilling activities will occur • Beware: -Dig Safe will not be able to locate the abandoned utilities at the site • Overhead utilities should be considered live until determined otherwise • Maintain a minimum distance of > 25 feet from overhead utilities • All underground utilities must be clearly marked before beginning work • No intrusive work shall be conducted within a 4 foot “Buffer Zone” of any underground utility marking

AHA – 01 (continued)

Activity	Potential Hazard(s)	Control Measures
General Site Activities, Site Mobilization, Traffic Control, Demobilization, Management of IDW from groundwater sampling (continued) [NOTE: The hazards and control measures presented in AHA 01 are applicable to all phases of the project]	Spills/Fire	• Fuel cans will be NFPA approved and equipped with pouring spout or funnel • Spill and absorbent materials will be readily available • Smoking and open flames are not permitted in fueling/greasing areas or in the work area • All heavy equipment will be equipped with a ABC type fire extinguishers which will be inspected weekly and documented • Provide fire extinguishers near all welding, soldering, or other sources of ignition • Keep fire extinguishers easy to see and reach in case of an emergency • Store gasoline and other flammable liquids in a safety can with flame arrestor outdoors or in an approved flammable cabinet • Ensure that leaks or spills of flammable or combustible materials are cleaned up promptly • 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
	Sharp objects, if encountered	• 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) • All exposed nails must be bent over or removed; all loose nails must be kept off the ground • Wear leather or Kevlar gloves while handling sharp objects to prevent lacerations
	Electrical, when used	• Ensure ground fault circuit interrupters (GFCI) are used in all outdoor environments, in any areas subject to moisture, and for all temporary power • 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. • 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. • Keep cords and electrical tools out of traffic areas where they may be damaged • 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. ONLY TRAINED ELECTRICIANS ARE PERMITTED TO WORK ON ELECTRICAL CIRCUITRY. • 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

AHA – 01 (continued)

Activity	Potential Hazard(s)	Control Measures
General Site Activities, Site Mobilization, Traffic Control, Demobilization, Management of IDW from groundwater sampling (continued) [NOTE: The hazards and control measures presented in AHA 01 are applicable to all phases of the project]	Ergonomics	• Avoid awkward postures • Avoid repetitive motions; switch hands and take rest breaks to give your affected body parts time to rest • Avoid excessive contact stress; provide padding if contact with a fixed object is prolonged such as the floor or a wall
	Vehicular traffic in work area and heavy equipment operation	• Wear ANSI Class II reflective traffic vest and cordon off work area • Maintain awareness of vehicle movement in work area and exercise caution when approaching heavy equipment exercise caution when approaching heavy equipment • Equipment will be equipped with functioning back-up alarms, signal lamps, lights, and alerting horns • Operators are required to use seat belts at all times • Only qualified / licensed operators will operate mobile equipment • All equipment must be inspected using the appropriate forms prior to use on each day of use
	Exposure to potential contaminants during management of Investigative-derived waste (IDW)	• Wear appropriate PPE including chemical resistant gloves (nitrile inner and neoprene outer) and Tyvek coveralls to minimize potential contact with groundwater, as appropriate • Conduct work activities in a manner that minimizes potential contact with groundwater • Collect all PPE and disposable sampling equipment and place in properly labeled DOT container for proper disposal • Wash hands and face prior to eating, drinking, or smoking

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 Program HASP, SSHP, hospital route map, SDSs/MSDSs, and AHAs At least two designated individuals onsite will have current CPR and First Aid training

Activity Hazard Analysis – 02

Task: Groundwater sampling	**Project:** SS062-AOC 9 WSA Landfill	**AHA Reviewed by:** Sally S. Smith, CIH, CSP, CHMM, CPEA
Minimum Personal Protective Equipment (PPE): Wear Modified Level D - hard hats, steel toed boots, and safety glasses with rigid side shields and, as needed, hearing protection. [NOTE: Upgrade to Level C based on air monitoring.]	**Location:** Former Griffiss AFB Rome, New York	**AHA Reviewed date:** November 2016

Activity	Potential Hazard(s)	Control Measures
Groundwater sampling Collect groundwater samples from existing groundwater monitoring wells using low-flow sampling techniques.	Exposure to contaminants	• To the extent feasible, limit contact with subsurface materials • Wear chemical resistant gloves (nitrile inner and outer) when handling groundwater samples • SSHO shall conduct breathing zone monitoring for chlorinated compounds (See contaminant list in Attachment 4 of this safety plan) 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) • Wash hands and face prior to eating, drinking, or smoking after handling potentially contaminated materials
	Spills/residue material	• Have absorbent materials available to control possible spills or leaks
	Heavy lifting	• Use proper lifting techniques • Lifting limit of 50 pounds per person • Use dollies or mechanical devices, as available
	Electrical Hazards (Extension cords, electrical equipment, temporary lighting, building electricity) if encountered	• Equipment must be inspected prior to use and must be in good condition • The use of extension cords or other portable electrical connections or devices that are not rated for use in wet environments is strictly prohibited • Only ground fault circuit interrupter outlets may be used
	Pinch points	• Use appropriate PPE (leather gloves) when handling well casings and tools

Activity Hazard Analysis – 02 (continued)

