AR Doc #3766
L.W.B.
12-22-2014

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 377TH AIR BASE WING (AFMC)

Received
DEC 18 2014
District 1

DEC 15 2014

Colonel Tom D. Miller
377 ABW/CC
2000 Wyoming Blvd SE
Kirtland AFB, NM 87117-5000

Mr. John Kieling, Manager
RCRA Permits Management Program
Hazardous Waste Bureau (HWB)
New Mexico Environment Department (NMED)
2905 Rodeo Park Road
Santa Fe, New Mexico 87505

Dear Mr. Kieling

Kirtland Air Force Base is pleased to submit the *September 2013 through June 2014 Interim Corrective Measures Operation Report for Solid Waste Management Unit (SWMU) ST-70, Buildings 481/482 Oil Water Separator(Former ST-219) November 2014.* Also included in this submittal is the *Site Characterization and Soil-Vapor Extraction Optimization Report for Solid Waste Management Unit ST-70, Buildings 481/482 Oil-Water Separator (Former ST-219), September 2013 through June 2014.*

Please contact Mr. Cole Crosgrove at (505) 853-3098 or at cole.crosgrove@kirtland.af.mil if you have any questions.

Sincerely

TOM D. MILLER, Colonel, USAF
Commander

cc:
AFCEC/CZRX(Mr. Oyelowo)
NMED-HWB (Mr. Moats)
NMED-HWB (Mr. McDonald)
EPA Region 6 (Ms. King))
Community College Montoya Campus
File

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

September 2013 through June 2014 Interim Corrective Measures Operation Report for Solid Waste Management Unit ST-70, Buildings 481/482 Oil-Water Separator (Former ST-219)

December 2014

377 MSG/CEANR
2050 Wyoming Boulevard SE
Kirtland AFB, New Mexico 87117-5670

Kirtland Air Force Base, Albuquerque, New Mexico **December 2014**

September 2013 through June 2014 Interim Corrective Measures Operation Report for Solid Waste Management Unit ST-70, Buildings 481/482 Oil-Water Separator (Former ST-219)

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

FINAL
SEPTEMBER 2013 THROUGH JUNE 2014 INTERIM CORRECTIVE MEASURES OPERATION REPORT FOR SOLID WASTE MANAGEMENT UNIT ST-70, BUILDINGS 481/482 OIL-WATER SEPARATOR (FORMER ST-219)

December 2014

Prepared for:
Air Force Civil Engineering Center
Environmental Restoration Division
2261 Hughes Avenue, Suite 163
Lackland Air Force Base, Texas 78236-9861

Contract No. FA8903-08-D-8602, Task Order No. R156

Prepared by
CAPE Environmental Management, Inc.
12037 Starcrest Drive
San Antonio, Texas 78247-4349

NOTICE

This Interim Corrective Measures Operation Report has been prepared for the U.S. Air Force by CAPE Environmental Management, Inc. for the purpose of aiding in the implementation of a final remedial action plan under the Environmental Restoration Program. As the report relates to actual or possible releases of potentially hazardous substances, its release prior to an Air Force final decision on remedial action may be in the public's interest. The limited objectives of this report and the ongoing nature of the Environmental Restoration Program, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this report, since subsequent facts may become known which may make this report premature or inaccurate.

A copy of this document is available for public review at the Central New Mexico Community College, Montoya Campus Library Reference Section, at 4700 Morris NE, Albuquerque, New Mexico.

Government agencies and their contractors registered with the Defense Technical Information Center should direct requests for copies of this report to: Defense Technical Information Center, Cameron Station, Alexandria, Virginia 22304-6145.

Non-government agencies may purchase copies of this report from: National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to U.S. Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. AGENCY USE ONLY	2. REPORT DATE December 2014	3. REPORT TYPE AND DATES COVERED Draft, September 2013 – June 2014

4. TITLE AND SUBTITLE	5. FUNDING NUMBERS
September 2013 through June 2014 Interim Corrective Measures Operation Report for Solid Waste Management Unit ST-70, Buildings 481/482 Oil-Water Separator (Former ST-219), Kirtland Air Force Base, New Mexico	Contract No. FA8903-08-D-8602 Task Order No. R156
6. AUTHOR(S) CAPE Environmental Management, Inc.	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) CAPE Environmental Management, Inc. 12037 Starcrest Drive San Antonio, Texas 78247-4349	8. PERFORMING ORGANIZATION REPORT NUMBER Not assigned
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) HQ AFCEC 2261 Hughes Avenue, Suite 163 Lackland Air Force Base, Texas 78236-9861	10. SPONSORING/MONITORING AGENCY REPORT NUMBER A001f

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT	12b. DISTRIBUTION CODE

13. ABSTRACT

Semi-annual reporting on the site monitoring results and interim corrective measure performance at Solid Waste Management Unit ST-70 at Kirtland Air Force Base, New Mexico.

14. SUBJECT TERMS Solid Waste Management Unit (SWMU) ST-70; soil-vapor extraction (SVE); vapor monitoring	15. NUMBER OF PAGES: 44
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION	20. LIMITATION OF ABSTRACT

THIS PAGE INTENTIONALLY LEFT BLANK

40 CFR 270.11
DOCUMENT CERTIFICATION
DECEMBER 2014

DEC 1 5 2014

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 ensure 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 fines and imprisonment for knowing violations.

TOM D. MILLER, Colonel, USAF
Commander, 377th Air Base Wing

This document has been approved for public release.

KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs

THIS PAGE INTENTIONALLY LEFT BLANK

NATURAL RESOURCE INJURY

The Department of Defense (DoD) policy requires the identification of Natural Resource Injury (NRI) and, whenever practicable, the rectification of any NRI during the site assessment, investigation, and remedy selection and implementation process for cleanup actions (DoD, 2000). As stated in the policy, the DoD objectives are as follows:

"…to promote earlier and more complete consideration of the risks to natural resources associated with past activities and cleanup alternatives; to ensure that Components exercise their statutory Trustee authorities to address NRI on behalf of the public; to lower the total life-cycle costs of the Components' remediation programs; and to reduce the potential for response cost recovery or natural resource damage claims against the Components."

Based on the above discussions and the site-specific conditions presented in this report, implementation of the selected remedial alternative of soil-vapor extraction at Solid Waste Management Unit ST-70 (Former ST-219) will not result in any NRIs. Site contamination is largely restricted to soil and soil gas present in the vadose zone below paved surfaces. Site conditions prevent migration of contamination to surface soil or the atmosphere, and soil-vapor extraction is expected to prevent further migration to the groundwater. Therefore, contamination at the site does not pose any harm to natural resources such as groundwater or ecological receptors. Likewise, the continued implementation of selected remedial alternative will create no significant disturbance to native soil or ecological habitat.

THIS PAGE INTENTIONALLY LEFT BLANK

ENVIRONMENTAL JUSTICE CONSIDERATION

Presidential Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of federal programs, policies, and activities on minority and low-income populations. For purposes of this report, the population within a 50-mile radius around Kirtland Air Force Base (AFB) was considered. Demographic and economic census information presented in Addressing Environmental Justice under the National Environmental Policy Act at Sandia National Laboratories (SNL)/New Mexico (SNL, 1997) and the United States Census Bureau (USCB) web site (http://quickfacts.census.gov/qfd/states/35/3502000.html accessed on October 6, 2010) were used as primary references.

The population living within a 50-mile radius of Kirtland AFB, which exceeds 49 percent of the total population according to census data (SNL, 1997), was evaluated with regard to health and environmental effects from activities at Kirtland AFB. Similarly, the low-income population, which exceeds 21 percent of the general population, was analyzed for effects from corrective measures activities at Kirtland AFB.

Minority populations are considered to be all people of all color except white people who are not Hispanic. In 1990, 49 percent (51 percent by 1996, 34.2 percent by 2000) of New Mexico's population was minority (USCB, 1998; http://quickfacts.census.gov/qfd/states/35/3502000.html accessed on October 6, 2010). Neighborhoods having minority population percentages exceeding the minority population percentage of 49 percent (slightly more conservative than 51 percent) were identified on a block-by-block basis with clusters of blocks known as block groups.

The USCB characterizes persons in poverty (low-income persons) as those whose incomes are less than a statistical poverty threshold. The threshold is a weighted-average based on family size and age of family members. For instance, the 1990 census threshold for a family of four was based on a 1989 household income of $12,674 (USCB, 1990). By 1996, the household income threshold rose to $16,036 (USCB, 1997). In 1989, 21 percent of New Mexico's population was listed in poverty or designated as having low income (USCB, 1996). By 1996, the estimated percentage stood at 24 percent (USCB, 1997) and by 2000, the state-wide percent decreased to 18.4 (http://quickfacts.census.gov/qfd/states/35/3502000.html accessed on October 6, 2010). In this analysis, low-income block groups (same as above) occur where the low-income population percentage in the block group exceeds the poverty percentage for the state of New Mexico.

According to 1990 census data, approximately 280,360 minority individuals from an approximate total population of 609,500 reside within the 50-mile radius. This represents 46 percent of the total radius of-influence population (SNL, 1997).

Block groups having less than 21 percent low-income individuals were not considered to contain a large number of low-income neighborhoods because they contain less than or equal to the state average of 21 percent. Approximately 85,330 persons were identified as being low income, thus representing approximately 14 percent of the radius-of-influence population.

This distribution of low-income population has a strong correlation to minority populations of Blacks, Native Americans, and Hispanics. For example, portions of the Pueblo of Isleta, south of the city, have high percentages of low-income individuals. To the southeast of Kirtland AFB, the rural Hispanic villages of Tajique, Torreon, and Escobosa are also low income. To the north of Kirtland AFB, high concentrations of low-income populations are located in the Pueblos of Jemez, Santo Domingo, and Cochiti, as well as in the rural Hispanic villages of La Cienega and Jemez Springs. High concentrations of

low-income populations occur west of Kirtland AFB, along the Rio Grande, in the predominantly Hispanic South Valley neighborhoods. In addition, small pockets of low-income populations reflect the locations of Black neighborhoods such as the Kirtland Addition and South Broadway/East San Jose areas.

The environmental and human health effects considered for this investigation include potential impacts to soil from contamination, restricted access by Native Americans to traditional cultural sites, biological resources, air quality, and noise. Based on the findings of this report, there are no identified negative impacts from the area of concern that would pose adverse health effects on the general human populations. Based on the analysis of any potential impacts, there would be no disproportionately high or adverse impacts to minority and low-income populations. Any impacts as a result of restrictions of access to cultural sites would be removed by coordination between Kirtland AFB and the local tribes to develop processes to allow access during periods in which safety standards and practices would be maintained.

PREFACE

This Interim Corrective Measures Operation Report for the period of September 2013 through June 2014 was prepared to document the operations and monitoring activities associated with the soil-vapor extraction system at Solid Waste Management Unit (SWMU) ST-70 (Former ST-219) at Kirtland Air Force Base, New Mexico.

This report was prepared by CAPE Environmental Management, Inc. in November 2014. Mr. Joe Urrutia of the Air Force Civil Engineer Center (AFCEC) served as the AFCEC Contracting Officer's Representative.

Dave Bettendorf
CAPE Environmental Management, Inc.
Project Manager

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENTS

Section **Page**

ACRONYMS AND ABBREVIATIONS xii

EXECUTIVE SUMMARY ES-1

1. INTRODUCTION 1-1

1.1 Interim Corrective Measures Remediation Objectives 1-1
1.2 Report Organization 1-1

2. SYSTEM OPERATION AND MAINTENANCE 2-1

2.1 Site Background 2-1
2.1.1 Site Description 2-1
2.1.2 Site Release History 2-1
2.2 Soil-Vapor Extraction System Construction and Operation 2-1
2.3 System Operations and Maintenance 2-2
2.3.1 Operating Hours and System Maintenance 2-2
2.3.2 SVE System Configuration 2-2

3. SOIL VAPOR, GROUNDWATER, AND SYSTEM PERFORMANCE DATA 3-1

3.1 Monitoring Activities 3-1
3.2 Groundwater Monitoring Results 3-2

4. INTERIM CORRECTIVE MEASURE PERFORMANCE SUMMARY 4-1

REFERENCES

APPENDICES

A Field Documentation and Measurements

B Waste Disposal Documentation

C Soil-Vapor Extraction Operational Data

D Historical Groundwater Analytical Data

E Data Quality Assessment Report

FIGURES

Figure

1-1 Site Location Map for Solid Waste Management Unit ST-70 (Former ST-219)

2-1 Location and Site Features for SWMU ST-70 (Former ST-219)

3-1 Trichloroethene Concentrations in Groundwater at Solid Waste Management Unit ST-70, Well KAFB-7001

TABLES

Table

2-1 Soil-Vapor Extraction System Operation and Downtime at Solid Waste Management Unit ST-70

2-2 Soil-Vapor Extraction System Maintenance Activities at Solid Waste Management Unit ST-70

3-1 Groundwater Analytical Results at Solid Waste Management Unit ST-70

ACRONYMS AND ABBREVIATIONS

µg/L	microgram per liter
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
CAPE	CAPE Environmental Management, Inc.
CB&I	CB&I Federal Services LLC
cfm	cubic feet per minute
COPC	contaminant of potential concern
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
GAC	granular-activated carbon
ICM	Interim Corrective Measures
NRI	Natural Resource Injury
OWS	oil-water separator
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SNL	Sandia National Laboratories
SVE	soil-vapor extraction
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TPH	total petroleum hydrocarbons
USAF	U.S. Air Force
USCB	U.S. Census Bureau
VOC	volatile organic compound

EXECUTIVE SUMMARY

Soil-vapor extraction (SVE) has been identified as the preferred interim abatement option for the volatile organic compound (VOC) contamination within the vadose zone at Solid Waste Management Unit (SWMU) ST-70 (Former ST-219). Chlorinated VOC and total petroleum hydrocarbon (TPH) impacts at the site appear to be a result of leaks from the former Oil-Water Separator (OWS) and the associated drains and piping. This Interim Corrective Measures (ICM) Operation Report for the SVE system has been prepared to document the operation, performance, and monitoring of the SVE system for the period from September 2013 through June 2014.

The primary objective of the SWMU ST-70 ICM is to remove VOC contamination released from the former OWS to the underlying vadose zone through the operation of an SVE system. This objective is evaluated by measuring the decrease in concentrations of contaminants of potential concern and VOCs within the extracted soil vapor. The primary contaminants of potential concern for SWMU ST-70 are trichloroethene, tetrachloroethene, and TPH as gasoline, as established in the ICM Construction Summary Report (U.S. Air Force, 2009).

Quarterly groundwater monitoring was performed in May 2014. Groundwater samples from KAFB-7001 were not collected during the third and fourth quarters of 2013 due to a subcontract not being in place and delays in obtaining sampling equipment, respectively. A safety accident occurred while sampling at a different site under this contract in December 2013, causing a stop-work order and subsequent safety investigation, which was conducted by the subcontractor performing the groundwater sampling, CB&I Federal Services LLC. As a result, groundwater samples were not collected during the first quarter of 2014. The stop-work order ended in March 2014, and groundwater sampling resumed shortly after in May 2014.

Groundwater monitoring results indicate that trichloroethene concentrations in groundwater have stabilized at 2.37 micrograms per liter. No vapor samples were collected during this reporting period at SWMU ST-70; therefore, a system performance analysis with contaminant mass removal calculations could not be conducted.

The SVE system ICM at SWMU ST-70 operated for approximately 91 days during the reporting period. It was determined that with the declining recovery rates and the non-sustainable operations, the SVE system would require major repairs in order to maximize contaminant mass removal, and to enhance the protection of groundwater quality. The SVE system was shut down from December 5, 2013 through the end of this reporting period with approval from Kirtland Air Force Base personnel. Due to routine maintenance and the permanent shut down of the SVE system in December 2013 4,896 hours of system downtime occurred during the reporting period.

From the time the SVE system was placed into full-scale operation on April 15, 2008 through the end of the reporting period, the SVE system has operated for approximately 1,720 days and has extracted and treated approximately 1.54 x 108 cubic feet (4.35 x 109 liters) of soil vapor.

Repair and operation of the SVE system is recommended to continue remedial efforts at the site.

THIS PAGE INTENTIONALLY LEFT BLANK

1. INTRODUCTION

The Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report for Solid Waste Management Unit (SWMU) ST-70 Building 481/482 Oil-Water Separator (OWS) (Former ST-219) (U.S. Air Force [USAF], 2005) identified soil-vapor extraction (SVE) as the preferred interim remedial option for the volatile organic compound (VOC) contamination within the vadose zone. Chlorinated solvent VOC and total petroleum hydrocarbon (TPH) impacts at the site appear to be a result of leaks from the former OWS and the associated drains and piping located near Buildings 481 and 482 (Figure 1-1). The SVE system was designed to recover chlorinated solvent and petroleum hydrocarbon VOCs present within the subsurface and was constructed according to the design presented in the Interim Corrective Measures (ICM) Work Plan for SWMU ST-70 (Former ST-219) (USAF, 2008).

This ICM Operation Report was prepared to document the operation, performance, and monitoring of the SVE system for the period of September 2013 through June 2014. The performance of the ICM is evaluated, and recommendations are proposed based on this evaluation.

1.1 Interim Corrective Measures Remediation Objectives

The primary objective of the SWMU ST-70 ICM is to remove soil VOC contamination at the site through the operation of an SVE system. This objective is evaluated by measuring the VOC concentrations within the extracted soil vapor and flow rates of the SVE system to calculate the contaminant mass removed. In addition to the contaminant mass recovery objective, a secondary objective of the ICM is to protect groundwater from chlorinated solvent VOC impacts. This is accomplished through pneumatic containment of the vapor-phase plume by the SVE system to minimize or eliminate vapor-phase contaminant transport to groundwater.

