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September 28, 2022

David S. Farnsworth, DAF
Program Manager/BRAC Environmental Coordinator
Air Force Civil Engineer Center (AFCEC/CIBE-Plattsburgh)
8 Colorado Street, Suite 121
Plattsburgh, NY 12903

Re: Final Letter Work Plan for Cleanup Time Frames at CERCLA Sites SD052-01, SD052-02, SD052-04, SD052-05, and SS062 (Document Control #106-NEBECOS-0014-GRI)
Former Griffiss Air Force Base, Rome, New York
Contract No. FA8903-20-D-0001

Dear Mr. Farnsworth:

Bhate Environmental Associates, Inc. (Bhate) is pleased to submit this Letter Work Plan for the tabletop exercise to assess groundwater cleanup time frames at on-base groundwater sites SD052-01, SD052-02, SD052-04, SD052-05, and SS062, located at the former Griffiss Air Force Base in Rome, New York. This Work Plan outlines the approach to assess the groundwater cleanup time frames and a path forward for each of these sites.

If you should have any questions regarding the information contained in this Work Plan, please do not hesitate to contact me at (720) 463-3903.

Sincerely,

Frank Gardner, PG
Program Manager

FINAL
LETTER WORK PLAN
CLEANUP TIME FRAMES AT CERCLA SITES
SD052-01, SD052-02, SD052-04, SD052-05, AND SS062
FORMER GRIFFISS AIR FORCE BASE
ROME, NEW YORK

PREPARED FOR:	Mr. David Farnsworth/Former Griffiss Air Force Base, Base Realignment and Closure (BRAC) Environmental Coordinator (BEC) and Contracting Officer's Representative (COR)
PREPARED BY:	Bhate Environmental Associates, Inc.
COPIES:	Mr. Robert Morse, United States Environmental Protection Agency Ms. Heather Bishop, New York State Department of Environmental Conservation
DATE:	September 2022

Bhate Environmental Associates, Inc. (Bhate) was retained by the Air Force Civil Engineer Center (AFCEC), under Contract Number FA8903-20-D-0001, to conduct environmental remediation activities at the former Griffiss Air Force Base (AFB) (**Figure 1**). Under this contract, Bhate has prepared this Letter Work Plan (Work Plan) to assess cleanup time frames at the following Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites based on the Record of Decisions (RODs) for each of the following sites (**Figure 2**).

- SD052-01: The Nosedocks/Apron 2 Chlorinated Plume
- SD052-02: Building 775/Pumphouse 3
- SD052-04: Landfill 6 Trichloroethene (TCE) Site
- SD052-05: Building 817/Weapon Storage Area (WSA) Site
- Site SS062: Area of Concern (AOC) 9

This Work Plan outlines the process for the tabletop exercise to assess groundwater cleanup time frames. The process will be to analyze historical and recent data in context of the selected remedies and ROD assumptions to assess remedial progress of the current groundwater cleanup. Revised projected cleanup time frames and corresponding impact to life-cycle cost for each site will be developed.

Approach for Conceptual Site Model (CSM)

This Work Plan describes the structure and content that will be included in a current CSM for each site. The CSM will be based on the current understanding of site history and conditions. The CSM approach will follow the general guidance of ASTM International (ASTM) E1689-20, *Standard Guide for Developing Conceptual Site Models for Contaminated Sites* (ASTM, September 2020) and *Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model* (United States Environmental Protection Agency [USEPA], July 2011). The following will be presented for the former Griffiss AFB as it applies to each of the five sites:

- **Facility Description**. This section will describe the geographical location, areal information, significant landforms, and historical and current functional purpose of the former Griffiss AFB.
- **Regional Geology**. This section will include a general description of key surficial and subsurface characteristics encountered at the former Griffiss AFB, including topography and elevation, general formation content and depths, aquifer characteristics and depths, and surface water bodies.

