DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH FIGHTER WING (ACC)
HOLLOMAN AIR FORCE BASE, NEW MEXICO

OCT 3 2007

MEMORANDUM FOR NEW MEXICO ENVIRONMENT DEPARTMENT
Attn: Mr. James Bearzi
Hazardous Waste Bureau
2905 Rodeo Park Drive East
Santa Fe NM 87505-6303

FROM: 49 CES/CD
550 Tabosa Ave
Holloman AFB NM 88330-8458

Subject: Response to 14 Apr 06 Notice of Deficiency--RCRA Facility Investigation (RFI) for Chemical Agent Disposal Site (DP-64), Holloman Air Force Base, NM

1. The RCRA RFI Work Plan for Chemical Agent Disposal Site (DP-64), Holloman AFB, is hereby submitted for your review and approval.

2. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

3. If you have any questions, please contact Ms. Deborah Hartell or Mr. Will Desmare at 505-572-3931.

A. DAVID BUDAK
Deputy Base Civil Engineer

Attachment:
RCRA RFI Work Plan for Chemical Agent Disposal Site (DP-64)

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RCRA FACILITY INVESTIGATION (RFI) WORK PLAN CHEMICAL AGENT DISPOSAL SITE (DP-64) HOLLOMAN AIR FORCE BASE, NEW MEXICO

Subcontract No.: 5020S.01

Under Prime Contract No.: W9128F-04-D-0017

Bhate Project Number: 9070127 01.02

Prepared For:

U.S. Army Corps of Engineers
Omaha District
Omaha, Nebraska

Prepared By:

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October 2007

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RCRA FACILITY INVESTIGATION (RFI) WORK PLAN CHEMICAL AGENT DISPOSAL SITE (DP-64) HOLLOMAN AIR FORCE BASE, NEW MEXICO

REVIEW SHEET

This Work Plan has been reviewed and approved by:

John Hymer Bhate Site Manager	Signature	Date
Katherine T. Thompson Bhate Field Team Leader/Geologist	Signature	Date
Doug Jorgensen NWI Project Manager	Signature	Date
Frank Gardner, P.G. Bhate Program Manager	Signature	Date

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RCRA FACILITY INVESTIGATION (RFI) WORK PLAN CHEMICAL AGENT DISPOSAL SITE (DP-64) HOLLOMAN AIR FORCE BASE, NEW MEXICO

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ACRONYMS AND ABBREVIATIONS

AAF	Army Air Field
AF Fm	Air Force Form
ANSI	American National Standards Institute
ASTM	American Standards for Testing and Materials
bgs	Below ground surface
Bhate	Bhate Environmental Associates, Inc.
BSOP	Bhate Standard Operating Procedure
CAIS	Chemical Agent Identification Set
CSS	Chemical Safety Submission
DOD	Department of Defense
DPT	Direct push technology
ERP	Environmental Restoration Program
°F	Degrees Fahrenheit
FID	Flame-ionization detector
FOC	Fractional Organic Carbon
ft	Feet
FWEC	Foster Wheeler Environmental Corporation
GPS	Global Positioning System
HAFB	Holloman Air Force Base
HASP	Health and Safety Plan
HSA	Hollow Stem Auger
NWI	North Wind, Inc.
OSHA	Occupational Safety and Health Administration
OVA	Organic vapor analyzer
P.G.	Professional Geologist
PID	Photo-ionization detector

ACRONYMS AND ABBREVIATIONS CONTINUED

PPE	Personal protective equipment
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RCWM	Recovered Chemical Warfare Material
RFI	RCRA Facility Investigation
SCH	Schedule
SOP	Standard Operating Procedure
SSFR	Site Specific Final Report
SSL	Soil Screening Level
SVOC	Semi-volatile organic compound
SWRI	Southwest Research Institute
TDS	Total dissolved solids
USACE	United States Corps of Engineers
USCS	Unified Soil Classification System
UTL	Upper Tolerance Limit
VOC	Volatile organic compound
WRCC	Western Regional Climate Center
WSMR	White Sands Missile Range
WWTP	Wastewater treatment plant
Zapata	Zapata Engineering, P.A.

1 INTRODUCTION

Bhate Environmental Associates, Inc. (Bhate), is working under Subcontract No. 5020S.01 to North Wind, Inc. (NWI), who has been retained by the U.S. Army Corps of Engineers (USACE), under contract W9128F-04-D-0017, to conduct a Resource Conservation and Recovery (RCRA) Facility Investigation (RFI) at the Chemical Agent Disposal Site (DP-64) at Holloman Air Force Base (HAFB), New Mexico. The RFI includes tasks as outlined in the USACE Scope of Services dated October 25, 2006. This document is to provide a work plan that will serve as the primary working document for the field activities at DP-64.

The RFI Work Plan provides the relevant site specific information and requirements as outlined in the Scope of Services for remedial activities at DP-64. The primary objective of this RFI is to characterize the quantity, concentration, and extent of contamination, if any, and to determine if there is any threat to human health and environment using the Triad approach. During this process, required data will be collected to support the closure of the site based on guidance from the New Mexico Environment Department (NMED). The ultimate objective is to achieve No Further Action (NFA) approval for site closure from NMED.