This ICM Operation Report (semiannual report) includes data on the ICM performance, system management, and site monitoring. Data evaluations, updates to the conceptual site model, and recommendations for future site monitoring, investigations, and corrective measures are presented in the Site Characterization and SVE Optimization Report (annual report) that will cover the period from September 2013 through June 2014. This semiannual report is limited to the following:

- System operation and maintenance information
- Analytical data and field measurements information from the SVE system
- Analytical data and field measurement information from SWMU ST-70 monitoring locations

1.2 Report Organization

This ICM Operation Report is organized into four sections, including this introduction, with additional material provided in three appendices.

Section 2 contains a brief discussion of site operations and documentation of the system operation and maintenance performed between September 2013 and June 2014.

Section 3 contains summaries of all SVE system and site monitoring data. A summary of system performance is also included in Section 3.

Section 4 contains a summary of the ICM operation for the monitoring period.

The appendices provide documentation of the operation and maintenance activities, field measurement data, waste disposal records, and the analytical data quality assessment report.

THIS PAGE INTENTIONALLY LEFT BLANK

2. SYSTEM OPERATION AND MAINTENANCE

A brief description of the SWMU ST-70 (Former ST-219) site and SVE system are presented in this section.

2.1 Site Background

2.1.1 Site Description

The SWMU ST-70 (Former ST-219) is located in the northwestern part of Kirtland Air Force Base (AFB), southeast of the intersection of Aberdeen Avenue and MacDill Street (Figure 1-1). The SWMU ST-70 area was previously used for aircraft movement and parking associated with Hangar Buildings 481 and 482. As such, the area was potentially subject to releases of fluids associated with aircraft maintenance such as fuels, lubricants, and degreasers. More recently, the areas adjacent to SWMU ST-70 have been used as an airline passenger terminal. The U.S. Department of Energy (DOE) operates an airline passenger terminal housed in the portable office buildings between Buildings 481 and 482 and within Building 481. Additionally, a covered hazardous materials storage and containment area is present directly northeast of the SVE system, and within the SWMU ST-70 investigation boundary. Building 482 is rarely used for aircraft maintenance or parking.

The SWMU ST-70 is located within an unrestricted portion of the flightline between the two buildings. The concrete tarmac between Buildings 481 and 482 comes to an end approximately 30 feet southeast of the northwestern extent of the two buildings, with asphalt pavement located northwest of the concrete. The site is located on both concrete tarmac and asphalt pavement. A chain-link fence (the flightline fence) topped with barbed wire separates the parking lot northwest of Buildings 481 and 482 from the flightline. Immediately west-northwest of the former OWS location is a set of portable office buildings that comprise a small airline passenger terminal operated by a DOE contractor. An OWS was located roughly midway between the two hangar buildings. The OWS collected surface water drainage from the tarmac, and separated the oily residues from aircraft operations from the surface water prior to discharge to the sanitary sewer system.

2.1.2 Site Release History

The OWS at SWMU ST-70 was identified as a contaminant release site from visual inspections and samples collected from inside the OWS in 1990 and 1992. Several phases of an RFI were performed at the site in subsequent years. Data from the RFIs indicated petroleum hydrocarbon contamination was present in soil and soil vapor adjacent to the OWS. The OWS was removed in 1994, and piping was reconfigured to direct drainage to the sanitary sewer. A covered hazardous materials storage and containment area is present within the flightline fence to the northeast of the SWMU ST-70 OWS location. The hazardous materials storage area consists of a concrete pad surrounded by a 6-inch concrete containment curb. A floor drain within the hazardous materials storage area, which formerly led to the OWS, has also been re-directed to the sanitary sewer.

2.2 Soil-Vapor Extraction System Construction and Operation

The SVE system was installed within the flightline fence between the hazardous waste storage area and the DOE contractor passenger terminal trailers. The SVE system is contained primarily within a wooden 10-foot by 12-foot storage shed. The shed houses the extraction blower, above-grade piping, gauges, and carbon vessels that are connected to subsurface piping for three extraction wells (219-28H, Kirtland AFB [KAFB]-7002, and KAFB-7003).

Between November 2007 and April 2008, the pilot-scale SVE system was modified into a full-scale SVE system with vapor monitoring wells KAFB-7002 and KAFB-7003 converted into extraction wells. The full-scale SVE system was put into operation on April 15, 2008. The performance of the SVE operations is monitored using soil vapor monitoring points, SVE wells, and groundwater monitoring well KAFB-7001. The site features are shown on Figure 2-1.

The contaminant mass removal efficiency of the SVE system has been observed to fluctuate seasonally, and a rebound study was proposed in prior ICM monitoring reports (USAF, 2011; USAF, 2012a) to evaluate the fluctuation. A limited rebound study was conducted in June 2011, and the results indicated that extended system downtime would not result in significant environmental impacts. An extended rebound study was conducted from January to April 2012. The results indicated that a seasonal system shutdown of between 1 and 3 months would decrease the volume of waste generated and reduce wear on SVE components without significant adverse effects on the overall ICM performance (USAF, 2012b).

2.3 System Operations and Maintenance

The SVE system at SWMU ST-70 operated with little downtime before the seasonal shutdown on December 5, 2013. The SVE system was not restarted in the spring of 2014 with approval from Kirtland AFB. It was determined that with the declining recovery rates and the non-sustainable operations, the SVE system would require major repairs in order to maximize contaminant mass removal, and to enhance the protection of groundwater quality.

2.3.1 Operating Hours and System Maintenance

The SVE system operated for a total of 91 days during the monitoring period with minimal downtime for routine monitoring and maintenance activities. The SVE system was offline from December 5, 2013 through the end of this reporting period. Routine maintenance and monitoring activities required system shutdown on one occasion.

Routine maintenance activities included exchange of granular-activated carbon (GAC) exhaust treatment vessels, draining of condensate liquids from the system piping, and waste management. Field monitoring records and measurements are presented in Appendix A. Waste disposal records are presented in Appendix B. SVE operational data is presented in Appendix C.

From the time the SVE system was placed into full-scale operation on April 15, 2008 through the end of the reporting period, the SVE system has operated for approximately 1,720 days and has extracted and treated approximately 1.54 x 108 cubic feet (4.35 x 109 liters) of soil vapor. The reporting period operational statistics are presented in Table 2-1.

2.3.2 SVE System Configuration

The combined intake of the SVE system decreased to rates between 15 and 24.8 cubic feet per minute (cfm) during the monitoring period. This is less than rates reported for the previous monitoring period from January 2013 through July 2013, where rates were between 57 and 63 cfm (Bhate Environmental Associates, Inc. and CH2M HILL, 2013). The intake configuration is maintained to maximize intake contaminant concentrations and to protect groundwater quality.

The following flow rates were recorded from September 24 to November 25, 2013:

- 36 to 0 cfm from ST219-28H (open full)
- 17.9 to 0 cfm from ST-70-02 (extraction point closed)
- 0 to 14.9 cfm from ST-70-03 (open one-quarter)

The maintenance activities for the reporting period are summarized in Table 2-2.

THIS PAGE INTENTIONALLY LEFT BLANK

3. SOIL VAPOR, GROUNDWATER, AND SYSTEM PERFORMANCE DATA

This section presents the monitoring analytical data collected from the site and treatment system at SWMU ST-70 for the current reporting period between September 2013 and June 2014.

3.1 Monitoring Activities

During the 9-month reporting period, the following activities were performed:

- One groundwater sampling event was conducted in May 2014.
- Four field monitoring events were conducted from September 2013 through December 2013.

Groundwater samples were not collected during the third quarter of 2013 because it occurred prior to the period of performance under this contract. Delays in obtaining sampling equipment postponed the fourth quarter 2013 sampling event until December 2013. However, on December 11, 2013, a stop-work order was issued due to a safety accident that occurred while sampling at a different site under this contract. A subsequent safety investigation was conducted by the subcontractor performing the sampling, CB&I Federal Services LLC. As a result, groundwater samples were not collected during the fourth quarter of 2013 or the first quarter of 2014. The stop-work order ended in March 2014, and groundwater sampling resumed shortly after in May 2014.

Measurements of the monitoring point vapor pressures and SVE system flow rates were collected on a monthly basis before the system was shut down permanently on December 5, 2013. Quarterly vapor sampling was not conducted during this reporting period due to the declining recovery rates and the non-sustainable operations the SVE system.

The following data was collected monthly at soil vapor monitoring points, and SVE system sample ports using field instrumentation:

- Vapor pressures or vacuums
- Total VOCs as measured by a photoionization detector

Quarterly groundwater sampling was conducted at monitoring well KAFB-7001. The following laboratory analyses were performed for the groundwater samples:

- VOCs by the U.S. Environmental Protection Agency (EPA) Method SW8260B
- TPH as gasoline by EPA Method SW8015
- Nitrate-nitrogen by EPA Method E300
- Dissolved RCRA metals by Methods SW6010C and SW7470A

Depth to water and groundwater quality parameter measurements of pH, temperature, specific conductance, and turbidity were also collected at groundwater monitoring well KAFB-7001 (Appendix A).

The groundwater sample analytical results are presented in Table 3-1. Historical groundwater analytical data for monitoring well KAFB-7001 is presented in Appendix D. The field monitoring data are presented in Appendix A. The laboratory data validation reports are presented in Appendix E.

3.2 Groundwater Monitoring Results

The purpose of groundwater monitoring is to evaluate whether contaminants of potential concern (COPCs) have impacted groundwater quality in the area. To date, groundwater has not been impacted by contaminants at concentrations above regulatory screening levels. Monitoring for nitrate-nitrogen and dissolved metals is performed to provide supplementary data for upgradient and cross-gradient contaminant plumes. Nitrate and metals are not considered COPCs at SWMU ST-70.

The primary groundwater COPC is trichloroethene (TCE). Laboratory analyses of groundwater samples from the May 2014 monitoring event detected TCE at a concentration of 2.37 micrograms per liter (µg/L). Groundwater concentrations of TCE have increased since 2012. However, groundwater TCE concentrations remain significantly below the regulatory screening level of 5.0 µg/L. The change in groundwater TCE concentration is believed to be associated with changes in the regional groundwater flow direction resulting from large-scale changes in groundwater use by the Albuquerque Bernalillo County Water Utility Authority. Chloroform and dibromochloromethane were also detected in groundwater samples at low J-flagged concentrations below 1 µg/L. No hydrocarbon fuel-related contaminants were detected during the reporting period. The laboratory analytical results for the May 2014 monitoring event are summarized in Table 3-1. The trends of groundwater TCE concentrations in monitoring well KAFB-7001 are presented on Figure 3-1. Appendix E provides the laboratory data validation report.

Purge water from sampling activities was contained in 55-gallon drums and stored at the wellhead, pending groundwater sampling analysis and subsequent disposal determination. Following groundwater sampling analysis, the investigation-derived waste water was classified as non-hazardous clean. Discharge approval from the New Mexico Environment Department Groundwater Quality Bureau was not required; therefore, purge water was discharged to the ground surface at the well location.

4. INTERIM CORRECTIVE MEASURE PERFORMANCE SUMMARY

The primary COPCs at SWMU ST-70 are TCE, tetrachloroethene, and TPH as gasoline for soil and TCE for groundwater. Soil vapor and groundwater COPC concentrations are relatively stable at the site. Groundwater concentrations of TCE appear to have increased slightly from 1.7 milligrams per liter in April 2013 to 2.37 milligrams per liter in May 2014. No fuel-related hydrocarbon compounds were detected in groundwater samples during the reporting period.

The SVE system ICM at SWMU ST-70 operated for approximately 91 days during the reporting period. Due to routine maintenance and the permanent shutdown of the SVE system in December 2013, 4,896 hours of system downtime occurred during the reporting period. No vapor samples were collected during this reporting period at SWMU ST-70; therefore, a system performance analysis with contaminant mass removal calculations could not be conducted. Repair and operation of the SVE system is recommended to continue remedial efforts at the site.

THIS PAGE INTENTIONALLY LEFT BLANK

REFERENCES

Bhate Environmental Associates, Inc. and CH2M HILL. 2013. *January 2013 through June 2013 Interim Corrective Measures Operation Report for Solid Waste Management Unit ST-70, Buildings 481/482 Oil Water Separator (Former ST-219)*. August.

Sandia National Laboratories. 1997. Addressing Environmental Justice Under the National Environmental Policy Act at Sandia National Laboratories/New Mexico. Sandia National Laboratories, Albuquerque, New Mexico.

Title 40, "Protection of Environment" Code of Federal Regulations, Part 270.11. "Signatories to permit applications and reports." EPA Administered Permit Programs: The Hazardous Waste Permit Program. July 14, 2006.

U.S. Air Force. 2012b. *January 2012 to June 2012 Interim Corrective Measures Report for SWMU ST-70, Buildings 481/482 Oil Water Separator (Former ST-219). Kirtland AFB, New Mexico*. August.

U.S. Air Force. 2012a. *July 2011 to December 2011 Interim Corrective Measures Report for SWMU ST-70, Buildings 481/482 Oil Water Separator (Former ST-219). Kirtland AFB, New Mexico*. February.

U.S. Air Force. 2011. *January 2011 to June 2011 Interim Corrective Measures Report for SWMU ST-70, Buildings 481/482 Oil Water Separator (Former ST-219). Kirtland AFB, New Mexico*. September.

U.S. Air Force. 2009. *Interim Corrective Measures, Construction Summary Report for the Soil Vapor Extraction System, Solid Waste Management Unit ST-70 (Former ST-219). Kirtland AFB, New Mexico*. April.

U.S. Air Force. 2008. *Interim Corrective Measures Work Plan for Solid Waste Management Unit ST-70 (Former ST-219). Kirtland AFB, New Mexico*. January.

U.S. Air Force. 2005. *Environmental Restoration Program RCRA Facility Investigation Report Solid Waste Management Unit ST-70 (Former ST-219). Kirtland AFB, New Mexico*. November 23.

U.S. Bureau of Census. 1998. *Estimations of the Population of States by Race and Hispanic Origin; April 1, 1990 and July 1, 1996.* January.

U.S. Bureau of Census. 1997. *Estimates of the Population of States by Counties: July 1, 1996 and Percent Population Change: April 1, 1990 to July 1, 1996.* CO-96-7. March 20. http://quickfacts.census.gov/qfd/states/35/3502000.html.

U.S. Bureau of Census. 1996. "Persons by Poverty Status in 1969, 1979, and 1989, by State," *Census Historical Poverty Tables*, CPH-L-162. June. http://quickfacts.census.gov/qfd/states/35/3502000.html.

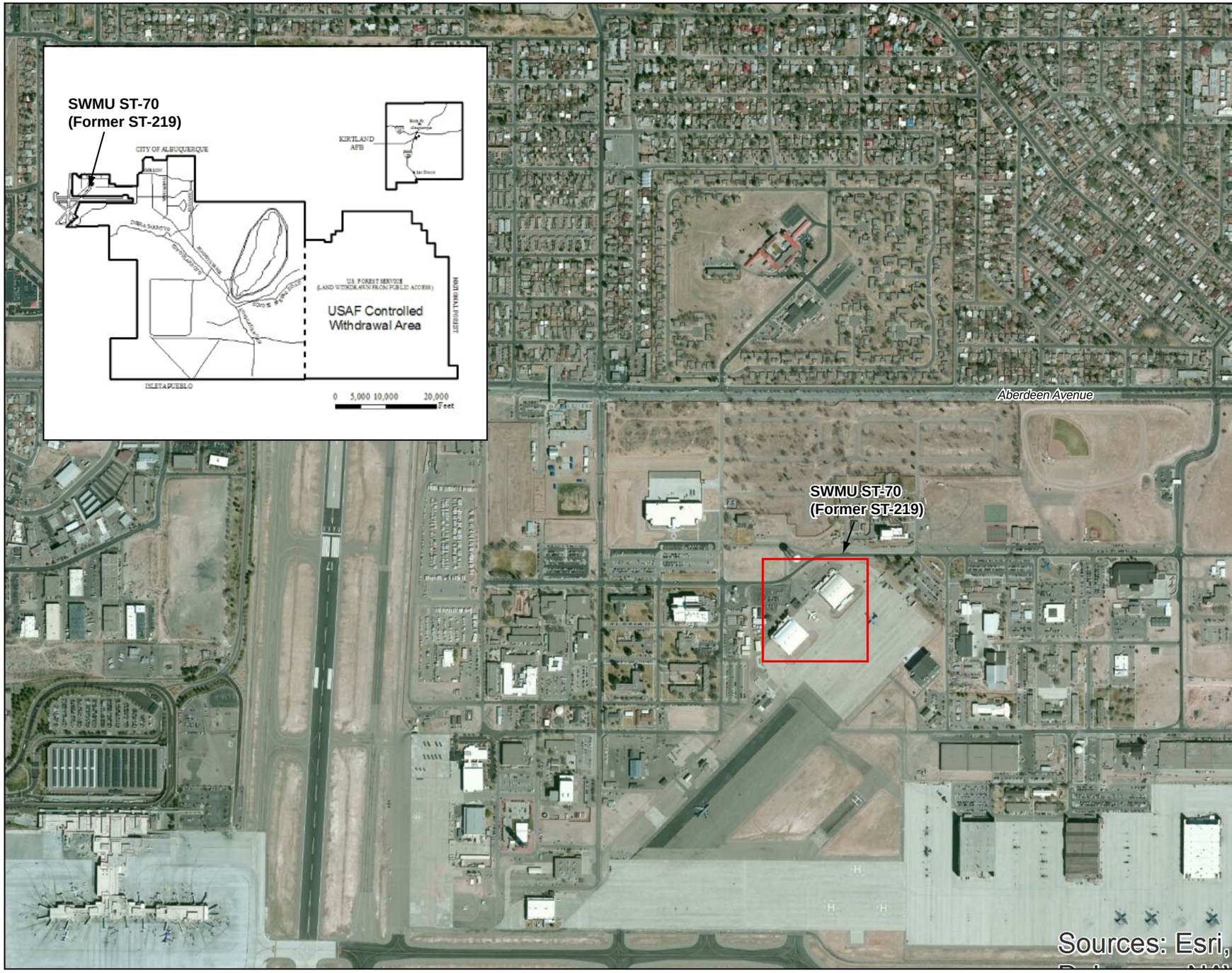
U.S. Bureau of Census. 1990. *Poverty Thresholds. 1989.* Washington, D.C.