The following CSM items will be evaluated separately for each site:

- **Site Location**. This section will include the geographical location, areal information, significant landforms, and historical and current functional purpose of the site.
- **Site Description**. This section will include a chronology of industrial or commercial activities at the site, known releases, previous investigations, and remedial activities, as applicable.
- **Nearby BRAC Sites**. This section will present a detailed summary of adjacent parcels, including current and historical use, known environmental impacts, and remedial activities.
- **Site-Specific Geology**. This section will summarize previous investigations to describe the subsurface at the site. This will include soil descriptions and information on the various formations encountered, dependent on the level of detail present in the data.
- **Site-Specific Hydrogeology**. This section will summarize previous investigations to describe the characteristics of groundwater and surface water at the site. This may include water table depths, aquifers encountered, direction and rate of groundwater flow, recharge rate, discharge locations, drainage patterns, and more depending on the level of detail present in the data. This section will also include determining if nearby surface water bodies are involved as potential pathways or receptors.
- **Sources of Known and Suspected Contamination.** This section will present a chronology of known and suspected releases and the contaminants of concern involved, if known. This may include targeted discussion of chemical storage at the site, previous investigations, and any conclusions.
- **Remedial Summary.** This section will present a chronology of remedial actions implemented at the site. The outcome and current status of the remedy will also be included.
- **Potable Well Survey**. This section will survey water collection and use at the facility and at the site, as applicable. Potable wells within a ¼-mile radius, major regional pumping,

and water supply sources will be reviewed in detail as applicable.

- **Exposure Routes and Receptors.** This section will discuss potential exposure routes and receptors identified in previous sections. This may include at-risk potable wells and nearby surface water bodies.
- **Data Gaps**. The CSM update will identify and summarize any data gaps discovered during the data review.

Cleanup Time Frame Assessments

After reviewing and incorporating historical investigation and remediation site data into a current CSM, a cleanup time frame assessment will be completed for each site. Cleanup time frames will be assessed with respect to on-going remediation or monitored natural attenuation (MNA) depending on the current site conditions.

On-going remediation time frames will be evaluated using graphical representations of COC concentrations over time and estimating a time to closure based on decreasing COC trends. If decreasing trends are not apparent or a site has no active remedy, an MNA assessment will be completed. The MNA assessment will employ tools including the *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water* (Wiedemeier, September 1998) and/or *Methodology for Estimating Times of Remediation Associated with Monitored Natural Attenuation* (United States Geological Survey [USGS], 2003) and the USEPA guidance *Use of Monitored Natural Attenuation at Superfund,* [Resource Conservation and Recovery Act] *RCRA Corrective Action, and Underground Storage Tank Sites* (USEPA, April 1999). The following approach will be used as a guide and may vary depending on site-specific characteristics.

1) The primary assessment will determine if degradation is occurring at the site by analyzing recent and historical data to evaluate whether the plume is stable or shrinking. Wells with sufficient recent and historical analytical data will be selected for trend analysis using best-fit statistical methods determined by ProUCL 5.1 technical guidance (USEPA, October 2015). If the plume is determined to not be stable and decreasing, then the remedy will be reevaluated and a change of course may be recommended. Following determination that the plume is stable and/or decreasing under the primary assessment, the secondary assessment will be completed.
2) The secondary assessment will characterize and quantify the degradation processes at sites where sufficient attenuation is occurring. Degradation rates will be calculated for wells with decreasing trends and sufficient recent and historical analytical data. Advection, dispersion, sorption, and biodegradation will be evaluated for each site based on soil type, aquifer characteristics, groundwater quality parameters, and analytical data collected. The results will be used to support remedial action time frame estimations and compare with time frames proposed in the RODs, where applicable. Following completion of degradation rate calculations, the tertiary assessment will be completed. In cases where criteria for this step is not met, proceed to the tertiary assessment.
3) The tertiary assessment will ensure that the aquifer conditions have the capacity to

continue to attenuate contaminant mass. Analytical data collected over the past decade, estimated biodegradation rate, residual mass calculations, groundwater flow direction and hydraulic properties, and the updated CSM will be used to complete the tertiary assessments. The remaining mass will be calculated to determine the contaminant loading. The natural attenuation capacity will be determined based on the degradation processes and calculations from the secondary assessment. Natural attenuation quantitative tools will be used to support remedial time frame estimations, optimize the sampling frequency, and recommend a path forward for each site under MNA (USGS, 2003 and USEPA, April 1999). Cleanup time frame estimations will be supported by secondary or tertiary assessment calculations, or both where applicable.

At the completion of the data analysis, a Technical Memorandum will be prepared documenting the data assessment, the updated CSM, cleanup time frames, conclusions, and recommendations for a path forward at each site.