This document has been written to outline the procedures by which the RFI will be completed in order to provide relevant information on the geologic, hydrologic, and other environmental conditions for HAFB and DP-64. Information is provided for HAFB and its surrounding environment as well as DP-64. This RFI Work Plan includes the process by which soil and groundwater sampling activities are to be conducted.

1.1 HAFB Site Description

HAFB is located in southeastern New Mexico in Otero County, New Mexico, approximately 100 miles north-northeast of El Paso, Texas and six miles west of Alamogordo, New Mexico (Figure 1-1). HAFB was first established in 1942 as Alamogordo Army Air Field (AAF). From 1942 through 1945, Alamogordo AAF served as the training grounds for over 20 different flight groups, flying primarily B-17s, B-24s, and B-29s. After World War II, most operations had ceased at the base. In 1947, Air Material Command announced the air field would be its primary site for the testing and development of un-manned aircraft, guided missiles, and other research programs. On January 13, 1948, the Alamogordo installation was renamed Holloman Air Force Base, in honor of the late Col. George V. Holloman; a pioneer in guided missile research. In 1968, the 49th Tactical Fighter Wing arrived at HAFB and has remained since. Today, HAFB also serves as the training center for the German Air Force's Tactical Training Center.

The DP-64 site is located in the northeastern portion of HAFB on the north side and adjacent to the former Main Base Landfill (LF-01) (Figure 1-2). The total area of the DP-64 site is approximately 5.5 acres (Figure 1-3).

1.2 Physiography

HAFB is located within the Sacramento Mountains Physiographic Province on the western edge of the Sacramento Mountains. HAFB is approximately 59,600 acres in area, and is located at a mean elevation of 4,093 feet above mean sea level. The region is characterized by high tablelands with rolling summit plains; cuesta-formed mountains dipping eastward and of west-facing escarpments with the wide bracketed basin forming the basin and range complex. The Base is located in the Tularosa Sub-basin which is part of the Central Closed Basins. The San Andres Mountains bound the basin to the west (about 30 miles) with the Sacramento Mountains approximately 10 miles to the east. At its widest, the basin is about 60 miles east to west and stretches approximately 150 miles north to south.

The ground surface at DP-64 consists of gently rolling terrain with some desert vegetation.

1.3 Surface Water

The Tularosa Basin contains all of the surface flow in its boundaries. The nearest inflow of surface waters to the Base comes from the Lost River, located in the north-central region of the Base. The upper reaches of the Three Rivers and the Sacramento River are perennial in the basin. HAFB is dissected by several southwest trending arroyos that control the surface drainage. Hay Draw arroyo is located in the far north. Malone and Rita's Draw, which drain into the Lost River, and Dillard Draw arroyos are located along the eastern perimeter of the Base. Approximately 10,000 years ago, indications are of a much wetter climate. The present day Lake Otero encompassed a much larger area, possibly upwards of several hundred square miles. Its remains are the Alkali Flat and Lake Lucero. Lake Lucero is a temporary feature of merely a few inches in depth during the rainy season.

Ancient lakes and streams deposited water bearing deposits over the older bedrock basement material. Fractures, cracks, and fissures in the Permian and Pennsylvanian bedrock yield small quantities of relatively good quality water in the deeper peripheral. Potable water is only found from a handful of wells near the edges of the basin with more saline water towards the center. Two of the principal sources of potable water are a long narrow area on the upslope sides of Tularosa and Alamogordo with the other in the far southwestern part of the basin. Alamogordo's water, as well as the Base's, is supplied from Lake Bonito (which is in the Pecos River Basin).

There are no apparent surface water features at DP-64.

1.4 Groundwater

The predominance of the groundwater occurs as an unconfined aquifer in the unconsolidated deposits of the central basin, with the primary source of recharge as rainfall percolation and minor amounts of stream run-off along the western edge of the Sacramento Mountains. Surface water/rainfall migrates downward into the alluvial sediments at the edge of the shallow aquifer near the ranges, and flows downgradient through progressively finer-grained sediments towards the central basin. Because the Tularosa Basin is a closed system, water that enters the area only leaves either through evaporation or percolation. This elevated amount of percolation results in a fairly high water table. Beneath HAFB, groundwater ranges from 5 to 50 feet. Flow for the Base is generally towards the southwest with localized influences from the variations in the topography of the Base. Near the arroyos, groundwater flows directly toward the surface drainage feature.

The approximate depth to the water table at DP-64 has not been clearly defined, however, the water table at LF-01, located adjacent to the south of DP-64 is reported at approximately 31.5 feet below ground surface (ft bgs) with groundwater flow direction to the southwest.

1.5 Climate

As a whole, New Mexico has a mild, arid to semi-arid continental climate characterized by light precipitation totals, abundant sunshine, relatively low humidity, and relatively large annual and diurnal temperature range (Western Regional Climate Center [WRCC], 2003). The climate of the Central Closed Basins varies with elevation. The Base is found in the low areas and is characterized by warm temperatures and dry air. Daytime temperatures often exceed 100 degrees Fahrenheit (°F) in the summer months and are in the middle 50s in the winter. A preponderance of clear skies and relatively low humidity permits rapid night time cooling resulting in average diurnal temperature ranges of 25 to 35°F. Potential evapotranspiration, at 67 inches per year, significantly exceeds annual precipitation, usually less than 10 inches. The very low rainfall amounts resulting in the arid conditions, which with the topographically induced wind patterns combining with the sparse vegetation, tend to cause localized "dust devils". Much of the precipitation falls during the mid-summer monsoonal period (July and August) as brief, yet frequent, intense thunderstorms culminating to 30 – 40% of the annual total rainfall.