U.S. Department of Defense, 2000. U.S. Department of Defense Policy. 63 Fed. Reg. 26846 (14 May).

THIS PAGE INTENTIONALLY LEFT BLANK

FIGURES

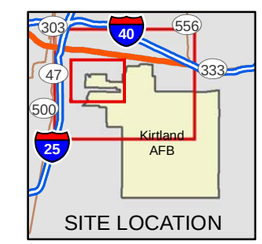
THIS PAGE INTENTIONALLY LEFT BLANK



150577.4A201430.B1

Legend

SWMU ST-70 (Former ST-219)



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Revision Date: 07/07/14

N

0 500 1000 2000

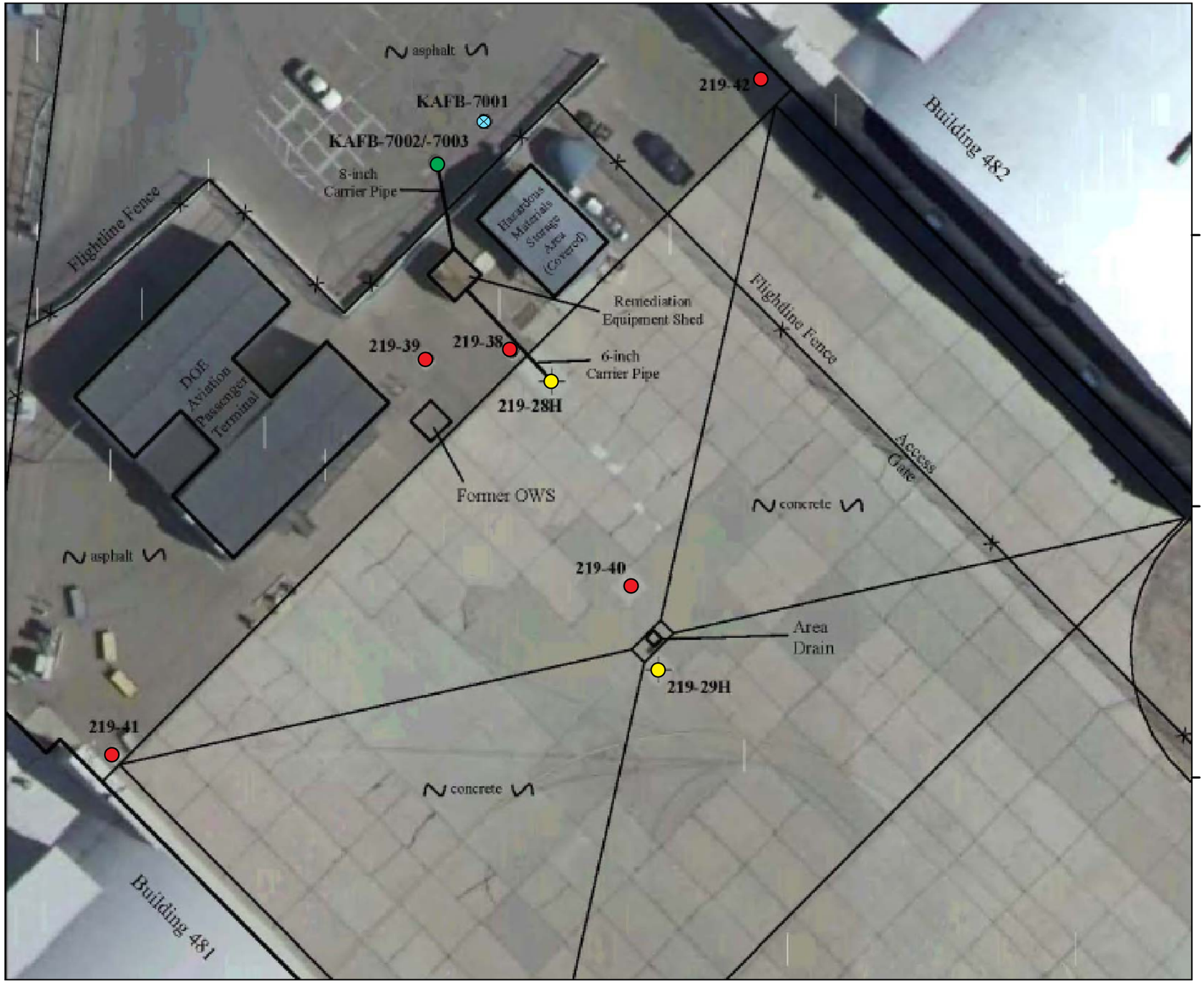
Feet
1 inch = 1000 ft

Projection : NAD83 State Plane New Mexico Central FIPS3002 Feet

LONG TERM MONITORING
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1-1

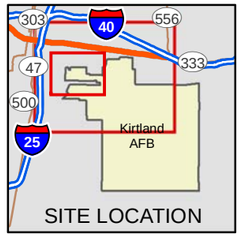
SITE LOCATION MAP FOR
SWMU ST-70 (FORMER ST-219)



150577.4A201430.B2

Legend

- Soil Vapor Monitoring Well
- Soil Vapor Monitoring/Extraction Well (Former Bioventing Well)
- Soil Vapor Monitoring/Extraction Well
- Groundwater Monitoring Well



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Revision Date: 07/07/14

N

0 150 30 60

Feet
1 inch = 30 ft

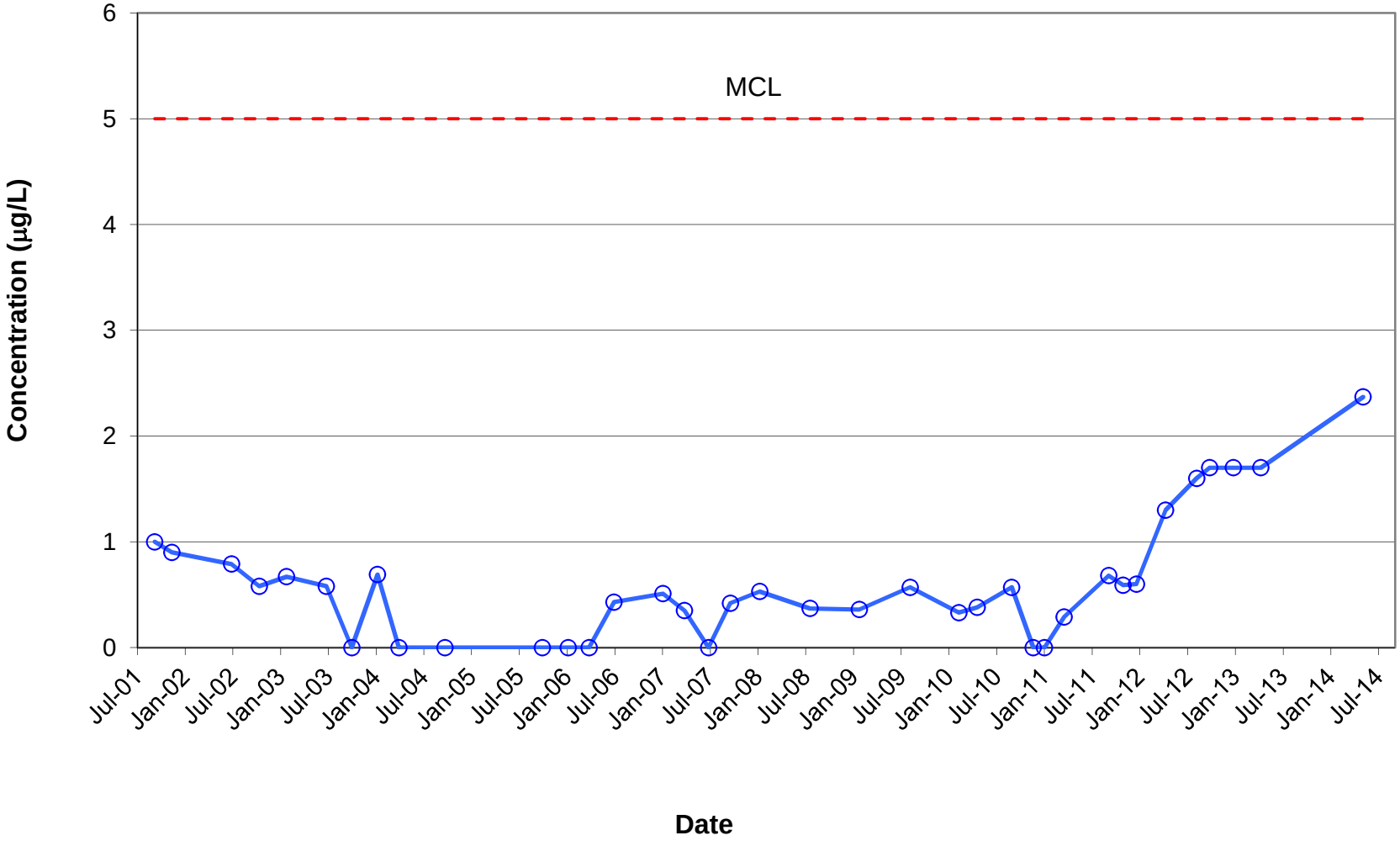
Projection : NAD83 State Plane New Mexico Central FIPS3002 Feet

LONG TERM MONITORING
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2-1

LOCATION AND SITE FEATURES OF SWMU ST-70 (FORMER ST-219)

Figure 3-1. Trichloroethene Concentrations in Groundwater at Solid Waste Management Unit ST-70, Well KAFB-7001



TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

Table 2-1. Soil-Vapor Extraction System Operation and Downtime at Solid Waste Management Unit ST-70

Date	SVE Operation		Cumulative Time		Percent Downtime (%)	Flow Rate (scfm)	Cumulative Volume Extracted (L)	Cumulative Volume Extracted (ft^3)	Notes
	Down Time (hours)	Start/ Restart (time)	Total Downtime (days)	Total Operation Time (days)					
Previously Reported Operation									
06/30/13	0.0	N/A	21.28	1563.55	1.36	64	4.04E+09	1.43E+08	end of reporting period
07/29/13	37.5	8:30	22.84	1590.98	1.44	58	4.11E+09	1.45E+08	maintenance downtime
08/28/13	0.5	16:50	22.86	1620.96	1.41	54	4.17E+09	1.47E+08	maintenance downtime
09/24/13	0	N/A	22.86	1647.96	1.39	54	4.23E+09	1.50E+08	inspection
11/25/13	0	N/A	22.86	1709.96	1.34	46	4.35E+09	1.54E+08	inspection
12/05/13	0.2	N/A	22.86	1719.96	1.33	0	4.35E+09	1.54E+08	maintenance; scheduled downtime begins
06/27/14	4896	N/A	226.86	1719.96	13.19	0	4.35E+09	1.54E+08	end of reporting period

ft^3 = cubic feet

L = liter

N/A = not applicable

scfm = standard cubic feet per minute

SVE = soil vapor extraction

Table 2-2. Soil-Vapor Extraction System Maintenance Activities at Solid Waste Management Unit ST-70

Date	Maintenance Performed	Notes
CAPE Environmental Management, Inc. Reporting Period (September 2013 to June 2014)		
09/24/13	SVE system inspection, monthly field monitoring, GAC change	Vapor flow, PID, and pressure readings were collected. FOD and waste mangament, and routine maintenance was performed.
09/25/13	Waste haul	GAC waste was removed from site, system was inspected, and flightline keys turned over to KAFB.
11/25/13	SVE system Inspection, Monthly field monitoring	Vapor flow, PID, and pressure readings were collected.
12/05/13	Waste haul, system shut down	Approximately 40 gallons of GAC waste was drummed on site; seasonal system shut down.
12/31/13	SVE system inspection, monthly field monitoring	Vapor flow, PID, and pressure readings were collected.

FOD = foreign object debris, or material presenting hazards to aircraft

GAC = granular-activated carbon

PID = photoionization detector

SVE = soil-vapor extraction

Table 3-1. Groundwater Analytical Results at Solid Waste Management Unit ST-70

		SAMPLE LOCATION	**KAFB-7001**	**KAFB-7001**
		SAMPLE DATE	**5/19/2014**	**5/19/2014**
		SAMPLE NUMBER	**ST70-30001**	**ST70-30002**
		SAMPLE PURPOSE	**REGULAR**	**FD**
Chemical Class & Analytical Method	**Analyte**	**EPA MCLs[1]**	**Result**	**Result**
VOCs (µg/L)	1,1,1,2-TETRACHLOROETHANE	--	ND	ND
Method SW8260B	1,1,1-TRICHLOROETHANE	200	ND	ND
	1,1,2,2-TETRACHLOROETHANE	--	ND	ND
	1,1,2-TRICHLOROETHANE	5	ND	ND
	1,1-DICHLOROETHANE	--	ND	ND
	1,1-DICHLOROETHENE	7	ND	ND
	1,1-DICHLOROPROPENE	--	ND	ND
	1,2,3-TRICHLOROBENZENE	--	ND	ND
	1,2,3-TRICHLOROPROPANE	--	ND	ND
	1,2,4-TRICHLOROBENZENE	70	ND	ND
	1,2,4-TRIMETHYLBENZENE	--	ND	ND
	1,2-DIBROMO-3-CHLOROPROPANE	0.2	ND	ND
	1,2-DIBROMOETHANE	0.05	ND	ND
	1,2-DICHLOROBENZENE	600	ND	ND
	1,2-DICHLOROETHANE	5	ND	ND
	1,2-DICHLOROPROPANE	5	ND	ND
	1,3,5-TRIMETHYLBENZENE	--	ND	ND
	1,3-DICHLOROBENZENE	--	ND	ND
	1,3-DICHLOROPROPANE	--	ND	ND
	1,4-DICHLOROBENZENE	75	ND	ND
	1-CHLOROHEXANE	--	ND	ND
	2,2-DICHLOROPROPANE	--	ND	ND
	2-BUTANONE	--	ND	ND
	2-CHLOROTOLUENE	--	ND	ND
	4-CHLOROTOLUENE	--	ND	ND
	4-METHYL-2-PENTANONE	--	ND	ND
	ACETONE	--	4.04 J	ND
	BENZENE	5	ND	ND
	BROMOBENZENE	--	ND	ND
	BROMOCHLOROMETHANE	--	ND	ND
	BROMODICHLOROMETHANE	80	ND	ND
	BROMOFORM	80	ND	ND
	BROMOMETHANE	--	ND	ND
	CARBON TETRACHLORIDE	5	ND	ND
	CHLOROBENZENE	100	ND	ND
	CHLOROETHANE	--	ND	ND
	CHLOROFORM	80	0.277 J	ND
	CHLOROMETHANE	--	ND	ND
	CIS-1,2-DICHLOROETHENE	70	ND	ND
	CIS-1,3-DICHLOROPROPENE	--	ND	ND
	DIBROMOCHLOROMETHANE	80	0.325 J	0.271 J
	DIBROMOMETHANE	--	ND	ND
	DICHLORODIFLUOROMETHANE	--	ND	ND
	ETHYLBENZENE	700	ND	ND
	HEXACHLOROBUTADIENE	--	ND	ND
	ISOPROPYLBENZENE	--	ND	ND
	M,P-XYLENES	--	ND	ND
	METHYL TERT-BUTYL ETHER	--	ND	ND

Table 3-1. Groundwater Analytical Results at Solid Waste Management Unit ST-70

		SAMPLE LOCATION	**KAFB-7001**	**KAFB-7001**
		SAMPLE DATE	**5/19/2014**	**5/19/2014**
		SAMPLE NUMBER	**ST70-30001**	**ST70-30002**
		SAMPLE PURPOSE	**REGULAR**	**FD**
Chemical Class & Analytical Method	**Analyte**	**EPA MCLs[1]**	**Result**	**Result**
VOCs (µg/L) Method SW8260B	METHYLENE CHLORIDE	5	ND	ND
	NAPHTHALENE	--	ND	ND
	N-BUTYLBENZENE	--	ND	ND
	N-PROPYLBENZENE	--	ND	ND
	O-XYLENE	--	ND	ND
	P-ISOPROPYLTOLUENE	--	ND	ND
	SEC-BUTYLBENZENE	--	ND	ND
	STYRENE	100	ND	ND
	TERT-BUTYLBENZENE	--	ND	ND
	TETRACHLOROETHENE	5	ND	ND
	TOLUENE	1000	ND	ND
	TRANS-1,2-DICHLOROETHENE	100	ND	ND
	TRANS-1,3-DICHLOROPROPENE	--	ND	ND
	TRICHLOROETHENE	5	2.37	2.38
	TRICHLOROFLUOROMETHANE	--	ND	ND
	VINYL CHLORIDE	2	ND	ND
TPH (µg/L) EPA Method 8015	DIESEL RANGE ORGANICS	--	ND	ND
	GASOLINE RANGE ORGANICS	--	ND	ND
	OIL RANGE ORGANICS (>C28-C40)	--	ND	ND
Dissolved Metals (mg/L) EPA Methods SW6010C and SW7470A	ARSENIC	0.01	ND	0.000893 J
	BARIUM	2	0.0402	0.0422
	CADMIUM	0.005	ND	ND
	CHROMIUM	0.1	0.00127 J	0.00135 J
	LEAD	0.015	0.000854 J	0.00112 J
	MERCURY	0.002	ND	ND
	SELENIUM	0.05	0.0244	0.0255
	SILVER	0.1	ND	ND
Anions (mg/L) EPA Method 300	NITRATE AS NITROGEN	10	7.36	7.38

[1] U.S. Environmental Protection Agency National Drinking Water Regulations, including primary and secondary standards (May 2009).