Site-Specific Background Discussions

The following presents a brief description of each site, its selected remedy, and a summary of the ROD. **Table 1** presents a summary of each site ROD in tabular format.

Site Background – SD052-01 The Nosedocks/Apron 2 Chlorinated Plume

Site SD052-01 is a chlorinated volatile organic compound (CVOC) plume in the Apron 2 area that is approximately 2,800 feet (ft) long and 500 ft wide and appears to originate in the area of the nosedock wash wastewater system near Building 786 (FPM Remediations, Inc. [FPM], April 2004). In accordance with the Final ROD (Air Force Real Property Agency [AFRPA], April 2009), MNA was the selected remedy using the ongoing physical, chemical, and natural biological processes to reduce the contaminants within the aquifer. Based on previous investigations and studies, it has been determined that natural attenuation is occurring at Site SD052-01. A remedial time frame was not specified in the final ROD (**Table 1**).

Site Background – SD052-02: Building 775/Pumphouse 3

Site SD052-02 is considered the Building 775 plume, which is located downgradient of former maintenance facilities in Buildings 774 and 776 and former fuel pump house Building 775. The selected remedy for SD052-02 is a groundwater extraction system with discharge to an off-site treatment facility, long-term monitoring, and institutional controls. The system began operation in January 2009 and was shut down in August 2016. MNA will continue until TCE is below 5 µg/L per the ROD. Per the Final ROD (AFRPA, April 2009), the time frame for monitoring was expected to be 20 years, beginning with the groundwater extraction system runtime of up to 10 years followed by long-term monitoring for 10 years.

Site Background – SD052-04: Landfill 6 TCE Site

Site SD052-04 is the Landfill 6 TCE Site plume, located downgradient and to the southwest of Landfill 6. The selected remedy in the ROD for Site SD052-04, Landfill 6 TCE Site, is enhanced bioremediation. As listed in the Final ROD (AFRPA, April 2009), this process is intended to increase biodegradation of the groundwater contaminants by injecting emulsified vegetable oil (EVO). Injections were first performed in 2008, with follow up injections in 2010, 2013, and 2018.

Per the final ROD, the monitoring time frame was expected to be 20 years.

Site Background – SD052-05: Building 817/WSA Site

Site SD052-05 is the Building 817/WSA Site, which is located on the north side of the main runway between Building 817 and the culverted section of Six Mile Creek, south of the former WSA. The selected remedy for Site SD052-05, Building 817/WSA Site is enhanced bioremediation followed by monitoring. As listed in the Final ROD (AFRPA, April 2009), this process is intended to increase biodegradation of the groundwater contaminants by injecting EVO into the subsurface. The EVO increases the biological breakdown of the chemicals, thereby, reducing the concentration of contaminants. Injections were first performed in 2008, with follow up injections in 2010 and 2017. Per the final ROD, the monitoring time frame was expected to be 15 years.

Site Background – Site SS062: AOC 9

Site SS062 is also known as AOC 9 and is a grass-covered area with a site boundary approximately 1,500 ft long and 650 ft wide and is located in the southwest portion of the inactive WSA. The Final ROD (Ecology and Environment Engineering, P.C. [EEEPC], July 2010] for Site SS062 was issued by the Air Force in August 2010 and signed by the USEPA in September 2010. The selected remedy for AOC 9 included removal of the source area through excavation of contaminated soil, polishing with oxidant in the excavation, treatment of contaminated groundwater using chemical oxidation and enhanced aerobic bioremediation, land use controls, and natural processes (attenuation). Per the ROD, monitoring will continue until four consecutive sampling results are below Remedial Action Objectives. A remedial time frame was not specified in the ROD.

References

AFRPA. April 2009. *Final Record of Decision for the On-base Groundwater AOC (SD-052) at the Former Griffiss Air Force Base, Rome, New York.*

ASTM. September 2020. *Standard Guide for Developing Conceptual Site Models for Contaminated Sites*.

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

FPM. April 2004. *Final Remedial Investigation Report, Nosedocks/Apron 2 Chlorinated Plume, Former Griffiss Air Force Base, Rome, New York*.