1.6 Geology

The sedimentary rocks which make up the adjacent mountain ranges are between 500 and 250 million years old (White Sands Missile Range [WSMR], 2003). During the period when the area was submerged under the shallow intra-continental sea, the layers of limestone, shale, gypsum, and sandstone were deposited. In time, these layers were pushed upward through various tectonic forces forming a large bulge on the surface. Approximately 10 million years ago the center began to subside resulting in a vertical drop of thousands of feet leaving the edges still standing (the present day Sacramento and San Andres mountain ranges). In the millions of years following, rainfall, snowmelt, and wind eroded the mountain sediments depositing them in the valley (i.e. Tularosa Basin). Water carrying eroded gypsum, gravel, and other matter continues to flow into the basin.

As the Tularosa Basin is a bolson, which is a basin with no surface drainage outlet, sediments carried by surface water into a closed basin are bolson deposits. The overlying alluvium generally consists of unconsolidated gravels, sands, and clays. Soils in the basin are derived from the adjacent ranges as erosional deposits of limestone, dolomite, and gypsum. A fining sequence from the ranges towards the basin's center characterizes the area with the near surface soils as alluvial, eolian, and lacustrine deposits. The alluvial fan deposits are laterally discontinuous units of interbedded sand, silt, and clay while the eolian deposits consist primarily of gypsum sands. The eolian and alluvial deposits are usually indistinguishable due to the reworking of the alluvial sediment by eolian processes. The playa, or lacustrine deposits, consist of clay containing gypsum and are contiguous with the alluvial fan and eolian deposits throughout HAFB. There has been the identification of stiff caliche layers, varying in thickness, at different areas of the Base. At the site, soils are predominantly silty sands and interbedded clays.

According to the *Final Site Specific Final Report (SSFR) for Ordnance and Explosive Removal Action,* prepared by Zapata Engineering in June 2005, the DP-64 area consists of well-drained soils and exposed gypsum. The SSFR indicates that the soil has a light brown surface layer of very fine sandy loam from one to 13 inches bgs and white gypsum mixed with brown or pink sandy loam underlies surface soils to a depth greater than 60 inches bgs.

2 HISTORICAL DATA REVIEW

On February 9, 2000, several broken vials and two intact vials filled with a clear to yellowish liquid were discovered by a pedestrian walking north of the closed Main Base Landfill (LF-01) site. During a re-vegetation project at the LF-01 site, the topsoil associated with the landfill had been turned and the pedestrian reported their findings to the 49th Environmental Flight. The 49th Environmental Flight in conjunction with Foster Wheeler Environmental Corporation (FWEC) responded by locating, recovering, and transporting the two intact vials to a laboratory at Brooks AFB, Texas, which was later transferred to the Southwest Research Institute (SWRI) for analysis. The vials were analyzed for chemical warfare agents and three industrial chemical agents. The results of the analyses indicated one vial contained 5 percent distilled mustard (HD) in chloroform and the second vial contained 5 percent Lewisite in chloroform (Zapata Engineering, P.A. [Zapata], June 2005). In addition to the ampoules, three burn areas, remnants of incendiary devices (M69X or M74), and broken glass ampoules were identified across the site during their surface clearance and debris removal activities.

FWEC prepared the Chemical Safety Submission (CSS) for the USACE in October 2003, which was then supplemented by the *Ordnance and Explosive Recovered Chemical Warfare Material Removal Action Work Plan* in April 2004 and the SSFR submitted in June 2005 by Zapata.

The Final SSFR field activities included a detailed search of the surface area of DP-64 and subsurface excavations associated with 123 anomalies. These anomalies were investigated based on the results of the Geophysical Prove Out using an electromagnetic system, magnetometer system, electromagnetic ground conductivity system, and a ground penetrating radar system. Detailed procedures and results were provided in Appendix D of the Final SSFR (Zapata, 2005). Zapata collected soil samples from the excavation site and from two areas where Recovered Chemical Warfare Material (RCWM) was found during the investigation of the surface area. These samples were analyzed for chemical agents. During these activities, Zapata removed all surface debris encountered, which included scrap metal, blasting caps, smoke pot components, and M69 incendiary bomb components. According to the Final SSFR, a total of 15 chemical agent identification set (CAIS) kit components were recovered, packaged, and stored. CAISs were used by military personnel to identify chemical agents. During the 1950s, the Chemical Test Squadron at Edgewood Maryland flew missions to HAFB. However, no documentation has been found to indicate that testing or disposal of any testing items occurred at DP-64.

In a Notice of Deficiency Letter, provided by the NMED, dated April 14, 2006, the NMED, in part, requested additional sampling to be conducted at DP-64. NMED has requested additional soil sampling at five anomalies (104, 105, 109, 112, and 137) associated with previous "burn pit" locations (Figures, tables, and dig sheets from the SSFR are provided in Appendix A of this Work Plan). The NMED is requiring one soil sample from the bottom of the "burn pits" and analysis of the soils for Resource Conservation and Recovery Action (RCRA) metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and explosives.

