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NMED
Hazardous Waste Bureau

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Dear Mr. Kieling

Kirtland Air Force Base is pleased to submit the *Final ST-070E – Oil-Water Separator, ST-219 (SWMU ST-70) Interim Measures Work Plan, January 2015.* This plan discusses the proposed measures to accelerate cleanup of ST-070E. Also included is the *Final Long-Term Monitoring Plan ST-070E – Oil-Water Separator (ST-219), December 2014.* Additionally, the *Final Uniform Federal Policy Quality Assurance Project Plan ST-070E – Oil-Water Separator (ST-219), December 2014* is included.

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
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KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

FINAL ST-070E – OIL-WATER SEPARATOR, ST-219 (SWMU ST-70)
INTERIM MEASURES WORK PLAN

January 2015

377 MSG/CEI
2050 Wyoming Blvd SE
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KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

ST-070E – OIL-WATER SEPARATOR, ST-219
(SWMU ST-70)

FINAL INTERIM MEASURES WORK PLAN

January 2015

Prepared for

Air Force Civil Engineer Center
Department of the Air Force, 772nd ESS/PKB
3515 S. General McMullen Dr., Suite 155
Joint Base San Antonio Lackland, Texas 78226-2018

Contract FA8903-13-C-0008

Submitted by

URS Group, Inc.
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This Interim Measures Work Plan specifies the activities that will be performed in support of the remediation of contaminated vadose zone soils underlying the former ST-219 Oil Water Separator site at Kirtland Air Force Base located in Albuquerque, New Mexico. Sampling of soils and groundwater at the site has occurred over the years to identify the source of contamination. Contamination in the vadose zone soils has not impacted the regional aquifer located beneath the site. The purpose of this plan is to describe the interim measures that will be taken to address the vadose zone contamination in an effort to mitigate any potential impacts on the underlying groundwater. Groundwater monitoring will be addressed in a separate long-term monitoring plan to support site closeout.

15. SUBJECT TERMS
Site ST-070E, groundwater monitoring, vadose zone, soil vapor extraction

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

This document has been approved for public release in accordance with Department of Defense Directives and Air Force Instructions.

KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs

PREFACE

This Interim Measures Work Plan addresses the activities that will be performed in support of remediation of contamination associated with the ST-070E, Oil-Water Separator, ST-219, site at Kirtland Air Force Base, New Mexico. The primary activities that will be performed include soil vapor extraction to remove contamination existing in the vadose zone underlying the site, monitoring of the remediation system to assess the efficacy of the cleanup action, and continued groundwater monitoring of the existing well to ensure that the residual contamination in the vadose zone has not impacted the underlying regional aquifer.

This work will be performed under the authority of the requirements of the Air Force Civil Engineer Center Contract No. FA8903-13-C-0008. This program is conducted under the Kirtland Air Force Base Environmental Restoration Section Chief, Mr. Ludie Bitner, and the Kirtland Air Force Base Project Manager, Mr. Cole Crosgrove. URS Group, Inc., as a subcontractor to FPM Remediations, Inc., has prepared this interim measures work plan as defined in the Performance-Based Remediation Contract for Cannon, Holloman, and Kirtland Air Force Bases located in New Mexico, and Luke Air Force Base located in Arizona. Mr. Richard Wells is the URS Group, Inc. Installation Manager for Environmental Restoration Project Sites at Kirtland Air Force Base.

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ACRONYMS AND ABBREVIATIONS

µg/L	microgram per liter
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
ANSI	American National Standards Institute
bgs	below ground surface
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
COPC	contaminant of potential concern
DOE	U.S. Department of Energy
DRO	diesel-range organics
EPA	U.S. Environmental Protection Agency
FPM	FPM Remediations, Inc.
ft	feet
ft/day	feet per day
FY	fiscal year
GAC	granular activated carbon
GRO	gasoline-range organics
HASP	Health and Safety Plan
ICM	interim corrective measure
IDW	investigation-derived waste
LTM	long-term monitoring
MCL	maximum contaminant level
mg/kg	milligram per kilogram
NA	not available
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OWS	oil-water separator
PCE	tetrachloroethene
PID	Photoionization Detector
ppbv	parts per billion by volume
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
ROI	radius of influence
SOP	standard operating procedure
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
TCE	trichloroethene
TPH	total petroleum hydrocarbons
URS	URS Group, Inc.
USAF	U.S. Air Force
USF	Santa Fe Group
USGS	U.S. Geological Survey
UST	underground storage tank
VOC	volatile organic compound

1.0 INTRODUCTION

This Interim Measures Work Plan addresses the activities that will be performed for the ST-070E Oil-Water Separator (OWS), ST-219 (Solid Waste Management Unit [SWMU] ST-70) site at Kirtland Air Force Base (AFB), New Mexico, hereinafter referred to as the Site. The Site location is shown in Figure 1-1. This plan was prepared in accordance with the requirements of the Air Force Civil Engineering Center (AFCEC) Contract No. FA8903-13-C-0008. URS Group Inc. (URS), as a subcontractor to FPM Remediations, Inc. (FPM), has prepared this work plan in accordance with the Performance-Based Remediation Contract for Cannon, Holloman, and Kirtland AFBs located in New Mexico, and Luke AFB located in Arizona. Monitoring requirements are further delineated in the *Final Long-Term Monitoring Plan, ST-070E – Oil-Water Separator (ST-219)* (U.S. Air Force [USAF], 2014a) and the *Final Uniform Federal Policy Quality Assurance Project Plan, ST—070E – Oil-Water Separator (ST-219)* (USAF, 2014b), which serve as companion documents to this Work Plan.

1.1 Purpose and Scope

The purpose of these interim measures is to facilitate a timely action that will mitigate the further migration of contaminants, as well as the actual or potential human and environmental exposure to contaminants. The purpose of this work plan is to outline the activities necessary to address volatile organic compound (VOC) and petroleum hydrocarbon contamination in the vadose zone that has the potential to impact the regional aquifer underlying the site of the former oil-water separator. To date, the concentrations of constituents in the groundwater have been below the applicable U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs) for drinking water, as well as the New Mexico Water Quality Commission Regulations as provided in the New Mexico Administrative Code (NMAC) 20.6.2. The ultimate goal of this project is to bring the Site to corrective action complete status without controls.

1.2 Interim Measures Objectives

The primary objectives of the interim measures are to:

(1) Reduce VOC and residual petroleum hydrocarbon concentrations in vadose zone soils to levels that are protective of the regional aquifer; and

(2) Induce pneumatic control of contaminated soil vapor to ensure that constituents do not impact the regional aquifer groundwater.

These objectives will be achieved in part through the following field activities, which are described herein:

- Implement soil vapor extraction (SVE) to address VOC and petroleum hydrocarbon contamination remaining in the vadose zone.
    - Extraction well installation and sample collection while drilling to provide additional vadose zone characterization.
    - Installation of an SVE unit to address remaining vadose zone contamination.
    - Routine operation and maintenance to verify system performance
- Implement long-term monitoring (LTM) to ensure that vadose zone contamination does not impact the underlying regional aquifer groundwater.

- Provide the necessary data to support a corrective action complete proposal to the New Mexico Environment Department (NMED) to delist the site from the Resource Conservation and Recovery Act (RCRA) Permit
- Site surveying.
- Site restoration following site closure.

1.3 Regulatory Setting

The interim measures described herein will be performed pursuant to the NMED Hazardous Waste Bureau regulations. The Site consists of a former OWS location between Buildings 481 and 482 at Kirtland AFB. An existing SVE system is currently operating at the site that can extract contaminated vapor from up to three extraction wells. The system has been operational since 2008. The primary media of concern for the Site is underlying groundwater for which constituent concentrations have been below regulatory levels of concern.

The groundwater cleanup levels will be defined as the more conservative of those specified in either the New Mexico Water Quality Control Commission as protective of human health (NMAC, 20.6.2) or by the current EPA MCLs as found in 40 Code of Federal Regulations (CFR) 141 and 40 CFR 142. Soil cleanup levels will be based on NMED soil screening levels for residential soil (NMED, 2012).

1.4 Work Plan Organization

This work plan is divided into six sections including:

- Section 1.0 – Introduction, purpose, objectives, and regulatory setting
- Section 2.0 – Background and History
- Section 3.0 – Previous Investigations
- Section 4.0 – Procedures for Implementation
- Section 5.0 – Reporting
- Section 6.0 – Project Schedule
- Section 7.0 – References

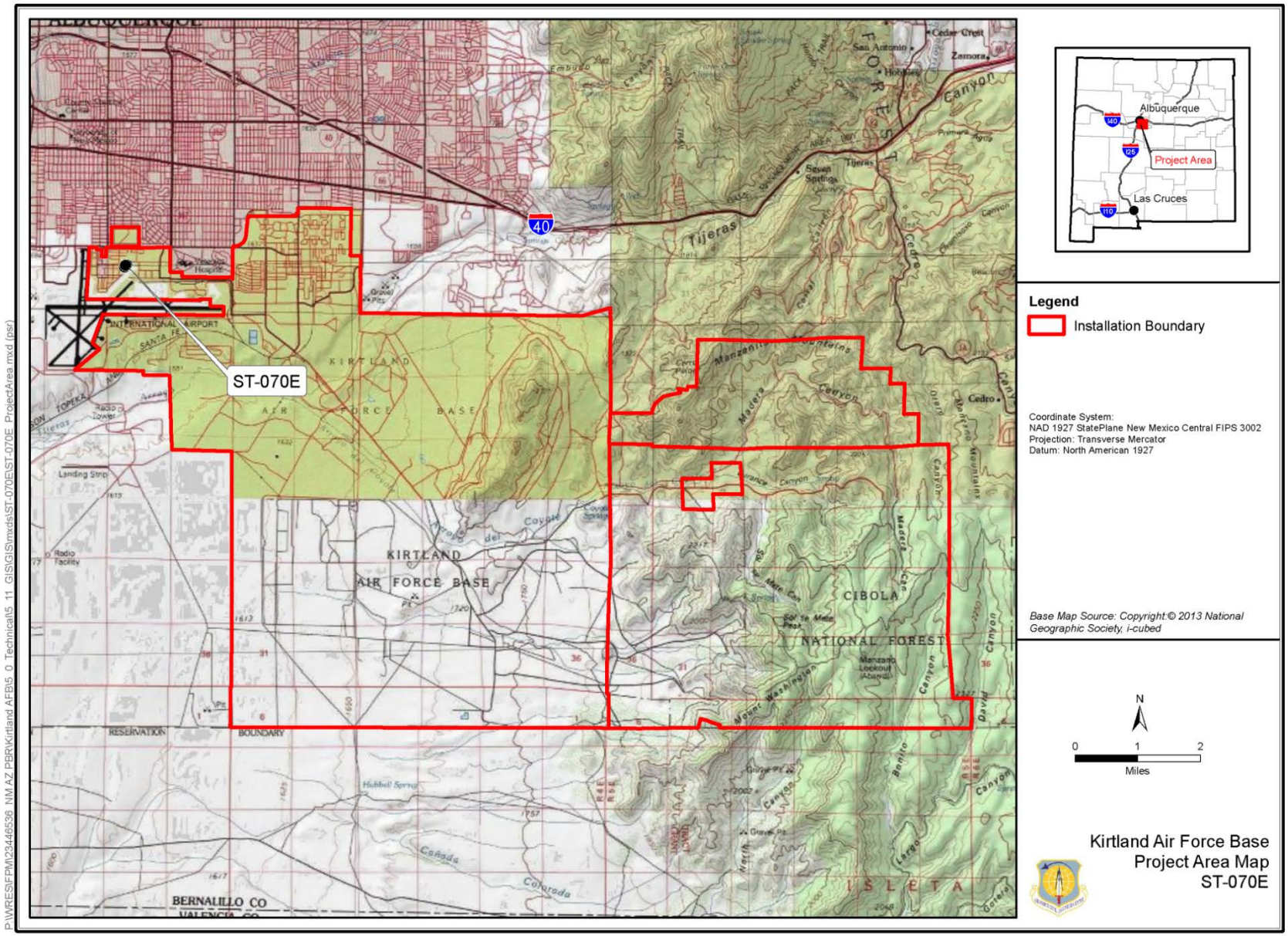

Figure 1-1. ST-070E Site Location

2.0 BACKGROUND AND HISTORY

2.1 Installation Description

Kirtland AFB occupies approximately 51,558 acres in southeastern Albuquerque, New Mexico, nestled between the Sandia and Manzano mountain ranges. The base is located in Bernalillo County, in central New Mexico, southeast of and adjacent to the Albuquerque International Sunport (Figure 1-1). Kirtland AFB employs more than 23,000 people, including more than 4,200 active duty, 1,000 National Guard, and 3,200 part-time reservists. Kirtland AFB is home to the Air Force Nuclear Weapons Center and its subordinate wings, the 498th Armament Systems Wing and the 377th Air Base Wing. It is also home to the Defense Threat Reduction Agency Albuquerque office, Air Force Safety Center, the Air Force Inspection Agency, the Air Force Operational Test and Evaluation Center, the 58th Special Operations Wing, Space Development and Test Wing, the New Mexico Air National Guard 150th Fighter Wing, the Directed Energy and Space Vehicle Directorates of the Air Force Research Laboratory, the Department of Energy Albuquerque Office, the National Nuclear Security Administration, and Sandia National Laboratories–New Mexico.

2.1.1 Regional Geology

The geology of the Kirtland AFB area varies with the regional geology. The eastern portion of Kirtland AFB is mountainous, with elevations reaching 7,900 feet (ft) above mean sea level. These mountains are composed of Precambrian metamorphic and igneous (primarily granite) and Paleozoic sedimentary rock (primarily marine carbonates). The western portion of the base lies within the Albuquerque Basin. Geologic features in this area of the basin include travertine and unconsolidated and semi-consolidated piedmont deposits, as well as eolian, lacustrine, and stream channel deposits.

In general, the near surface geology is characterized by recent deposits (i.e., mixtures of sandy silt and silty sand with minor amounts of clay and gravel); Ortiz gravel (i.e., alluvial piedmont sand and gravel deposits); and the Santa Fe Group (USF) (i.e., a mixture of sand, silt, clay, gravel, cobbles, and boulders). Generally, the northern and western portions of Kirtland AFB are dominated by unconsolidated geologic units; consolidated units predominate in the eastern half of the base.

Kirtland AFB lies within the eastern portion of the Albuquerque structural basin that contains the through-flowing Rio Grande. The basin is approximately 90 miles long and 30 miles wide. The deposits within the Albuquerque Basin consist of interbedded gravel, sand, silt, and clay. The thickness of basin-fill deposits within most of the basin exceeds 3,000 ft, though the thickness varies considerably because of the significant amount of faulting in the basin.

Geologic materials of primary importance within the basin are the USF and piedmont slope deposits. The USF consists of beds of unconsolidated to loosely consolidated sediments and interbedded volcanic rocks. The materials range from boulders to clay and from well sorted stream channel deposits to poorly sorted slope wash deposits. Coalescing alluvial fans of eroded materials from the surrounding mountains were deposited unconformably over the USF, extending westward from the base of the Sandia and Manzano mountains to the eastern edge of the Rio Grande floodplain. The fan sediments range from poorly sorted mud flow material to well sorted stream gravel. The beds consist of channel fill and interchannel deposits. The fan deposits range in thickness from 0 to 200 ft and thicken toward the mountains. The USF is further broken down into two depositional facies called the USF-1 and USF-2 (Hawley et al., 1995). USF-1 is present from ground surface to approximately 86 ft below ground surface (bgs), and then a transition occurs where USF-1 and USF-2 are interfingered to a depth of 144 ft bgs, underneath which USF-2 is present to a depth of greater than 500 ft bgs (CH2M Hill, 2008).

2.1.2 Regional Hydrogeology

The groundwater system at Kirtland AFB and in the Albuquerque area lies within the Albuquerque Basin, also referred to as the Middle Rio Grande Basin. The basin is part of the Rio Grande Rift. As the Rio Grande Rift spread, the Albuquerque Basin filled with sediments several miles in thickness, most of which are referred to as the USF. The unit consists of unconsolidated sediments that thin toward the basin boundary. Edges of the basin are marked by normal faults. Overlying the USF are the Pliocene Ortiz gravel and Rio Grande fluvial deposits.

Generally, USF-2 contains the most productive portion of the regional aquifer that supplies groundwater to the City of Albuquerque and Kirtland AFB. The unit is characterized by piedmont slope, river, and floodplain deposits. The ancestral Rio Grande formed a large aggradational plain in the central basin, depositing a mix of coarse- to fine-grained sand, silt, and clay with variable bed thickness.

Basin-fill deposits make up the aquifer in the Albuquerque Basin. Hydraulic conductivity values range from 0.25 to 130 feet per day (ft/day) due to large variations in the lithology of the basin-fill deposits. The average hydraulic conductivity is 70 ft/day with flow to the northeast. Clay layers have relatively low hydraulic conductivity, whereas gravel and cobble deposits exhibit relatively high hydraulic conductivity. Deposits of interbedded gravel, sand, silt, and clay have intermediate hydraulic conductivity.

This principal aquifer underlies Kirtland AFB, with the basin fill in this area consisting of unconsolidated and semi-consolidated sand, gravel, silt, and clay of the USF; alluvial fan deposits associated with erosion of upland areas; and valley alluvium associated with stream development. The alluvium varies in thickness from a few feet near the mountains on the east side of the base to greater than 2,100 ft bgs at a location 5 miles southwest of the airfield (USAF, 2004). Depth to the regional aquifer in the vicinity of the former sewage lagoons ranged from 501.99 ft below the measuring point to 510.25 ft as measured in wells KAFB-0505, KAFB-2628, and KAFB-2629 in June 2012 (USAF, 2012a).