USEPA. October 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.*

USEPA. April 1999. *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.*

USEPA. July 2011. *Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model.*

USEPA. October 2015. *Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations.*

USGS. 2003. *Methodology for Estimating Times of Remediation Associated with Monitored Natural Attenuation.*

Wiedemeier. September 1998. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water.*

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FIGURES

Former Griffiss AFB Site Map

Figure 1

Letter Work Plan for Cleanup Time Frames at CERCLA Sites
SD052-01, SD052-02, SD052-04, SD052-05, and SS062
Former Griffiss Air Force Base, Rome, New York

PROJECT NO: MSC2021.0012.0003.0002

DATE: 5/12/2022

SCALE: As Shown

DRAWN BY: MRM

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Letter Work Plan for Cleanup Time Frames at CERCLA Sites
SD052-01, SD052-02, SD052-04, SD052-05, and SS062
Former Griffiss Air Force Base, Rome, New York

PROJECT NO:	SCALE:	DATE:	DRAWN BY:
MSC2021.0012.0003.0002	As Shown	5/12/2022	MRM

Former Griffiss AFB
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Locations

Figure 2

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TABLE

Table 1
Cleanup Time Frames at CERCLA Sites
SD052-01, SD052-02, SD052-04, SD052-05, and SS062
Former Griffiss AFB, Rome, New York

Site	Remedial Action Objectives (RAOs) from the Final Records of Decision (RODs)	Remedial Action	Contingency Triggers	Remedial Time Frame
SD052-01 Selected Remedy: MNA	Achieve the cleanup goals for Contaminants of Concern (COCs): trichloroethene (TCE) - 5 micrograms per liter (µg/L); cis-1,2-dichloroethene (cis-1,2-DCE) - 5 µg/L; vinyl chloride (VC) - 2 µg/L Prevent human exposure to groundwater through groundwater use restrictions until cleanup goals are achieved. Prevent contaminated groundwater from the site from adversely impacting surface water (in Six Mile Creek), which is defined as surface water concentrations above performance indicators (New York State Department of Environmental Conservation [NYSDEC] Class GA Groundwater Quality Standard of 2 µg/L for VC). Prevent development and use of the property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.	Monitored Natural Attenuation (MNA) Institutional Controls (ICs) for non-residential and for groundwater restrictions	If surface water samples from Six Mile Creek contain elevated VC, then a contingency alternative such as horizontal air sparging barrier (or other agreed action) will be implemented.	Not Specified
SD052-02 Selected Remedy: Pump and treat to below 50 µg/L then MNA	Achieve the cleanup goal for the COC: TCE of 5 µg/L Prevent human exposure to groundwater through groundwater use restrictions until cleanup goals are achieved. Prevent contaminated groundwater from the site from adversely impacting surface water (in Three Mile Creek), which is defined as surface water concentrations above performance indicators (NYSDEC Class GA Groundwater Quality Standards of 5 µg/L for cis-1,2-DCE and 2 µg/L for VC). Prevent development and use of the property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.	Groundwater extraction, treatment, and discharge with groundwater Long-Term Monitoring (LTM) ICs for non-residential and for groundwater restrictions	Install second extraction well (EW-2) if pumping tests from EW-1 indicate the need.	20 years - Up to 10 years of active treatment - 10 years MNA
SD052-04 Selected Remedy: Enhanced bioremediation	Achieve the cleanup goals for COCs: TCE - 5 µg/L; cis-1,2-DCE - 5 µg/L; VC - 2 µg/L Prevent human exposure to groundwater through groundwater use restrictions until cleanup goals are achieved.	Enhanced bioremediation with long-term groundwater monitoring (increase and sustain dissolved organic carbon in plume where total Volatile Organic Compounds (VOCs) > 500 µg/L) ICs for non-residential and for groundwater restrictions Remedy Performance Monitoring and LTM	If total VOC concentrations exceed projected future concentrations (to be presented in the remedial design) in monitoring wells within the treatment area, additional vegetable oil injection may be performed. If total VOCs exceed 50 µg/L in LF6TW-38 (after the second emulsified vegetable oil [EVO] injections) then "it may be necessary to install an *in-situ* bioreactor by extracting groundwater from the downgradient edge of the treatment area, amending it with additional organic substrate, and re-injecting it on the upgradient edge of the treatment area." If total VOC concentrations in downgradient monitoring well LF6TW-38 exceed 500 µg/L, recirculation of on-site groundwater would be considered for implementation. In general, groundwater will be extracted from a downgradient extraction well and reinjected near the source area. By recirculating site groundwater, an artificial hydraulic gradient would be created that is greater than that observed under normal conditions, allowing an increased flow of groundwater through the treatment zone.	20 years