Activity	Potential Hazard(s)	Control Measures
Groundwater sampling (continued) [NOTE: Hazards and recommended controls from AHA-01 - Mobilization/Demobilization/Site Preparation apply]	Dust	• Use care when installing well materials (sand, bentonite, Portland cement) into monitoring well to prevent dust generation • Position body in an upwind location from materials while installing • Use wet methods to prevent dust generation
	Cut hazards	• Use care when handling glassware • Do not reach "blindly" into sample container cooler
Preparing shipping container after sampling	Back strain when lifting (could be heavy from ice in sample shipping containers)	• Do not overload shipping containers with ice and with samples • Use proper lifting techniques (50 pound maximum weight per person) • Wear disposable gloves to avoid contact

Equipment Used	Inspection Requirements	Training Requirements
Modified Level D PPE First Aid Kits Eyewash Fire Extinguishers	Employees inspect their own PPE. 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. Weekly inspections will be performed on fire extinguishers, first aid kits and eyewash.	All personnel attend safety orientation and have read and understand the Program HASP, SSHP, hospital route map, SDSs/MSDSs, and AHAs At least two designated individuals onsite will have current CPR and First Aid training

Activity Hazard Analysis – 03

Task: Oxidant injectate mixing and injecting into substrate	**Project:** SS062-AOC 9 WSA Landfill	**AHA Reviewed by:** Sally S. Smith, CIH, CSP, CHMM, CPEA
Minimum Personal Protective Equipment (PPE): Modified Level D - hard hats, steel toed boots, and safety glasses with rigid side shields and as needed, hearing protection. When mixing injectate, splash apron and splash goggles, in addition to above, are to be worn [NOTE: Upgrade to Level C based on air monitoring.]	**Location:** Former Griffiss AFB Rome, New York	**AHA Reviewed date:** August 2016

Activity	Potential Hazard(s)	Control Measures
Oxidant injection is a two-step process. 1. The first step involves mixing the injectate -50 pound bags of Oxygen Biochem® (OBC®) mixed with potable water in a portable polyethylene tank equipped with mixer 2. The second step is the injection if OBC® injectate into the substrate using a direct push technology (DPT) drill rig. [NOTE 1: All mixing and injection activities will be supervised and documented by Bhate personnel.] [NOTE 2: Hazards and recommended controls from AHA-01 also apply.]	Caught by (for personnel on the ground during DPT operation)	• Geoprobe/DPT drill rig operators must have experience and authorization from employer(s) to operate equipment. • To the extent possible, the terrain should be level and the condition of the ground such that unexpected movement of the DPT rig is unlikely • Stabilize the rig prior to injection in accordance with manufacturer's recommendations • Wear required PPE (hard hat, safety glasses, work gloves, ear muffs or plugs, steel toe work boots), ensure loose clothing is secured • Maintain good housekeeping • Keep hands, fingers, and other body parts clear of all moving machinery; ensure machine guards are in place while in operation • Have spotter(s) where visibility impaired and/or difficult maneuvers
	Chemical exposure during mixing (mixing OBC® and water)	• Use proper lifting techniques and material handling devices to move chemicals from storage • Position body upwind to minimize dust exposure • 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 • Conduct work activities in a manner that minimizes potential contact with chemicals • Collect all PPE and disposable equipment and dispose of properly • Wash hands and face prior to eating, drinking, or smoking

Activity Hazard Analysis – 03 (continued)

Activity	Potential Hazard(s)	Control Measures
Oxidant injection (continued)	Spills/residue material	• Have absorbent materials available to control possible spills or leaks
	Struck by moving equipment	• Wear ANSI Class II reflective safety vest and cordon off work area • When delivering and removing tank/mixer, moving equipment will be equipped with functioning back-up alarms, signal lamps, lights, and alerting horns • When delivering and removing tank/mixer, operators are required to use seat belts at all times • Only qualified/licensed operators will operate mixing tank and mobile equipment • All equipment must be inspected daily before use and results of inspection documented
	Exposure to high noise from mixer and power tools	• 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) • SSHO/FOM will determine the need for hearing protection • All equipment will be equipped with manufacturer's required mufflers
	Hazards from forklift operation: • Vehicular Accidents • injuries • Dropping of loads • Falling off vehicle	• Only qualified personnel will operate the forklift. • Confirm OSHA-required forklift training of operators (Forklift Operator Training is required to operate a forklift) • Watch out, be alert for traffic • Drive defensively, report violations, follow all traffic rules • Secure unsteady or unbalanced loads in vehicles or on forklifts • Wear ANSI Class II reflective safety vest • Maintain awareness of vehicle movement in work area and exercise caution • Moving equipment will be equipped with functioning back-up alarms, signal lamps, lights and alerting horns • Operators are required to use seat belts at all times
	Overhead/buried utilities	• Beware: Dig Safe will not be able to locate the abandoned utilities at the site • 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. • Refer to the U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM 385-1-1) for a complete description of procedures required when working at a location adjacent to overhead power lines.

Activity Hazard Analysis – 03 (continued)

Activity	Potential Hazard(s)	Control Measures
Oxidant Injection (continued)	Overhead/buried utilities (continued)	• The minimum required clearance distances from energized overhead electric lines are provided below.