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3 INVESTIGATION ACTIVITIES

There are five areas of concern (Anomalies 104, 105, 109, 112, and 137) located at DP-64 which require further investigation. These locations were identified during the field activities as described in the Final SSFR submitted by Zapata in June 2005. These anomalies were described as burn pits and debris locations, all detected within two feet of the surface. According to the Final SSFR, all chemical agents were removed from the site.

Work conducted under this RFI Work Plan will be conducted in a TRIAD-like approach. This TRIAD-like approach will utilize dynamic work strategies in order to determine the vertical and horizontal extent of contamination. These strategies include rapid turns on laboratory analytical data and on-site determination of additional soil boring and/or monitoring well locations. This approach is beneficial due to an accelerated site investigation with only one large-scale mobilization. A flow chart for the TRIAD RFI Dynamic Decision Logic is provided as Figure 3-1. All field activities, including soil boring/monitoring well installation, groundwater sampling, and surveying, are to be completed within three weeks.

The first phase of field activities is to collect soil samples, including surface samples to a maximum depth of 2 ft bgs and subsurface samples to a maximum depth of 50 feet, in the five areas of concern shown on Figure 3-2 (Anomalies 104, 105, 109, 112, and 137). In addition, one geotechnical sample will be collected in order to conduct a Risk-Based Evaluation for ecological and human health. Once this has been completed, if results from the soil samples do not indicate concentrations above the reporting limit, additional sampling will not be conducted and the RFI Report will be prepared. However, if soil sampling results indicate concentrations greater than the reporting limit, additional borings will be installed for further delineation. Upon receipt of the additional soil sampling, locations for groundwater monitoring wells will be determined on-site and sampled for the appropriate analytes.

Field activities for DP-64 have been designed as a TRIAD-like approach as outlined in Figure 3-1. The following list of activities may be performed.

- Advance 5 soil borings (1 from each area) from the 5 areas of concern (anomalies 104, 105, 109, 112, and 137) to determine the presence of contamination, if any (Figure 3-3)

- Collect 3 soil samples from each boring including one surface soil sample (0 to 2 feet bgs) and two subsurface samples with the highest headspace reading from each boring

- Analyze the soil samples for VOCs, SVOCs, RCRA metals, and explosives

- Advance additional soil borings (up to 5 borings) based on the initial soil boring analytical results

- Analyze the additional soil samples for VOCs, SVOCs, RCRA metals, and explosives

- Install groundwater monitoring wells (up to 5 monitoring wells) in locations determined on-site based on the soil analytical data
- Install one deep monitoring well nested with one of the monitoring wells in order to determine the vertical extent of contamination in the area with the highest contamination
- Collect one groundwater sample from each monitoring well (including the deep well and well LF01-1W1) and sample for the appropriate analytes (including total dissolved solids [TDS])
- A geotechnical sample will be collected for dry bulk density, fractional organic carbon (FOC), moisture content, and specific gravity
- Perform physical survey of surface soil sample locations and monitoring wells with survey grade Global Positioning System (GPS)

3.1 Pre-Sampling Activities

Prior to the initiation of any sampling activities, Air Force Form (AF Fm) 332 and utility clearance permitting will need to be completed.

3.1.1 AF Form 332

Prior to initiating field activities at the site, a completed and approved AF Fm 332 will be obtained. This form authorizes construction or other work at HAFB and is required for the initiation of any such work. This work order describes what activities will take place at the location.

3.1.2 Dig Permit/Utility Clearances

Prior to the submittal of the dig permit (AF Fm 103), the area of investigation will be clearly delineated with marker flags, stakes, or paint, as appropriate. Utility clearance approvals will be completed by the appropriate HAFB utility office (e.g., telephone, sewer, water, natural gas etc.). Upon receipt of the approved dig permit (AF Form 103) with the utility clearances, the Bhate Site Manager or other authorized project personnel will complete a site walk-through confirming the dig permit authorizations and make any required changes.

3.1.3 Pre-Drilling Screening Activities

Prior to any drilling activities, the surface soil at the soil boring locations and monitoring well locations will be screened for ordnance and munitions as a precautionary measure due to the historical nature of the site. The surface soils will be visually checked for debris, followed by the use of a magnetometer in order to detect any metal debris which may not be visually apparent. If any anomalies are detected, the soil borings/monitoring well location will be shifted to avoid this area. No other screening process for ordnance/munitions will be conducted during this investigation as the site should be cleared based on the SSFR.

3.2 Soil Assessment

The field work for the RFI will be conducted in accordance with HAFB Standard Operating Procedures (SOPs) provided in the *Basewide Quality Assurance Project Plan* (QAPP) (Bhate, November 2003). These SOPs outline methodologies for soil boring advancement, soil sampling, soil sample description, field screening, sample management, equipment decontamination, and chain-of-custody procedures.

A maximum of 10 soil borings will be advanced at the site to the depth where groundwater is encountered using conventional hollow stem auger (HSA) techniques with a 2-foot stainless steel split spoon sampler. Continuous soil samples will be collected from these borings with lithologic descriptions per HAFB SOP No. 7. A maximum of 37 soil samples, including up to three field duplicate samples and four matrix spike (MS)/matrix spike duplicates (MSD), may be submitted to the laboratory for analysis of VOCs (Method 8260B), SVOCs (Method 8370C), RCRA metals (Method 6010B/7471A), and explosives (Method 8330A). The samples will be placed on ice and shipped under strict chain-of-custody to the laboratory for a 24-hour turn around time. In addition, one geotechnical sample will be collected from the most upgradient soil boring above groundwater. This sample will be analyzed for moisture content by Method 160.3M, specific gravity by American Society for Testing and Materials (ASTM) Method D1429, fractional organic carbon by ASTM Method 2974, and dry bulk density by ASTM Method D2937.