Notes:

Shading indicates the analyte was detected

-- = standard not established

EPA = U.S. Environmental Protection Agency

FD = field duplicate

ID = identifier

J = estimated value, concentration is less than the level of quantitation (LOQ) but greater than the detection limit (DL)

KAFB = Kirtland Air Force Base

MCL = maximum contaminant level

mg/L = milligram per liter

µg/L = microgram per liter

ND = analyte was not detected

SWMU = Solid Waste Management Unit

TPH = total petroleum hydrocarbon

VOC = volatile organic compound

APPENDIX A

Field Documentation and Measurements

THIS PAGE INTENTIONALLY LEFT BLANK

SWMU ST-70 (Former ST-219) Field Measurements - Vacuum Readings											
		SVE System					Vapor Extraction Wells				
Date	System ON/OFF	Combined Inlet	Pre-Blower	Post-Blower	Primary Exhaust	Final Exhaust	219-28H	ST-70-02		ST-70-03	
9/24/2013	ON	15.0	16.0	10.5	5.2	0.04	9.5	3.6		0	
11/25/2013	ON	24.8	27.0	9.5	0.0	0.0	23.94	17.62		0	
12/31/2013	OFF	0.0	0.0	0.0	0.0	0.0	0	0		0	
		Vapor Monitoring Wells									
		219-29H	219-38-41	219-38-74	219-38-99	219-39-42	219-39-75	219-40-20	219-41	219-42	ST-70-01
9/24/2013	ON	0.04	0.02	clogged	0.03	atm	clogged	0.01	atm	clogged	0.18
11/25/2013	ON	NM[1]	0.02	clogged	0.02	0.02	clogged	NM[1]	0.07	clogged	0
12/31/2013	OFF	0.005	0.12	clogged	0	0.08	clogged	0.25	NM[2]	clogged	0

All vacuum readings are in pressure readings on negative inches of water

Shading indicates that the pressure is in positive inches of water

1 = not measured due to aircraft on tarmac

2 = not measured due to ice in vapor port

atm = atmoshperic pressure

NM = not measured

OFF = SVE was offline for seasonal downtime

Vapor monitoring wells 219-38-74, 219-37-75, 219-40-40, 219-42, and 219-39-75 are no longer functional

SWMU ST-70 (Former ST-219) Field Measurements
Vapor Quality Readings

Location	PID Reading (ppmv)	Fixed Gas Readings (%)				
		O2	CO2	CO	CH4	N2
SVE System 09/24/13						
Combined Inlet	121	NM	NM	NM	NM	NM
Primary Exhaust	3.6	NM	NM	NM	NM	NM
Final Exhaust	0	NM	NM	NM	NM	NM
Vapor Extraction Wells 09/24/13						
219-28H	182	NM	NM	NM	NM	NM
ST-70-02	5.3	NM	NM	NM	NM	NM
ST-70-03	3.1	NM	NM	NM	NM	NM
SVE System 11/25/13						
Combined Inlet	NM	NM	NM	NM	NM	NM
Primary Exhaust	NM	NM	NM	NM	NM	NM
Final Exhaust	NM	NM	NM	NM	NM	NM
Vapor Extraction Wells 11/25/13						
219-28H	0	NM	NM	NM	NM	NM
ST-70-02	0	NM	NM	NM	NM	NM
ST-70-03	0	NM	NM	NM	NM	NM
SVE System 12/31/13						
Combined Inlet	NM	NM	NM	NM	NM	NM
Primary Exhaust	NM	NM	NM	NM	NM	NM
Final Exhaust	NM	NM	NM	NM	NM	NM
Vapor Extraction Wells 12/31/13						
219-28H	0	NM	NM	NM	NM	NM
ST-70-02	0	NM	NM	NM	NM	NM
ST-70-03	0	NM	NM	NM	NM	NM

Shaw Environmental, Inc.

GROUNDWATER PURGE LOG

Kirtland Air Force Base, Bulk Fuels Facility Spill

Project Name: KAFB BEOS **Well ID No.:** KAFB-7001

Site / SWMU No.: ST70 **Date:** 5/19/14

Weather: Clear, ~70° **Time:** 0935

Field Crew: GP **Crew Signature:** [signature]

Review Signature: _____ **Date Review:** _____

WELL OBSERVATIONS

Protective Casing / Vault: - Intact - Damaged - **Locked:** Yes - No **Well ID Mark:** Yes - No

Notes: _____

CALCULATIONS

(A) Depth to Well Bottom	480	ft	(J) Filter Pack Volume (H x I)	25.74	gal
(B) Pre-Purge Depth to Water	457.55	ft	(K) Min Purge Volume (E + J)	40.33	gal
(C) Water Column Height (A-B)	22.45	ft	**EQUIPMENT / MODEL**	**ID NUMBER**	
(D) Casing Factor: 4"=0.65 5"=1.02	0.65		Parameter Meter		
(E) One Well Casing Volume (C x D):	14.59	gal	In Situ	R25194	
(F) Depth to Top of Screen	454	ft	Turbidity Meter		
(G) Depth to Bottom of Screen	479	ft	HACH 2100Q	0165	
(H) Saturated Filter Pack Length (G –F, or B)	21.45	ft	Pump		
			Dedicated Bennett	On-File	
(I) Casing/Borehole Factor 4/10 = 1.2, 5/10 = 1.07, _____	1.2		Field Alkalinity		
			LaMotte	3467-01	

PURGING INFORMATION

Description first water purged: clear

Date and / or Time	Gallons Removed	Depth to Ground-water (Ft)	Temp (°C)	pH	Spec Cond (µS/cm²)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comment
0935	0	457.55	20.26	6.90	1207	7.46	26	6.04	2.8 L/min
0952	13	—	19.28	7.64	1179	8.52	16	3.38	↓
1010	26	—	19.27	7.64	1180	8.54	0	1.47	
1029	31	—	19.62	7.65	1188	8.49	-17	0.59	1.0 L/min
1048	36	—	19.91	7.65	1195	8.49	-20	0.33	↓
1107	41	—	20.13	7.65	1200	8.47	-24	0.32	
Values Prior to Sampling									
1107	41	—	20.13	7.65	1200	8.47	-24	0.32	1.0 L/min

Field Alkalinity Result 60 mg/L $CaCO_3$ **Sample ID:** ST70-30001, ST70-30002

BUBBLES: YES ____ **NO** X **WHERE** _____ **AMOUNT** _____ **SIZE** _____

Note: For calculations, additional casing factors (D) and casing/borehole factors (I) can be found in the *Groundwater Investigation Work Plan, Part I: Field Investigation Activities*

140705

APPENDIX B

Waste Disposal Documentation

THIS PAGE INTENTIONALLY LEFT BLANK

SPECIAL WASTE SHIPMENT RECORD

Rio Rancho Sanitary Landfill / Valencia Regional Landfill & Recycling Facility Shipment № 66834

Mailing Address:
P.O. Box 15700
Rio Rancho, NM 87174
505/892-2055

☐ *Physical Address:*
33rd St. & Northern Blvd.
Rio Rancho, NM 87144
SWM #231402

☒ *Physical Address:*
1600 W. Highway 6
Los Lunas, NM 87031
SWM #013230 (sp)

Profile # 101142NM

1. Generator's work site name and address
Kirtland Air Force Base

2. Generator's name and address
Kirtland Air Force Base
2050 Wyoming Blvd. SE - 377 MSG/CEANC
Albuquerque, NM 87117

Generator's Telephone no.
(505)846-6362

3. Authorized Agent's name and mailing address (if different from #2)
Advanced Environmental Solutions, Inc.
2318 Roldan Drive
Belen, New Mexico 87002

Agent's Telephone no.
(505)861-1700

4. Proper name and type of waste	5. Containers No.	Type	6. Total quantity (yd3)	(tons)
Carbon, NM Special Waste, Non-Hazardous, Non-DOT Regulated	1	DT	2	Y

7. Special handling instructions:
Job #:J10870, Shipment:SHIP0004891, WMI P.O. # P12258 12 x 55g drums

8. GENERATOR'S OR AUTHORIZED AGENT'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway in accordance with applicable international and government regulations.

I hereby certify that the above named material does not contain free liquid as defined by 40CFR Part 258.28 and is not a hazardous waste as defined by 40CFR 261 or any applicable state law.

Generator's or Authorized Agent's printed/typed name	Signature	Month / Day / Year
Cole Crosgrove		9 / 25 / 13

9. Transporter 1 (Acknowledgement of receipt of materials)

Printed/typed name, address, telephone no.	Signature	Month / Day / Year
Name: Felix Espinoza Advanced Environmental Solutions, Inc. 2318 Roldan Dr. Belen, NM 87002 (505) 861-1700		9 / 25 / 13

10. Transporter 2 (Acknowledgement of receipt of materials)

Printed/typed name, address, telephone no.	Signature	Month / Day / Year
		/ /

11. Discrepancy indication space

12. Waste disposal site location coordinates
N: 34° 43.413' W: 107° 2.153' ELEV: 5480' (LANDFARM)

Received By (printed/typed name):	Signature	Month / Day / Year
DANNY BACA		9 / 25 / 13

White/GEN Yellow/CUSTOMER Pink/LANDFILL

APPENDIX C

Soil-Vapor Extraction Operational Data

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix C-1. SWMU ST-70 Vacuum and Pressure Readings

Date	System ON/OFF	SVE System					Vapor Extraction Wells		
		Combined Inlet	Pre-Blower	Post-Blower	Primary Exhaust	Final Exhaust	219-28H	ST-7002	ST-7003
1/11/2011	ON	>30	>20	6.5	2.8	0.0	>10	>10	>10
1/18/2011	ON	18.7	>20	10.0	5.3	0.0	>10	>10	>10
2/16/2011	ON	19.5	20.0	10.5	5.3	0.0	>10	>10	>10
3/9/2011	ON	19.0	20.5	10.0	5.2	0.0	>10	2.8	4.5
4/5/2011	ON	40.0	>30	7.0	4.0	0.0	>20	4.0	2.4
4/21/2011	ON	22.0	23.0	9.5	5.2	0.0	>20	2.2	1.0
5/10/2011	ON	14.2	16.0	11.0	6.2	0.0	9.5	1.3	2.1
6/22/2011	ON	13.2	14.8	11.3	6.0	0.1	8.5	4.0	2.6
6/22/2011	OFF	3.2	NM	0.0	0.0	0.0	3.3	1.8	1.0
6/22/2011	OFF	limited rebound study		0.0	0.0	0.0	1.0	0.4	0.0
6/23/2011	OFF	limited rebound study		0.0	0.0	0.0	0.5	1.7	0.8
6/28/2011	ON	limited rebound study		0.0	0.0	0.0	1.8	2.1	0.3
7/20/2011	ON	14.2	16.0	11.5	6.0	0.0	9.2	2.2	1.7
8/30/2011	ON	14.4	15.8	10.8	5.8	0.0	9.2	1.8	1.7
9/28/2011	ON	14.5	16.0	11.2	5.6	0.0	9.2	3.0	2.0
10/28/2011	ON	20.5	21.0	11.0	5.4	0.0	15.5	4.8	2.0
11/16/2011	ON	22.0	23.0	8.4	4.0	0.1	16.5	7.8	2.2
12/9/2011	ON	20.5	22.0	7.4	4.2	0.1	14.5	6.2	3.2
12/15/2011	ON	21.0	22.5	8.5	4.5	0.1	15.5	8.2	3.0
12/29/2011	ON	21.0	22.5	8.5	4.3	0.0	15.5	6.2	2.9
1/3/2012	ON	20.0	21.0	8.8	4.6	0.0	14.5	7.2	1.9
1/11/2012	OFF	Off for winter downtime/rebound study					0.2	0.4	0.8
1/17/2012	OFF	Off for winter downtime/rebound study					0.3	0.5	0.6
2/16/2012	OFF	Off for winter downtime/rebound study					0.8	0.9	1.7
3/13/2012	OFF	Off for winter downtime/rebound study					0.1	0.1	0.2
4/13/2012	OFF	Off for winter downtime/rebound study					0.5	0.3	0.6
4/13/2012	ON	15.5	18.0	9.2	4.8	0.1	11.5	0.0	1.9
4/20/2012	ON	16.0	18.0	9.2	4.8	0.1	11.0	0.0	1.9
4/25/2012	ON	17.5	18.5	9.2	4.8	0.1	11.2	0.0	1.8
4/27/2012	ON	18.5	20.0	9.6	4.9	0.1	12.0	0.0	1.4
5/4/2012	ON	17.5	19.8	9.5	5.0	0.1	12.2	0.8	3.8
5/14/2012	ON	17.8	20.0	9.6	4.9	0.1	12.6	0.8	3.5
6/12/2012	ON	18.5	20.0	9.2	5.0	0.1	11.8	0.7	2.2
6/16/2012	ON	19.8	20.9	8.6	4.3	0.1	12.2	2.0	2.5
7/11/2012	ON	20.0	21.0	9.4	4.2	0.1	13	1.0	1.7
8/23/2012	ON	19.5	21.0	9.2	4.2	0.1	13	0.3	2.0
9/14/2012	ON	17.2	18.5	10.5	5.6	0.1	11	0.2	2.9
10/12/2012	ON	17.0	18.5	11.0	5.4	0.2	10.8	0.0	1.6
11/16/2012	ON	22.0	23.0	9.5	5.0	0.1	15	0.0	0.8
12/13/2012	ON	27.5	29.0	7.8	4.3	0.1	19	0.0	0.8
12/21/2012	OFF		Off for winter downtime				0	0	0
1/16/2013	OFF	0.0	0.0	0.0	0.0	0.0	0	0	0
2/25/2013	OFF	0.0	0.0	0.0	0.0	0.0	0	0	0
3/5/2013	Restart	19.0	20.0	10.5	5.6	0.04	18	1.0	6.0
3/21/2013	ON	21.0	22.5	8.6	4.0	0.04	15	0.0	6.0
4/24/2013	ON	18.0	20.0	10.0	5.0	0.05	15	5.0	3.0
5/22/2013	ON	16.0	14.5	10.5	3.6	0.04	7.5	3.6	0.0
6/26/2013	ON	13.5	15.0	10.8	4.7	0.08	9	4.9	2.0
7/29/2013	ON	15.0	16.2	9.9	5.1	0.04	9.8	3.6	0
8/28/2013	ON	15.0	15.8	10.5	4.6	0.15	9.2	3.0	0
9/24/2013	ON	15.0	16.0	10.5	5.2	0.04	9.5	3.6	0
11/25/2013	ON	24.8	27.0	9.5	0.0	0.0	23.94	17.62	0
12/31/2013	OFF	0.0	0.0	0.0	0.0	0.0	0	0	0