Soil moisture content at Kirtland AFB ranges from wet to dry. The finer-grained upper soil is generally moist while the coarser-grained deeper soil could be moist or dry. Several minor perched water-bearing zones are present in the vadose zone above the regional water table. Some of these water-bearing zones below 400 ft bgs are likely remnants of the regional aquifer left behind as the water table has dropped.

2.2 Site Characterization and Setting

The *July 2012 to December 2012 Interim Corrective Measures Operation Report for Solid Waste Management Unit ST-70, Buildings 481/482 Oil Water Separator (Former ST-219)* (USAF, 2013a) provides a summary of the background information pertaining to the ST-070E site. ST-070E is located in the northwestern portion of the Kirtland AFB, southeast of the intersection of Aberdeen Avenue and MacDill Street. The area in which ST-070E, hereinafter referred to as the Site (see Figure 2-1), is located 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 the Site have been used as a passenger aircraft 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 location of the existing SVE system, and within the Site investigation boundary. Building 482 is rarely used for aircraft maintenance or parking.

The Site 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 ft southeast of the northwestern

Figure 2-1. Site ST-070E.

extent of the two buildings, with asphalt pavement located northwest of the concrete. The Site is located on both the concrete tarmac and the asphalt pavement. A chain-link fence serves as the flightline fence and is topped with barbed wire separating 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 air 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.

The OWS was identified as a contaminant release site based upon visual inspections and samples collected from inside the OWS in 1990 and 1992. Several phases of a RCRA Facility Investigation (RFI) were performed at the Site over subsequent years. Data from these investigations indicated petroleum hydrocarbon contamination was present in soils and soil vapor adjacent to the OWS. The OWS was removed in 1994 and piping was reconfigured to direct drainage to the sanitary sewer.

The existing 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 wooded 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, KAFB-7002, and KAFB-7003).

3.0 PREVIOUS INVESTIGATIONS

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. In subsequent years, several phases of RFIs were performed at the site that confirmed both the OWS and the area drain were primary routes of contaminant release to the subsurface. Data from the RFIs indicated that petroleum hydrocarbons were the primary type of contamination and the extent of contamination was limited to vadose zone soils and soil vapor adjacent to the OWS and the area drain. A bioventing interim corrective measure (ICM) was initiated in 1999 and continued into 2001. During this initial ICM, additional site characterization data were collected and identified significant soil contamination from chlorinated VOCs along with minor impacts to groundwater. After 2001, site investigations focused on data collection to evaluate the feasibility of using SVE to replace bioventing technology as the ICM.

3.1 Initial Assessments and Source Site Releases

Initial inspections of the site were performed at the former OWS as part of routine maintenance activities. Visual inspections of the OWS vault and sediment samples were collected from within the OWS in 1990 and 1992. Sample results indicated that releases had occurred from structural failure of the OWS (USAF, 2005). The sample analytical data and visual inspection records prompted several rounds of soil investigation and these investigations were followed by corrective actions. The primary route of contaminant release to the subsurface was eliminated in October 1994 with the removal of the OWS and plumbing the area drain to the sanitary sewer.

Site records and staff interviews indicate that small releases over a long period of time resulted in subsurface contamination. According to site use history and site characterization data, the following materials may have been released to the subsurface at the SWMU ST-70 site:

- Fuel: Avgas, jet fuel formulation 4 and 8 (JP-4 and JP-8), diesel, and gasoline.
- Oils and grease: hydraulic and lubricating oils, and mechanical lubricating grease.
- Solvents: Stoddard solvent (also known as mineral spirits) and chlorinated solvents including tetrachloroethene (PCE) and trichloroethene (TCE).

Sudden failures of subsurface pipes or large spills are not documented for the site. Instead, it is believed that the majority of the contaminant mass released to the subsurface resulted from small spills that occurred incrementally over a long period of time.

Only one significant release has been reported for the site and no documentation of the release was available. According to the 2005 RFI Report (USAF, 2005), a verbal account from a former Air Force employee familiar with the site described an approximately 1,000-gallon underground storage tank (UST) that had been located in the ST-219 area (Holmes, 2003). The UST reportedly contained Stoddard solvent and fed a pressurized system that supplied solvent for use within Buildings 481 and 482. (Stoddard solvent is an unspecified mixture of a variety of petroleum-based solvents.) The employee recounted a catastrophic failure of the tank in the early 1970s when nearly the entire contents of the tank were discharged to the subsurface. The tank was taken out of service following the incident and removed. Reportedly, no significant soil excavation or remedial actions were performed other than removal of the tank.

3.2 Soil Characterization Investigations

Several phases of RFIs were conducted at the site between 1993 and 1999 to characterize the nature and extent of soil contamination. A summary of soil boring data collected during these investigations is presented in Table 3-1.

Subsurface investigations from 2001 to 2004 were primarily focused on soil vapor and groundwater characterization. Results of the investigations conducted during the period from 1993 to 2004 were presented in the following reports:

- *IRP Stage 2B Work Plan for Kirtland AFB* (U.S. Geological Survey [USGS], 1993)
- *Final RCRA Facility Investigation (RFI) Report with Notice of Deficiency for Appendix II, Stage 2B* (USAF, 1995a)
- *RCRA Facility Investigation Report Appendix III Wasteline Sites, Draft Final* (USAF, 1995b)
- *RCRA Facility Investigation Report for Appendix I, Phase 2 Draft Final* (USAF, 1997)
- *Environmental Restoration Program RCRA Facility Investigation Report Solid Waste Management Unit ST-70 (Former ST-219)* (USAF, 2005)

3.2.1 1994 Stage 2B Resource Conservation and Recovery Act Facility Investigation

Twelve soil borings (219-01 through 219-12) were advanced at the site, with six adjacent to the OWS, one adjacent to the area drain, two on the south side of the passenger terminal, one on the northeast corner of the passenger terminal, one on the southwest side of the hazardous materials storage area, and one on the outside of the access gate to the east of the hazardous materials storage area. Soil samples were collected at depths ranging from 7 ft to 150 ft bgs. During the OWS removal action, two shallow soil borings were advanced adjacent to subsurface pipelines with one soil sample collected from each boring. Soil was analyzed for VOCs, semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and metals. Soil analytical results indicated chlorinated solvent and fuel range petroleum hydrocarbon compounds had impacted subsurface soils in samples collected from soil borings 219-02 through 219-06.

3.2.2 1997 Phase 2 Resource Conservation and Recovery Act Facility Investigation

Fifteen soil borings (219-13 through 219-27) were installed across the site to 50 ft bgs with soil samples collected at 10-foot intervals. Samples from these 15 borings were analyzed for VOCs, SVOCs, TPH, and metals. An additional 10 soil borings (219-28 through 219-37) were installed in locations incrementally out from the OWS and area drain locations to determine the extent of petroleum hydrocarbon contamination. Soil samples from 219-28 through 219-37 were analyzed for TPH. Two soil vapor wells, ST-219-28H and ST-219-29H, were installed in the areas of highest TPH contamination near the OWS and area drain. Soil samples from ST-219-28H and ST-219-29H were collected at 10-foot intervals to a total depth of 150 ft and 120 ft bgs, respectively, and analyzed for TPH. The data from this phase of investigation were used to define the extent of TPH contamination in the vadose zone.

3.2.3 1999 Resource Conservation and Recovery Act Facility Investigation

Five soil vapor monitoring wells (ST-219-38 through ST-219-42) and two soil borings (219-43 and 219-44) were installed to depths ranging from 15 ft to 110 ft bgs and sampled for TPH. Soil vapor

Table 3-1. Soil Boring Maximum Concentration Data

Investigation Period	Soil Boring	Sample Depth [feet bgs]	PCE [mg/kg]	TCE [mg/kg]	TPH - GRO [mg/kg]	TPH-DRO [mg/kg]	TPH-JP4 (mg/kg)
1994 Stage 2B RFI	ST-219-01	7 – 9	<0.0023	<0.0034	< 0.1	< 3.7	—
		12 - 16	< 0.0023	< 0.0034	< 0.1	4.0	—
	ST-219-02	7 – 11	<0.023	< 0.035	1.0	1,700	—
		12 – 14	< 0.23	< 0.035	3.7	2.6	—
		22 - 24	< 0.24	< 0.036	6.9	1.7	—
	ST-219-03	7 – 9	45	12	18	1,300	—
		12 – 16	1.8	1.1	90	170	—
		22 - 24	< 0.36	< 0.36	12	570	—
	ST-219-04	7 – 9	7,200	120	7,800	1,100	—
		12 – 14	81	11	93	1,700	—
		22 – 24	< 0.0036	< 0.013	1.8	280	—
	ST-219-05	7 – 11	45	3.1	15	8,100	—
		12 – 15	41	3.8	87	3,000	—
		22 - 25	1.3	1.2	70	3,000	—
	ST-219-06	7 – 9	16	3.1	340	5,300	—
		12 - 14	2.6	0.52	270	2,500	—
		24 – 26	15	1	130	3,500	—
		32 – 34	< 0.34	< 0.34	37	160	—
		42 – 44	< 0.34	< 0.34	300	19,000	—
		52 – 54	< 0.34	< 0.34	29	1,700	—
		74 – 76	< 0.34	< 0.34	40	2,100	—
		105 - 107	< 0.021	< 0.032	56	2,300	—
	ST-219-07*	74 – 76	< 0.65	< 0.65	< 0.5	< 10	< 10
		80 – 82	< 0.65	< 0.65	< 0.5	< 10	200
		90 – 92	< 0.65	< 0.65	< 0.5	< 10	170
		100 – 102	< 0.006	< 0.006	< 0.5	< 10	< 10
		110 – 112	< 0.006	< 0.006	< 0.5	< 10	< 10

Investigation Period	Soil Boring	Sample Depth [feet bgs]	PCE [mg/kg]	TCE [mg/kg]	TPH - GRO [mg/kg]	TPH-DRO [mg/kg]	TPH-JP4 (mg/kg)
		120 – 122	< 0.006	< 0.006	< 0.5	< 10	< 10
		130 – 132	< 0.005	< 0.005	< 0.5	< 10	< 10
		140 – 144	< 0.005	< 0.005	< 0.5	< 10	< 10
		150 - 152	< 0.005	< 0.005	< 0.5	< 10	< 10
	ST-219-08	10 – 12	< 0.006	< 0.006	< 0.62	< 12	< 12
		20 - 22	< 0.006	< 0.006	< 0.62	< 12	< 12
		30 – 32	< 0.006	< 0.006	< 0.62	< 12	< 12
		40 – 42	< 0.006	< 0.006	< 0.59	< 11	< 11
		55 – 57	< 0.006	< 0.006	< 0.59	< 11	< 11
		60 – 62	< 0.006	< 0.006	< 0.59	< 11	< 11
		70 – 74	0.009	0.009	< 2.6	< 11	8,500
		80 – 84	< 0.026	< 0.026	< 2.6	< 11	< 11
		90 – 92	< 0.026	0.023	< 2.6	< 11	< 11
		100 - 102	< 0.006	< 0.006	< 0.7	< 14	< 14
	ST-219-09	10 – 12	< 0.7	< 0.7	< 81	< 11	620
		20 – 22	< 0.7	< 0.7	< 81	< 11	360
		30 – 32	< 0.7	1.8	< 81	< 11	2,800
		40 – 44	< 0.74	2.0	< 74	< 120	6,700
		50 – 52	< 0.74	< 0.74	< 74	< 120	110
		60 – 62	< 0.74	0.83	< 74	< 120	13,000
		70 – 72	< 0.65	< 0.65	< 65	< 100	1,900
		80 – 82	< 0.65	< 0.65	< 65	< 100	4,100
		90 – 92	< 0.65	< 0.65	< 65	< 100	3,200
		100 - 102	< 0.74	1.1	< 74	< 1,100	49,000
	ST-219-10	10 – 12	< 0.005	< 0.005	< 0.54	< 11	< 11
		20 – 22	< 0.005	< 0.005	< 0.54	< 11	< 11
		30 – 34	< 0.005	< 0.005	< 0.54	< 11	< 11
		40 – 42	< 0.006	< 0.006	< 0.58	< 11	< 11
		50 – 52	< 0.006	< 0.006	< 0.58	< 11	< 11

Investigation Period	Soil Boring	Sample Depth [feet bgs]	PCE [mg/kg]	TCE [mg/kg]	TPH - GRO [mg/kg]	TPH-DRO [mg/kg]	TPH-JP4 (mg/kg)
		60 – 62	< 0.006	< 0.006	< 0.58	< 11	< 11
		70 – 72	< 0.005	< 0.005	< 0.54	< 11	< 11
		80 – 82	< 0.005	< 0.005	< 0.54	< 11	< 11
		90 – 92	< 0.005	< 0.005	< 0.54	< 11	< 11
		100 - 102	< 0.006	< 0.006	< 0.53	< 10	< 10
	ST-219-11	10 – 12	< 0.27	< 0.27	< 2.6	< 11	22
		20 – 24	< 0.27	< 0.27	< 2.6	< 11	25
		30 – 34	< 0.27	< 0.27	< 2.6	< 11	< 11
		40 – 42	< 0.29	< 0.29	< 0.56	< 12	140
		50 – 52	< 0.29	< 0.29	< 0.56	< 12	< 12
		60 - 62	< 0.29	< 0.29	< 0.56	< 12	< 12
		70 – 72	< 0.005	< 0.005	< 0.51	< 10	< 0.51
		80 – 82	< 0.005	< 0.005	< 0.51	< 10	< 0.51
		90 – 94	< 0.005	< 0.005	< 0.51	< 10	< 0.51
		100 - 102	< 0.006	< 0.006	< 0.61	< 12	< 0.61
	ST-219-12	10 – 12	< 0.005	< 0.005	< 0.55	< 11	< 11
		20 – 22	< 0.005	< 0.005	< 0.55	< 11	< 11
		30 – 32	< 0.005	< 0.005	< 0.55	< 11	< 11
		40 – 44	< 0.006	0.015	< 0.64	< 13	< 13
		50 – 54	< 0.006	< 0.006	< 0.64	< 13	< 13
		60 – 62	< 0.006	< 0.006	< 0.64	< 13	< 13
		70 – 72	< 0.005	< 0.005	< 0.53	< 10	< 10
		80 – 82	< 0.005	< 0.005	< 0.53	< 10	< 10
		90 – 92	< 0.005	< 0.005	< 0.53	< 10	< 10
		100 - 102	< 0.006	< 0.006	< 0.52	< 10	< 10
1997 Phase 2 RFI	ST-219-13	10 – 12	—	—	< 5	< 5	—
		20 – 22	< 0.69	< 0.69	1,900	22	—
		30 – 32	< 0.71	< 0.71	3,100	91	—
		40 – 42	—	—	1,100	40	—

Investigation Period	Soil Boring	Sample Depth [feet bgs]	PCE [mg/kg]	TCE [mg/kg]	TPH - GRO [mg/kg]	TPH-DRO [mg/kg]	TPH-JP4 (mg/kg)
		49 - 51	< 0.005	< 0.005	< 5	< 5	—
	ST-219-14	10 – 12	—	—	490	6.5	—
		20 – 22	< 0.066	< 0.066	2,900	6.7	—
		30 – 32	< 0.78	< 0.78	3,000	120	—
		40 – 42	—	—	1,400	7.6	—
		49 - 51	< 0.06	< 0.06	7.0	< 0.5	—
	ST-219-15	10 – 12	—	—	690	15	—
		20 – 22	< 0.66	< 0.66	1,600	81	—
		30 – 32	< 0.78	< 0.78	2,300	89	—
		40 – 42	—	—	3,300	93	—
		49 - 51	< 0.006	< 0.006	< 5	< 0.5	—
	ST-219-16	10 – 12	—	—	3,100	< 0.5	—
		20 – 22	< 0.76	< 0.76	4,000	100	—
		30 – 32	< 0.78	< 0.78	1,300	< 5.0	—
		40 – 42	—	—	1,900	63	—
		49 - 51	< 0.005	< 0.005	< 5.0	< 5.0	—
	ST-219-17	10 – 12	—	—	1,700	44	—
		20 – 22	< 0.68	< 0.68	2,000	280	—
		30 – 32	< 0.006	< 0.006	640	34	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 - 51	< 0.029	< 0.029	1,300	< 5.0	—
	ST-219-18	10 – 12	—	—	34	< 5.0	—
		20 – 22	< 0.005	< 0.005	< 5.0	< 5.0	—
		30 – 32	< 0.006	0.014	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 - 51	< 0.007	0.011	< 5.0	< 5.0	—
	ST-219-19	10 – 12	—	—	6.9	< 5.0	—
		20 – 22	< 0.006	< 0.006	< 5.0	< 5.0	—
		30 – 32	< 0.006	< 0.006	< 5.0	< 5.0	—