Soils collected from above the water table will be field screened in accordance with HAFB SOP No. 6 using an organic vapor analyzer (OVA) to perform soil-headspace screening techniques. Notation will also be made of any visual (discoloration) and/or aromatic indicative of potential contamination.

Based on headspace screening results, two soil samples from each soil boring with the highest OVA readings and one surface sample (0 to 2 feet, bgs) will be selected for laboratory analyses. Should the screening not identify one or more intervals in which to select, then the lower most interval at the soil-water interface and a mid-range shall be retained for laboratory analysis.

3.3 Groundwater Assessment

3.3.1 Monitoring Well Installation and Development

Six permanent monitoring wells (including one deep well) may be installed at DP-64 based on information obtained from the soil laboratory analytical results discussed in the previous section. The location of these wells will be determined in the field, upon receipt of the soil laboratory analytical results (within 72 hours). These wells will be advanced using HSA drilling technology. The monitoring wells will be constructed of 2-inch Schedule (SCH) 40 polyvinyl chloride (PVC) casing and screen with a slot opening of 0.10 inch in accordance with the Bhate

Standard Operating Procedure (BSOP) No. 10. The wells will be located and elevations taken using GPS.

The deep well will be nested with one of the Type II groundwater monitoring wells. This well will be located in the area with the highest soil concentration in order to determine the vertical extent of contamination.

A geologist or engineer will log each borehole. Each boring will be visually classified and lithologically described in the field according to HAFB SOP No. 7 and the Unified Soil Classification System (USCS) (ASTM D 2487-92 and ASTM D 2488-90). Based upon the adjacent Environmental Restoration Program (ERP) site LF-01 groundwater levels (11.05 to 31.39 feet bgs), the monitoring wells will be installed to a maximum depth of approximately 50 ft bgs. Each monitoring well will be completed with 10 feet of 2-inch diameter 0.010 or 0.020 inch slotted PVC screen. The remaining borehole casing will be comprised of flush threaded 2-inch PVC casing. The annular space surrounding the screen will be backfilled with 10/20 silica sand capped with at least 2 feet of bentonite pellets. The bentonite pellets will be hydrated prior to backfilling the remaining annular space with neat cement. The surface completion will consist either of a lockable and tamper proof 8-inch diameter steel cover or a flush mount well completion with a concrete pad (3 feet square). The deep well will be installed inside the same boring as one of the monitoring wells. This well will be completed with 5 feet of screen at a maximum depth of 80 feet bgs.

The completed wells will be developed to remove fine particulate and improve hydraulic communication with the surrounding saturated material. Well development will begin no sooner than 48 hours after grouting. Monitoring well development will take place by over-pumping each well until at least five well volumes have been removed, and the turbidity, pH, specific conductivity, and temperature have stabilized by +/- 10 percent for a least 3 consecutive readings.

3.3.2 Groundwater Sampling

Groundwater samples will be collected from the six newly installed wells, as well as existing monitoring well 1W1, associated with the adjacent ERP site LF-01. One field duplicate and a matrix spike/matrix spike duplicate (MS/MSD) will be collected along with the samples and submitted to the laboratory for analysis. The samples will be placed on ice and shipped under strict chain-of-custody to the laboratory.

Groundwater samples will be collected using the low-flow sampling techniques with the use of either a peristaltic or submersible pump and polyethylene tubing. The tubing will be placed at mid-screen and purged until field parameters are stabilized. The samples will be collected from mid-screen and analyzed for: VOCs (EPA Method 8260B), SVOCs (EPA Method 8370C), RCRA metals (EPA Method 6010B/7470A), explosives (EPA Method 8330A SW846), and TDS (EPA Method 160.1).

3.4 Laboratory Analysis

During this investigation, a maximum of 37 soil samples (including the field duplicates and MS/MSD) and a maximum of 10 groundwater samples (including the field duplicate and MS/MSD) will be analyzed for VOCs by Method 8260B, SVOCs by Method 8270C, RCRA metals by Method 6010B/7471A (soil)/7470A (groundwater), explosives by Method 8330A SW846, and TDS (groundwater only) by Method 160.1. Each soil and groundwater sample, including the quality control samples, will be analyzed for their respective analytes in accordance with Table 3-1.

Soil samples will be submitted to the laboratory for a 24-hour turn around time to accelerate field activities in order to complete the installation of all soil borings and monitoring wells, if applicable, within one mobilization.

Appendix B details the method detection limits by method for chemical constituents indicated for DP-64.

3.5 Surveying

The five permanent monitoring well locations will be surveyed in accordance with methods described in the Basewide QAPP (Bhate, November 2003). Horizontal locations will be relative to the State Plane Coordinate System, New Mexico Central and surveyed to an accuracy of +/-1.0 ft. Vertical elevations will be referenced to North American Datum (NAD) 1983. The top of casing (vertical control) will be used to determine the depth and elevation of the groundwater and surveyed to an accuracy of +/-0.01 ft. All DP-64 site maps will include a coordinate system (e.g., latitude/longitude) with the site and pertinent features.