Appendix C-1. SWMU ST-70 Vacuum and Pressure Readings

Date	System ON/OFF	Vapor Monitoring Wells						Groundwater Monitoring Well
		219-29H	219-38-41	219-38-99	219-39-42	219-40-20	219-41	KAFB-7001
1/18/2011	ON	0.61	1.10	0.79	0.52	0.06	0.04	0.2
2/16/2011	ON	0.10	0.04	atm	0.04	0.16	atm	1.1
3/9/2011	ON	0.10	0.04	0.06	0.02	atm	atm	0.1
4/21/2011	ON	0.22	0.02	atm	0.04	atm	0.05	0.4
5/10/2011	ON	0.31	0.03	0.02	0.09	0.08	0.42	0.3
6/22/2011	ON	0.48	0.32	0.07	0.08	atm	0.03	1.3
6/22/2011	OFF	0.32	0.08	0.18	0.04	0.08	atm	1.4
6/23/2011	OFF	0.45	0.02	0.12	0.03	0.02	0.45	1.0
6/28/2011	ON	0.58	0.11	0.02	0.05	0.04	atm	0.7
7/20/2011	ON	0.26	0.06	0.04	0.07	atm	atm	0.4
8/30/2011	ON	0.10	0.02	atm	0.04	0.04	0.02	0.2
9/28/2011	ON	0.53	0.10	0.07	0.08	0.07	0.10	0.8
10/28/2011	ON	0.26	0.08	0.04	0.06	0.06	0.05	0.3
11/16/2011	ON	0.50	0.04	0.10	0.11	0.06	atm	0.6
12/15/2011	ON	0.54	0.04	0.08	0.08	0.04	0.06	0.9
1/3/2012	ON	0.10	0.02	0.02	0.21	0.04	atm	1.3
1/11/2012	OFF	0.11	0.05	atm	0.02	0.02	0.02	0.1
1/17/2012	OFF	0.02	0.06	0.06	0.02	0.02	0.01	0.8
2/16/2012	OFF	1.30	0.05	0.12	0.03	0.02	atm	1.6
3/13/2012	OFF	0.42	0.02	0.04	atm	0.02	atm	0.6
4/13/2012	OFF	0.46	0.63	0.39	0.22	0.53	atm	0.1
4/13/2012	ON	0.42	0.06	0.24	0.04	0.24	atm	0.2
4/27/2012	ON	0.05	0.04	0.02	0.05	atm	atm	0.4
5/4/2012	ON	atm	0.06	0.02	0.06	0.03	0.01	0.3
5/14/2012	ON	0.03	0.05	0.02	0.05	0.04	atm	0.1
6/12/2012	ON	0.04	atm	0.02	0.04	0.06	atm	0.2
7/11/2012	ON	0.07	0.02	0.04	0.08	atm	atm	0.42
8/23/2012	ON	0.19	0.03	0.02	0.05	atm	0.08	0.42
10/12/2012	ON	0.05	0.07	0.04	0.08	0.05	0.06	0.32
11/16/2012	ON	0.04	0.02	atm	0.06	0.02	0.02	0.3
12/13/2012	ON	0.10	0.03	0.04	0.03	0.01	atm	0.1
1/16/2013	OFF	0.04	atm	atm	0.05	0.09	atm	0.05
2/25/2013	OFF	0.02	0.01	0.02	atm	atm	atm	0.18
3/5/2013	Restart	0.4	0.22	0.09	0.25	0.26	0.08	0.09
3/21/2013	ON	NM	NM	NM	NM	NM	NM	NM
4/24/2013	ON	0.62	atm	atm	0.05	0.03	0.21	0.18
5/22/2013	ON	0.24	0.04	0.06	0.04	0.02	0.02	0.18
6/26/2013	ON	0.20	0.06	0.02	0.04	atm	0.01	0.21
7/29/2013	ON	atm	0.02	0.04	atm	atm	0.01	NM
8/28/2013	ON	No access to VMPS due to aircraft and emergency vehicle maneuvers on tarmac						NM
9/24/2013	ON	0.04	0.02	0.03	atm	0.01	atm	NM
11/25/2013	ON	NM[1]	0.02	0.02	0.02	NM[1]	0.07	NM
12/31/2013	OFF	0.005	0.12	0	0.08	0.25	NM[2]	NM

All vacuum readings are in pressure readings of negative inches of water

shading indicates that the pressure is in positive inches of water

[1] - Not measured due to aircraft on tarmac

[2] - Not measured due to ice in vapor port

atm = atmospheric pressure

NM = not measured

OFF = SVE was offline for seasonal downtime, maintenance or rebound testing

SVE = soil vapor extraction system

Vapor monitoring wells 219-38-74, 219-37-75, 219-40-40, and 219-42 are no longer functional

Appendix C-2. SWMU St-70 Flow Rate Readings

Date	System ON/OFF	SVE System		Vapor Extraction Wells			Note
		Combined Inlet	Final Exhaust	219-28H	ST-70-02	ST-70-03	
1/11/2011	ON	60	48	35	10	10	SVE well flow meters corroded
1/18/2011	ON	62	54	24	20	18	SVE well flow meters corroded
2/16/2011	ON	67	55	30	17	17	SVE well flow meters corroded
3/9/2011	ON	65	52	35	5	15	SVE well flow meters corroded
4/5/2011	ON	55	48	43.9	3.5	3.8	Re-plumb lines with flow meter ports and vacuum meter replacement (all SVE flow reads from anenometer)
4/21/2011	ON	65	55	48.7	5.6	3.2	
5/10/2011	ON	71	60	35	10.4	10.5	
6/22/2011	ON	72	55	36	12	9	
6/22/2011	OFF	0	0	0	0	0	SVE off for limited rebound testing
6/28/2011	ON	82	56	38	11	8	Restart SVE for normal operation
7/20/2011	ON	73	50	37	10	8	
8/30/2011	ON	72	52	38	9	8	
9/28/2011	ON	71	52	39	9.4	7.1	
10/28/2011	ON	70	55	40	9.5	7.0	
11/16/2011	ON	68	55	30.5	14.6	8.8	
12/9/2011	ON	70	55	38	11	8.0	
12/15/2011	ON	68	54	40	9.4	7.2	
12/29/2011	ON	70	58	40	8	7	
1/3/2012	ON	70	55	34	16	11.5	Pre-rebound readings
1/3/2012	OFF	0	0	0	0	0	START Rebound Test
4/13/2012	OFF	72	58	52	0	12	Temporary Re-start
4/20/2012	ON	72	58	51	0.5	12	Full Restart
4/25/2012	ON	78	55	52	0	12	
5/4/2012	ON	72	55	35	2.8	12.7	2 week restart reading
5/14/2012	ON	72	54	37.1	2.6	12.2	3 week restart reading
6/12/2012	ON	70	54	50.2	2.1	9.6	
6/16/2012	ON	72	54	45	5	10	
7/11/2012	ON	73	55	50	1.9	12	
8/23/2012	ON	75	55	49.7	0.9	10.2	
9/14/2012	ON	68	55	47.1	0.7	12.3	
10/12/2012	ON	75	55	50.1	0.5	10.2	
11/16/2012	ON	65	55	49.6	0.2	8.3	
12/13/2012	ON	75	40	39.8	0	14.4	
12/21/2012	OFF	0	0	0	0	0	Season shut down.
1/16/2013	OFF	0	0	0	0	0	Winter downtime
2/25/2013	OFF	0	0	0	0	0	Winter downtime
03/05/13	Restart	75	55	47	0.5	10	Restart system
03/21/13	ON	71	58	42	0	15	
04/24/13	ON	71	58	31.7	16.4	14.9	
05/22/13	ON	75	55	36.5	19.9	2.4	
06/26/13	ON	79	50	39.3	18.5	6.0	
07/29/13	ON	80	50	39.2	16.4	2.2	
08/28/13	ON	78	50	37.5	16.9	0	
09/24/13	ON	80	- -	36	17.9	0	
11/25/2013	ON	0	50	0	0	14.9	

Notes:

NM = not measured

OFF = SVE was offline for seasonal downtime, maintenance or rebound testing

SVE = soil vapor extraction system

Vapor monitoring wells 219-38-74, 219-37-75, 219-40-40, and 219-42 are no longer functional

Appendix C-3. SWMU ST-70 SVE System Operation and Downtime

Date	SVE Operation		Cumulative Time		Percent Downtime (%)	Flow Rate (scfm)	Cumulative Volume Extracted (L)	Cumulative Volume Extracted (ft^3)
	Down Time (hours)	Start/ Restart (time)	Total Downtime (days)	Total Operation Time (days)				
Initial period reported in Construction Summary Report (April 2008 to March 2009)								
04/15/08		11:00	0	0	0	70	0	
05/14/08	2	9:45	0.083	28.92	0.29	70	8.25E+07	2.91E+06
05/16/08	1	9:47	0.125	30.88	0.40	72	8.83E+07	3.12E+06
05/30/08	1.5	9:45	0.188	44.81	0.42	74	1.30E+08	4.60E+06
06/18/08	0.5	8:20	0.208	63.79	0.33	69	1.84E+08	6.49E+06
07/10/08	1	11:11	0.250	85.75	0.29	70	2.46E+08	8.70E+06
08/06/08	72	14:25	3.250	109.75	2.96	70	3.15E+08	1.11E+07
08/07/08	off for optimization		3.250	110.75	2.93	70	3.18E+08	1.12E+07
Optimization Period (August to December 2008)								
12/17/08		11:00		110.75		70		
12/23/08	1	13:00	3.292	113.46	2.90	72	3.26E+08	1.15E+07
Full-Time Operation Period (2009 to 2012)								
01/08/09	1.5	12:41	3.354	129.40	2.59	70	3.71E+08	1.31E+07
01/14/09	0.5	12:30	3.375	135.38	2.49	67	3.88E+08	1.37E+07
01/21/09	1	16:00	3.417	142.33	2.40	67	4.07E+08	1.44E+07
02/11/09	1.5	12:22	3.479	163.27	2.13	70	4.66E+08	1.65E+07
02/23/09	0.75	11:09	3.510	175.24	2.00	67	4.99E+08	1.76E+07
03/14/09	25	11:05	4.552	193.20	2.36	70	5.50E+08	1.94E+07
03/30/09	0.75	12:55	4.583	209.20	2.19	70	5.96E+08	2.10E+07
04/14/09	0.25	9:40	4.594	224.19	2.05	70	6.39E+08	2.26E+07
04/29/09	0.67	9:30	4.622	239.16	1.93	67	6.80E+08	2.40E+07
06/12/09	1	10:10	4.663	283.12	1.65	67	8.00E+08	2.82E+07
07/27/09	1.5	13:00	4.726	328.06	1.44	70	9.28E+08	3.28E+07
08/07/09	0.75	10:45	4.757	339.02	1.40	69	9.59E+08	3.39E+07
09/14/09	0.25	11:15	4.768	377.01	1.26	69	1.07E+09	3.76E+07
09/18/09	0.5	9:45	4.788	380.99	1.26	67	1.08E+09	3.80E+07
10/07/09	1.0	10:00	4.830	399.99	1.21	67	1.13E+09	3.99E+07
10/27/09	0.25	9:40	4.840	419.98	1.15	67	1.18E+09	4.18E+07
11/09/09	0.33	14:20	4.854	432.97	1.12	67	1.22E+09	4.30E+07
11/11/09	0.67	9:57	4.882	434.94	1.12	67	1.22E+09	4.32E+07
12/15/09	1.0	14:28	4.924	468.90	1.05	50	1.29E+09	4.57E+07
01/27/10	0.50	14:34	4.945	511.88	0.97	50	1.38E+09	4.88E+07
01/29/10	0.67	12:25	4.973	513.85	0.97	50	1.38E+09	4.89E+07
02/10/10	26.5	16:20	6.077	524.75	1.16	60	1.41E+09	4.98E+07
02/17/10	1.0	15:25	6.118	531.70	1.15	67	1.43E+09	5.05E+07
03/08/10	1.0	15:25	6.160	550.66	1.12	67	1.48E+09	5.23E+07
04/07/10	0.5	14:15	6.181	580.64	1.06	67	1.56E+09	5.52E+07
05/07/10	0.5	12:15	6.202	610.62	1.02	67	1.65E+09	5.81E+07
09/02/10	0.5	11:57	6.223	728.60	0.85	67	1.97E+09	6.95E+07
09/17/10	0.25	12:02	6.233	743.59	0.84	67	2.01E+09	7.10E+07
10/01/10	0.5	14:45	6.254	757.57	0.83	65	2.05E+09	7.23E+07
11/05/10	0.67	11:40	6.282	792.54	0.79	65	2.14E+09	7.55E+07
11/12/10	0.5	11:45	6.303	799.52	0.79	64	2.16E+09	7.62E+07
12/08/10	0.5	13:50	6.323	825.50	0.77	64	2.23E+09	7.86E+07
12/31/10	0	N/A	6.323	848.50	0.75	64	2.29E+09	8.07E+07
01/11/11	1.0	16:35	6.365	859.46	0.74	54	2.31E+09	8.16E+07
01/18/11	1.0	14:15	6.407	866.42	0.74	58	2.33E+09	8.21E+07
02/16/11	2.5	11:30	6.511	895.31	0.73	61	2.40E+09	8.47E+07
03/09/11	1.0	14:45	6.553	916.27	0.72	59	2.45E+09	8.65E+07
04/05/11	2.75	12:30	6.667	943.16	0.71	52	2.51E+09	8.85E+07
04/21/11	2.0	15:25	6.750	959.07	0.70	58	2.54E+09	8.98E+07
05/10/11	0.75	10:35	6.782	978.04	0.69	52	2.58E+09	9.12E+07
06/22/11	0	15:51OFF	6.782	1021.04	0.66	58	2.68E+09	9.48E+07

Appendix C-3. SWMU ST-70 SVE System Operation and Downtime

Date	SVE Operation		Cumulative Time		Percent Downtime (%)	Flow Rate (scfm)	Cumulative Volume Extracted (L)	Cumulative Volume Extracted (ft^3)
	Down Time (hours)	Start/ Restart (time)	Total Downtime (days)	Total Operation Time (days)				
06/28/11	139.3	9:10	12.59	1021.24	1.23	58	2.69E+09	9.48E+07
06/30/11	0	N/A	12.59	1023.24	1.23	58	2.69E+09	9.50E+07
07/20/11	0.5	12:50	12.61	1043.22	1.21	58	2.74E+09	9.67E+07
08/30/11	0.5	10:30	12.63	1084.20	1.16	62	2.84E+09	1.00E+08
09/28/11	1	12:05	12.67	1113.15	1.14	62	2.91E+09	1.03E+08
10/28/11	0.66	12:15	12.70	1143.13	1.11	62	2.99E+09	1.06E+08
11/16/11	0.25	11:00	12.71	1162.12	1.09	62	3.04E+09	1.07E+08
12/09/11	0.5	10:35	12.73	1185.10	1.07	62	3.10E+09	1.09E+08
12/15/11	0.2	16:20	12.74	1191.09	1.07	62	3.11E+09	1.10E+08
12/31/11	0	N/A	12.74	1207.09	1.06	66	3.15E+09	1.11E+08
Pulsed Operation with Winter Downtime (2012 and ongoing)								
01/03/12	0	N/A	12.74	1210.09	1.05	62	3.16E+09	1.12E+08
01/03/12	shut down for rebound study starting at 13:45							
04/20/12	0	16:25	12.74	1210.09	1.05	0	3.16E+09	1.12E+08
04/25/12	0	N/A	12.74	1215.09	1.05	64	3.17E+09	1.12E+08
04/27/12	1	15:05	12.78	1217.05	1.05	64	3.18E+09	1.12E+08
05/04/12	0.5	9:15	12.80	1224.02	1.05	64	3.20E+09	1.13E+08
05/14/12	0	N/A	12.80	1234.02	1.04	64	3.22E+09	1.14E+08
06/08/12	6.0	15:35	13.05	1258.77	1.04	64	3.29E+09	1.16E+08
06/12/12	0	N/A	13.05	1262.77	1.03	62	3.30E+09	1.16E+08
06/16/12	24	7:30	14.05	1265.77	1.11	62	3.31E+09	1.17E+08
06/30/12	0	N/A	14.05	1279.77	1.10	62	3.34E+09	1.18E+08
07/11/12	0.5	7:50	14.07	1290.75	1.09	64	3.37E+09	1.19E+08
08/23/12	0.6	15:15	14.09	1333.73	1.06	61	3.48E+09	1.23E+08
09/14/12	0.5	17:00	14.12	1355.71	1.04	62	3.53E+09	1.25E+08
10/12/12	0.4	14:55	14.13	1383.69	1.02	65	3.61E+09	1.27E+08
11/16/12	168	15:45	21.13	1411.69	1.50	58	3.67E+09	1.30E+08
12/13/12	0.75	14:45	21.16	1438.66	1.47	54	3.73E+09	1.32E+08
12/21/12	0.2	16:20	21.17	1446.65	1.46	54	3.75E+09	1.32E+08
12/31/12	0	N/A	21.17	1446.65	1.46	0	3.75E+09	1.32E+08
01/16/13	OFF	N/A	21.17	1446.65	1.46	0	3.75E+09	1.32E+08
02/25/13	OFF	N/A	21.17	1446.65	1.46	0	3.75E+09	1.32E+08
03/05/13	Restart	11:05	21.17	1446.65	1.46	58	3.75E+09	1.32E+08
03/21/13	0.5	8:45	21.19	1462.63	1.45	57	3.79E+09	1.34E+08
04/24/13	1.0	11:55	21.23	1496.59	1.42	63	3.87E+09	1.37E+08
05/22/13	0.5	13:15	21.26	1524.57	1.39	59	3.94E+09	1.39E+08
06/26/13	0.5	10:15	21.28	1559.55	1.36	64	4.03E+09	1.42E+08
06/30/13	0.0	N/A	21.28	1563.55	1.36	64	4.04E+09	1.43E+08
07/29/13	37.5	8:30	22.84	1590.98	1.44	58	4.11E+09	1.45E+08
08/28/13	0.5	16:50	22.86	1620.96	1.41	54	4.17E+09	1.47E+08
09/24/13	0	N/A	22.86	1647.96	1.39	54	4.23E+09	1.50E+08
11/25/13	0	N/A	22.86	1709.96	1.34	46	4.35E+09	1.54E+08
12/05/13	0.2	N/A	22.86	1719.96	1.33	0	4.35E+09	1.54E+08
06/27/14	4896	N/A	226.86	1719.96	13.19	0	4.35E+09	1.54E+08