Investigation Period	Soil Boring	Sample Depth [feet bgs]	PCE [mg/kg]	TCE [mg/kg]	TPH - GRO [mg/kg]	TPH-DRO [mg/kg]	TPH-JP4 (mg/kg)
		40 – 42	—	—	< 5.0	< 5.0	—
		49 - 51	< 0.005	< 0.006	< 5.0	< 5.0	—
	ST-219-20	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	< 0.006	< 0.006	< 5.0	< 5.0	—
		30 – 32	< 0.005	< 0.005	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 - 51	< 0.006	< 0.006	< 5.0	< 5.0	—
	ST-219-21	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	< 0.006	< 0.006	< 5.0	< 5.0	—
		30 – 32	< 0.006	< 0.006	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 - 51	< 0.005	< 0.005	< 5.0	< 5.0	—
	ST-219-22	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	< 0.005	< 0.005	< 5.0	< 5.0	—
		30 – 32	< 0.005	< 0.005	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 - 51	< 0.005	< 0.005	< 5.0	< 5.0	—
	ST-219-23	10 – 12	< 0.006	< 0.006	< 5.0	< 5.0	—
		20 – 22	—	—	< 5.0	< 5.0	—
		30 – 32	< 0.006	< 0.006	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 - 51	< 0.006	< 0.006	< 5.0	< 5.0	—
	ST-219-24	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	0.006	0.008	< 5.0	< 5.0	—
		30 – 32	< 0.005	< 0.005	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 - 51	< 0.006	< 0.006	< 5.0	< 5.0	—
	ST-219-25	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	< 0.006	0.007	< 5.0	< 5.0	—

Investigation Period	Soil Boring	Sample Depth [feet bgs]	PCE [mg/kg]	TCE [mg/kg]	TPH - GRO [mg/kg]	TPH-DRO [mg/kg]	TPH-JP4 (mg/kg)
		30 – 32	< 0.005	< 0.005	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 - 51	< 0.006	< 0.006	< 5.0	< 5.0	—
1997 Phase 2 RFI	ST-219-26	10 – 12	—	—	3,200	11	—
		20 – 22	< 0.64	< 0.64	690	20	—
		30 – 32	< 0.67	< 0.67	8,800	110	—
		40 – 42	—	—	11	< 5.0	—
		49 - 51	< 0.006	0.008	130	< 5.0	—
	ST-219-27	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	< 0.005	< 0.005	< 5.0	< 5.0	—
		30 – 32	< 0.65	< 0.65	540	< 5.0	—
		40 – 42	—	—	3,200	< 5.0	—
		49 - 51	< 0.82	2.6	850	< 5.0	—
	ST-219-28	10 – 12	—	—	1,400	< 5.0	—
		20 – 22	—	—	970	< 5.0	—
		30 – 32	—	—	6,600	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 – 51	—	—	< 5.0	< 5.0	—
		60 – 62	—	—	200	320	—
	ST-219-29	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	—	—	< 5.0	< 5.0	—
		30 – 32	—	—	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 – 51	—	—	< 5.0	< 5.0	—
	ST-219-30	10 – 12	—	—	2,000	< 5.0	—
		20 – 22	—	—	5,000	< 5.0	—
		30 – 32	—	—	56	< 5.0	—
		37 – 39	—	—	120	< 5.0	—
	ST-219-31	10 – 12	—	—	1,300	< 5.0	—

Investigation Period	Soil Boring	Sample Depth [feet bgs]	PCE [mg/kg]	TCE [mg/kg]	TPH - GRO [mg/kg]	TPH-DRO [mg/kg]	TPH-JP4 (mg/kg)
		20 – 22	—	—	4,600	< 5.0	—
		30 – 32	—	—	250	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 – 51	—	—	< 5.0	< 5.0	—
	ST-219-32	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	—	—	< 5.0	< 5.0	—
		30 – 32	—	—	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
		49 – 51	—	—	< 5.0	< 5.0	—
	ST-219-33	10 – 12	—	—	4,700	< 5.0	—
		20 – 22	—	—	< 5.0	< 5.0	—
		30 – 32	—	—	< 5.0	< 5.0	—
		40 – 42	—	—	< 5.0	< 5.0	—
	ST-219-34	10 – 12	—	—	2,300	< 5.0	—
		20 – 22	—	—	< 5.0	< 5.0	—
	ST-219-35	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	—	—	< 5.0	< 5.0	—
	ST-219-36	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	—	—	< 5.0	< 5.0	—
	ST-219-37	10 – 12	—	—	< 5.0	< 5.0	—
		20 – 22	—	—	< 5.0	< 5.0	—
		30 – 32	—	—	< 5.0	< 5.0	—
1999 RFI	ST-219-28H	40 – 42	—	—	3,800	21	—
		50 – 52	—	—	3,600	16	—
		60 – 62	—	—	880	< 5.0	—
		70 – 72	—	—	11	< 5.0	—
		80 – 82	—	—	5.7	< 5.0	—
		90 – 92	—	—	< 5.0	< 5.0	—
		100 – 102	—	—	< 5.0	< 5.0	—

Investigation Period	Soil Boring	Sample Depth [feet bgs]	PCE [mg/kg]	TCE [mg/kg]	TPH - GRO [mg/kg]	TPH-DRO [mg/kg]	TPH-JP4 (mg/kg)
		110 – 112	—	—	< 5.0	9.4	—
		120 – 122	—	—	< 5.0	< 5.0	—
		130 – 132	—	—	< 5.0	< 5.0	—
		140 – 142	—	—	< 5.0	< 5.0	—
		150 – 152	—	—	< 5.0	< 5.0	—
	ST-219-29H	40 – 42	—	—	1,300	15	—
		50 – 52	—	—	1,300	20	—
		60 – 62	—	—	8.4	< 5.0	—
		70 – 72	—	—	18	< 5.0	—
		80 – 82	—	—	12	< 5.0	—
		90 – 92	—	—	< 5.0	< 5.0	—
		100 – 102	—	—	140	< 5.0	—
		110 – 112	—	—	< 5.0	< 5.0	—
		120 - 122	—	—	< 5.0	< 5.0	—

bgs – below ground surface
DRO – diesel-range organics
GRO – gasoline-range organics
JP – jet propellant
mg/kg – milligram per kilogram
PCE – tetrachloroethene
RFI – Resource Conservation and Recovery Act Facility Investigation
TCE – trichloroethene
— not analyzed for this constituent

monitoring points ST-219-38 (screened at 38 to 43, 73 to 78, and 98 to 103 ft bgs), ST-219-39 (screened at 38 to 43 and 73 to 78 ft bgs), ST-219-40 (screened at 18 to 23 and 38 to 43 ft bgs), ST-219-41 (screened at 10 to 15 ft bgs), and ST-219-42 (screened at 10 to 15 ft bgs) were installed at the site and used for performance monitoring of the ICM (bioventing). Soil sample analytical results were used to refine the extent of TPH vadose zone contamination and to aid in placement of the screen intervals for the soil vapor monitoring points. It should be noted that each screened interval was given a name to designate the specific screen interval soil vapor samples were obtained. An example of this would be the screened interval of 73-78 ft bgs for ST-219-38 would be called ST-219-38-74. Soil boring data are not available for these soil borings; however, ST-219-38, ST-219-39, and ST-219-40 are in close proximity to previously advanced borings ST-219-09, ST-219-04/-06/-07, and ST-219-13/-17, respectively.

3.3 Soil Vapor and Groundwater Characterization Investigations

Initial soil vapor characterization investigations were performed between 1999 and 2001. Subsequent soil vapor investigation occurred between 2003 and 2008 with the installation of additional vapor monitoring points to support SVE feasibility testing. Groundwater characterization began in 2001 with the installation of monitoring well KAFB-7001. Locations of soil borings and monitoring wells are shown on Figure 3-1. The location of KAFB-7001 is downgradient of the former OWS and was placed outside the flightline fence due to restrictions on drilling near the former OWS.

Contaminants are believed to have been flushed downward through the vadose zone as a result of leaking from failures in the area drain and the OWS. Removal of the OWS and repair of the area drain piping eliminated this mechanism for contaminant transport. Infiltration of precipitation is greatly inhibited by the pavement, and the primary mechanism for contaminant migration is currently believed to be vapor-phase transport, although storm water may still infiltrate the subsurface through the area drain. Vertical transport of contaminants is inhibited by low permeability sediments at roughly 25 to 45 feet bgs and 95 to 110 feet bgs. Some of the soil vapor monitoring and extraction wells have screened intervals that may overlap the low permeability sediments. Figure 3-1 presents the historic soil sampling locations at the Site. Soil sample data from previous investigation indicate TPH impacts are present, primarily at and between the OWS and the area drain as shown in Figure 3-2 which represents the TPH plume shell for soil concentrations above 250 mg/kg. Vapor and groundwater monitoring data indicate that these low permeability units significantly inhibit TPH migration to the regional aquifer. However, chlorinated solvents are denser and migrate downward through the vadose zone via vapor-phase transport. The chlorinated solvent, TCE, is currently detected in the deeper vadose zone soil vapor, as well as in groundwater at the site although at concentrations below regulatory concern.

3.3.1 1999 to 2001 Resource Conservation and Recovery Act Facility Investigaiton

Beginning in 1999, soil vapor monitoring points were routinely sampled during bioventing operations. Samples were analyzed for VOCs, TPH, and fixed gases (oxygen, nitrogen, carbon dioxide, and carbon monoxide). The vapor monitoring points were equipped with downhole electronic sensors for oxygen and TPH. Large data sets of oxygen and TPH concentrations were accumulated and used to evaluate the performance of the bioventing ICM. The results of the investigation indicated that bioventing was not effectively remediating TPH soil contamination and that the soil vapor plume was not migrating away from the site.

3.3.2 2001 Groundwater Investigation

One regional groundwater monitoring well, KAFB-7001, was installed in May 2001. The well was sampled on a quarterly basis to the present. Groundwater analysis has been performed for VOCs, SVOC, TPH, metals, and nitrate. The results of this investigation identified chlorinated and fuel-related VOCs as

groundwater contaminants of potential concern (COPCs). Fuel-related contaminants were rarely detected in groundwater samples and if detected, concentrations were far less than regulatory levels. The chlorinated solvent compound, TCE, is routinely detected in groundwater samples at concentrations less than the MCL of 5 micrograms per liter (µg/L).

3.3.3 2001 to 2004 Resource Conservation and Recovery Act Facility Investigation

Additional soil vapor investigations were performed at the site in response to the identification of TCE detections in groundwater. A large-scale passive soil gas investigation was performed in 2001 to determine if there were other areas of chlorinated solvent releases to the subsurface. One additional soil boring was drilled with two nested soil vapor wells, KAFB-7002 and KAFB-7003, installed to depths of 95 and 330 ft bgs, respectively. Feasibility testing was performed to determine if SVE was a viable alternative to bioventing at the site. The results of these investigations indicated that TCE migration to groundwater was by vapor transport and that SVE was a viable remediation technology for the site. The investigations did not identify other significant sources of chlorinated solvent releases in the area.

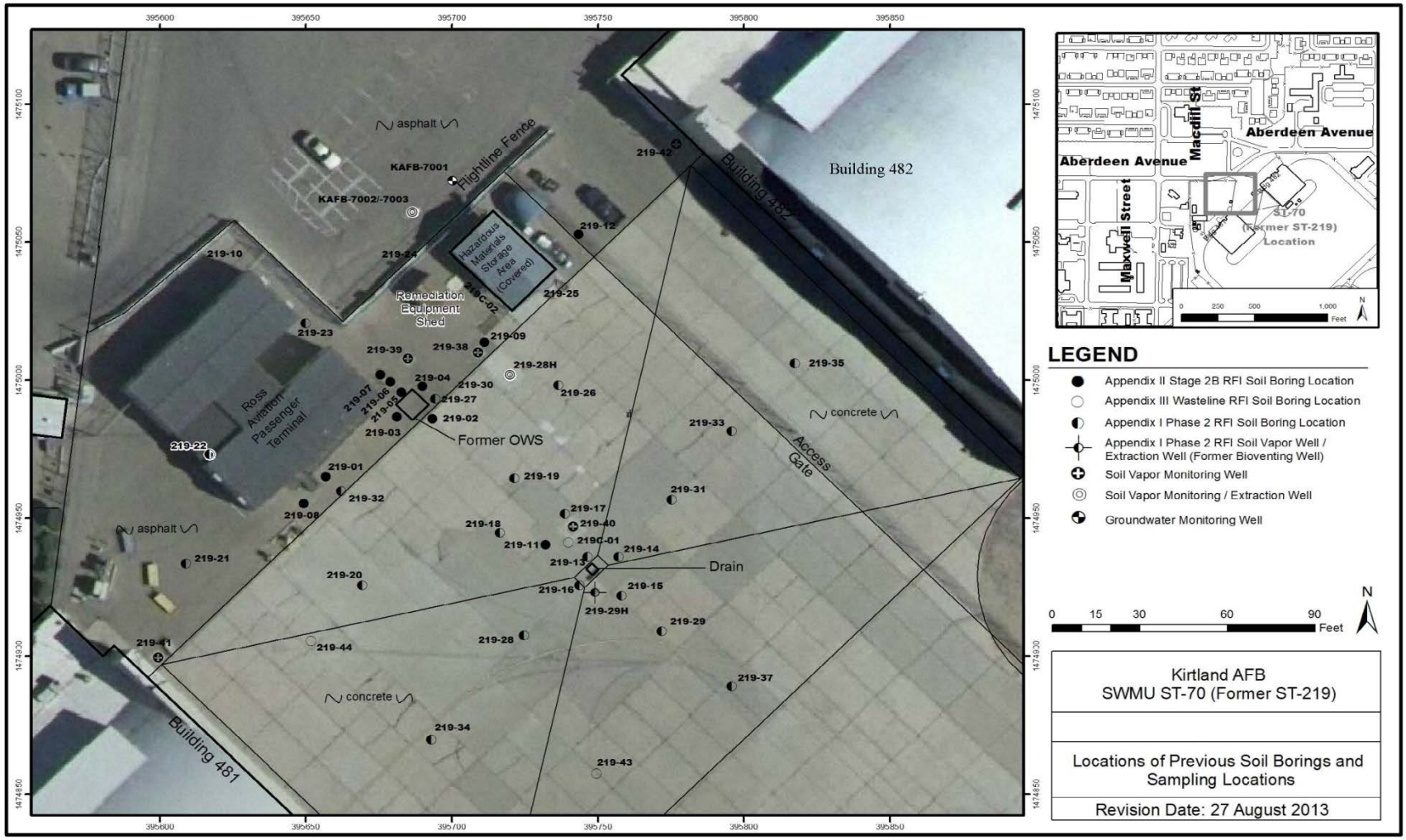

Figure 3-1. Locations of Previous Soil Borings and Sampling Locations

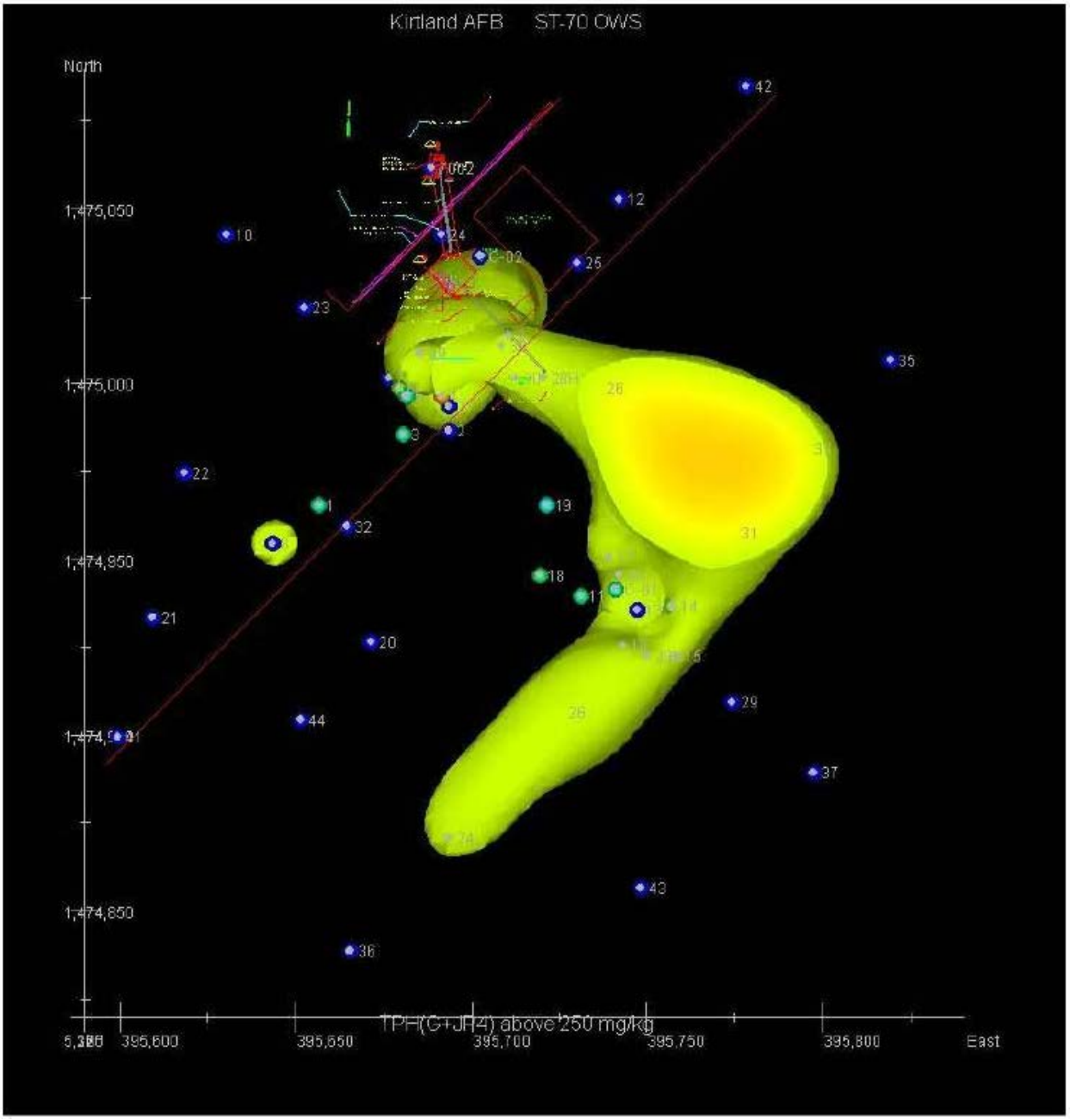

Figure 3-2. Total Petroleum Hydrocarbon Plume Shell

Note: Figure was excerpted from the *Site Characterization and Soil Vapor Extraction Optimization Report for Solid Waste Management Unit ST-70, Buildings 481/482 Oil Water Separator (Fromer ST-219), July 2012 Through June 2013* (USAF, 2013b).