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)

Equipment Used	Inspection Requirements	Training Requirements
Modified Level D PPE (Level C, if SSHO determines needed) Splash apron and chemical goggles Fire Extinguishers First Aid Kits Eyewash Portable Hand wash station (not hand sanitizer) due to impacted groundwater at the site. Portable polyethylene mixing tank with mixer Pallet jack, as needed Geoprobe/DPT rig	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. Daily Drill Rig Inspection form will be completed when using DPT 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 Program HASP, SSHP, hospital route map, SDSs/MSDSs, and AHAs At least two designated individuals onsite will have current CPR/ First Aid and Blood-borne pathogens (BBP) training Geoprobe Operators must have experience and authorization from employer(s) to operate equipment.

SSHP ATTACHMENT 2

COMMON SAFETY SIGNS


DANGER
CONSTRUCTION AREA
KEEP OUT
Created 04.18.07, using Industrial Safety Sign Builder by St. Claire, Inc. www.stclaire.com (888) 741-8252

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

SSHP ATTACHMENT 3

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

SAFETY DATA SHEET

1. Identification

Product identifier	**Oxygen Biochem (OBC)™**
Other means of identification	Not available.
Recommended use	Oxygen Biochem (OBC)™ is used to promote chemical oxidation and aerobic bioremediation of petroleum compounds in groundwater.
Recommended restrictions	Use in accordance with supplier's recommendations.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer/Supplier	Redox Tech, LLC
Address	200 Quade Drive Cary NC 2751
Telephone	+1 919-6780140
E-mail	haselow@redox-tech.com
Contact person	Dr. John Haselowi
Emergency Telephone	For Hazardous Materials [or Dangerous Goods] Incidents ONLY (spill, leak, fire, exposure or accident), call CHEMTREC at CHEMTREC®, USA: 001 (800) 424-9300 CHEMTREC®, Mexico (Toll-Free - must be dialed from within country): 01-800-681-9531 CHEMTREC®, Other countries: 001 (703) 527-3887

2. Hazard(s) identification

Physical hazards	Oxidizing solids	Category 3
Health hazards	Acute toxicity, oral	Category 4
	Skin corrosion/irritation	Category 2
	Serious eye damage/eye irritation	Category 2
	Sensitization, respiratory	Category 1
	Sensitization, skin	Category 1
	Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation

OSHA defined hazards Not classified.

Label elements

Signal word	Danger
Hazard statement	May intensify fire; oxidizer. Harmful if swallowed. Causes skin irritation. Causes serious eye irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction. May cause respiratory irritation.

Precautionary statement

Prevention	Keep away from heat. Keep/Store away from clothing and other combustible materials. Take any precaution to avoid mixing with combustibles. Wear protective gloves/eye protection/face protection. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid breathing dust/fume. In case of inadequate ventilation wear respiratory protection. Contaminated work clothing must not be allowed out of the workplace. Use only outdoors or in a well-ventilated area.
Response	In case of fire: Use foam, carbon dioxide, dry powder or water fog for extinction. If swallowed: Call a poison center/doctor if you feel unwell. Rinse mouth. If on skin: Wash with plenty of water. If skin irritation or rash occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse. 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. If inhaled: If breathing is difficult, remove person to fresh air and keep comfortable for breathing. If experiencing respiratory symptoms: Call a poison center/doctor.

Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.

3. Composition/information on ingredients

Mixtures

Chemical name	CAS number	%
Sodium persulfate	7775-27-1	70 - 90
Calcium peroxide	1305-79-9	10 - 20

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

Inhalation Move to fresh air. Do not use mouth-to-mouth method if victim inhaled the substance. For breathing difficulties, oxygen may be necessary. Call a physician or poison control center immediately.

Skin contact Remove and isolate contaminated clothing and shoes. For minor skin contact, avoid spreading material on unaffected skin. Wash clothing separately before reuse. If skin irritation or an allergic skin reaction develops, get medical attention.

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.

Ingestion Rinse mouth. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Do not use mouth-to-mouth method if victim ingested the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Get medical attention if any discomfort continues.

Most important symptoms/effects, acute and delayed May cause redness and pain. Symptoms may include coughing, difficulty breathing and shortness of breath.

Indication of immediate medical attention and special treatment needed Provide general supportive measures and treat symptomatically.

General information Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).

Unsuitable extinguishing media None known.

Specific hazards arising from the chemical Contact with combustible material may cause fire.

Special protective equipment and precautions for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire-fighting equipment/instructions In the event of fire, cool tanks with water spray.

General fire hazards May intensify fire; oxidizer.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Avoid skin contact and inhalation of vapors during disposal of spills. Ventilate closed spaces before entering them. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see Section 8 of the SDS.

Methods and materials for containment and cleaning up Stop the flow of material, if this is without risk. Prevent entry into waterways, sewer, basements or confined areas. Following product recovery, flush area with water. For waste disposal, see Section 13 of the SDS.

Environmental precautions Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling Avoid inhalation of vapors/dust and contact with skin and eyes. Wash thoroughly after handling. Keep away from clothing and other combustible materials. Use only with adequate ventilation. Do not taste or swallow. Wear appropriate personal protective equipment (See Section 8). Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities Store in original tightly closed container. Store away from incompatible materials (See Section 10). Keep locked up.

8. Exposure controls/personal protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Sodium persulfate (CAS 7775-27-1)	TWA	0.1 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Observe occupational exposure limits and minimize the risk of exposure. Ensure adequate ventilation, especially in confined areas.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Wear protective gloves.