Table 1
Cleanup Time Frames at CERCLA Sites
SD052-01, SD052-02, SD052-04, SD052-05, and SS062
Former Griffiss AFB, Rome, New York

Site	Remedial Action Objectives (RAOs) from the Final Records of Decision (RODs)	Remedial Action	Contingency Triggers	Remedial Time Frame
SD052-04 (continued)	Prevent contaminated groundwater from the site from adversely impacting surface water (in Three Mile Creek), which is defined as surface water concentrations above performance indicators (NYSDEC Class GA Groundwater Quality Standards of 5 µg/L for cis-1,2-DCE and 2 µg/L for VC). Prevent intrusive work or other activities that will impact the effectiveness of the landfill closure and post-closure activities. Prevent development and use of the property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.		If total VOC concentrations in a monitoring well along the centerline of the plume near Three Mile Creek (within 100 feet of the creek) exceed 50 µg/L, implementation of a contingency plan such as installation of an air sparge wall (or other action agreed upon by the Air Force, United States Environmental Protection Agency [EPA], and NYSDEC) will be considered. Similarly, if cis-1,2-DCE and/or VC concentrations attributable to site groundwater are detected in surface water in Three Mile Creek above performance indicators (NYSDEC Class GA Groundwater Quality Standards of 5 µg/L for cis-1,2-DCE and 2 µg/L for VC), additional round(s) of sampling will be performed to confirm contaminant concentrations. Site data will then be evaluated to determine whether the elevated concentrations are attributable to site groundwater. If the concentrations are attributable to site groundwater, the Air Force will discuss future actions at the site with EPA and NYSDEC. The regulatory agencies will have final approval of the criteria and decision regarding implementation of contingency measures after receiving the Air Force's assessment and recommendation in accordance with the Interagency Agreement.	
SD052-05 Selected Remedy: Enhanced Bioremediation	Achieve the cleanup goals for COCs: tetrachloroethene (PCE) - 5 µg/L; TCE - 5 µg/L Prevent human exposure to groundwater through groundwater use restrictions until cleanup goals are achieved. Prevent contaminated groundwater from the site from adversely impacting surface water (in Six Mile Creek), which is defined as surface water concentrations above performance indicators (NYSDEC Class GA Groundwater Quality Standards of 5 µg/L for cis-1,2-DCE and 2 µg/L for VC). Prevent development and use of the property for residential housing, elementary and secondary schools, childcare facilities, and playgrounds.	Enhanced anaerobic bioremediation with long-term groundwater monitoring ICs for non-residential and for groundwater restrictions Remedy Performance Monitoring and LTM	If total VOCs in WSA-MW9 are > 30 µg/L, then surface water will be sampled from culverted section of Six Mile Creek for cis-1,2-DCE and VC. If surface water samples from culverted section of Six Mile Creek are above cis-1,2-DCE: 5 µg/L and VC: 2 µg/L, then implement contingency of Air Sparge Wall (or other as agreed).	15 years

Table 1
Cleanup Time Frames at CERCLA Sites
SD052-01, SD052-02, SD052-04, SD052-05, and SS062
Former Griffiss AFB, Rome, New York

Site	Remedial Action Objectives (RAOs) from the Final Records of Decision (RODs)	Remedial Action	Contingency Triggers	Remedial Time Frame
SS062 Selected Remedy: excavation of soils, in-situ chemical oxidation (ISCO) of groundwater	Achieve the cleanup goals for COCs: tetrachloroethene (PCE) - 5 µg/L; cis-1,2-DCE - 5 µg/L; benzene - 1 µg/L; chlorobenzene - 5 µg/L Prevent potential unacceptable human risk associated with exposure to groundwater through groundwater-use restrictions until cleanup goals are achieved. Prevent contaminated groundwater from the site from adversely impacting surface water (in Six Mile Creek), which is defined as surface water concentrations above performance indicators for COCs specified above. Prevent the potential for unacceptable human risk under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) associated with exposure to soil vapor until the groundwater cleanup goals are achieved.	Excavation of contaminated source area soils. ISCO of remaining groundwater contamination. Land Use Controls for non-residential and for groundwater restrictions. Groundwater monitoring until four consecutive sampling events provide results below cleanup goals.	None given.	Not Specified