3.6 Groundwater Elevations

During the sampling of monitoring wells under this Work Plan, groundwater elevations will be measured. The water level in each well will be gauged to the nearest 0.01 feet using an electronic water level indicator prior to sampling. The depth to water information will be used to prepare a water table contour map and calculate the volume of water to be purged from the well prior to sample collection. Elevations will be measured for each of the five new wells (DP64-MW01, -MW02, -MW03, -MW04, and DMW01) and the existing well from LF-01 (1W1). A potentiometric surface map of DP-64 (including well 1W1 from LF-01) will be developed from the groundwater elevation data collected during this investigation.

3.7 Site Restoration

Upon completion of monitoring well installation, the well locations will be restored to the grading of the surrounding area. Drilling equipment and debris will be removed. The site will be canvassed for trash, debris, etc. Final grade for the wells will allow for positive drainage in accordance with the surrounding area.

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4 RISK BASED CLEAN-UP APPROACH

The objective of this investigation is to determine the presence and quantity of contamination and to determine if there is any threat to human health and the environment. The results from the soil and groundwater sampling activities at the site will be evaluated to determine whether further investigation activities are warranted or if there is an acceptable risk given possible exposure at the site. If the completed Risk-Based Evaluation indicates an acceptable risk, then no further investigation activities will be required and the site can be considered for closure with no further action.

4.1 Evaluation of VOCs and SVOCs

For any VOCs or SVOCs that are detected in soil, the concentration will be evaluated against the Soil Screening Levels (SSLs) provided in Appendix A of the revised NMED guidance document *Technical Background Document for Development of Soil Screening Levels, Revision 4.0*, June 2006 (NMED, 2006). The laboratory data for each collected soil sample will be compared to these SSLs.

For VOCs and SVOCs detected in groundwater, the results will be compared to the New Mexico Water Quality Control Commission (NMWQCC) published groundwater quality standards. The NMWQCC are standards for aquifers with TDS concentrations less than or equal to 10,000 milligrams per liter (mg/L) [20.6.2.3101 New Mexico Administrative Code (NMAC)]. The TDS concentration is a direct measure of the presence of total ions in the aquifer and is one of the primary criteria for classifying the aquifer based on its use as a potential drinking water source. Under the NMWQCC regulations, if TDS in groundwater is more than 10,000 mg/L, the aquifer is classified as non-potable and results will be compared to the EPA maximum contaminant levels (MCLs).

4.2 Evaluation of Metals

Metals detected in soil will be evaluated against the current NMED residential risk-based soil screening levels (NMED, 2006). Groundwater metals concentrations will be compared to the NMWQCC standards.

4.3 Evaluation of Explosives

For any explosives that are detected in soil, the concentration will be evaluated against the screening levels provided in Appendix A of the revised NMED guidance document *Technical Background Document for Development of Soil Screening Levels, Revision 4.0*, June 2006 (NMED, 2006). The laboratory data for each collected soil sample will be compared to these SSLs.

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5 INVESTIGATION DERIVED WASTE MANAGEMENT

Investigation derived waste (IDW) will be managed and characterized according to HAFB SOP No. 9. Whenever possible, waste minimization techniques will be used to reduce the amount of IDW. IDW generated by advancing soil borings, installing the new monitoring wells, and subsequent groundwater sampling activities will be managed and characterized according to the following guidelines. All soil cuttings will be placed in appropriate 55-gallon steel drums and screened with an OVA for the presence of organic vapors. Results from the soil sampling analysis will determine whether the soil can be spread on the ground surrounding the well or if it will need to be placed in the FT-31 Landfarm at HAFB. Purged groundwater will be containerized and maintained by HAFB until disposal, pending laboratory analysis. Other liquid wastes, such as decontamination rinses, are anticipated to be non-hazardous and as such, can be disposed of through the HAFB wastewater treatment plant (WWTP). Personal protective equipment (PPE) and other site non-hazardous debris/waste shall be disposed in standard trash receptacle.

5.1 General Decontamination Procedures

All equipment, both small hand tools and large machinery (such as augers, etc.) will require some level of decontamination dependant upon its contact with the contaminated subsurface. Small hand tools can be decontaminated in five-gallon buckets at the site in accordance with the *Bhate Standard Operating Procedures* (Bhate, 2002) and the Basewide QAPP (Bhate, November 2003).

5.2 Personal Protective Equipment

Prior to disposal, used PPE, disposable items, and the decontamination pad liner will be rinsed clean with tap water and diluted detergent solution. Cleaned PPE and presumed clean, based upon non-contact with contaminated soils, water or equipment, and other disposable clean items will be contained in trash bags and disposed of at the applicable receptacle.

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6 PROJECT QUALITY ASSURANCE

The laboratory performing the chemical sample analysis will follow the *Basewide Quality Assurance Project Plan* (Bhate, November 2003) and the Quality Assurance Project Plan Addendum (Appendix B of this Work Plan).

6.1 Standard Operating Procedures

Applicable HAFB SOPs for completing this investigation are located in Appendix A of the *Basewide QAPP* (Bhate, November 2003).

6.2 Sample Identification

Each environmental sample collected will be identified on the sample label and chain-of-custody records. Table 3-1 provides the sample collection information inclusive of the quantity for the soil and groundwater samples that will be collected during this investigation. Sample documentation, handling, and shipping will be in accordance with HAFB SOP No. 1. The field duplicate samples will appear in sequence with the regular samples.