Notes:

ft^3 = cubic feet

L = liters of soil vapor at standard temperature and pressure

scfm = standard cubic feet per minute

APPENDIX D

Historical Groundwater Analytical Data

THIS PAGE INTENTIONALLY LEFT BLANK

Appendix D. Groundwater Analytical Sample Results, SWMU ST-70, 2008 to 2013

Chemical Class & Analytical Method	Analyte	Location	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001
		Sample Date	5/19/14	5/19/14	4/22/13	1/9/13	1/9/13	10/10/12	8/23/12	4/25/12	1/5/12	11/15/11	9/21/11	9/21/11
		Sample ID / EPA MCLs [a]	ST70-30001	ST70-30002 (Duplicate)	ST70-GW-7001-220413	ST70-GW-7001-090113	ST70-FD-7001-090113 (Duplicate)	ST70-GW-7001-101012	ST70-GW-7001-230812	ST70-GW-7001-250412	ST70-GW-7001-21092011	ST70-GW-7001-151111	ST70-GW-7001-21092011	ST70-FD-7001-21092011 (Duplicate)
VOCs (µg/L) SW8260B	1,1,1,2-Tetrachloroethane	N/A	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.17	<0.17	<0.17
	1,1,1-Trichloroethane	60 [c]	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.16	<0.16	<0.16
	1,1,2,2-Tetrachloroethane	10 [c]	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.20	<0.20	<0.20
	1,1,2-Trichloroethane	5.0	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.32	<0.32	<0.32
	1,1-Dichloroethane	25 [c]	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.16	<0.16	<0.16
	1,1-Dichloroethene	5.0 [c]	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.14	<0.14	<0.14
	1,1-Dichloropropene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.15	<0.15	<0.15
	1,2,3-Trichlorobenzene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.18	<0.18	<0.18
	1,2,3-Trichloropropane	N/A	ND	ND	< 0.8	< 0.8	< 0.8	<0.8	<0.8	<0.8	<0.8	<0.77	<0.77	<0.77
	1,2,4-Trichlorobenzene	70	ND	ND	< 0.8	< 0.8	< 0.8	<0.8	<0.8	<0.8	<0.8	<0.32	<0.32	<0.32
	1,2,4-Trimethylbenzene	N/A	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.14	<0.14	<0.14
	1,2-Dibromo-3-chloropropane	0.2	ND	ND	< 1.6	< 1.6	< 1.6	<1.6	<1.6	<1.6	<1.6	<0.81	<0.81	<0.81
	1,2-Dibromoethane (EDB)	0.05	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.13	<0.13	<0.13
	1,2-Dichlorobenzene	600	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.13	<0.13	<0.13
	1,2-Dichloroethane	5.0	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.15	<0.15	<0.15
	1,2-Dichloropropane	5.0	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.13	<0.13	<0.13
	1,3,5-Trimethylbenzene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.8	<0.14	<0.14	<0.14
	1,3-Dichlorobenzene	N/A	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.16	<0.16	<0.16
	1,3-Dichloropropane	N/A	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.15	<0.15	<0.15
	1,4-Dichlorobenzene	75	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.16	<0.16	<0.16
	2,2-Dichloropropane	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.20	<0.20	<0.20
	2-Butanone (MEK)	N/A	ND	ND	< 3.2	< 3.2	< 3.2	<3.2	<3.2	<3.2	<3.2	<1.8	<1.8	<1.8
	2-Chlorotoluene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.17	<0.17	<0.17
	2-Hexanone	N/A	ND	ND	< 3.2	< 3.2	< 3.2	<3.2	<3.2	<3.2	<3.2	<1.4	<1.4	<1.4
	4-Chlorotoluene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.17	<0.17	<0.17
	4-Isopropyltoluene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.17	<0.17	<0.17
	4-Methyl-2-pentanone	N/A	ND	ND	< 3.2	< 3.2	< 3.2	<3.2	<3.2	<3.2	<3.2	<1.0	<1.0	<1.0
	Acetone	N/A	4.04 J	ND	< 6.4	< 6.4	< 6.4	<2.8	<6.4	<2.8	<6.4	<1.9	<1.9	<1.9
	Benzene	5.0	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.16	<0.16	<0.16
	Bromobenzene	N/A	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.17	<0.17	<0.17
	Bromoform	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.19	<0.19	<0.19
	Bromomethane	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.21	<0.21	<0.21
	Carbon disulfide	N/A	ND	ND	< 0.8	< 0.8	< 0.8	<0.8	<0.8	<0.8	<0.8	<0.45	<0.45	<0.45
	Carbon tetrachloride	5.0	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.19	<0.19	<0.19
	Chlorobenzene	100	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.17	<0.17	<0.17
	Chloroethane	N/A	ND	ND	< 1.6	< 1.6	< 1.6	<1.6	<1.6	<1.6	<1.6	<0.10	<0.10	<0.41
	Chloroform	100 [c]	0.277 J	ND	0.17J	0.16J	0.17J	0.17 J	0.2 J	<0.2	<0.2	<0.16	<0.16	<0.16
	Chloromethane	N/A	ND	ND	< 0.8	< 0.8	< 0.8	0.82 J	<1.6	<0.8	<1.6	<0.30	<0.30	<0.30
	cis-1,2-Dichloroethene	70	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.15	<0.15	<0.15
	cis-1,3-Dichloropropene	N/A	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.16	<0.16	<0.16
	Dibromochloromethane	N/A	0.325 J	0.271 J	0.18J	0.18J	< 0.2	0.29 J	0.28 J	0.24 J	<0.4	<0.17	<0.17	<0.17
	Dibromomethane	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.2	<0.2	<0.2	<0.2	<0.17	<0.17	<0.17
	Dichlorodifluoromethane	N/A	ND	ND	< 0.8	< 0.8	< 0.8	<0.8	<0.8	<0.8	<0.8	<0.31	<0.31	<0.31
	Ethylbenzene	700	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.16	<0.16	<0.16
	Hexachlorobutadiene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.18	<0.18	<0.12
	Isopropylbenzene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.16	<0.12	<0.16
	Methylene chloride	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<1.3	<0.4	<1.3	<0.4	0.46 J	<0.32	<0.21
	Methyl tert-butyl ether (MtBE)	5.0	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.25	<0.25	<0.25
	Naphthalene	30 [d]	ND	ND	< 0.8	< 0.8	< 0.8	<0.8	<0.8	<0.8	<0.8	<0.22	<0.22	<0.22
	n-Butylbenzene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.14	<0.14	<0.14
	n-Propylbenzene	N/A	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.16	<0.16	<0.16
	sec-Butylbenzene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.17	<0.17	<0.17

Appendix D. Groundwater Analytical Sample Results, SWMU ST-70, 2008 to 2013

Chemical Class & Analytical Method	Analyte	Location	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001
		Sample Date	5/19/14	5/19/14	4/22/13	1/9/13	1/9/13	10/10/12	8/23/12	4/25/12	1/5/12	11/15/11	9/21/11	9/21/11
		Sample ID / EPA MCLs [a]	ST70-30001	ST70-30002 (Duplicate)	ST70-GW-7001-220413	ST70-GW-7001-090113	ST70-FD-7001-090113 (Duplicate)	ST70-GW-7001-101012	ST70-GW-7001-230812	ST70-GW-7001-250412	ST70-GW-7001-21092011	ST70-GW-7001-151111	ST70-GW-7001-21092011	ST70-FD-7001-21092011 (Duplicate)
VOCs (µg/L) SW8260B	Styrene	100	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.18	<0.17	<0.17
	tert-Butylbenzene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.16	<0.16	<0.16
	Tetrachloroethene	5.0	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.20	<0.20	<0.20
	Toluene	750 [c]	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.17	<0.17	<0.17
	trans-1,2-Dichloroethene	100	ND	ND	< 0.2	< 0.2	< 0.2	<0.2	<0.2	<0.2	<0.2	<0.15	<0.15	<0.15
	trans-1,3-Dichloropropene	N/A	ND	ND	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	<0.4	<0.19	<0.19	<0.19
	Trichloroethene	5.0	2.37	2.38	1.7	1.7	1.8	1.7	1.6	1.3	0.60 J	0.59 J	0.68 J	0.67 J
	Trichlorofluoromethane	N/A	ND	ND	< 0.8	< 0.8	< 0.8	<0.8	<0.8	<0.8	<0.8	<0.29	<0.29	<0.29
	Vinyl chloride	1.0 [c]	ND	ND	< 0.4	< 0.8	< 0.8	<0.8	<0.8	<0.8	<0.8	<0.40	<0.40	<0.40
	Xylenes (total)	620 [c]	ND	ND	< 1.6	< 1.6	< 1.6	<0.8	<0.8	<0.8	<0.8	<0.38	<0.38	<0.38
TPH (µg/L) Method 8015	Gasoline Range Organics (GRO) C6-C10	N/A	ND	ND	< 20	< 20	< 25	<20	<20	NA	NA	NA	NA	NA
Dissolved Metals (mg/L) SW6010C and SW7470A	Arsenic	0.01	ND	0.000893 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Barium	2	0.0402	0.0422	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Cadmium	0.005	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Chromium	0.1	0.00127 J	0.00135 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lead	0.015	0.000854 J	0.00112 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mercury	0.002	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Selenium	0.05	0.0244	0.0255	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Silver	0.1	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anions (mg/L) EPA Method 300	Nitrate as Nitrogen	10	7.36	7.38	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Appendix D. Groundwater Analytical Sample Results, SWMU ST-70, 2008 to 2013

Chemical Class & Analytical Method	Analyte	Location	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001
		Sample Date	4/4/11	1/19/11	12/7/10	12/7/10	9/16/10	5/7/10	2/26/10	8/24/09	2/11/09	8/7/08	1/27/08
		Sample ID / EPA MCLs [a]	ST70-GW-7001-04042011	ST70-GW-7001-19012011	ST70-GW-7001-07122010	ST70-FD-7001-07122010 (Duplicate)	ST70-GW-7001-16092010	ST70-GW-7001-05072010	ST219-GW-7001-26022010	ST219-GWQ3-7001-24082009	ST219-GW-7001-11022009	ST219-GW-7001-07082008	ST219-GW-7001-27012008
VOCs (µg/L) SW8260B	1,1,1,2-Tetrachloroethane	N/A	<0.0681	<0.399	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	1,1,1-Trichloroethane	60 [c]	<0.0243	<0.408	< 1	< 1	< 0.5	< 1	< 1	< 1	< 1	< 1	< 1
	1,1,2,2-Tetrachloroethane	10 [c]	<0.04	<0.469	< 1	< 1	< 0.18	< 1	< 1	< 1	< 1	< 1	< 1
	1,1,2-Trichloroethane	5.0	<0.0675	<0.336	< 1	< 1	< 0.13	< 1	< 1	< 1	< 1	< 1	< 1
	1,1-Dichloroethane	25 [c]	<0.0268	<0.412	< 1	< 1	< 0.25	< 1	< 1	< 1	< 1	< 1	< 1
	1,1-Dichloroethene	5.0 [c]	<0.0332	<0.352	< 1	< 1	< 0.11	< 1	< 1	< 1	< 1	< 1	< 1
	1,1-Dichloropropene	N/A	<0.0353	<0.391	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	1,2,3-Trichlorobenzene	N/A	<0.0571	<0.546	< 1	< 1	NA	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
	1,2,3-Trichloropropane	N/A	<0.065	<0.464	< 1	< 1	NA	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
	1,2,4-Trichlorobenzene	70	<0.0555	<0.447	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	1,2,4-Trimethylbenzene	N/A	<0.0508	<0.7	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	1,2-Dibromo-3-chloropropane	0.2	<0.0626	<0.65	< 2	< 2	NA	< 5	< 5	< 5	< 5	< 5	< 5
	1,2-Dibromoethane (EDB)	0.05	<0.0758	<0.504	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	1,2-Dichlorobenzene	600	<0.0495	<0.401	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	1,2-Dichloroethane	5.0	<0.0789	<0.336	< 1	< 1	< 0.1	< 1	< 1	< 1	< 1	< 1	< 1
	1,2-Dichloropropane	5.0	<0.0417	<0.429	< 1	< 1	< 0.13	< 1	< 1	< 1	< 1	< 1	< 1
	1,3,5-Trimethylbenzene	N/A	<0.0362	<0.441	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	1,3-Dichlorobenzene	N/A	<0.0558	<0.435	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	1,3-Dichloropropane	N/A	<0.0588	<0.395	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	1,4-Dichlorobenzene	75	<0.0475	<0.353	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	2,2-Dichloropropane	N/A	<0.0432	<0.312	< 2	< 2	NA	< 5	< 5	< 5	< 5	< 5	< 5
	2-Butanone (MEK)	N/A	<0.146	<0.888	< 10	< 10	< 1	< 6	< 6	< 6	< 6	< 6	< 6
	2-Chlorotoluene	N/A	<0.046	<0.489	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	2-Hexanone	N/A	<0.0969	<1.36	< 1	< 1	< 1	< 5	< 5	< 5	< 5	< 5	< 5
	4-Chlorotoluene	N/A	<0.0454	<0.345	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	4-Isopropyltoluene	N/A	<0.0338	<0.384	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	4-Methyl-2-pentanone	N/A	<0.0897	<1.79	< 10	< 10	< 1	< 5	< 5	< 5	< 5	< 5	< 5
	Acetone	N/A	<0.569	<1.61	< 10	< 10	< 5	< 10	< 10	92.8 J	< 10	< 10	< 10
	Benzene	5.0	<0.0351	<0.347	< 1	< 1	< 0.25	< 1	< 1	< 1	< 1	< 1	< 1
	Bromobenzene	N/A	<0.0691	<0.436	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	Bromoform	N/A	<0.0631	<0.247	< 1	< 1	< 0.5	< 1	< 1	< 1	< 1	< 1	< 1
	Bromomethane	N/A	<0.107	<0.419	< 3	< 3	< 0.8	< 2	< 2	< 2	< 2	< 2	< 2
	Carbon disulfide	N/A	<0.0774	<1.54	< 10	< 10	< 0.6	< 2	0.22 J	< 2	< 2	< 2	< 2
	Carbon tetrachloride	5.0	<0.0387	<0.42	< 1	< 1	< 0.5	< 1	< 1	< 1	< 1	< 1	< 1
	Chlorobenzene	100	<0.0617	<0.404	< 1	< 1	< 0.25	< 1	< 1	< 1	< 1	< 1	< 1
	Chloroethane	N/A	<0.0998	<0.463	< 2	< 2	< 1	< 2	< 2	< 2	< 2	< 2	< 2
	Chloroform	100 [c]	<0.153	<0.402	< 1	< 1	< 0.14	0.62 J	< 1	< 1	< 1	< 1	< 1
	Chloromethane	N/A	<0.13	<0.43	< 2	< 2	< 0.33	< 2	< 2	< 2	< 2	< 2	< 2
	cis-1,2-Dichloroethene	70	<0.0571	<0.407	< 1	< 1	< 0.15	< 1	< 1	< 1	< 1	< 1	< 1
	cis-1,3-Dichloropropene	N/A	<0.0487	<0.391	< 1	< 1	< 0.11	< 1	< 1	< 1	< 1	< 1	< 1
	Dibromochloromethane	N/A	<0.101	<0.357	< 1	< 1	0.17 J	1.9	< 1	< 1	< 1	< 1	< 1
	Dibromomethane	N/A	<0.0641	<0.35	< 1	< 1	NA	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1
	Dichlorodifluoromethane	N/A	<0.302	<0.857	< 1	< 1	NA	< 2	< 2	< 2	< 2	< 2	< 2
	Ethylbenzene	700	<0.0327	<0.404	< 1	< 1	<0.11	< 1	< 1	< 1	< 1	< 1	< 1
	Hexachlorobutadiene	N/A	<0.0411	<0.589	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	Isopropylbenzene	N/A	<0.0278	<0.397	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	Methylene chloride	N/A	<0.0271	<0.49	< 3	< 3	< 1	< 5	< 5	< 5	< 5	< 5	< 5
	Methyl tert-butyl ether (MtBE)	5.0	<0.033	<0.32	< 1	< 1	NA	< 5	< 5	< 5	< 5	< 5	< 5
	Naphthalene	30 [d]	<0.0434	<0.365	< 2	< 2	NA	< 1	< 1	< 1	< 1	< 1	< 1
	n-Butylbenzene	N/A	<0.0431	<0.422	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	n-Propylbenzene	N/A	<0.029	<0.434	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	sec-Butylbenzene	N/A	<0.0367	<0.412	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1

Appendix D. Groundwater Analytical Sample Results, SWMU ST-70, 2008 to 2013

Chemical Class & Analytical Method	Analyte	Location	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001	KAFB-7001
		Sample Date	4/4/11	1/19/11	12/7/10	12/7/10	9/16/10	5/7/10	2/26/10	8/24/09	2/11/09	8/7/08	1/27/08
		Sample ID / EPA MCLs [a]	ST70-GW-7001-04042011	ST70-GW-7001-19012011	ST70-GW-7001-07122010	ST70-FD-7001-07122010 (Duplicate)	ST70-GW-7001-16092010	ST70-GW-7001-05072010	ST219-GW-7001-26022010	ST219-GWQ3-7001-24082009	ST219-GW-7001-11022009	ST219-GW-7001-07082008	ST219-GW-7001-27012008
VOCs (µg/L) SW8260B	Styrene	100	<0.0409	<0.345	< 1	< 1	<0.11	< 1	< 1	< 1	< 1	< 1	< 1
	tert-Butylbenzene	N/A	<0.0247	<0.454	< 1	< 1	NA	< 1	< 1	< 1	< 1	< 1	< 1
	Tetrachloroethene	5.0	<0.04	<0.347	< 1	< 1	<0.15	< 1	< 1	< 1	< 1	< 1	< 1
	Toluene	750 [c]	<0.0523	<0.415	< 1	< 1	<0.33	0.19 J	1.4	1.6	< 1	< 1	< 1
	trans-1,2-Dichloroethene	100	<0.0505	<0.43	< 1	< 1	<0.2	< 1	< 1	< 1	< 1	< 1	< 1
	trans-1,3-Dichloropropene	N/A	<0.0512	<0.442	< 1	< 1	<0.21	< 1	< 1	< 1	< 1	< 1	< 1
	Trichloroethene	5.0	0.29 J	<0.455	< 1	< 1	0.57 J	0.38 J	0.33 J	0.57 J	0.36 J	0.37 J	0.53 J
	Trichlorofluoromethane	N/A	<0.167	<0.477	< 1	< 1	NA	< 2	< 2	< 2	< 2	< 2	< 2
	Vinyl chloride	1.0 [c]	<0.0421	<0.328	< 1	< 1	<0.18	< 1	< 1	< 1	< 1	< 1	< 1
	Xylenes (total)	620 [c]	<0.112	<1.56	< 1.5	< 1.5	<0.2	1.4 J	< 3	0.35 J	< 1	< 1	< 1
TPH (µg/L) Method 8015	Gasoline Range Organics (GRO) C6-C10	N/A	NA	NA	NA	NA	NA	N/A	<64	<64	<64	<64	<64
Dissolved Metals (mg/L) SW6010C and SW7470A	Arsenic	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Barium	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Cadmium	0.005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Chromium	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lead	0.015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Mercury	0.002	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Selenium	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Silver	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anions (mg/L) EPA Method 300	Nitrate as Nitrogen	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

APPENDIX E

Data Quality Assessment Report

THIS PAGE INTENTIONALLY LEFT BLANK

ACRONYMS AND ABBREVIATIONS

%	percent
%D	percent difference
µg/L	microgram per liter
CCV	continuing calibration verification
DoD	U.S. Department of Defense
EPA	U.S. Environmental Protection Agency
ICP	inductively coupled plasma
ICS	interference check sample
KAFB	Kirtland Air Force Base
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOQ	limit of quantitation
mg/L	milligram per liter
MS	matrix spike
MSD	matrix spike duplicate
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RPD	relative percent difference
RRF	relative response factor
SDG	sample delivery group
SOP	Standard Operating Procedure
TPH	total petroleum hydrocarbon
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

THIS PAGE INTENTIONALLY LEFT BLANK

LABORATORY DATA QUALITY ASSESSMENT – GROUNDWATER MAY 2014

1. LABORATORY DATA QUALITY SUMMARY

This Laboratory Data Quality Assessment describes the findings of the review of data for the May 2014 groundwater monitoring event at site ST070, and is provided to document the quality of the analytical data used in the September 2013 Through June 2014 Interim Corrective Measures Operation Report for Solid Waste Management Unit ST-70, Buildings 481/482 Oil Water Separator (Former ST-219). Sampling procedures and overall quality control (QC) and quality assurance protocols for the May 2014 groundwater monitoring event are presented in the *Quality Assurance Project Plan for Long-Term Groundwater Monitoring at Multiple Sites: Solid Waste Management Unit (SWMU) 6-1, Landfill 1; SWMU 6-2, Landfill 2; SWMU 6-4, Landfills 4,5 and 6; ST-105 (CG-C564); UST-58 (PL567); WP026; and ST070, Kirtland Air Force Base, New Mexico* (QAPP, U.S. Army Corps of Engineers [USACE], 2013).