Other Neoprene or rubber gloves are recommended. Apron and long sleeves are recommended.

Respiratory protection In the case of respirable dust, use self-contained breathing apparatus. Wear positive pressure self-contained breathing apparatus (SCBA).

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance Off-white, granular solid.

Physical state Solid.

Form Solid.

Color Off-white.

Odor Odorless.

Odor threshold Not available.

pH 11.7±0.4 (1-40% solution, slurry)

Melting point/freezing point Not available.

Initial boiling point and boiling range Not applicable.

Flash point Not available.

Evaporation rate Not available.

Flammability (solid, gas) Not available.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) Not available.

Flammability limit - upper (%) Not available.

Explosive limit - lower (%) Not available.

Explosive limit - upper (%) Not available.

Vapor pressure Not applicable.

Vapor density Not applicable.

Relative density 2.76±0.16 (25°C)

Solubility(ies)	
Solubility (water)	Soluble in water.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Oxidizing properties	Oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Contact with combustibles.
Incompatible materials	Combustible material. Oxidizing material. Reducing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Ingestion	Harmful if swallowed.
Inhalation	May cause irritation to the respiratory system.
Skin contact	Causes skin irritation.
Eye contact	Causes serious eye irritation.
Symptoms related to the physical, chemical and toxicological characteristics	May cause redness and pain. Exposed individuals may experience eye tearing, redness, and discomfort. Symptoms may include coughing, difficulty breathing and shortness of breath.

Information on toxicological effects

Acute toxicity	Harmful if swallowed.
Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/eye irritation	Causes serious eye irritation.
Respiratory or skin sensitization	
Respiratory sensitization	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
Skin sensitization	May cause an allergic skin reaction.
Germ cell mutagenicity	No data available.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.
Reproductive toxicity	No data available.
Specific target organ toxicity - single exposure	May cause respiratory irritation.
Specific target organ toxicity - repeated exposure	No data available.
Aspiration hazard	Not applicable.
Chronic effects	Prolonged exposure may cause chronic effects.
Further information	No data available.

12. Ecological information

Ecotoxicity	This product's components are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.
Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	No data available for this product.

Mobility in soil	Not available.
Other adverse effects	No data available.

13. Disposal considerations

Disposal instructions	Consult authorities before disposal. Dispose in accordance with all applicable regulations.
Hazardous waste code	The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations.
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN1479
UN proper shipping name	Oxidizing solid, n.o.s. (Sodium persulfate)
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	II
Environmental hazards	
Marine pollutant	No
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	62, IB5, IP1
Packaging exceptions	None
Packaging non bulk	211
Packaging bulk	242

IATA

UN number	UN1479
UN proper shipping name	Oxidizing solid, n.o.s. (Sodium persulfate, Calcium peroxide)
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Label(s)	5.1
Packing group	II
Environmental hazards	No
ERG Code	5L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN1479
UN proper shipping name	OXIDIZING SOLID, N.O.S. (Sodium persulfate, Calcium peroxide)
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Label(s)	5.1
Packing group	II
Environmental hazards	
Marine pollutant	No
EmS	F-A, S-Q
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	This product is not intended to be transported in bulk.

15. Regulatory information

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All components are on the U.S. EPA TSCA Inventory List.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - Yes
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical

Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA)

Not regulated.

US state regulations

This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

US. Massachusetts RTK - Substance List

Not regulated.

US. New Jersey Worker and Community Right-to-Know Act

Calcium peroxide (CAS 1305-79-9)
Sodium persulfate (CAS 7775-27-1)

US. Pennsylvania Worker and Community Right-to-Know Law

Not listed.

US. Rhode Island RTK

Not regulated.

US. California Proposition 65

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Not listed.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 09-May-2014

Revision date -

Version # 01

Further information HMIS® is a registered trade and service mark of the NPCA.

NFPA Ratings

List of abbreviations NFPA: National Fire Protection Association.

References Registry of Toxic Effects of Chemical Substances (RTECS)
HSDB® - Hazardous Substances Data Bank

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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							
Chlorobenzene CAS # 108-90-7	75 ppm	10 ppm IDLH = 1,000 ppm	Inhalation Ingestion Contact	Irritation of eyes, skin, nose; drowsiness; incoordination	Central nervous system (CNS) depression; Liver damage	Eyes, skin, respiratory system, CNS, liver	9.07	1.11	9	82	1.3	9.6
1,2-Dichloroethylene cis-1,2-DCE CAS # 540-59-0	200 ppm	200 ppm IDLH = 1,000 ppm	Inhalation Ingestion Contact	Irritation of eyes, skin	CNS impairment, eye irritation	Eyes, respiratory system, CNS	9.65	1.27	180-265	36-39	5.6	12.8
Trichloroethylene (TCE) CAS # 79-01-6	100 ppm Ceiling = 200 ppm 300 ppm (for 5-minute maximum peak in any 2 hours)	10 ppm STEL = 25 ppm IDLH = 1,000 ppm	Inhalation Absorption Ingestion Contact	Irritation of eyes, skin, head, visual disturbance; drowsiness	CNS impairment, cognitive decrements, renal toxicity	Eyes, skin, resp. sys, heart, liver, kidneys, CNS (in animals – liver and kidney cancer)	9.45	1.46	58	Not known	8.0	10.5