An example of the sample identification nomenclature for groundwater samples collected from monitoring wells will be as follows:

DP64-MW01-a

Site alpha-numeric identifier: DP64 = Chemical Agent Disposal Site

Sample type identifier: MW = monitoring well

Monitoring well number: 01, 02, etc.

Reserved for quality assurance (QA) sample identifiers: a = field duplicate, TB = trip blank, MS = matrix spike, MSD = matrix spike duplicate

6.3 Project Documentation

The following subsections present the procedures for documenting information that will be collected in the field during this investigation.

6.3.1 Sample Documentation

Sample documentation, identification, and tracking will adhere to the prescribed methods found in the *Basewide QAPP*. All sampling activities will include documentation of significant activities, potential environmental influences during sampling, field variances, and sample identification information. At a minimum, field logbooks will be utilized to record dates and times, sampling protocols, project numbers, and sampler's name. Daily Quality Assurance Reports will be completed and submitted weekly to the HAFB Project Manager. Other pertinent information will include chain-of-custody numbers and air-bill tracking number. Chain-of-custody forms will be completed and included with each sample shipment; one chain-of-custody per cooler.

At a minimum, the following sample collection information will be logged in the field book:

- Date and time
- Sample identification number
- Project number
- Sampler name
- Preservative (if any)
- Analysis
- Map or schematic of sampling location

If a map of sampling locations is not available prior to sampling, a drawing of the site will be sketched on the left page of the field logbook to provide an illustration of all sampling points. Measured distances from sampling points to a fixed reference point will be recorded.

6.3.2 Field Logbook

Personnel will use only bound field logbooks for the maintenance of field records. The Project Manager will ensure that all field notes can be efficiently traced, filed, and retrieved. All entries will be recorded in indelible, waterproof ink. If errors are made, corrections will be made by crossing a single line through the error, correcting the information, and initialing and dating the correction. Entries will be made in the following format:

Documentation and reporting of events and activities will be made in chronological order on the right page of an open logbook. All entries will be dated and time of entry recorded. At the beginning of each day, the first two entries will be "personnel/contractors on site" and "weather". At the end of each day's entry, the personnel will draw a diagonal line originating from the bottom left corner of the page to the conclusion of the entry and sign along the line indicating the conclusion of the entry or the day's activity. Once completed, the field logbooks become accountable documents and will be maintained as part of the project files.

The following general requirements apply to field logbooks:

- The left page of the logbook will be used for auxiliary reporting such as sketches, tables, etc.
- The date will be recorded at the top of every page in the left-hand corner of the right page.
- The time of entry recordings will be in columnar form down the left-hand side of the right page.

6.3.3 Field Analytical Data

The field analytical data collected at the site will include the field screening readings for selection of PPE, as well as field screening for headspace analysis. The breathing zone of the site will be screened for VOCs in the field at the time of sample collection utilizing an OVA. If a high humidity condition exists at the time of sample collecting, a flame ionization detector (FID) is recommended since a photo-ionization detector (PID) is not a completely reliable screening instrument under these conditions. The field screening data will be recorded in the field logbook.

6.3.4 Data Reporting

Soil and groundwater data obtained during this investigation will be reported according to the *Basewide QAPP* (Bhate, November 2003). In accordance with Department of Defense (DOD) Quality Systems Manual (QSM) version 3, the investigative data is classified as definitive data. The data will be generated using rigorous, analyte-specific analytical methods where analyte identifiers and quantitations are confirmed and Quality Assurance/Quality Control (QA/QC) requirements have been satisfied. For this project, regular, field duplicate, and MS/MSD samples are to be collected concurrently. The data will meet the objectives of the project for level of accuracy and precision required, intended use of the data, analytical methods, time constraints, and allowable decision errors. Sampling results will be tabulated and summarized in the RFI Report for the site.

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7 HEALTH AND SAFETY REQUIREMENTS

Project Health and Safety practices will adhere to the *Basewide Health and Safety Plan* (HASP) (Bhate, December 2003) and the Site Specific Addendum to the *Basewide HASP*, as included in Appendix B of this Work Plan, for the field investigation activities at DP-64. All work will be conducted in accordance with the USACE *Safety and Health Requirements Manual, EM 385-1-1,* 3 November 2003. It is anticipated that no greater than modified level D PPE will be required to complete the site inspection and sampling activities. This includes: Occupational Safety and Health Administration (OSHA) approved safety shoes, American National Standards Institute (ANSI) approved safety glasses (Z87.1) and hard hat (Z89.1-1997: Type I), sleeved shirt and long pants, and as required, hearing protection, leather work gloves, and/or nitrile gloves during sampling.

Site security is part of safety at the site for the investigation. Items of concern include the proper designation and demarcation of the investigation boundaries (i.e., Support Zone, Contaminant Reduction Zone, and Exclusion Zone) as appropriate. Likewise, compliance with any intrusive work requirements, posting of potential hazards, and control of un-authorized site personnel will be completed. This is discussed in the *Basewide HASP*.

At a minimum, the site will be secured with caution tape surrounding the perimeter of the site delineating the outer boundary of the Support Zone. This is essential in the utility clearance process and it serves as the demarcation of the site for both project and non-project persons. A Contaminant Reduction Zone and/or Exclusion Zone will be established as guided by the HASP and site prevailing conditions.