3.4 Soil Vapor and Groundwater Characterization Monitoring

The ICM at SWMU ST-70 was converted from bioventing to SVE in 2008. The feasibility testing and results are presented in the *Interim Corrective Measures Work Plan for Solid Waste Management Unit ST-70 (Former ST-219)* (USAF, 2008) and the *Interim Corrective Measures, Construction Summary Report for the Soil Vapor Extraction System, Solid Waste Management Unit ST-70 (Former ST-219)* (USAF, 2009a). Subsequent to initiation of full-scale SVE operations, routine site monitoring and ICM performance monitoring was performed on a quarterly basis.

Soil vapor and groundwater monitoring have been performed using the existing monitoring points and well network from 2008 to the present. Soil vapor and groundwater have been analyzed for VOC and TPH COPCs. Kirtland AFB has added supplemental analyses for nitrate and metals to the groundwater monitoring program to provide additional regional groundwater data.

The existing vapor monitoring network was largely constructed to support bioventing. The installed monitoring points and downhole electronic sensors were not intended for use in an LTM program. The electronic sensors failed prior to the conversion from bioventing to SVE and are no longer in use. The sample port tubing has clogged or failed at vapor well point locations ST-219-38-74, ST-219 39-75, ST-219-40-40, and ST-219-42, and is not repairable. Soil vapor monitoring is currently performed at nine vapor monitoring points consisting of three vapor extraction wells (ST-219-28H and KAFB 7002/7003) and several operational monitoring well sample ports from six monitoring wells (ST-219-29H [1 port], ST-219-38 [2 ports – 41 ft and 99 ft], ST-219-39 [2 ports – 42 ft and 75 ft], ST-219-40 [1 port – 20 ft], ST-219 41 [1 port – 15 ft], and KAFB 7001 [1 port]).

The groundwater monitoring well, KAFB-7001 continues to be monitored quarterly. A dedicated Bennett pump is installed in the well, which can be removed and repaired as necessary.

3.5 History of Interim Corrective Measures

The USAF has performed extended vadose zone remediation and treatment at SWMU ST-70. The primary source of contamination was eliminated with the removal of the OWS and repair of the area drain conveyance piping. The bioventing ICM was initiated subsequent to the 1999 RFI and was discontinued in 2001. The SVE ICM was initiated in 2008 and continues to the present. The history of the ICMs is summarized in the following paragraphs.

3.5.1 Bioventing

A bioventing system was installed in 1999 and operated until 2001 to remediate vadose-zone petroleum hydrocarbon impacts. A groundwater monitoring well (KAFB-7001) was installed in 2001. In December 2001, the bioventing system was shut down due to the low observed rates of petroleum hydrocarbon degradation in the vadose zone and the identification of chlorinated solvents in groundwater samples (USAF, 2005).

Construction of the bioventing system began in 1999. Much of the bioventing infrastructure installed at the site was later used for the SVE system. A bioventing pilot-scale study involved the installation of five soil vapor sensor wells (ST-219-38 through ST-219-42) and the active ventilation of the site subsurface with humidified air through a previously installed injection well (ST-219-28H). The bioventing system at ST-219 was constructed using a single air-injection well (ST-219-28H) and a single vent well (ST-219 29H). Soil vapor sensor wells were located within the bioremediation zone, as well as at the extent of the anticipated radius of influence (ROI) of the injection well to evaluate the system performance (USAF, 2005).

Bioventing feasibility testing was performed using data from the wells constructed on site, from subsurface sampling, and from testing at other similar areas of Kirtland AFB. The ROI information was gathered from the nearby site ST 341 and the blower size was calculated based on the air flow needed to affect the contaminated vadose zone area. Soil samples were collected from ST-219-38, ST-219-39, and ST-219-40 at SWMU ST-70 in 1999 and analyzed for microbial populations. The sample analyses identified the presence of bacteria capable of degrading TPH contamination. In situ respiration testing was performed at the site and initial results indicated that conditions were favorable for bioventing. Initial calculations indicated that most of the TPH contaminant mass would be degraded after two and a half years of bioventing (USAF, 2005). However, in situ respiration testing conducted during bioventing operations in 2000 and 2001 failed to confirm the initial estimate of TPH degradation rates.

Although monitoring data have indicated that bacterial populations at the site were sufficient to degrade the TPH mass in the subsurface, data collected during operation of the bioventing system in 2000 and 2001 did not identify significant contaminant mass removal at the site. Continual operation of the system proved to be ineffective.

The bioventing system was shut down in December 2001 due to poor contaminant degradation rates and the inability to address chlorinated VOC contamination. In 2001, TCE was detected in groundwater beneath the site. The SWMU ST-70 remediation strategy subsequently changed to one that was capable of addressing both petroleum hydrocarbon and chlorinated solvent contamination.

3.5.2 Soil Vapor Extraction Feasibility and Testing

SVE feasibility testing was performed in 2003 using a short-term SVE feasibility test. These data were published in the 2005 RFI report, along with the recommendation that SVE be adopted as the preferred ICM. The recommendation was approved by reviewers, and the bioventing system was converted to the current SVE system between 2007 and 2008.

The initial pilot-scale SVE feasibility test in early 2003 used the existing well, ST-219-28H, as the extraction well. The existing blower was reversed and soil vapor was extracted from the well. The SVE system monitoring data indicated that contaminant mass was successfully removed from the vadose zone (USAF, 2009a). Further pilot-scale testing was conducted in late 2003 following the installation of wells KAFB-7002 and KAFB-7003. The second phase of pilot-scale testing used the new soil vapor monitoring wells (KAFB-7002/7003), in addition to well ST-219-28H, as extraction points. Monitoring well ST-219 29H was not used as an extraction well; it was only used as a soil vapor monitoring wells during these tests. Results of the pilot-scale tests indicated that SVE would be an effective alternative for remediation of chlorinated solvents and petroleum hydrocarbons in the subsurface at the site (USAF, 2009a).

Between November 2007 and April 2008, the pilot-scale system was expanded into a full-scale system with vapor monitoring wells (KAFB-7002 and KAFB-7003) converted into vapor extraction wells. The full-scale system was started in April 2008. After three months of operation, TPH concentrations in the treatment system influent soil vapor increased to levels higher than anticipated in the original design. These high concentrations had the effect of rapidly loading the granular activated carbon (GAC) offgas treatment system more than originally designed for or expected. The SVE system was shut down to perform further testing and evaluate options for offgas treatment. The offgas treatment was modified to handle higher influent vapor concentrations by passing the treated effluent through two 55-gallon GAC drums in series, and the SVE system was restarted in December 2008 (USAF, 2009a).

3.5.3 Current SVE Operations

The current SVE system was designed to recover chlorinated solvent and petroleum hydrocarbon VOCs released at the site and was constructed according to the design presented in the ICM Work Plan for SWMU ST-70 (USAF, 2008). 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 via subsurface piping to the three extraction wells (ST-219-28H, KAFB-7002, and KAFB-7003).

The SVE system had been in full-scale operation since the December 2008 restart with minimal unplanned downtime. System operational data indicate that TPH contaminant mass continues to be removed from the subsurface. However, site monitoring data indicate that a significant mass of TPH and chlorinated solvents remain in the subsurface.

According to previous reports (USAF, 2012c), contaminant mass removal efficiency during SVE operations was observed to fluctuate on a seasonal basis. A rebound study was proposed in prior ICM monitoring reports to evaluate the seasonal change in removal efficiency (USAF, 2011; USAF, 2012b). A limited rebound study was implemented in June 2011 and the results indicated that extended downtime would not result in significant contaminant migration. An extended rebound study was implemented from January to April 2012. The results indicated that a seasonal shut down of between one and three months would decrease the volume of waste generated and reduce wear on SVE system components without significant adverse impacts to the overall ICM performance (USAF, 2012c).

URS received responsibility of the ST-070E site the end of March 2014. The system had not been operating for an indeterminate period of time, but is assumed to have been shut down in June 2013. Following a technical evaluation of the existing system, it was restarted in June 2014 and has been operational since that time. As discussed in the *System Evaluation Report for Solid Waste Management Unit ST-70 (ST-070E), Buildings 481/482 Oil Water Separator* (USAF, 2014c), operation of the existing system will be optimized by selectively extracting from those wells exhibiting the higher VOC and TPH concentrations. Currently, the system is extracting vapor solely from extraction well ST-219-28H, which has screened intervals from 10 to 35 feet and from 50 to 90 feet bgs. The system is able to extract vapors at a flow rate of 80 to 85 standard cubic feet per minute.

3.6 Contaminated Pathways and Receptors

The potential migration pathways for petroleum hydrocarbons and chlorinated solvent contamination at the ST-070E Site are limited by site factors. The upper physical boundary of contaminants in both soil and soil vapor is primarily either the concrete or asphalt paved ground surface. During field work, the asphalt and concrete at the Site was observed to be in generally good condition and would be expected to limit direct contact with contaminants in soil, or vapor-phase transport of contaminants to the ground surface and potential for exposure.

As discussed in the *Environmental Restoration Program RCRA Facility Investigation Report, Solid Waste Management Unit ST-70 (Former ST-219)* (USAF, 2005), a preliminary indoor air survey indicated no significant soil vapor intrusion appeared to be occurring at buildings adjacent to the Site. The indoor air sampling completed did not warrant additional sampling at the time. Additional shallow soil vapor sampling was recommended based on findings of a passive (Gore-Sorber®) soil vapor survey that identified elevated chlorinated solvents (TCE and PCE) in soil vapor at the north corner of Building 482 on the outer extent of the vapor survey.

The lower boundary of the soil contamination has been vertically delineated as only extending to roughly 100 ft bgs, which is several hundred feet above the regional groundwater table. The former OWS source has been removed and remaining contaminants are sorbed to the soil. Based on very low infiltration rates and the impermeable cover in the area, it is unlikely that residual soil concentrations will migrate to the groundwater. The lower boundary of the detected contaminants in the vapor phase is the regional groundwater table. Vapor-phase contaminants may be responsible for low-level impacts to the regional water table through diffusion directly into the groundwater. TCE has been detected in well KAFB-7001 at concentrations below the MCL. Potential receptors of contaminants in the regional groundwater table include the downgradient Kirtland AFB drinking water production wells, KAFB-12, KAFB-14, and KAFB-15.

Continued remediation of the vapor-phase chlorinated hydrocarbons and petroleum hydrocarbons within the subsurface of the Site will limit migration of the vapor plume and continue to shrink the plume reducing potential exposures. The existing system has limited efficiency; therefore, a new, larger system will be installed that will more aggressively extract and treat the vapor-phased contaminants residing in the subsurface thereby mitigating the risk to human and ecological receptors.

3.6.1 Analytical Results Summary

Soil vapor concentrations have fluctuated over time, but indicate significant contaminant mass remains in the areas adjacent to the former OWS and area drain. Soil vapor concentrations fluctuated significantly during the first year of SVE operation, but no longer show significantly decreasing trends at most monitoring locations. Contaminant concentrations at SVE wells fluctuate seasonally, with the lowest concentrations occurring in the winter months. The extraction system is less efficient during the winter months due to vapor condensation in the extraction piping and reduced volatilization of soil contaminants due to low temperatures (USAF, 2013c). A subset of time series plots of soil vapor concentrations for specific compounds (i.e., PCE, TCE, and TPH) detected in SVE wells, the SVE influent, and/or soil vapor monitoring wells are presented in Appendix A. These plots show a fluctuating trend for TPH and a decreasing trend for PCE and TCE concentrations in the SVE wells and SVE influent. However, TCE concentrations in most monitoring wells, with the exception of ST-219-29H, generally do not show a decreasing trend. This may point to possible diffusion-limited mass transfer at the SVE wells and a need for system optimization.

3.6.2 Current Vapor Contamination Extent

Contaminants detected in soil vapor are primarily associated with chlorinated solvents, fuel hydrocarbons, and their breakdown products. The highest concentrations of VOC contaminants are detected adjacent to the former OWS and the area drain. Recent concentrations and detection patterns are consistent with historical values from 2010 and 2011.

In 2012 and 2013, all 10 chlorinated VOC COPCs were detected in samples from vapor monitoring points and vapor extraction wells. However, only PCE, TCE and cis-1,2-dichloroethene (cis-1,2-DCE) were detected at relatively high concentrations above 500 parts per billion by volume (ppbv). The highest concentrations of these COPCs detected during the 2013 monitoring events were in samples from vapor monitoring point ST-219-39-42. This location is the shallow sample port adjacent to the former OWS. In addition, the screened interval of ST-219-39-42 appears to overlap a low permeability zone approximately between 25 and 40 ft bgs. This may suggest a significant VOC mass is bound within the low permeability zone.

In 2012 and 2013, all 10 fuel-related COPCs including TPH-gasoline-range organics (GRO) were detected in samples from vapor monitoring points. However, only 1,2,4-trimethylbenzene, 1,3,5-

trimethylbenzene, xylenes, and TPH GRO were detected at concentrations above 500 ppbv. The highest concentrations of these analytes were detected during the 2013 monitoring events in samples from vapor monitoring point ST-219-40-20. This location is the shallow sample port adjacent to the area drain.

In addition to fuel and chlorinated solvent-related contaminants, three chlorofluorocarbons and one brominated VOC are regularly detected in samples from SWMU ST-70. These detections are typically at concentrations below 10 ppbv with no observed spatial distribution pattern.

3.6.3 Vapor Contamination Trends

Vapor concentrations of TPH fluctuate seasonally and concentrations of chlorinated COPCs decreased sharply during 2008 and 2009 at the SVE wells. Vapor concentrations of all COPCs in samples from monitoring points adjacent to the area drain and the former OWS remain high, with little or no downward trend. Appendix A presents a selection of time series plots of soil vapor concentrations in soil vapor monitoring and extraction wells, as well as in the SVE system influent. Appendix B presents historical soil vapor concentration data.

Chlorinated VOC concentrations in the 2012 and 2013 vapor samples from all extraction wells were below 600 ppbv. When SVE operations began, soil vapor concentrations of TCE and PCE from the extraction wells were as high as 5,060 ppbv and 1,980 ppbv, respectively. The highest PCE concentrations were typically detected in the shallowest extraction well, ST-219-28H. The highest cis-1,2-DCE concentrations were detected at the mid-depth extraction well, KAFB-7002. High concentrations of TCE (up to 577 ppbv) were detected at all three extraction wells.

Chlorinated VOCs continue to be detected at high concentrations in samples from monitoring points ST-219-38 and ST-219-39, which are nearest the OWS. Concentrations of TCE and cis-1,2-DCE continue to be detected in samples from these monitoring points at concentrations greater than 5,000 ppbv. PCE is typically detected at lower concentrations; however, it continues to be detected at ST-219-39 at concentrations greater than 1,000 ppbv. Both of these monitoring wells have screened intervals which appear to overlap low permeability zones which may contain sorbed VOC mass.

Soil vapor concentrations of TPH fluctuate seasonally in samples collected from the extraction wells. Low concentrations are measured during the winter months when condensation is present in the extraction piping and contaminant volatilization decreases due to lower temperatures. The highest measured concentrations typically occur in the summer months in samples from extraction well ST-219-28H. Long-term trends in sample data from the extraction wells do not indicate a significant decline in TPH mass.

High concentrations of TPH-GRO are detected in samples from vapor monitoring points adjacent to both the OWS and the area drain (ST-219-38, ST-219-39, and ST-219-40). Soil vapor concentrations of TPH GRO in samples from these monitoring locations remain above 1,000 µg/L.

3.6.4 Groundwater Constituent Trends

The purpose of groundwater monitoring is to evaluate whether site constituents have impacted groundwater. To date, groundwater has apparently not been impacted with concentrations greater than regulatory standards. There is currently one groundwater monitoring well (KAFB-7001) associated with ST-070E and it is located north of the hazardous materials storage area outside the flightline fence. Regional groundwater flow in the vicinity of ST-070E is believed to flow to the east-northeast. Therefore, impacts to groundwater originating from the source area may reasonably be expected to be detected in KAFB-7001. Groundwater monitoring of KAFB-7001 is performed on a quarterly basis.

The primary groundwater constituent of potential concern is TCE, which has been detected at concentrations between 0.29 and 1.8 µg/L. Concentrations remain less than the drinking water MCL of 5.0 µg/L. Hydrocarbon fuel-related COPCs such as toluene and acetone have been sporadically detected in groundwater samples at concentrations less than regulatory limits. Halogenated VOCs are detected in groundwater samples more regularly, but are less than regulatory limits and commonly at J-flagged (estimated) concentrations below 1 µg/L. Groundwater is occasionally monitored for TPH-GRO and was historically monitored for SVOCs. TPH has not been detected in validated groundwater sample results since at least 2008.