Notes:
NA = Not Applicable
IP = Ionization Potential
eV = Electron volt
LEL = Lower Explosive Limit
UEL = Upper Explosive Limit
PEL = Permissible Exposure Limit
IDLH = Immediately Dangerous to Life and Health
C = Ceiling Limit (Exposure never to exceed)
STEL = Short-term Exposure Limit (Exposure averaged over 15 minutes)
TLV = Threshold Limit Value
mg/m^3 = Milligrams per cubic meter of air
ppm = Parts per million
atm = atmospheres
mm Hg = Millimeters of mercury
VP = Vapor Pressure

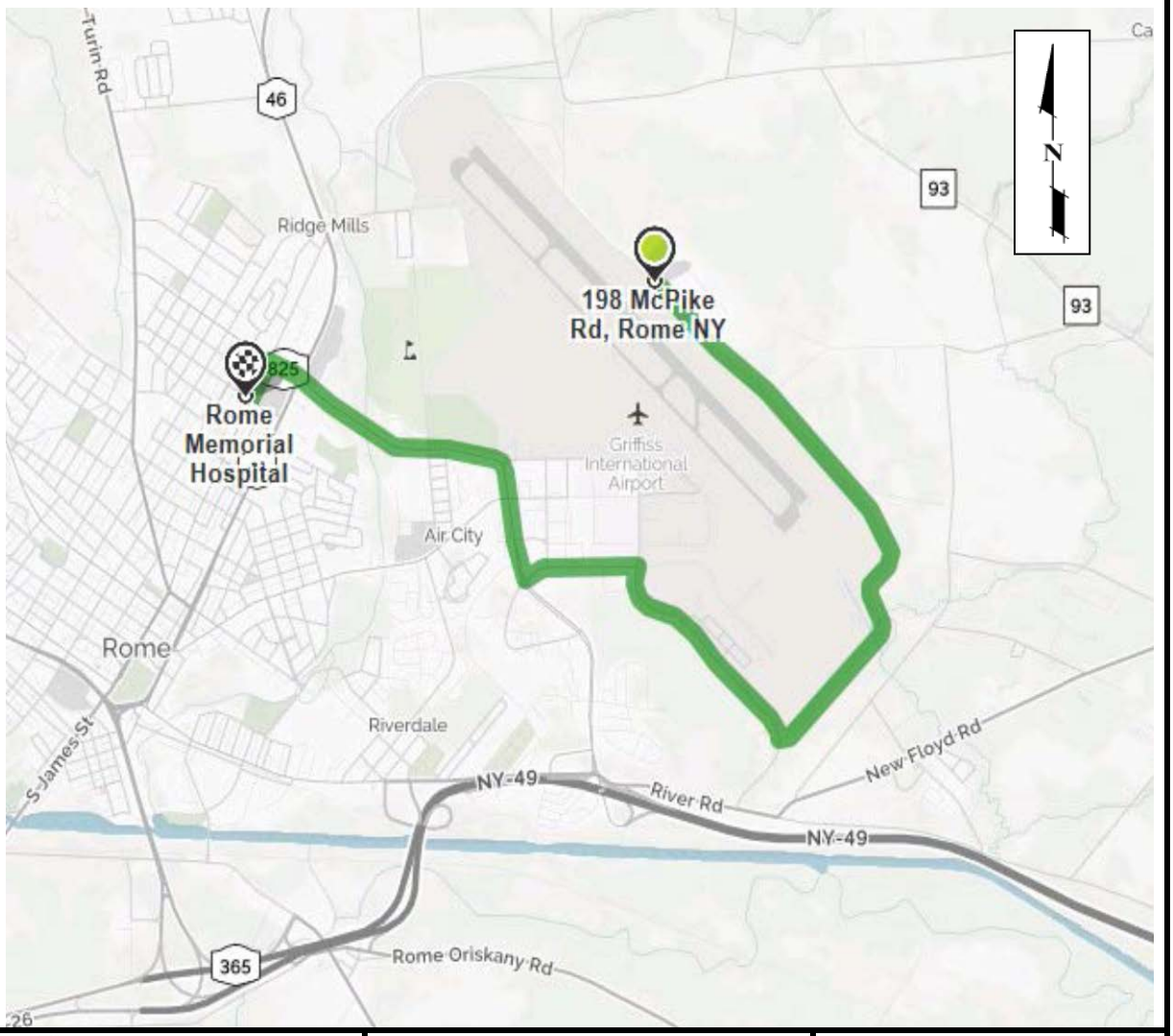
ATTACHMENT 5

HOSPITAL MAPS
FROM GRIFFISS PROGRAM HASP

Figure 9-1A. Rome Memorial Hospital Map
Figure 9-1B. Rome Memorial Hospital Directions
Figure 9-2A. Mohawk Glen Urgent Care (Non-Emergency Clinic) Map
Figure 9-2B. Mohawk Glen Urgent Care (Non-Emergency Clinic) Directions