On May 19, 2014, one groundwater sample, one field duplicate, and one trip blank were collected and submitted to Empirical Laboratories LLC in Nashville, Tennessee, for analyses. The laboratory holds a current U.S. Department of Defense (DoD) Environmental Laboratory Accreditation Program certification to perform the listed analyses.

The groundwater sample and its duplicate were analyzed for the following list of parameters:

- Volatile organic compounds (VOCs) – U.S. Environmental Protection Agency (EPA) Method SW8260B
- Total petroleum hydrocarbons (TPH) as gasoline (C6-C10) – EPA Method SW8015C
- TPH as diesel (C10-C28) and motor oil (C28-C40) – EPA Method SW8015C
- Dissolved metals – EPA Methods SW6010C and SW7470A
- Nitrate and nitrite as nitrogen – EPA Method 353.2

All analytical results reported were received in one sample delivery group (SDG) Kirtland-016. Table 1 (provided at the end of this report) summarizes sample collection dates, sample numbers, sample locations, laboratory, sample types, extraction and analysis methods, extraction and analysis dates, and SDG numbers. An EPA Level III data review was performed for all analytical results for the SDG. The review was performed in accordance with the guidelines and control criteria specified in the following documents:

- The project QAPP (USACE, 2013)
- *DoD Quality Systems Manual for Environmental Laboratories, Version 4.2* (2010)
- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (2006), SW-846* (EPA, 1996 and updates)

- *Environmental Quality – Guidance for Evaluating Performance-Based Chemical Data*, EM 200-1-10 (USACE, 2005)

- *USEPA Contract Laboratory Program, National Functional Guidelines for Superfund Organic Methods Data Review, Final* (EPA, 2008)

- *USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Data Review, Final* (EPA, 2010)

The following QC elements were included in the EPA Level III data review:

- Sample preservation and sample extraction and analysis holding times
- Laboratory method blanks
- Initial and continuing calibration blanks (metals and nitrate and nitrite as nitrogen analyses only)
- Surrogate recoveries (organic analyses)
- Laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) recoveries
- Matrix spike (MS)/matrix spike duplicate (MSD) recoveries
- Relative percent differences (RPDs)
- Initial calibration and verifications
- Continuing calibration verifications (CCVs)
- Inductively coupled plasma (ICP) interference check samples (ICS) (metal analysis only)
- Field blanks
- Field duplicates

Analytical data were reviewed in terms of precision, bias, representativeness, comparability, and completeness as follows:

- *Bias* is demonstrated by recovery of target analytes from fortified blank and sample matrices LCS/LCSD, and MS/MSD, respectively. For organic methods, bias is also demonstrated through recovery of surrogates from each field and QC sample. The recovery of target analytes from fortified samples is compared with the acceptance criteria defined in the QAPP (USACE, 2013) and DoD 2010 Quality Systems Manual (QSM). When the acceptance criteria are not available in the QAPP or DoD QSM, results are compared with the laboratory in-house control limits. When these criteria are not met, the data are qualified accordingly.

- *Precision* is expressed as the RPD between the results of replicate sample analyses: sample duplicates, LCSDs, and MSDs. When analyte RPDs exceed the acceptance criteria, the data are qualified accordingly.

- *Representativeness* of the samples submitted for analysis is ensured by adherence to standard sampling techniques and protocols.

- *Comparability* of sample results is ensured through the use of approved sampling and analysis methods.

- *Completeness* is expressed as a ratio of the number of usable data points to the total number of analytical data results.

The following sections present the EPA Level III data review findings. The discussion summarizes data quality exceedances and their potential impact on the quality and usability of analytical results. Table 2 presents definitions of data qualification and reason codes applied to the analytical results. Table 3

summarizes the qualified data. For informational purposes, qualified field QC data are also presented in this table.

1.1 Data Quality Outliers

1.1.1 Sample Preservation and Sample Extraction and Analysis Holding Times (Reason Code H)

The sample coolers and samples contained within were received intact at the laboratory and were held within the required 0 to 6 degrees Celsius and when required were chemically preserved in accordance with EPA preservation requirements.

Sample holding times were evaluated by comparing the sample collection dates to the sample extraction and analysis dates. Extraction and analysis holding times were reviewed for all samples to determine the validity of the sample results. All samples for TPH as diesel and motor oil analysis were prepared and analyzed within the extraction and analysis holding-time requirements. The analysis holding time requirements were achieved for VOC, TPH as gasoline, metals, and nitrate and nitrite as nitrogen analyses.

1.1.2 Laboratory Method Blanks (Reason Code B1)

The field sample results were evaluated with respect to the laboratory method blank prepared and analyzed for each analytical batch and for each analytical method. All laboratory method blanks were free of VOCs, TPH as gasoline, diesel, and motor oil, metals, and nitrate and nitrite as nitrogen.

1.1.3 Initial and Continuing Calibration Blanks (Reason Code B2)

In addition to the laboratory method blanks for metals and nitrate and nitrite as nitrogen analyses, initial and continuing calibration blank results were reviewed to ensure that the instrument was free of contamination prior to the analyses. All initial and continuing calibration blanks were free of metals and nitrate and nitrite as nitrogen.

1.1.4 Surrogate Recoveries (Reason Code S)

Surrogate standards are organic compounds added to field and laboratory QC samples for organic analysis to evaluate the matrix effect and method performance on an individual sample basis. The surrogates bromofluorobenzene, dibromofluoromethane, 1,2-dichloroethane-d4, and toluene-d8 in all VOC samples, the surrogate o-terphenyl in all TPH as diesel and motor oil samples, and the surrogate bromofluorobenzene in all TPH as gasoline samples were recovered within the established control criteria. The surrogate recovery results indicated acceptable sample procedures for the VOC and TPH analyses.

1.1.5 Laboratory Control Sample/Laboratory Control Sample Duplicate Recoveries and Precisions (Reason Codes L and D3)

The LCS is an aliquot of analyte-free matrix spiked with target analytes that is prepared with each analytical batch for each analytical method. The recovery of target analytes from the LCS analysis is a measurement of method performance in an interference-free sample matrix. Non-compliant LCS recoveries were reported for EPA Method SW8260B. The non-compliant LCS results that led to data qualification is presented as follows:

Analytical Method	Laboratory QC Batch #	LCS Recovery Outlier (%)	Control Limit (%)
EPA SW8260B	4E23014	Acetone: 159/147%	40-140%

As shown in the table, the reported LCS bias results for acetone exceeded its upper control criteria, however the precision between the LCS and LCSD recoveries for the analyte met the precision control limit. As a result of the LCS recovery bias, the detected results for acetone were qualified as estimated (J+) . This data qualification was applied to the results of acetone in all detected samples in the non-compliant batch. The high-biased LCS recovery did not affect the data quality of the non-detected results. It should be noted that surrogates in all VOC samples qualified for the LCS recovery outliers were recovered within the accuracy specifications, thus indicating effective sample preparation procedures for the VOC analysis.

In addition, high-biased LCS recoveries were observed for other VOCs in the same batch. Because these analytes were not detected in any associated samples, the sample results are not affected by the LCS recovery outliers, and no data qualification was warranted.

The LCS results meet the acceptance criteria for TPH as gasoline, diesel, and motor oil, metals, and nitrate as nitrogen analyses.

1.1.6 Matrix Spike/Matrix Spike Duplicate Recoveries and Precisions (Reason Codes M and D2)

The MS and MSD samples are a portion of a field sample spiked with target analytes that are prepared with each analytical batch and with each method. The MS/MSD results are used to evaluate any bias introduced to the method due to matrix interference, and to measure bias and precision for each analytical batch.

In accordance with the project QAPP requirements (USACE, 2013), the MS/MSD samples are to be collected at a rate of 1 per 20 groundwater samples or 5 percent. During the sampling period from November 2013 to May 2014, groundwater sampling was conducted at sites ST070, ST105, WP026, and Landfills. Although no MS/MSD samples were collected from site ST070, MS/MSD samples were collected from other listed sites to meet the MS/MSD sample frequency requirements. The bias and precision results of the VOC, TPH as gasoline, diesel and motor oil, metals, and nitrate analyses from site ST070 were evaluated through recoveries of surrogates and LCS, LCSD RPD discussed in the previous sections.

1.1.7 Initial Calibration (Reason Code G)

Instrument calibration is performed for VOC, TPH as gasoline, diesel, and motor oil, metals, and nitrate and nitrite as nitrogen analyses according to the EPA method requirements (EPA, 1996). The linear analytical range is established for each method by analysis of calibration standards prepared at increasing concentrations that cover the expected sample concentrations. The acceptability of the initial calibration is determined by calculation of a percent relative standard deviation or coefficient. The initial calibration results are acceptable for all the listed methods.

Immediately after the initial calibration for each analysis, an initial calibration verification was conducted at the mid-point of instrument calibration range by using a second-source calibration standard to verify the accuracy of the initial calibration. The review indicated acceptable initial calibration verification results for all target analytes.

1.1.8 Continuing Calibration Verification (Reason Code C)

Routinely during sample analysis, the stability of the analytical system is monitored by analysis of continuing calibration standards at concentrations near the mid-point of the instrument calibration range. The percent difference (%D) values between the relative response factor (RRF) in the initial calibration and the RRF in the continuing calibration exceeded the acceptance criteria for VOC. The CCV outliers that resulted in data qualification are summarized as follows:

Analytical Method	Calibration ID	CCV Outlier, D (%)	Control Limit (%)
EPA SW8260B	4E14707-CCV	Bromomethane: -22.4%	<20%

ID identification

The analyte bromomethane was not detected in samples associated with the CCV outlier. As a result of the low-biased %D values, the LOQ for the non-detected results were qualified as estimated UJ. This data qualification was applied to the results of the bromomethane in all samples associated with the non-compliant CCV. As the CCV outlier is marginally below the control limit, the data usability of the qualified results is not affected.

Except as noted, the CCV results are acceptable for all other analyses.

1.1.9 Interference Check Samples (Reason Code O)

The ICS verifies the inter-element and background correction factors. An ICS was analyzed at the required frequencies, and all ICS results are within the established control limit for EPA Method SW6010C for the May 2014 groundwater monitoring event.

1.1.10 Trip Blanks (Reason Code K3)

Trip blanks were prepared by the laboratory and stored with the groundwater samples collected for VOCs analysis. In accordance with the project QAPP requirements (USACE, 2013), one trip blank is to be collected at a rate of one per day when collecting groundwater samples for VOC analysis. One trip blank was submitted with VOC samples collected for ST070 on May 19, 2014, and thus met the trip blank collection frequency requirement. The trip blank was free of VOCs. The trip blank results are acceptable and demonstrate that valid sample storage and shipping procedures are being implemented.

1.1.11 Equipment Rinse Blanks (Reason Code K1)

Equipment rinse blanks are designed to check for contamination from sampling equipment, and the results for the equipment rinse blanks are used to evaluate the efficiency of equipment decontamination procedures.

In accordance with the project QAPP requirements (USACE, 2013), no equipment rinse blanks will be collected when dedicated or disposable sampling equipment is used to collect groundwater samples. When non-dedicated or non-disposable sampling equipment is used, one equipment rinse blank will be collected at a rate of one per day.

During the May 2014 groundwater monitoring event at site ST070, non-dedicated sampling equipment was used to collect groundwater samples. Following sample collection, the sampling equipment was decontaminated in accordance with equipment decontamination procedures, however no equipment rinse blank was collected.

1.1.12 Field Duplicates

In accordance with the project QAPP requirements (USACE, 2013), field duplicate samples are to be collected at a minimum rate of 10 percent of the total number of groundwater samples. Field duplicate samples are evaluated by calculating the RPD between the parent sample and its duplicate. The RPD is calculated using the following equation:

$$RPD = /(S-D)/[(S+D)/2]/ \times 100$$

where:

S = sample result
D = duplicate result

Acceptable precision control criteria are established at less than or equal to 35 percent for water samples. The RPD is calculated between pairs of field duplicate samples when both results are reported above the LOQ.

One field duplicate pair was collected for the May 2014 groundwater monitoring event and met the 10 percent field duplicate frequency objective. The duplicate pair was collected from location KAFB-7001. The pair was analyzed for VOC, TPH as gasoline, diesel, and motor oil, dissolved metals, and nitrate and nitrite as nitrogen. Table 4 presents the field duplicate results.

As indicated on Table 4, nitrate and nitrite as nitrogen by EPA Method 353.2, barium and selenium by EPA Method SW6010C, and trichloroethene by EPA Method SW8260B were detected above their respective LOQ in the pair. The RPDs for the listed analytes ranged from 0.3 to 4.9 percent, which is well within the 35 percent field precision requirement. Except as noted, no other target analytes were detected above the LOQ in the pair. The field duplicate demonstrating acceptable overall field sampling and analytical precision for all methods.

1.2 Completeness

The following sections present a discussion of technical completeness for the May 2014 groundwater monitoring event. Completeness calculations were performed only for the groundwater samples that are used for project decisions. For informational purposes, completeness calculations were also calculated for the field QC samples. Completeness results are presented in Table 5.

1.2.1 Technical Completeness

Technical completeness is a quantitative measure of the data usability based on the number of rejected data compared to the total number of sample results. The technical completeness goal for each method is equal to or greater than 95 percent. The technical completeness calculation considers all data that are not rejected to be usable. The technical completeness is calculated as follows:

$$\% \text{ Technical Completeness} = \frac{\text{Number of Usable Results}}{\text{Total Number of Results}} \times 100$$

As discussed in the previous sections, minor LCS recovery bias and CCV outliers were observed for the VOC analysis. While the affected results were qualified as estimated, the data usability is not affected. Despite the exceedances noted, the technical completeness was 100 percent for all methods exceeding the 95 percent technical completeness objective. Therefore, the project data quality objectives were achieved for all methods for the May 2014 groundwater monitoring event.

1.3 Analysis Completeness

As a part of the data review process, CB&I reviewed chain-of-custody forms against Groundwater Monitoring and Soil Gas Planners for site ST070 to ensure that analytical results were reported for all planned methods and samples. The review indicated the following:

- Groundwater samples were collected from well KAFB-7001 as planned.
- No soil gas samples were collected from any wells at site ST070 due to SVE operational issues.

Except where noted above, analytical results were reported for all methods and for all samples as planned.

1.4 Summary

The analytical data reported for the May 2014 Groundwater Monitoring Event at site ST070 have been reviewed for precision, accuracy/bias, and completeness. During sampling, samplers followed the approved project QAPP requirements and established sampling standard operating procedures (SOP) to collect, preserve, document, and ship samples to an off-site laboratory, ensuring the representativeness of the groundwater samples collected for the event. The selected laboratory is DoD ELAP certified and adhered to the most current EPA method requirements, project QAPP and DoD QSM requirements to prepare, analyze, and report the data. This ensures the comparability of the analytical results between different samples and different sites. An EPA data review was performed to evaluate the laboratory data and to verify that the laboratory complied with the DoD QSM and project QAPP requirements, and to apply qualifiers to the affected analytical data that was outside the established control criteria. Based on a review of the completed sample collection logs, chain of custody forms, sample receipt forms, and laboratory data packages, the analytical data reported for this event has met the representativeness and comparability requirements.