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8 ORGANIZATION AND SCHEDULE

During the field activities at DP-64, Mr. Doug Jorgensen from NWI and Ms. Katherine Thompson from Bhate will serve as the Project Manager and the Field Team Leader, respectively, overseeing and directing all investigation sampling activities. Ms. Thompson will also provide on-site management of any sub-contractors for the project. Mr. Frank Gardner is the Bhate Program Manager and will ensure required project documents, permits, contractual agreements, and other program tasks are completed. Key project personnel and their responsibilities are listed in Table 8-1. A project schedule is provided as Figure 8-1.

Mr. Doug Jorgensen and Ms. Katherine Thompson will be on-site during field activities. All decisions regarding placement of soil borings and monitoring wells will be determined by the key personnel listed in Table 8-1.

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9 REFERENCES

Bhate Environmental Associates, Inc. August 2002. *Bhate Standard Operating Procedures.*

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White Sands Missile Range. 2003. Public Affairs Office, Site Informational Web Page, http://www.wsmr.army.mil/paopage/Pages/WU%2360.htm.

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TABLES

Table 3-1
Soil and Groundwater Sampling and Analysis
Chemical Agent Disposal Site (DP-64)
RCRA Facility Investigation Work Plan
Holloman AFB, NM
Bhate Project No.: 9070127

Target Areas of Concern	Identification Number	Media	Analysis	Number of Field Samples
104	DP64-SB04	Soil	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7471A Explosives by EPA Method 8330A	3
	To Be Determined			3
	DP64-MW01	Groundwater	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7470A Explosives by EPA Method 8330A TDS by EPA Method 160.1	1
105	DP64-SB05	Soil	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7471A Explosives by EPA Method 8330A	3
	To Be Determined			3
	DP64-MW02	Groundwater	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7470A Explosives by EPA Method 8330A TDS by EPA Method 160.1	1
109	DP64-SB08	Soil	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7471A Explosives by EPA Method 8330A	3
	To Be Determined			3
	DP64-MW03	Groundwater	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7470A Explosives by EPA Method 8330A TDS by EPA Method 160.1	1
112	DP64-SB06	Soil	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7471A Explosives by EPA Method 8330A	3
	To Be Determined			3
	DP64-MW04	Groundwater	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7470A Explosives by EPA Method 8330A TDS by EPA Method 160.1	1
137	DP64-SB07	Soil	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7471A Explosives by EPA Method 8330A	3
	To Be Determined			3
	DP64-MW05	Groundwater	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7470A Explosives by EPA Method 8330A TDS by EPA Method 160.1	1
To Be Determined	To Be Determined	Soil (Geotechnical Sample)	Moisture Content by Method 160.3M Specific Gravity by Method ASTM D1429 Fractional Organic Carbon by Method ASTM 2974 Dry Bulk Density by Method ASTM D2937	1
Not Determined	DP64-DMW01	Groundwater	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7470A Explosives by EPA Method 8330A TDS by EPA Method 160.1	1
Field Duplicate		NA	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7471A/7470A Explosives by EPA Method 8330A TDS by EPA Method 160.1 (groundwater only)	A minimum of one or one per 10 samples collected
MS/MSD		NA	VOCs by EPA Method 8260B SVOCs by EPA Method 8270C RCRA Metals by EPA Method 6010B/7471A/7470A Explosives by EPA Method 8330A TDS by EPA Method 160.1 (groundwater only)	A minimum of one or one per 20 samples collected
Trip Blank		NA	VOCs by EPA Method 8260B	1 per cooler

Notes:
SB = Soil boring
MW = Monitoring well
DMW = Deep monitoring well
MS/MSD = Matrix Spike/Matrix Spike Duplicate
VOCs = Volatile organic compounds
SVOCs = Semi-volatile organic compounds
EPA = Environmental Protection Agency
RCRA = Resource Conservation and Recovery Act
TDS = Total Dissolved Solids
ASTM = American Society for Testing and Materials
NA = Not Applicable

Table 8-1

Key Personnel and Responsibilities

Chemical Agent Disposal Site (DP-64)
RCRA Facility Investigation Work Plan
Holloman AFB, New Mexico
Bhate Project No. 9070127

Name	Project Title/Assigned Role	Phone Numbers
Mr. John Hymer	Bhate Site Manager	Work: (505) 491-9171
Ms. Katherine Thompson	Bhate Field Team Leader/SSHO/Geologist	Work: (205) 918-4000
Mr. Mike D'Auben	Bhate Chemist	Work: (205) 918-4000
Ms. Marcia Olive	Bhate Chemist	Work: (303) 386-6454
Mr. Frank Gardner, P.G.	Bhate Program Manager	Work: (303) 386-6454
Mr. Doug Jorgensen	NWI Project Manager	Work: (208) 520-1097
Mr. Brian Muller, CIH, CHMM	Bhate Health and Safety Specialist	Work: (205) 918-4000

Notes:
RCRA = Resource Conservation and Recovery Act
SSHO = Site Safety and Health Officer
CIH = Certified Industrial Hygienist
CHMM = Certified Hazardous Materials Manager
P.G. = Professional Geologist
NWI = North Wind, Inc.

FIGURES