Concentration trends of TCE in groundwater samples from monitoring well KAFB-7001 were stable for most of the historic monitoring period and then slightly increased in 2012. Groundwater TCE concentrations were at or below 0.6 µg/L for much of the monitoring history from 2004 to 2011. Concentrations increased to 1.7 µg/L in 2012 and remained close to that concentration in sample results from 2013. 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. Over the last three years, groundwater elevations in monitoring well KAFB-7001 have risen from 464 ft bgs in 2010 to 458.5 ft bgs in 2013. Regional groundwater flow direction appears to have shifted slightly in the northern portions of Kirtland AFB during this period. According to groundwater monitoring data from 2009 to 2012 in this area, flow gradients shifted from a northeasterly flow to an east-northeasterly flow. It is believed that the shift in groundwater flow direction resulted in the increase in groundwater TCE concentration in monitoring well KAFB-7001.

4.0 PROCEDURES FOR IMPLEMENTATION

This section provides the general procedures for implementing the interim measures to be undertaken at ST-070E. SVE will be implemented to address the remaining contamination in the vadose zone in an effort to mitigate potential impacts that the vadose zone contaminants may have on the regional aquifer. Figure 4-1 provides a proposed layout for the SVE system installation, including the proposed locations of the extraction wells. The proposed well locations are based on a combination of the historic soil boring data coupled with the TPH shell developed and presented in Figure 3-2. As determined during the SVE feasibility test, the presumed ROI for ST-070E is approximately 200 ft (USAF, 2009). Evaluation of the ROI will be performed during installation of the new extraction wells and SVE system. The actual layout and final installation locations of the wells may differ depending on factors encountered in the field (e.g., utilities preclude access to a location). The following specific tasks will take place at the site subject to interim measures under this work plan:

- Pre-mobilization activities
- Mobilization/site setup
- Extraction well installation
- SVE system installation
- Long-term groundwater monitoring
- System operation and maintenance
- Management of investigation-derived waste (IDW)
- Site restoration
- Site surveying.

4.1 Pre-Mobilization Activities

Prior to mobilization of equipment, subcontracted services (e.g., drilling subcontractor, New Mexico licensed surveyor, and approved analytical laboratory) will be procured. All necessary permits (e.g., digging permits, drilling permits, etc.) will be initiated. All site activities will be coordinated with the appropriate Kirtland AFB personnel.

Prior to initiating intrusive activities, a completed and approved Air Force Form 332 will be obtained for authorization of construction work at Kirtland AFB. A request for locating underground utilities in the area will be submitted to the local one-call utility notification center, as applicable. Additionally, Air Force Form 103 will be submitted to request that the location of underground utilities be marked at the specific sites. Drilling and excavation locations will be identified with white paint, white flags, or stakes, as appropriate to the surface material. Utility clearance approvals will be completed by the appropriate Kirtland AFB utility office (e.g., telephone, sewer, water, natural gas, etc.).

In support of the activities to be performed at the ST-070E site, a project-specific Quality Assurance Project Plan (QAPP) and a basewide Health and Safety Plan (HASP) have been prepared.

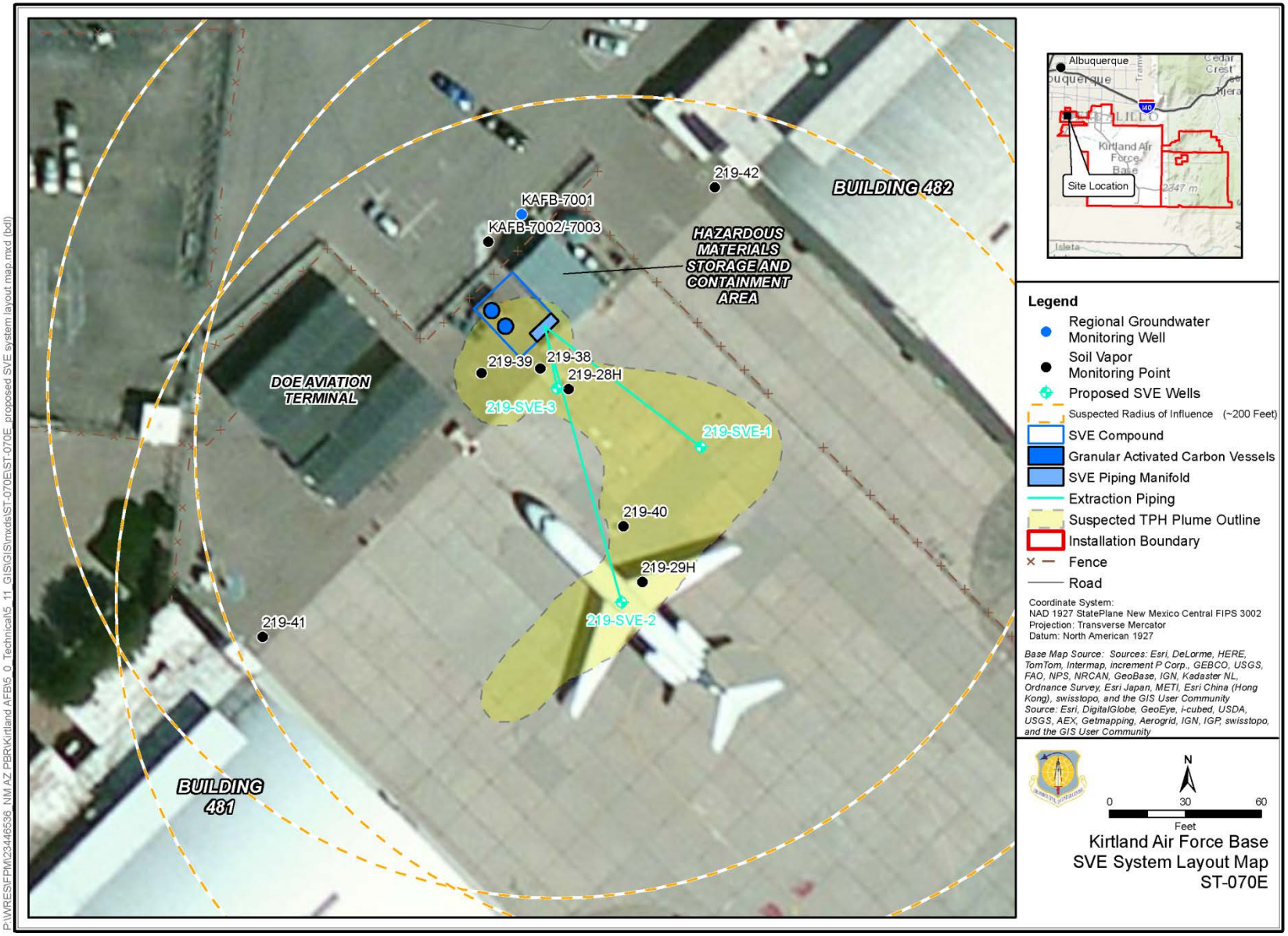

Figure 4-1. SVE System Conceptual Design Layout

4.1.1 Quality Assurance Project Plan

The *Draft Uniform Federal Policy Quality Assurance Project Plan, ST-070E – Oil-Water Separator (ST-219)* (USAF, 2014b) provides the direction necessary for the collection of data required for assessment of the groundwater underlying the Site, vadose zone soils collected during extraction well installation, and operation and maintenance of the SVE system. The plan was written in accordance with the QAPP requirements and elements set forth in the Intergovernmental Data Quality Task Force Uniform Policy for QAPPs by the EPA, dated March 2005, which was adopted by the AFCEC. QAPPs written in the Uniform Federal Policy format integrate the technical and quality aspects of a project, including planning, implementation, and assessment and include all the elements of a Sampling and Analysis Plan. Groundwater sampling requirements will also follow URS Standard Operating Procedures (SOP)-15 Groundwater Purging and Sampling (Appendix A of the QAPP).

As outlined in the QAPP, quality assurance objectives are specified to ensure that data produced are of a known and sufficient quality for determining whether a risk to human health or the environment exists. Minimum precision, accuracy, and completeness measurements and minimum detection limits are quantitative objectives specified in the QAPP. Representativeness and comparability are qualitative objectives. During the sampling discussed in the QAPP, field quality control samples will be collected and analyzed to evaluate the achievement of the precision and accuracy objectives specified in the QAPP. Overall, both field and laboratory precision will be evaluated through the results of duplicate samples, equipment rinsates, and field blanks. The duplicate samples, equipment rinsates, and field blanks will be analyzed for the same suite of analytes as the regular samples. Trip blanks to be analyzed for VOCs will be included in each cooler containing VOC samples shipped to the laboratory.

Environmental analyses are critical, because decision-making based on inaccurate measurements or data of unknown quality can have significant economic and health consequences. Data verification and validation will be performed as specified in the QAPP to ensure data meet the project requirements. Method data validation is the process whereby analytical data are reviewed against set criteria to ensure that the results conform to the requirements of the analytical method and any other specified requirements. All laboratory-generated data will be validated in accordance with the requirements of the QAPP. The field-generated data will not be validated, but the quality of the field-generated data will be ensured through adherence to established operating procedures and use of equipment calibration and standardization, as appropriate.

4.1.2 Health and Safety Plan

The *Health and Safety Plan – Basewide* (USAF, 2014d) has been prepared and addresses the tasks and conditions to be encountered during this project. The HASP presents the health and safety requirements and guidelines for field operations addressed under the Environmental Restoration Program at Kirtland AFB, specifically for the 12 sites being administered by URS under terms of the AFCEC Contract No. FA8903-13-C-0008. The purpose of the HASP is to identify and educate personnel of the potential hazards associated with field activities at Kirtland AFB. Subcontractors working for URS at task sites will be responsible to provide their own HASPs and provide documentation to URS that describes their plan for addressing applicable health and safety requirement for activities that are unique to their scope of services. The HASP is a living document and may be updated as conditions dictate. The HASP covers the following items:

- Project team organization and responsibilities
- Training and medical monitoring requirements
- Site hazard analysis

- Emergency response plan
- Personal protective equipment and medical screening
- Frequencies and types of air monitoring
- Site control measures and safe work practices
- Decontamination procedures
- Site inspections
- Recordkeeping

The *Health and Safety Plan – Basewide* (USAF, 2014d) is augmented by the URS Health and Safety Program's relevant Safety Management Standards that were developed under the company's Health and Safety Management System and are required to be available on-site during all activities.

4.2 Mobilization and Site Setup

Personnel, equipment, and resources necessary to implement the interim measures will be mobilized to the Site. Warning signs and safety fencing may be used, where necessary, to delineate the work zone and indicate the potential hazards. The work zone will be established so as to maintain the work area clear of obstructions and to provide clearly marked vehicle paths and parking areas. Setup will also include establishing a laydown area for material storage and other equipment staging as required.

4.3 Vapor Extraction Well Installation

Three new extraction wells will be installed at the Site along with conveyance piping connecting the wells to the location of the new SVE system. Well drilling activities will be performed by a drilling company licensed by the State of New Mexico. The wells will be installed in accordance with NMED *Ground Water Quality Bureau Monitoring Well Construction and Abandonment Guidelines* (NMED, 2011), as well as the applicable parts of Section 6.5.17.10, "Groundwater Monitoring Well Construction Requirements," as provided in the *Hazardous Waste Treatment Facility Operating Permit, EPA ID No. NM9570024423* (NMED, 2010).. The boreholes will be advanced such that the borehole diameter will be at least 4 inches larger than the outer extent of the nested wells to allow for proper placement of the well piping, filter pack(s), and sealant.

During drilling, a geologist will document the following information for each boring:

- Well identification (this identification will be unique, and ensure it has not been used previously at the Base);
- Purpose of the boring (e.g., vapor extraction well);
- Location in relation to an easily identifiable landmark;
- Names of drilling subcontractor and logger;
- Start and finish dates and times;
- Drilling method;
- Diameters of surface casing, casing type, and methods of installation;
- Lithologic descriptions and depths of lithologic boundaries;

- Sampling-interval depths; and
- Other pertinent field observations.

Descriptions of unconsolidated soil samples from drill cuttings, continuous core, and/or split spoons will be described in the following order:

- Material type (i.e., sand [sandstone], silt [siltstone], clay [claystone], etc.)
- Color
- Grain size, sorting, rounding, and make-up of the material (for sand or gravel)
- Types and amounts of secondary constituents
- Other pertinent characteristics (plasticity, hardness, bedding, etc.)
- Moisture content
- Unified Soil Classification System code (for unconsolidated material)

Consolidated rock material (granite bedrock) will be logged using drill cuttings, rock core, and/or split spoons and described in the following order:

- Rock Type
- Color
- Grain size and shape
- Texture (stratification. foliation)
- Mineral composition
- Weathering and alteration
- Strength
- Other relevant notes

Well installation equipment will be decontaminated according to the specifications of the URS SOP-20 *Decontamination* provided in the Appendix A of the project QAPP, and will comply with the decontamination requirements outlined in Section 6.5.3, "Decontamination Procedures," provided in the *Hazardous Waste Treatment Facility Operating Permit, EPA ID No. NM9570024423* (NMED, 2010).

4.3.1 Well Construction and Vadose Zone Sampling

Each of the three boreholes will be advanced to a depth of up to 180 ft. As the boreholes are being drilled, soil samples will be collected from split-spoons during the advancement initially at 10-foot intervals. The frequency may be increased based on field VOC measurements. Photoionization detector (PID) measurements will be collected at each sample interval in accordance with URS SOP -33 *Organic Vapor Measurement* provided in Appendix A of the QAPP. PID measurements will be recorded on the sample collection logs. In addition to PID measurements, a direct-reading meter will be employed to identify chlorinated VOC versus petroleum constituents. Results of the PID measurements coupled with the direct-reading meter results will be used to determine the optimum locations for the extraction zones for each of up to three nested wells to be constructed in each borehole. The decision as to placement of the

extraction intervals will be based on a combination of higher VOC concentrations and lithology taking into account the soils that are most amenable (higher permeability) to vacuum extraction.

Soil sample collection and documentation will be performed according to URS SOP-30, *Soil Sampling*, provided in Appendix A of the project QAPP. This SOP outlines the step by step procedure for describing the methodology for collecting soil samples in order to document the horizontal and vertical extent of impacts to soils. Soil samples collected from the Site will be analyzed for VOCs (SW-846 Method 8260B), PAHs (SW-846 Method 8270D-SIM), metals (SW-846 Method 6010B), anions (SW-846 Method 9056), and TPH-GRO and diesel range organics (EPA 8015M). Soil sample collection will be performed in accordance with the *Draft Uniform Federal Policy Quality Assurance Project Plan, ST-070E – Oil-Water Separator (ST-219)* (USAF, 2014b). Soil samples will be collected using a 2-foot long split spoon. The VOC samples will be obtained directly from the split spoon material immediately upon opening of the split spoon to minimize volatilization of constituents. Sample material from the split spoon for other analyses will be homogenized prior to placement in the analytical laboratory sample containers.

The nested wells will be screened with 2-inch diameter American National Standards Institute (ANSI) Schedule 40 polyvinyl chloride (PVC) piping. Each well will be constructed with a 2-inch diameter ANSI Schedule 40 PVC 0.01-inch slotted well screen at depths determined from the field PID measurements. If it is determined that only one interval will be screened in a given borehole, the extraction well will be completed as a 4-inch diameter rather than as 2-inch diameter extraction well. Annular materials will be installed during nested well installation as the drill casing is removed from the borehole. Silica sand (10-20) will be used to form the filter pack around the slotted casings. The filter pack will be installed to a depth of 2 to 3 ft above the top of each screen to allow for settling. A bentonite seal of a minimum of 2 to 3 ft will be placed in the interval between well screens. Following placement of the bentonite pellets, the material will be allowed to hydrate for at least 2 hours prior to proceeding with additional placement of annular materials. The remaining annulus will be sealed from the shallowest bentonite seal to the surface using cement-bentonite grout (5% bentonite). The tops of the nested well casing will be finished with slip caps pending connection to the SVE conveyance piping and final wellhead completion. Figure 4-2 provides a conceptual design of the typical SVE extraction well.

4.3.2 SVE Well Head Completion

Each nested well will be connected to dedicated PVC ball valves and the well capped with threaded PVC caps. The threaded caps topping the wells will have ¼-inch brass ball valves and sampling ports. Each sampling interval will be equipped with its own sampling port and vacuum gauge. Both the sampling port and the vacuum gauge will be located on the well side of the ball valves. The vacuum gauges will have a measurement range of 0 to 60 inches of water.

The SVE wells will be completed to surface grade in an aircraft traffic-rated locking vault. The concrete completion for the well vault will extend at least 6 inches around the vault, and the design will specify that the concrete depth will be rated for aircraft. Figures 4-3 and 4-4 present the top and side views of the conceptual design of the SVE well heads.