Figure 9-1A: Hospital Route Map

Rome Memorial Hospital



bhate ENVIRONMENT INFRASTRUCTURE

HOSPITAL ROUTE MAP

Rome Memorial Hospital
Phone: 315-338-7000
Source: Map Quest.com

GRIFFISS AFB

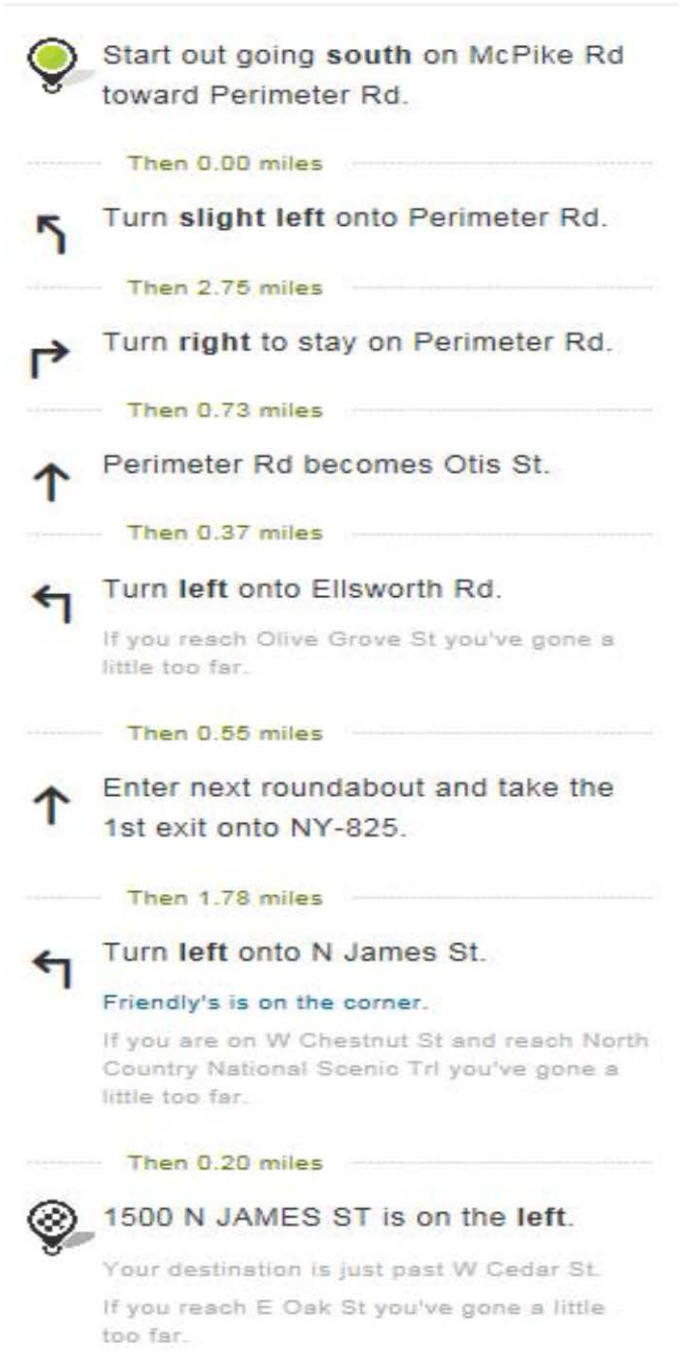
Figure 9-1A

Not to Scale

Date: November 2016

Figure 9-1B: Hospital Route Directions

Rome Memorial Hospital



Start out going **south** on McPike Rd toward Perimeter Rd.

Then 0.00 miles

Turn **slight left** onto Perimeter Rd.

Then 2.75 miles

Turn **right** to stay on Perimeter Rd.

Then 0.73 miles

Perimeter Rd becomes Otis St.

Then 0.37 miles

Turn **left** onto Ellsworth Rd.

If you reach Olive Grove St you've gone a little too far.

Then 0.55 miles

Enter next roundabout and take the 1st exit onto NY-825.

Then 1.78 miles

Turn **left** 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.