Data quality exceedances consist of minor LCS recovery bias and continuing calibration outliers. The affected data were qualified as estimated. In all cases, the degree of these data quality exceedances was minor, and the data usability was not affected. The 95 percent technical completeness goal was exceeded for all methods for the May 2014 groundwater monitoring event. All data are usable for their intended purposes.

REFERENCES

DoD. 2010. *DoD Quality Systems Manual for Environmental Laboratories, Version 4.2.* October.

EPA. 2010. *USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Superfund Data Review, Final.* Office of Superfund Remediation and Technology Innovation, OSWER 8240.1-51 and EPA-540-R-10-011. January.

EPA. 2008. *USEPA Contract Laboratory Program, National Functional Guidelines for Superfund Organic Methods Data Review, Final.* Office of Superfund Remediation and Technology Innovation, OSWER 9240.1-48 and EPA-540-R-08-01. June.

EPA. 1996. *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (2006), SW-846 On-line*. Office of Solid Waste, Washington D.C. http://www.epa.gov/osw/hazard/testmethods/sw846.

USACE. 2013. *Quality Assurance Project Plan for Long-Term Groundwater Monitoring at Multiple Sites: Solid Waste Management Unit (SWMU) 6-1, Landfill 1; SWMU 6-2, Landfill 2; SWMU 6-4, Landfills 4,5 and 6; ST-105 (CG-C564); UST-58 (PL567); WP026; and ST070, Kirtland Air Force Base, New Mexico* Prepared by CB&I. for the USACE Albuquerque District under USACE Contract No. FA8903-10-D-8595, Task Order 002. December.

USACE. 2005. *Environmental Quality – Guidance for Evaluating Performance-Based Chemical Data*, EM 200-1-10. June 30.

TABLES

THIS PAGE INTENTIONALLY LEFT BLANK

List of Appendix E Tables

Table 1: Summary of Samples Collected, Sample Date, Sample Location, Preparation Method, Analysis Method, and Data Review Level

Table 2: Data Qualification Flags and Reason Codes

Table 3: Qualified Data Summary

Table 4: Field Duplicate Summary

Table 5: Technical Completeness

THIS PAGE INTENTIONALLY LEFT BLANK

Table 1: Summary of Samples Collected, Sample Date, Sample Location, Preparation Method, Analysis Method, and Data Review Level ST070, May 2014 Kirtland Air Force Base

Date Collected	Field Sample ID	Sample Location	Lab	Sample Type	Date Prepared	Prep Method	Date Analyzed	Analytical Method	Review Level
Environmental Samples									
SDG ECOS_016									
5/19/2014	ST70-30001	KAFB_7001	EPLN	REG	6/6/2014	NONE	6/6/2014	E353.2	III
5/19/2014	ST70-30001	KAFB_7001	EPLN	REG	5/22/2014	SW3005	6/9/2014	SW6010C-DISS	III
5/19/2014	ST70-30001	KAFB_7001	EPLN	REG	5/27/2014	METHOD	5/27/2014	SW7470A-DISS	III
5/19/2014	ST70-30001	KAFB_7001	EPLN	REG	5/22/2014	SW3510	5/28/2014	SW8015C	III
5/19/2014	ST70-30001	KAFB_7001	EPLN	REG	5/29/2014	SW5030	5/29/2014	SW8015C	III
5/19/2014	ST70-30001	KAFB_7001	EPLN	REG	5/23/2014	SW5030	5/23/2014	SW8260B	III
5/19/2014	ST70-30002	KAFB_7001	EPLN	FD	6/6/2014	NONE	6/6/2014	E353.2	III
5/19/2014	ST70-30002	KAFB_7001	EPLN	FD	5/22/2014	SW3005	6/9/2014	SW6010C-DISS	III
5/19/2014	ST70-30002	KAFB_7001	EPLN	FD	5/27/2014	METHOD	5/27/2014	SW7470A-DISS	III
5/19/2014	ST70-30002	KAFB_7001	EPLN	FD	5/22/2014	SW3510	5/28/2014	SW8015C	III
5/19/2014	ST70-30002	KAFB_7001	EPLN	FD	5/29/2014	SW5030	5/29/2014	SW8015C	III
5/19/2014	ST70-30002	KAFB_7001	EPLN	FD	5/23/2014	SW5030	5/23/2014	SW8260B	III
Field QC Samples									
SDG ECOS_016									
5/19/2014	ST70-80001	FIELDQC	EPLN	TB	5/23/2014	SW5030	5/23/2014	SW8260B	III

Notes:

SDG Sample Delivery Group
EPLN Empirical Laboratories
REG Normal sample sent to the lab
FD Field Duplicate
TB Trip Blank
III Samples received Level III data review

Table 2. Data Qualification Flags and Reason Codes

Data Qualifier Definitions for Organic Data Review

Qualifier	Definition
	No Qualifier indicates that the data are acceptable both qualitatively and quantitatively.
U	The analyte was analyzed for but was not detected above the reported limit of quantitation.
J	The analyte was analyzed for and was positively identified, but the reported numerical value may not be consistent with the amount actually present in the environmental sample. Results are estimated, although the data are considered usable and may be used as appropriate to meet project objectives. Results are qualitatively acceptable and quantitatively uncertain.
J-	The analyte was positively identified; the associated numerical value is its approximate concentration with a low bias in the sample.
J+	The analyte was positively identified; the associated numerical value is its approximate concentration with a high bias in the sample.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification.”
NJ	The analysis indicates the presence of an analyte that has been ”tentatively identified,” and the associated value represents its approximate concentration.
UJ	The analyte was not detected above the reported limit of quantitation. However, the reported limit of quantitation is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Re-sampling and re-analysis may be necessary to confirm or deny the presence of the analyte. Results are rejected, and data are unusable for any purposes.

Data Qualifier Definitions For Inorganic Data Review

Qualifier	Definition
	No Qualifier indicates that the data are acceptable both qualitatively and quantitatively.
U	The analyte was analyzed for but was not detected above the level of the reported value. The reported value is the limit of quantitation for water and soil for all the analytes except cyanide and mercury. For cyanide and mercury, the reported value is the contract-required detection limit.
J	The analyte was analyzed for and was positively identified, but the reported numerical value may not be consistent with the amount actually present in the environmental sample. Results are estimated, although the data are considered usable and may be used as appropriate to meet project objectives. Results are qualitatively acceptable and quantitatively uncertain.
J-	The analyte was positively identified; the associated numerical value is its approximate concentration with a low bias in the sample.
J+	The analyte was positively identified; the associated numerical value is its approximate concentration with a high bias in the sample.
UJ	The analyte was analyzed for but was not detected above the reported value. The reported value may not accurately or precisely represent the sample limit of quantitation.
R	The analyte was analyzed for, but the presence or absence of the analyte has not been verified. Re-sampling and re-analysis may be necessary to confirm or deny the presence of the analyte. Results are rejected, and data are unusable for any purposes.

Table 2. Data Qualification Flags and Reason Codes (concluded)

Reason Codes for Data Review and Validation

Reason Code	Description
A	Serial dilution outside criteria (Level IV).
B1	Method blank contaminants above reporting limit.
B2	Calibration blank contaminants above reporting limit.
B2, Bias Flag "-"	Calibration blank indicates negative interference; false negatives may be present.
C	Calibration outside control limits.
D	Sample results precision between primary and secondary columns outside control limit.
D1	Sample duplicate RPD outside control limit.
D2	Matrix duplicate RPD outside control limit.
D3	Laboratory control sample duplicate RPD outside control limit.
E	The sample results exceed the linear calibration range of the instrument.
F	Hydrocarbon pattern does not match hydrocarbon pattern in the standard.
G1	Initial calibration relative standard deviation outside control limit.
G2	Initial continuing calibration RRF outside control limit.
G3	Continuing calibration RRF outside control limit.
H	Holding time exceeded.
I	Internal standard recovery outside control limit.
K1	Equipment rinsate contamination.
K2	Ambient blank contamination.
K3	Trip blank contamination.
L	LCS outside control limits.
M	MS outside control limits.
O	Interference check sample outside acceptance criteria.
P	Analyte qualified based on the professional judgment of the reviewer.
S	Surrogate recovery outside control limit.
T	Temperature outside acceptance criteria.
Tr	Value reported detected between the detection limit and LOQ.
W	Pesticide breakdown outside criteria (Level IV).
X	Raised reporting limit due to matrix interference or high analyte concentration.
Y	Analyte was not confirmed by a second column.

Table 3
Qualified Data Summary
ST070, May 2014
Kirtland Air Force Base

Sample ID	Sample Type	Sample Date	Analyte	SDG	Result	DL	LOQ	Dilution	Units	Qualifier
Environmental Samples										
Reason Code C		**Method SW8260B**								
ST70-30001	REG	5/19/2014	Bromomethane	ECOS_016	ND	0.5	2	1	ug/L	UJ
ST70-30002	FD	5/19/2014	Bromomethane	ECOS_016	ND	0.5	2	1	ug/L	UJ
Reason Code LTr		**Method SW8260B**								
ST70-30001	REG	5/19/2014	Acetone	ECOS_016	4.04	2.5	10	1	ug/L	J+
Field QC Samples										
Reason Code C		**Method SW8260B**								
ST70-80001	TB	5/19/2014	Bromomethane	ECOS_016	ND	0.5	2	1	ug/L	UJ

Notes: See Table 2 for definitions of Qualifiers and Reason Codes.

SDG	Sample delivery group
DL	Detection limit
LOQ	Limit of quantitation
ND	Not detected at the LOQ
REG	Normal sample sent to the lab
FD	Field duplicate
TB	Trip blank
µg/L	Micrograms per liter

Table 4
Field Duplicate Summary
ST070, May 2014
Kirtland Air Force Base

Well ID/Method	Analyte	Sample Date	Normal Sample Result	Normal Sample LOQ	Duplicate Sample Result	Duplicate Sample LOQ	Units	RPD %	RPD Goal of 35% Met
KAFB 7001									
E353.2	Nitrate/Nitrite as N	5/19/2014	7.36	1.5	7.38	1.5	mg/L	0.3	Yes
SW6010C-DISS	Arsenic		ND	2.5	0.893 J	2.5	ug/L	--	--
	Barium		40.2	10	42.2	10	ug/L	4.9	Yes
	Cadmium		ND	1.25	ND	1.25	ug/L	--	--
	Chromium		1.27 J	2.5	1.35 J	2.5	ug/L	--	--
	Lead		0.854 J	1.25	1.12 J	1.25	ug/L	--	--
	Selenium		24.4	2.5	25.5	2.5	ug/L	4.4	Yes
	Silver		ND	2.5	ND	2.5	ug/L	--	--
SW7470A-DISS	Mercury		ND	0.2	ND	0.2	ug/L	--	--
SW8015C	Diesel Range Organics (C10-C28)		ND	0.189	ND	0.189	mg/L	--	--
	Gasoline Range Organics (C6-C10)		ND	0.15	ND	0.15	mg/L	--	--
	Oil Range Organics (>C28-C40)		ND	0.0943	ND	0.0943	mg/L	--	--
SW8260B	1,1,1,2-Tetrachloroethane		ND	1	ND	1	ug/L	--	--
	1,1,1-Trichloroethane		ND	1	ND	1	ug/L	--	--
	1,1,2,2-Tetrachloroethane		ND	1	ND	1	ug/L	--	--
	1,1,2-Trichloroethane		ND	1	ND	1	ug/L	--	--
	1,1-Dichloroethane		ND	1	ND	1	ug/L	--	--
	1,1-Dichloroethene		ND	1	ND	1	ug/L	--	--
	1,1-Dichloropropene		ND	1	ND	1	ug/L	--	--
	1,2,3-Trichlorobenzene		ND	1	ND	1	ug/L	--	--
	1,2,3-Trichloropropane		ND	2	ND	2	ug/L	--	--
	1,2,4-Trichlorobenzene		ND	1	ND	1	ug/L	--	--
	1,2,4-Trimethylbenzene		ND	1	ND	1	ug/L	--	--
	1,2-Dibromo-3-chloropropane		ND	2	ND	2	ug/L	--	--
	1,2-Dibromoethane (EDB)		ND	1	ND	1	ug/L	--	--
	1,2-Dichlorobenzene		ND	1	ND	1	ug/L	--	--
	1,2-Dichloroethane		ND	1	ND	1	ug/L	--	--
	1,2-Dichloropropane		ND	1	ND	1	ug/L	--	--
	1,3,5-Trimethylbenzene		ND	1	ND	1	ug/L	--	--
	1,3-Dichlorobenzene		ND	1	ND	1	ug/L	--	--
	1,3-Dichloropropane		ND	1	ND	1	ug/L	--	--
	1,4-Dichlorobenzene		ND	1	ND	1	ug/L	--	--
	1-Chlorohexane		ND	2	ND	2	ug/L	--	--
	2,2-Dichloropropane		ND	1	ND	1	ug/L	--	--
	2-Butanone		ND	10	ND	10	ug/L	--	--
	2-Chlorotoluene		ND	1	ND	1	ug/L	--	--
	4-Chlorotoluene		ND	1	ND	1	ug/L	--	--
	4-Methyl-2-pentanone		ND	5	ND	5	ug/L	--	--
	Acetone		4.04 J+	10	ND	10	ug/L	--	--
	Benzene		ND	1	ND	1	ug/L	--	--
	Bromobenzene		ND	1	ND	1	ug/L	--	--
	Bromochloromethane		ND	1	ND	1	ug/L	--	--

Table 4
Field Duplicate Summary
ST070, May 2014
Kirtland Air Force Base

Well ID/Method	Analyte	Sample Date	Normal Sample Result	Normal Sample LOQ	Duplicate Sample Result	Duplicate Sample LOQ	Units	RPD %	RPD Goal of 35% Met
KAFB 7001									
SW8260B	Bromodichloromethane	5/19/2014	ND	1	ND	1	ug/L	--	--
	Bromoform		ND	1	ND	1	ug/L	--	--
	Bromomethane		ND	2	ND	2	ug/L	--	--
	Carbon tetrachloride		ND	1	ND	1	ug/L	--	--
	Chlorobenzene		ND	1	ND	1	ug/L	--	--
	Chloroethane		ND	2	ND	2	ug/L	--	--
	Chloroform		0.277 J	1	ND	1	ug/L	--	--
	Chloromethane		ND	1	ND	1	ug/L	--	--
	cis-1,2-Dichloroethene		ND	1	ND	1	ug/L	--	--
	cis-1,3-Dichloropropene		ND	1	ND	1	ug/L	--	--
	Dibromochloromethane		0.325 J	1	0.271 J	1	ug/L	--	--
	Dibromomethane		ND	1	ND	1	ug/L	--	--
	Dichlorodifluoromethane		ND	2	ND	2	ug/L	--	--
	Ethylbenzene		ND	1	ND	1	ug/L	--	--
	Hexachlorobutadiene		ND	1	ND	1	ug/L	--	--
	Isopropylbenzene		ND	1	ND	1	ug/L	--	--
	m,p-Xylene		ND	2	ND	2	ug/L	--	--
	Methyl t-Butyl Ether		ND	1	ND	1	ug/L	--	--
	Methylene chloride		ND	2	ND	2	ug/L	--	--
	Naphthalene		ND	1	ND	1	ug/L	--	--
	n-Butylbenzene		ND	1	ND	1	ug/L	--	--
	n-Propylbenzene		ND	1	ND	1	ug/L	--	--
	o-Xylene		ND	1	ND	1	ug/L	--	--
	p-Isopropyltoluene		ND	1	ND	1	ug/L	--	--
	sec-Butylbenzene		ND	1	ND	1	ug/L	--	--
	Styrene		ND	1	ND	1	ug/L	--	--
	tert-Butylbenzene		ND	1	ND	1	ug/L	--	--
	Tetrachloroethene		ND	1	ND	1	ug/L	--	--
	Toluene		ND	1	ND	1	ug/L	--	--
	trans-1,2-Dichloroethene		ND	1	ND	1	ug/L	--	--
	trans-1,3-Dichloropropene		ND	1	ND	1	ug/L	--	--
	Trichloroethene		2.37	1	2.38	1	ug/L	0.4	Yes
	Trichlorofluoromethane		ND	2	ND	2	ug/L	--	--
	Vinyl chloride		ND	1	ND	1	ug/L	--	--

Table 4
Field Duplicate Summary
ST070, May 2014
Kirtland Air Force Base

Notes:

LOQ	Limit of quantitation
RPD	Relative percent difference
ND	Not detected at the LOQ
mg/L	Milligrams per liter
µg/L	Micrograms per liter

RPD formula = 100 x |Primary Result - Duplicate Result| / ((Primary Result + Duplicate Result) / 2)

-- Not applicable since RPD not calculated. RPD is only calculated when the analyte is detected at or above the LOQ in both the normal sample and the duplicate sample.

Table 5
Technical Completeness
ST070, May 2014
Kirtland Air Force Base

Analytical Method	Number of Analytes	Number of Samples	Number of Results	Number of Useable Results	Technical Completeness [Goal = 95 percent] (percent)
Environmental Samples					
E353.2	1	2	2	2	100.0
SW6010C-DISS	7	2	14	14	100.0
SW7470A-DISS	1	2	2	2	100.0
SW8015C - Diesel and Motor Oil	2	2	4	4	100.0
SW8015C - Gasoline	1	2	2	2	100.0
SW8260B	64	2	128	128	100.0
Field QC Samples					
SW8260B	64	1	64	64	100.0