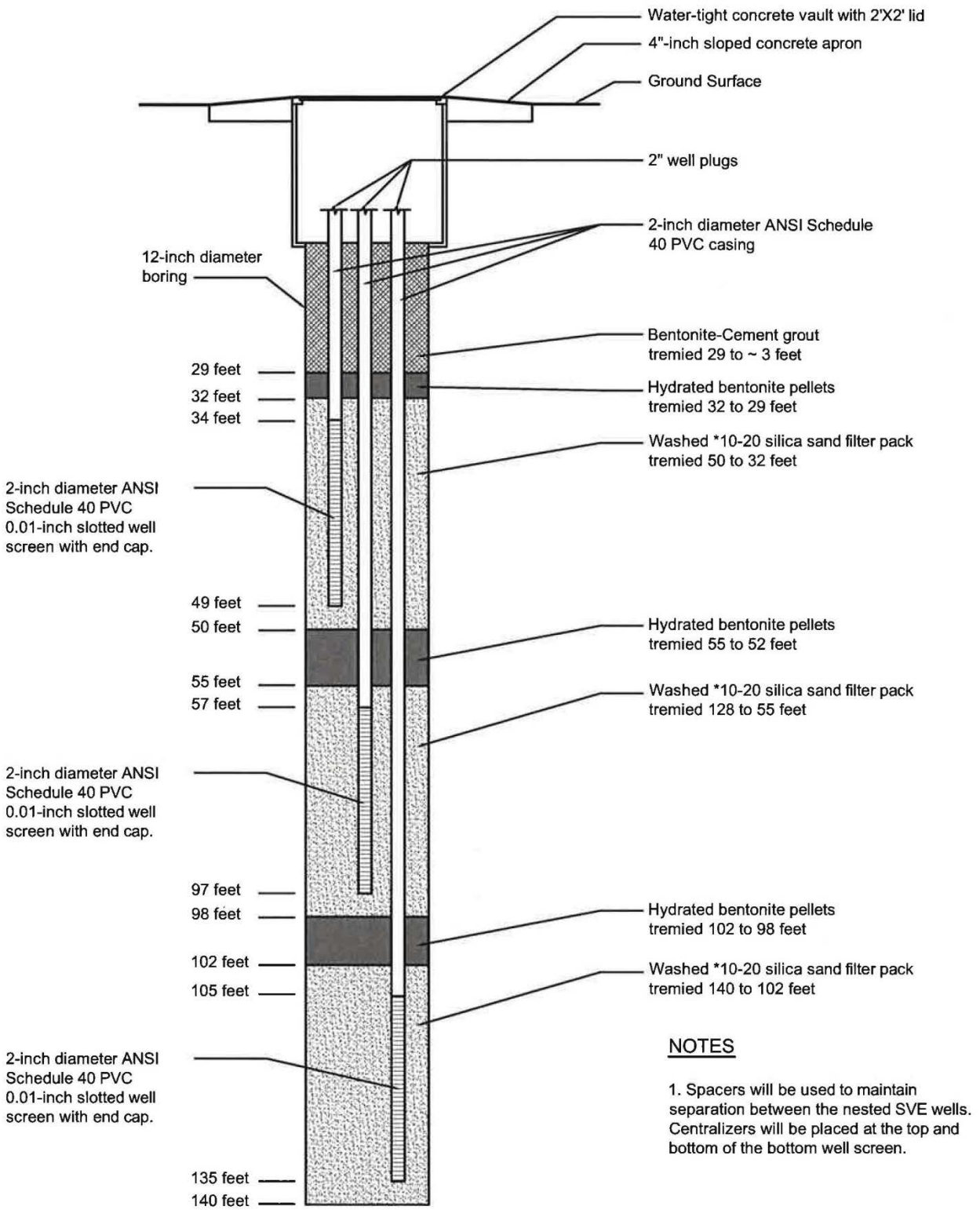

Figure 4-2. Typical SVE Well

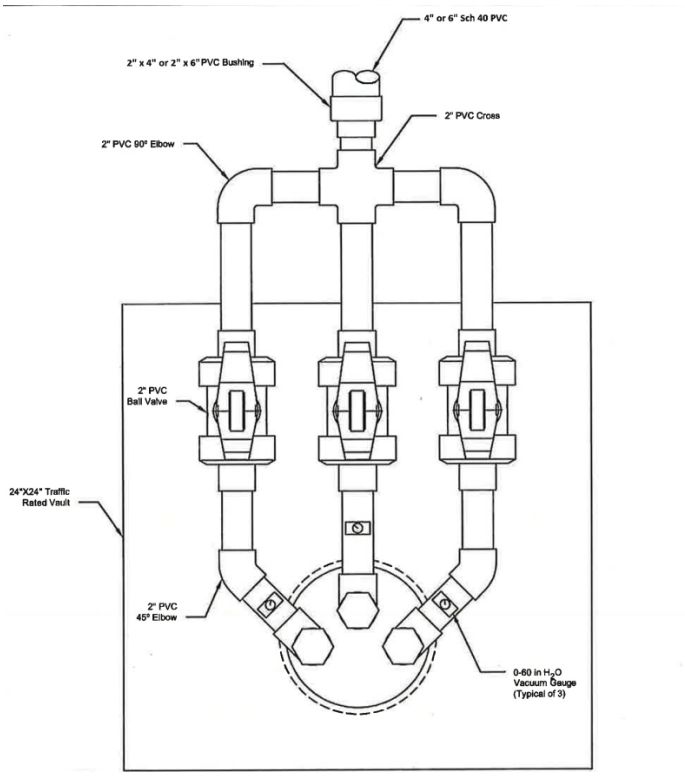

Figure 4-3. Typical SVE Well Head – Top View

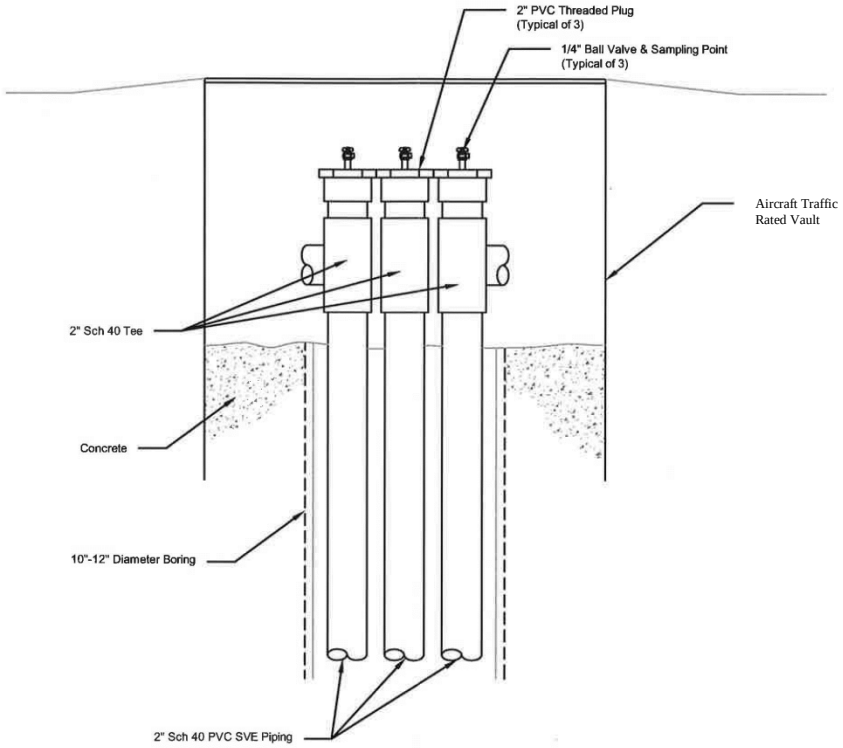

Figure 4-4. Typical SVE Well Head – Side View

4.4 Soil Vapor Extraction System Installation

Contamination in the vadose zone will be addressed through implementing SVE at the site. An existing SVE system is currently operating at the site. The extraction wells associated with the existing system are not optimally located to address the vadose zone contamination plume. In addition, the existing system is undersized for addressing the estimated volume of VOCs and petroleum hydrocarbons residing in the subsurface at the Site. This section provides an overview of the design elements for a new proposed SVE system. The final design details will be determined during execution of this Work Plan. Figure 4-1 provides a conceptual site layout showing the proposed location of the new SVE system and the new extraction wells. Based on results of the evaluation performed during the SVE system pilot test discussed above, a ROI of 200 ft was determined for the Site. The ROI will be evaluated during installation of the new extraction wells and SVE system. The proposed locations for the new extraction wells provide for adequate overlap of extraction zones. The actual placement may be adjusted based on field conditions and measurements at the time of installation. Figure 4-5 provides treatment compound layout and mechanical details for the SVE system. The SVE system is proposed to consist of the following elements:

- SVE blower will be able to produce between 250 and 500 standard cubic feet per minute.
- The blower motor will be totally enclosed-fan cooled, 240 volt, 3-phase.
- The blower will be enclosed in a sound enclosure to reduce noise levels approximately 10 decibels from the baseline at 3 ft from the blower. The sound enclosure will include any necessary cooling/heating to operate year round.
- An air-to-air heat exchanger will be installed to cool the discharge of the blower before entering the GAC vessels. As an alternative, the GAC vessels may be located prior to the blower thereby negating the need for the air-to-air heat exchanger.
- An air separator (knock-out pot) with discharge pump and level controls for automatic pump down to a secondary condensate storage vessel consisting of a high-density polyethylene tote to be staged either on or within 10 ft of the SVE system skid. The separator will incorporate a high liquid level shutdown interlock. The secondary storage vessel will incorporate a high-level shutdown that interlocks with the SVE control system.
- The SVE blower will be used to concurrently extract vapor from the newly constructed extraction wells described above. Flow rates will be determined following installation of the system and optimized to achieve maximum contaminant mass removal.
- Conveyance piping will connect the extraction wells to the SVE blower assembly using Schedule 80 PVC piping that is buried in a piping trench below the frost line (approximately 36-40 inches). The soils returned to the trench will be compacted and concrete surface added that is aircraft rated. The piping diameter, lengths and fitting types will be determined during execution of the Work Plan.
- Vapor abatement of the extracted vapor is proposed to consist of two 3,000 pound GAC vessels containing either virgin coconut or regenerated carbon. Carbon change-out of the GAC vessels will be performed on-Site with the spent carbon shipped off-Site for regeneration. If contaminants are determined to be present that are not readily adsorbed to carbon (e.g., vinyl chloride), a “polishing” vessel containing 500-pounds of permanganate-impregnated zeolite beads will be included in the treatment train.

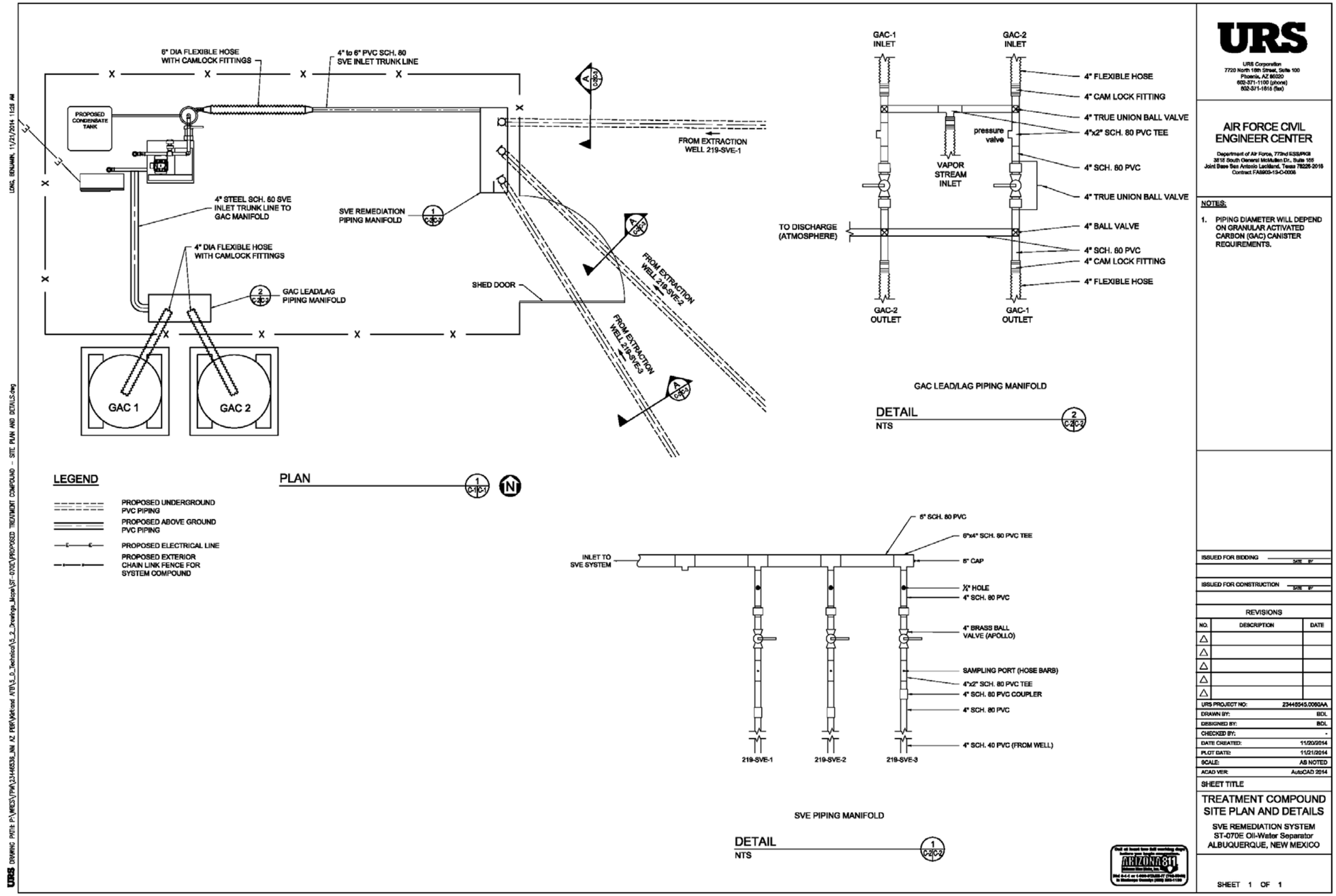

Figure 4-5. ST-070E Treatment Compound Layout and Mechanical Details

- The SVE unit will be installed inside a weather-proof building with the GAC vessels (and permanganate polishing vessel if required) located outside adjacent to the building. The GAC vessels will be weatherproof.
- The SVE system will include a discharge stack that vents to the atmosphere.

Final design is considered to be a component of execution of this Work Plan. The final as-built design will be presented in the interim measures report. Design activities to be conducted prior to installation will include the following:

- Final sizing and specification of the vacuum blower to be used for the SVE system.
- Sizing and specification of the moisture knockout vessel.
- Evaluation of the requirement for and specification for controls for the SVE system.
- Evaluation and specification of the electrical supply required for the SVE system and verification that the availability and suitability of electrical power for the temporary operation of the SVE blower. A New Mexico-license electrical engineer will be subcontracted as needed to design the electrical supply for the SVE blower and controls and to prepare electrical drawings suitable for submittal to the Kirtland AFB for review and approval.

Formal construction drawings will be prepared prior to installation of the SVE system. Diagrams will consist of a process flow diagram, a site plan indicating blower placement, location of piping runs, and the location of the electrical supply to power the SVE system blower. A wellhead construction diagram indicating the underground piping connections and trenching requirements will be prepared to guide field personnel in the installation of the system. Final as-built drawings will be provided in the interim measures report.

The SVE system will be installed in accordance with the developed process flow diagram, Site plan, and wellhead construction diagram(s). A conceptual site plan is provided in Figure 4-1 with Figure 4-5 providing the treatment compound layout and mechanical details. A subcontractor will place the SVE system, moisture knockout vessel, and treatment train at their designated locations and construct the piping runs and connections. The system may either be installed in the shed currently existing at the Site or a new shed may be required if the current shed cannot accommodate the new equipment. Licensed subcontractors will be used as needed to make necessary connections to wellheads and the electrical supply.

4.5 Long-Term Groundwater Monitoring

The *Final Long-Term Monitoring Plan, ST-070E – Oil-Water Separator (ST-219)* (USAF, 2014a) has been developed to provide guidance for long-term groundwater monitoring at the Site. Annual groundwater monitoring and well gauging will be performed at the single regional aquifer well (KAFB-7001) located at the Site (see Figure 4-1). Samples will be collected and analyzed for the suite of analyses as provided in Table 1 of the monitoring plan.

The objective of the LTM is to provide groundwater sample analytical data of sufficient quality and quantity to adequately characterize and monitor groundwater underlying the Site. The *Final Long-Term Monitoring Plan, ST-070E – Oil-Water Separator (ST-219)* (USAF, 2014a) is used in conjunction with the *Final Uniform Federal Policy Quality Assurance Project Plan, ST-070E – Oil-Water Separator (ST-219)* (USAF, 2014b) to ensure that the functional activities, organization, and quality assurance/quality control protocols are achieved in accordance with the project's data quality objectives.

As additional monitoring data are collected, the analyte list and sampling frequency may be adjusted to focus on those constituents of interest. A monitoring report will be prepared on an annual basis to evaluate the results and provide recommendations as to future monitoring requirements. The change in monitoring scope or schedule will be documented in a revision to the *Final Long-Term Monitoring Plan, ST-070E – Oil-Water Separator (ST-219)* (USAF, 2014a), as well as the *Final Uniform Federal Policy Quality Assurance Project Plan, ST-070E – Oil-Water Separator (ST-219)* (USAF, 2014b), which will undergo review by the USAF and NMED prior to implementation.

4.6 System Operation and Maintenance

The following sections describe the operations and maintenance activities required for the SVE system.

4.6.1 System Start Up

The system will be started and initial system monitoring and sampling of the vapor influent and effluent streams will be conducted. Samples will be collected and submitted for laboratory analysis of VOCs, TPH-GRO, and fixed gases using Summa® canisters in accordance with the project QAPP. The system will be shut down following this initial sampling pending receipt of the analytical results. Following confirmation that the analytical results demonstrate that the system is operating as designed, the system will be started for continuous operation. The sampling frequency during system start-up will be on a semi-weekly basis for the first week followed by weekly sampling for three additional weeks. Samples will undergo analyses for VOCs, TPH-GRO, and fixed gases as specified in the project QAPP.

Initial system monitoring consisting of PID measurements, vacuum measurements, and mechanical system checks will be conducted daily for the first week (Monday through Friday) of continuous operation, semi-weekly for three additional weeks, and monthly thereafter. A visual inspection of the wellhead connections and above-ground piping will also be performed on a weekly basis during this initial startup phase.