Then 0.20 miles

1500 N JAMES ST is on the **left**.

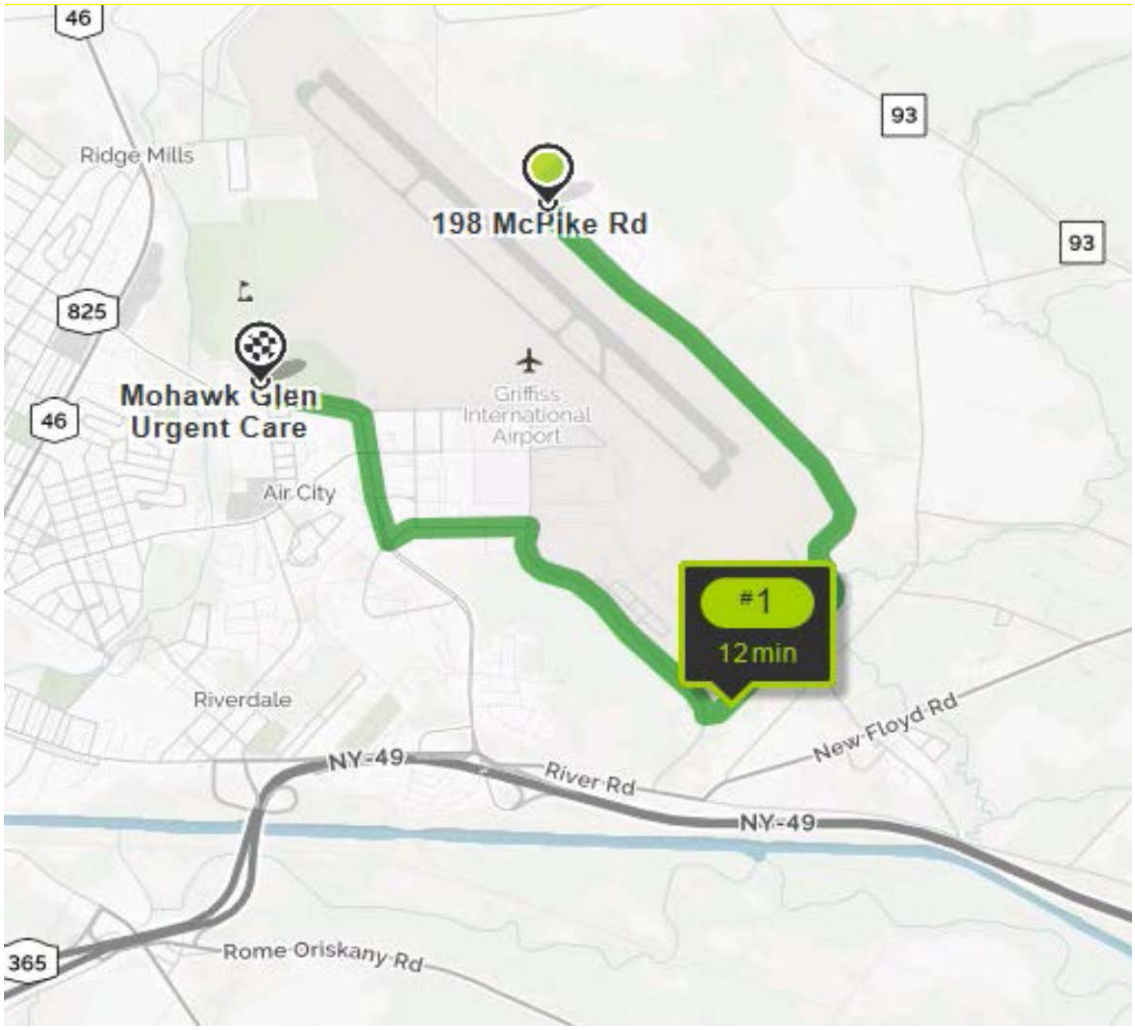
Your destination is just past W Cedar St.

If you reach E Oak St you've gone a little too far.

bhate ENVIRONMENT INFRASTRUCTURE	**HOSPITAL ROUTE MAP** Rome Memorial HospitalPhone: 315-338-7000 Source: MapQuest.com	GRIFFISS AFB Figure 9-1B
	Not to Scale / Date: November 2016	

Figure 9-2A: Clinic Route Map

Mohawk Glen Urgent Care



bhate ENVIRONMENT INFRASTRUCTURE	**CLINIC ROUTE MAP** Mohawk Glen Urgent Care Phone: 315-337-2156 Source: MapQuest.com	GRIFFISS AFB Figure 9-2A
	Not to Scale / Date: November 2016	

Figure 9-2B: Clinic Route Directions

Mohawk Glen Urgent Care

bhate ENVIRONMENT INFRASTRUCTURE	**CLINIC ROUTE MAP** Mohawk Glen Urgent Care Phone: 315-337-2156 Source: MapQuest.com	GRIFFISS AFB Figure 9-2B
	Not to Scale / Date: November 2016	

APPENDIX B
INJECTION VOLUME/QUANTITY EVALUATION SPREADSHEET

OBC® Injection Volume-Quantity Evaluation
SS062 AOC 9 - Former Griffiss AFB, Rome, New York

Volume Calculation

Area to be treated (ft^2)	1170.00	ft^2					
Treatment Interval (ft)	15	ft					
Volume Treated	17550.0	ft^3	650	yards	497.016	m3	
Estimated Radius of Influence (ft)	7.0	ft					
Estimated Percent Overlap	0%	be between 0.0 and 0.20)					
eff. porosity =	0.25						
Total Pore volume =	4387.5	cu ft	32,819	gallons			
Injecting 10% of pore volume =	3282	gallons					
Estimated Number of Injection Points	8						

Low Total Oxidant Demand

OBC needed:

Bulk density of soil =	1600	kg/m3					
Mass of soil =	795225.6	kg					
Oxidant demand =	0.93	g/kg					
Oxidant required =	739.55981	kg					
	1627	lbs					
OBC solution =	0.50	lbs/gallon		0.059537	kg/L	59.53724	g/L