4.6.2 System Monitoring

SVE system vapor samples will be collected from the influent, mid-carbon, and effluent sampling ports installed in the SVE system. The influent sampling port will be located in between the extraction well manifold and the flow meter prior to the SVE blower motor. The mid-carbon sampling port will be located between the two GAC filters, The effluent sampling port will be located prior to the final flow meter just before the system exhaust. A minimum of monthly samples from the three monitoring ports will undergo VOC analysis using a PID and fixed gases using an air monitoring meter. Initially, samples will be collected on a more frequent basis to determine when breakthrough of contaminants in the GAC occurs. Sampling frequency will be adjusted based on this evaluation. Quarterly samples will be collected and submitted for laboratory analysis of VOCs, TPH-GRO, and fixed gases using Summa® canisters in accordance with the project QAPP.

In addition to the SVE system monitoring, soil vapor samples will be collected from each of the sampling ports installed in the extraction wells. A sampling port is associated with each depth interval within an extraction well; therefore, the samples will be collected from each discrete interval from which vapor is being extracted. If the SVE system is not currently extracting vapor from an interval, a sample will not be collected from the port associated with that interval. The soil vapor samples will undergo monthly analysis for VOCs and fixed gases using the PID and air monitoring meter with quarterly sampling be collected and submitted for off-site laboratory analysis of VOCs, TPH-GRO, and fixed gases using Summa® canisters in accordance with the project QAPP.

4.6.3 System Condensate

Condensate from the SVE system is expected to be generated, especially during the winter operating months. The condensate will be removed from the moisture separator and pumped to a 275-gallon tote. The condensate will be periodically sampled and analyzed to evaluate contaminant concentrations and to ensure that the condensate is not hazardous. If analytical results demonstrate that the condensate may be hazardous, the quantity of condensate collected will be limited to less than 55 gallons prior to disposal. As the tote becomes full, the contents will be evaluated for disposal in accordance with the requirements specified in Section 4.7.

4.6.4 Granular Activated Carbon

The GAC performance will be monitored as part of the routine SVE system monitoring with collection of samples from the influent, mid-carbon, and effluent sample ports. When breakthrough of the lead GAC vessel occurs, the spent GAC will be replaced with fresh GAC and the vessel will be moved into the lag vessel position. The vessel previously in the lag vessel position will become the lead vessel. The movement of vessels from lead to lag will be achieved using a valve manifold. A mechanical design drawing will be prepared providing the specifications for the GAC system.

4.6.5 Permanganate-Impregnated Zeolite Beads

If used, status of the permanganate-impregnated zeolite beads will be monitored using PID readings, effluent analytical results, and visual confirmation, as the bead color changes from purple to brown when the permanganate reacts with any VOCs that may not be adsorbed in the GAC vessels. The bed will be replaced prior to the color change progressing throughout the entire length of the bed.

4.6.6 System Shutdown and Rebound Testing

Once SVE concentrations have reached an asymptotic level for a period of three consecutive months, the SVE system will be shut down and rebound testing will commence. Rebound testing will consist of collection of soil vapor samples from each of the extraction well sampling ports as discussed in Section 4.6.2, as well as the existing vapor monitoring wells located in the vicinity of ST-070E. Samples will be collected on a weekly basis and analyzed for VOCs using the PID. The results will be compared to results obtained prior to the rebound test to evaluate whether or not the VOC concentrations rebound to levels observed at the conclusion of the SVE system operation. Such rebound may indicate volatilization of VOCs from a low permeability zone in soil into soil vapor. If soil vapor concentrations rebound, the continued long-term operation of the SVE system will be considered.

4.7 Management of Investigation-Derived Waste

The IDW will be generated as a result of the activities conducted during this project. The types of waste expected to be generated include, but are not limited to, the following:

- Personal protective equipment
- Equipment decontamination liquid residue
- Purge water
- Condensate water
- Blower filters

- Blower oil
- GAC (will be regenerated and recycled as appropriate)
- Spent permanganate-impregnated zeolite beads
- Plastic sheeting
- Unused/unaltered sample material
- Analytical residues
- Sample containers
- Hydraulic spills from mechanical equipment used during installation
- Miscellaneous waste

Waste could be hazardous. Waste will be managed in accordance with the *Environmental Restoration Program Investigation-Derived Waste Management Plan* (USAF, 2009b). As the project continues, additional waste streams could be identified. All generated waste streams are required to have the waste identified and characterized as required by RCRA regulations (40 CFR 262.11, "Hazardous Waste Determination"). Hazardous waste determinations will be prepared for each waste stream in accordance with URS SOP-49 (Appendix A of the *Final Uniform Federal Policy Quality Assurance Project Plan, ST-070E – Oil-Water Separator (ST-219)* [USAF, 2014b]). Wastes generated will be designated and characterized using process knowledge, historical analytical data, and/or analytical data generated during the course of the field activities. Hazardous waste determinations for all waste streams will be generated and maintained as part of the project file. Samples of IDW may be collected, if necessary, and submitted to the laboratory for analysis. The waste will be disposed of in accordance with applicable federal, state and local regulations. All drums will be labeled "Investigation Derived Waste, Awaiting Analysis" with contact information provided while being stored pending analysis.

Waste minimization techniques will be incorporated primarily through design, planning, and efficient operations. Specific waste minimization practices to be implemented during the project will include, but not be limited to, the following"

- Historic data evaluation to identify waste streams that may need to be segregated because of the potential of being hazardous
- Excluding materials that could become hazardous waste in the decontamination process (if any)
- Controlling transfer of materials and equipment between clean and contaminated areas
- Designing containment such that spread of contamination is minimized
- Deploying appropriate decontamination methods

Reuse and recycling opportunities also will be evaluated for waste, such as GAC, batteries, scrap metal, and equipment or materials that are no longer needed. Uncontaminated equipment that is determined to be excess will be evaluated for reused by other projects.

Wastes generated during the performance of LTM activities will be handled in accordance with the requirements provided in Section 5.0 of the *Final Long-Term Monitoring Plan, ST-070E – Oil-Water Separator (ST-219)* (USAF, 2014a) and URS SOP-49 *Investigative Derived Waste* (Appendix A of the project QAPP).

4.8 Site Surveying

Surveying of the locations (northing and easting) of new extraction wells, and other pertinent site features will be conducted by a State of New Mexico-licensed surveyor. Elevation data for extraction wells will include the top of the PVC riser and ground surface elevation at the well locations. Surveying data will be provided in a spreadsheet format for import into the geographic information system, and the data will also be incorporated into the report figures.

Horizontal coordinates will be referenced to the New Mexico Central State Plane Coordinate System, and surveyed to an accuracy of ±1.0 foot. Vertical elevations will be referenced to North American Datum 1983 coordinate system to an accuracy of ±0.01 foot.

Geospatial information will also be submitted as a separate deliverable to the USAF. All applicable federal, U.S. Department of Defense, and USAF geospatial data standards will be followed. Spatial data will be compliant with the Spatial Data Standards for Facilities, Infrastructure, and Environment v2.6.

Each geospatial data set will be accompanied by metadata that conforms to the Spatial Data Facilities, Infrastructure, and Environment standards. The horizontal accuracy of any geospatial data created will be tested and reported in accordance with the National Standard for Spatial Data Accuracy, and the results will be recorded in the metadata.

4.9 Site Restoration

Following delineation and remedial action activities at the former Site, site conditions will be restored to a similar state as initial conditions. Following regulatory approval of site closure, the existing monitoring well may be abandoned according to the *NMED Water Quality Bureau Monitoring Well Construction and Abandonment guidelines* (NMED, 2011), if determined that it is not required for other Kirtland AFB groundwater monitoring activities. The SVE system will be dismantled and recycled. Underground piping will be left in place given that it will be under the tarmac. The electrical service will be decommissioned.

5.0 REPORTING

Reporting will be comprised of an Interim Measures Report and annual LTM reports.

5.1 Interim Measures Report

Documentation of the project will include field notes and forms, photographs, and analytical data. The Interim Measures Report will be prepared following completion of the interim measures detailing the activities conducted to address contamination at the Site. The report will be submitted for USAF and NMED review. The Interim Measures Report will include, at a minimum, the following elements:

- A description of the interim measures implemented
    - SVE operations
    - Well completion diagrams
- As-built drawings showing the SVE system construction diagrams including the well installation and electrical installation details
- Summaries of LTM analytical results
- Summaries of problems encountered and deviations from the planned work scope
- Summaries of accomplishments and/or effectiveness of the interim measures
- Recommendations for disposition of the site.

The Interim Measures Report will include either VLEACH or SESOIL vapor modeling and an evaluation of risk associated with any residual constituents that remain in the vadose zone and groundwater underlying the site. Both VLEACH and SESOIL are one-dimensional, finite difference models used to make preliminary assessments of the effects on groundwater from the leaching of volatile, sorbed constituents through the vadose zone utilizing soil vapor results and soil physical properties. The program models four main processes including liquid-phase advection, solid-phase sorption, vapor-phase diffusion, and three-phase equilibration. The software is available on-line at the following EPA web address: http://www.epa.gov/ada/csmos/models/vleach.html

For vapor intrusion, vapor concentrations will be evaluated in accordance with the "OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)" (EPA, 2002) and compared to the action levels provided in the following:

- EPA Regional Screening Levels for Residential Air available online at http://www.epa.gov/region6/6pd/rcra_c/pd-n/screen.htm.

The final corrective action complete without controls determination will include the vapor modeling described above to ensure that residual concentrations in the vadose zone will not adversely impact groundwater, evaluation of vapor intrusion to ensure that residual concentrations will not threaten human health of site workers, and evaluation of surface soil concentrations by collection of samples from 0 to 15 feet bgs using soil borings to ensure that residential soil screening levels have been achieved.

5.2 Long-Term Monitoring Reports

Annual LTM reports will be prepared to document the results of the groundwater sampling and well gauging activities completed during the FY. The annual monitoring reports will provide evaluation of the data and associated trends and provide recommendations as to future monitoring requirements and optimization actions. The LTM reports will also discuss the operations and maintenance activities performed in support of the SVE operations, including SVE system monitoring and vapor port monitoring results. Concentration versus time trend analysis for key constituents will be performed using appropriate statistical analysis software such as the Monitoring and Remediation Optimization System, which was developed by GSI Environmental Inc. of Houston, Texas and the University of Houston for the Air Force Center for Environmental Excellence in accordance with the organization's Long-Term Monitoring Optimization guide. Other appropriate statistical methods may be employed with approval of the USAF.

In addition to the above reports, analytical data will be exported for upload to AFCEC's Environmental Restoration Program Information Management System database within 90 days of sample collection.

6.0 PROJECT SCHEDULE

An integrated master schedule has been prepared for the overall anticipated sequence of activities to be performed in support of the interim measures at the Site (see Table 6-1). The schedule is dependent on many independent factors including, but not limited to, USAF and NMED review and comment, subcontractor availability, weather, and site conditions. The USAF and NMED will be notified 30 days prior to the implementation of interim measure field activities. Additionally, during implementation of the interim measures, monthly status reports will be submitted to Kirtland AFB Environmental Restoration Program personnel by electronic mail. These reports will summarize the previous month's activities, the planned activities for the following month, and any other pertinent information.

The interim measures implementation schedule will allow for evaluation of screening level data during field work to allow for timely response to changing conditions. Post-interim measures groundwater monitoring will be conducted to monitor effectiveness of the interim measures implemented, to augment the implemented interim measures with additional actions if determined to be necessary in order to achieve the project objectives, and to demonstrate that the interim measures have successfully addressed contamination at the site based on mitigation of contaminant impacts on groundwater underlying the site thereby supporting a corrective action completion without controls determination.

The Interim Measures Report will be submitted for review and approval by USAF and NMED personnel.

Table 6-1. Project Schedule

Milestone Tasks	Completion Date
Long-Term Monitoring Plan and Quality Assurance Project Plan	
Deliver draft LTM Plan/QAPP for USAF review	July 14, 2014
USAF review of draft LTM Plan/QAPP	December 22, 2014
Deliver final LTM Plan/QAPP for NMED review	January 2, 2015
NMED review of draft final LTM Plan/QAPP	June 23, 2015
Deliver revised final LTM Plan/QAPP	August 18, 2015
Interim Measures Work Plan	
Deliver draft Interim Measures Work Plan for USAF review	November 21, 2014
USAF review of draft Interim Measures Work Plan	January 8, 2015
Deliver final Interim Measures Work Plan for NMED review	January 19, 2015
NMED review of draft final Interim Measures Work Plan	December 22, 2015
Deliver revised final Interim Measures Work Plan	February 9, 2016
Soil Vapor Extraction Well Installation	
Complete Pre-Fieldwork Activities	April 6, 2016
Mobilization	March 24, 2016
Install New SVE Wells and Sample Vadose Zone	April 28, 2016
Complete New SVE Wells	May 5, 2016
Demobilize from Well Drilling Activities	May 6, 2016
Well Completion Report	
Deliver draft Well Completion Report for USAF review	July 22, 2016
USAF review of draft Well Completion Report	August 26, 2016
Deliver final Well Completion Report for NMED review	September 16, 2016
NMED review of draft final Well Completion Report	March 3, 2017
Deliver revised final Well Completion Report	April 28, 2017

Milestone Tasks	Completion Date
Evaluation of Existing SVE System	
Deliver draft SVE System Evaluation Report for USAF review	June 3, 2014
USAF review of draft SVE System Evaluation Report	July 10, 2014
Deliver final SVE System Evaluation Report for NMED review	July 21, 2014
NMED review of draft final SVE System Evaluation Report	May 1, 2015
Deliver revised final SVE System Evaluation Report	June 12, 2015
Existing SVE System Monitoring	
Monthly System Operational Measurements and Sampling – July 2014	July 22, 2014
Monthly System Operational Measurements and Sampling - August 2014	August 29, 2014
Monthly System Operational Measurements and Sampling – September 2014	October 1, 2014
Monthly System Operational Measurements and Sampling – October 2014	October 29, 2014
Monthly System Operational Measurements and Sampling – November 2014	December 3, 2014
Monthly System Operational Measurements and Sampling – December 2014	December 31, 2014
Monthly System Operational Measurements and Sampling – January 2015	January 28, 2015
Monthly System Operational Measurements and Sampling – February 2015	February 25, 2015
Monthly System Operational Measurements and Sampling –March 2015	March 25, 2015
Monthly System Operational Measurements and Sampling – April 2015	April 22, 2015
Monthly System Operational Measurements and Sampling – May 2015	May 27, 2015
Monthly System Operational Measurements and Sampling – June 2015	June 24, 2015
Monthly System Operational Measurements and Sampling – July 2015	July 29, 2015
Monthly System Operational Measurements and Sampling – August 2015	August 26, 2015
Monthly System Operational Measurements and Sampling –September 2015	September 30, 2015
Monthly System Operational Measurements and Sampling – October 2015	October 28, 2015
Monthly System Operational Measurements and Sampling – November 2015	December 2, 2015
Monthly System Operational Measurements and Sampling – December 2015	December 30, 2015
Monthly System Operational Measurements and Sampling – January 2016	February 3, 2016
Monthly System Operational Measurements and Sampling – February 2016	March 2, 2016
Monthly System Operational Measurements and Sampling – March 2016	March 30, 2016
New SVE System Installation	
Remove Existing SVE System Components	May 20, 2016
Install New SVE System Components	July 21, 2016
Perform Operational Checks	August 18, 2016
Fiscal Year (FY) 2015 Annual Groundwater/Soil Vapor Monitoring	
Complete 1st Quarter Groundwater/Soil Vapor Monitoring	December 10, 2014
Complete 2nd Quarter Groundwater/Soil Vapor Monitoring	January 21, 2015
Complete 3rd Quarter Groundwater/Soil Vapor Monitoring	April 29, 2015
Complete 4th Quarter Groundwater/Soil Vapor Monitoring	July 29, 2015
Deliver draft FY 2015 LTM Report for USAF review	November 5, 2015
USAF review of draft FY 2015 LTM Report	December 10, 2015
Deliver final FY 2015 LTM Report for NMED review	December 31, 2015
NMED review of final FY 2015 LTM Report	June 16, 2016
Deliver revised final FY 2015 LTM Report	August 11, 2016
FY 2016 Annual Groundwater/Soil Vapor Monitoring	
Complete 1st Quarter Groundwater/Soil Vapor Monitoring	November 2, 2015
Complete 2nd Quarter Groundwater/Soil Vapor Monitoring	February 1, 2016
Complete 3rd Quarter Groundwater/Soil Vapor Monitoring	May 2, 2016