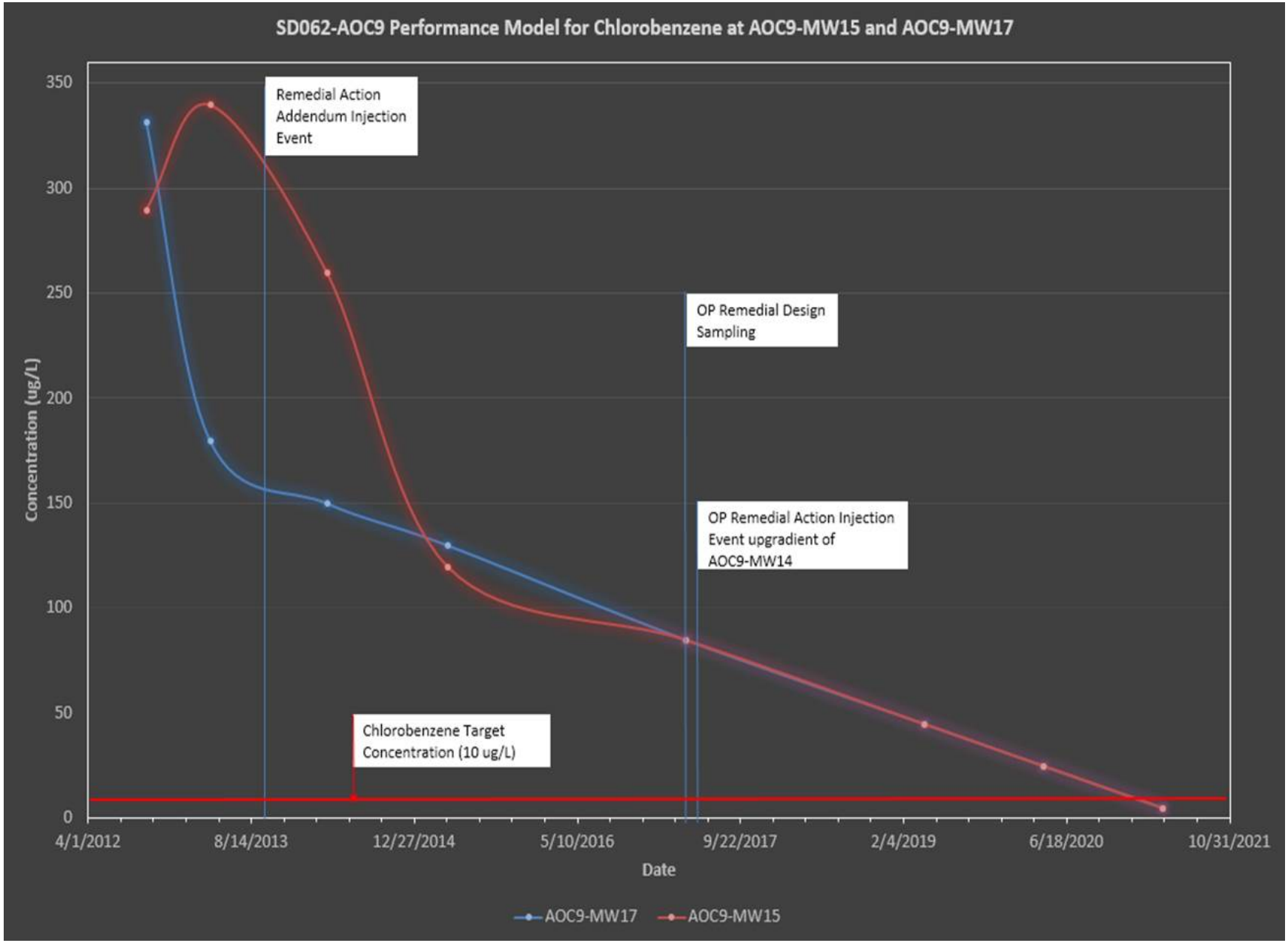
Higher Total Oxidant Demand

OBC needed:

Bulk density of soil =	1600	kg/m3					
Mass of soil =	795225.6	kg					
Oxidant demand =	1.86	g/kg					
Oxidant required =	1479.1196	kg					
	3254	lbs					
OBC solution =	6563.70	lbs/gallon		788.2431	kg/L	788243.1	g/L

APPENDIX C
PERFORMANCE MODEL

To assess and predict the centerline concentration along the AOC 9 plume for development of the Performance Model, historical groundwater data were compiled from the time the PermeOx Plus® injections occurred in November 2013 through April 2015. From the historical groundwater data, chlorobenzene concentrations were plotted against their associated sampling date to calculate attenuation rate constants for chlorobenzene at AOC9-MW15 and AOC9-MW17, which are positioned along the centerline of the plume. As expected, the attenuation rate constant for AOC9-MW15 is more rapid since the monitoring well is closest to the former injection area. As a result, Bhate used the rate constant developed for AOC9-MW17 to predict the concentrations for both AOC9-MW15 and AOC9-MW17 at the end of the POP using the estimated initial or starting concentration of 85 µg/L for April 2017. Therefore, using this approach, 10 µg/L for chlorobenzene was determined to be the target level for both AOC9-MW15 and AOC9-MW17. Depending on the date of the baseline remedial design sampling event, as discussed in Sections 3.1 and 3.4 of the OP, the Performance Model may require revisions.


SD062-AOC9 Performance Model for Chlorobenzene at AOC9-MW15 and AOC9-MW17
Remedial Action Addendum Injection Event
OP Remedial Design Sampling
OP Remedial Action Injection Event upgradient of AOC9-MW14
Chlorobenzene Target Concentration (10 ug/L)
Concentration (ug/L)
350
300
250
200
150
100
50
0
4/1/2012
8/14/2013
12/27/2014
5/10/2016
9/22/2017
2/4/2019
6/18/2020
10/31/2021
Date
AOC9-MW17
AOC9-MW15