Milestone Tasks	Completion Date
Complete 4th Quarter Groundwater/Soil Vapor Monitoring	August 1, 2016
Deliver draft FY 2016 LTM Report for USAF review	November 3, 2016
USAF review of draft FY 2016 LTM Report	December 8, 2016
Deliver final FY 2016 LTM Report for NMED review	December 29, 2016
NMED review of final FY 2016 LTM Report	June 15, 2017
Deliver revised final FY 2016 LTM Report	August 10, 2017
FY 2017 Annual Groundwater/Soil Vapor Monitoring	
Complete 1st Quarter Groundwater/Soil Vapor Monitoring	October 31, 2016
Complete 2nd Quarter Groundwater/Soil Vapor Monitoring	January 30, 2017
Complete 3rd Quarter Groundwater/Soil Vapor Monitoring	May 1, 2017
Complete 4th Quarter Groundwater/Soil Vapor Monitoring	July 31, 2017
FY 2017 New SVE System Monitoring	
Monthly System Operational Measurements and Sampling – October 2016	October 27, 2016
Monthly System Operational Measurements and Sampling – November 2016	November 24, 2016
Monthly System Operational Measurements and Sampling – December 2016	December 28, 2016
Monthly System Operational Measurements and Sampling – January 2017	January 26, 2017
Monthly System Operational Measurements and Sampling – February 2017	February 27, 2017
Monthly System Operational Measurements and Sampling – March 2017	March 29, 2017
Monthly System Operational Measurements and Sampling – April 2017	April 27, 2017
Monthly System Operational Measurements and Sampling – May 2017	May 29, 2017
Monthly System Operational Measurements and Sampling – June 2017	June 28, 2017
Monthly System Operational Measurements and Sampling – July 2017	July 27, 2017
Monthly System Operational Measurements and Sampling – August 2017	August 24, 2017
Monthly System Operational Measurements and Sampling – September 2017	September 28, 2017
FY 2017 Annual Monitoring Report	
Deliver draft FY 2017 LTM Report for USAF review	December 14, 2017
USAF review of draft FY 2017 LTM Report	January 18, 2018
Deliver final FY 2017 LTM Report for NMED review	February 8, 2018
NMED review of final FY 2017 LTM Report	July 26, 2018
Deliver revised final FY 2017 LTM Report	September 20, 2018
FY 2018 Annual Groundwater/Soil Vapor Monitoring	
Complete 1st Quarter Groundwater/Soil Vapor Monitoring	October 30, 2017
Complete 2nd Quarter Groundwater/Soil Vapor Monitoring	January 29, 2018
Complete 3rd Quarter Groundwater/Soil Vapor Monitoring	April 30, 2018
Complete 4th Quarter Groundwater/Soil Vapor Monitoring	July 30, 2018
FY 2018 New SVE System Monitoring	
Monthly System Operational Measurements and Sampling – October 2017	October 26, 2017
Monthly System Operational Measurements and Sampling – November 2017	November 24, 2017
Monthly System Operational Measurements and Sampling – December 2017	December 28, 2017
Monthly System Operational Measurements and Sampling – January 2018	January 29, 2018
Monthly System Operational Measurements and Sampling – February 2018	February 26, 2018
Monthly System Operational Measurements and Sampling – March 2018	March 29, 2018
Monthly System Operational Measurements and Sampling – April 2018	April 26, 2018
Monthly System Operational Measurements and Sampling – May 2018	May 29, 2018
Monthly System Operational Measurements and Sampling – June 2018	June 28, 2018
Monthly System Operational Measurements and Sampling – July 2018	July 27, 2018

Milestone Tasks	Completion Date
Monthly System Operational Measurements and Sampling – August 2018	August 29, 2018
Monthly System Operational Measurements and Sampling – September 2018	September 27, 2018
FY 2018 Annual Monitoring Report	
Deliver draft FY 2018 LTM Report for USAF review	November 1, 2018
USAF review of draft FY 2018 LTM Report	December 6, 2018
Deliver final FY 2018 LTM Report for NMED review	December 27, 2018
NMED review of final FY 2018 LTM Report	June 13, 2019
Deliver revised final FY 2018 LTM Report	August 8, 2019
FY 2019 Annual Groundwater/Soil Vapor Monitoring	
Complete 1st Quarter Groundwater/Soil Vapor Monitoring	October 29, 2018
Complete 2nd Quarter Groundwater/Soil Vapor Monitoring	January 28, 2019
Complete 3rd Quarter Groundwater/Soil Vapor Monitoring	April 29, 2019
Complete 4th Quarter Groundwater/Soil Vapor Monitoring	July 29, 2019
FY 2019 New SVE System Monitoring	
Monthly System Operational Measurements and Sampling – October 2018	October 29, 2018
Monthly System Operational Measurements and Sampling – November 2018	November 28, 2018
Monthly System Operational Measurements and Sampling – December 2018	December 27, 2018
Monthly System Operational Measurements and Sampling – January 2019	January 29, 2019
Monthly System Operational Measurements and Sampling – February 2019	February 26, 2019
Monthly System Operational Measurements and Sampling – March 2019	March 28, 2019
Monthly System Operational Measurements and Sampling – April 2019	April 26, 2019
Monthly System Operational Measurements and Sampling – May 2019	May 29, 2019
SVE System Rebound Test – June 2019	June 27, 2019
SVE System Rebound Test – July 2019	July 29, 2019
Monthly System Operational Measurements and Sampling – August 2019	August 29, 2019
Monthly System Operational Measurements and Sampling – September 2019	September 26, 2019
FY 2019 Annual Monitoring Report	
Deliver draft FY 2019 LTM Report for USAF review	October 31, 2019
USAF review of draft FY 2019 LTM Report	December 5, 2019
Deliver final FY 2019 LTM Report for NMED review	December 26, 2019
NMED review of final FY 2019 LTM Report	June 11, 2020
Deliver revised final FY 2019 LTM Report	August 6, 2020
FY 2020 Annual Groundwater/Soil Vapor Monitoring	
Complete 1st Quarter Groundwater/Soil Vapor Monitoring	October 28, 2019
Complete 2nd Quarter Groundwater/Soil Vapor Monitoring	January 27, 2020
Complete 3rd Quarter Groundwater/Soil Vapor Monitoring	April 27, 2020
Complete 4th Quarter Groundwater/Soil Vapor Monitoring	July 27, 2020
FY 2020 New SVE System Monitoring	
Monthly System Operational Measurements and Sampling – October 2019	October 29, 2019
Monthly System Operational Measurements and Sampling – November 2019	November 28, 2019
Monthly System Operational Measurements and Sampling – December 2019	December 27, 2019
Monthly System Operational Measurements and Sampling – January 2020	January 29, 2020
Monthly System Operational Measurements and Sampling – February 2020	February 26, 2020
FY 2020 Annual Monitoring Report	
Deliver draft FY 2020 LTM Report for USAF review	October 29, 2020
USAF review of draft FY 2020 LTM Report	December 3, 2020

Milestone Tasks	Completion Date
Deliver final FY 2020 LTM Report for NMED review	December 24, 2020
NMED review of final FY 2020 LTM Report	June 10, 2021
Deliver revised final FY 2020 LTM Report	August 5, 2021
FY 2021 Annual Groundwater/Soil Vapor Monitoring	
Complete 1st Quarter Groundwater/Soil Vapor Monitoring	October 26, 2020
Complete 2nd Quarter Groundwater/Soil Vapor Monitoring	January 25, 2021
Complete 3rd Quarter Groundwater/Soil Vapor Monitoring	April 26, 2021
Complete 4th Quarter Groundwater/Soil Vapor Monitoring	July 26, 2021
FY 2021 Annual Monitoring Report	
Deliver draft FY 2021 LTM Report for USAF review	October 28, 2021
USAF review of draft FY 2021 LTM Report	December 2, 2021
Deliver final FY 2021 LTM Report for NMED review	December 23, 2021
NMED review of final FY 2021 LTM Report	June 9, 2022
Deliver revised final FY 2021 LTM Report	August 4, 2022
FY 2022 Annual Groundwater/Soil Vapor Monitoring	
Complete 1st Quarter Groundwater/Soil Vapor Monitoring	October 25, 2021
Complete 2nd Quarter Groundwater/Soil Vapor Monitoring	January 24, 2022
Complete 3rd Quarter Groundwater/Soil Vapor Monitoring	April 25, 2022
Complete 4th Quarter Groundwater/Soil Vapor Monitoring	July 25, 2022
FY 2022 Annual Monitoring Report	
Deliver draft FY 2022 LTM Report for USAF review	October 21, 2022
USAF review of draft FY 2022 LTM Report	November 25, 2022
Deliver final FY 2022 LTM Report for NMED review	December 16, 2022
NMED review of final FY 2022 LTM Report	June 2, 2023
Deliver revised final FY 2022 LTM Report	July 28, 2023
Interim Measures Completion Report	
Deliver draft Interim Measures Completion Report for USAF review	April 8, 2020
USAF review of draft Interim Measures Completion Report	May 13, 2020
Deliver final Interim Measures Completion Report for NMED review	June 17, 2020
NMED review of final Interim Measures Completion Report	August 27, 2021
Deliver revised final Interim Measures Completion Report	October 15, 2021
Well Abandonment and Reporting	
Submit Required Abandonment Documentation	April 15, 2022
Mobilize for Well Abandonment	May 27, 2022
Demobilize SVE System Components	July 8, 2022
Complete Well Abandonment Field Work	June 24, 2022
Demobilize from Well Abandonment	June 29, 2022
Deliver draft Well Abandonment Report for USAF Review	August 11, 2022
USAF review of draft Well Abandonment Report	September 15, 2022
Deliver final Well Abandonment Report for NMED Review	October 20, 2022
NMED review of final Well Abandonment Report	April 6, 2023
Deliver revised final Well Abandonment Report	May 25, 2023
Corrective Action Completion Proposal	
Deliver draft Corrective Action Completion Proposal for USAF Review	December 17, 2021
USAF review of draft Corrective Action Completion Proposal	January 7, 2022
Deliver final Corrective Action Completion Proposal for NMED Review	May 27, 2022

Milestone Tasks	Completion Date
Prepare and Publish Newspaper Notice	June 3, 2022
Complete Public Comment Period	August 4, 2022
Public Meeting	July 6, 2022
NMED review of Final Correction Action Completion Proposal	March 1, 2023
NMED Approval of Revised Final Corrective Action Completion Proposal	June 16, 2023
FY – fiscal year LTM – long-term monitoring NMED – New Mexico Environment Department QAPP – quality assurance project plan SVE – soil vapor extraction USAF – U.S. Air Force	

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APPENDIX A

SOIL VAPOR CONCENTRATIONS IN EXTRACTION AND MONITORING WELLS

Note: These figures were excerpted from the *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)* (USAF, 2013c).

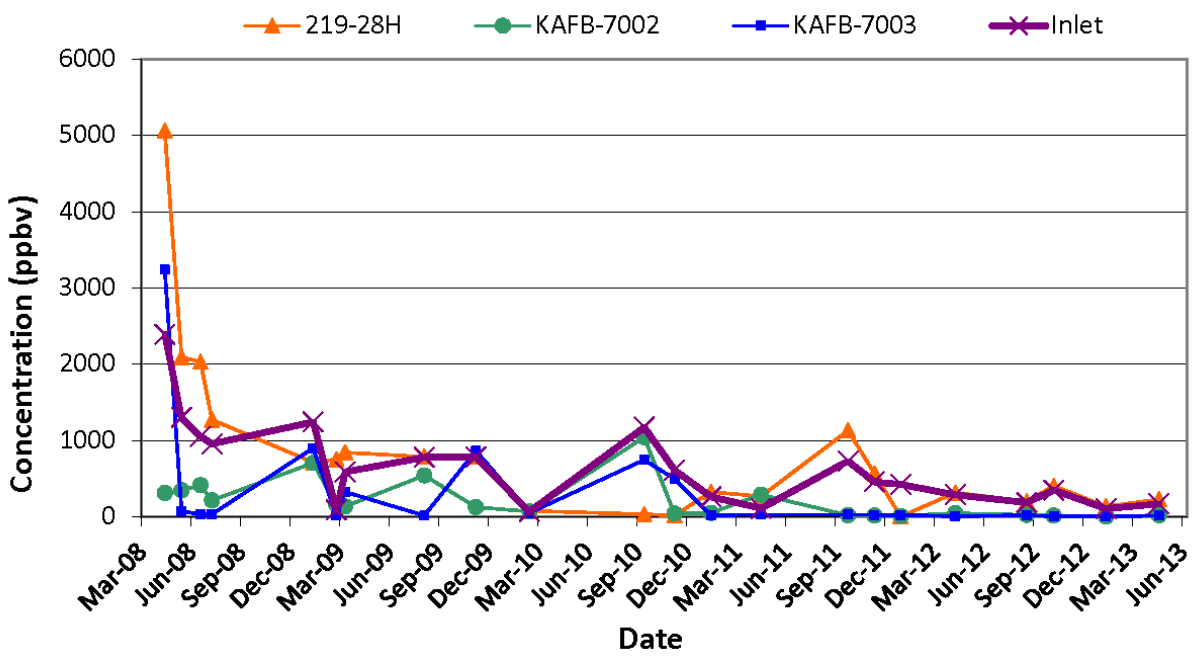

Figure A-7-1. Tetrachloroethene Vapor Concentrations at ST-070E Soil Vapor Extraction Wells.

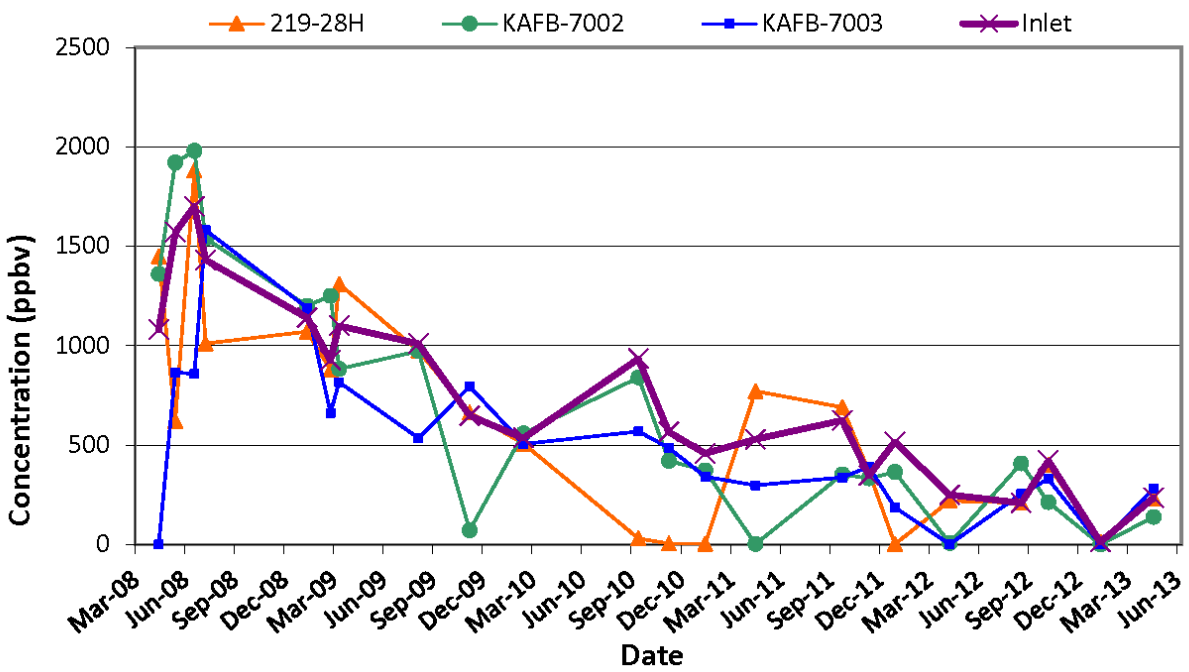

Figure A-7-2. Trichloroethene Vapor Concentrations at ST-070E Soil Vapor Extraction Wells.

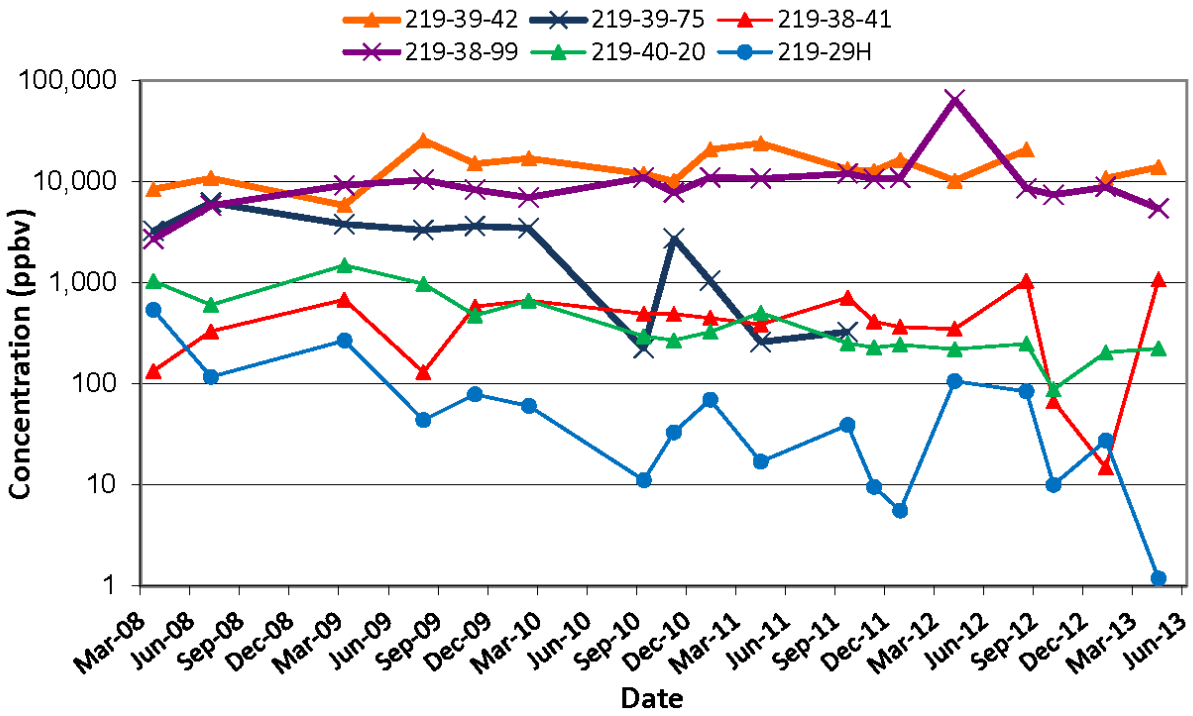

Figure A-7-3. Trichloroethene Vapor Concentrations at ST-070E Soil Vapor Monitoring Points.

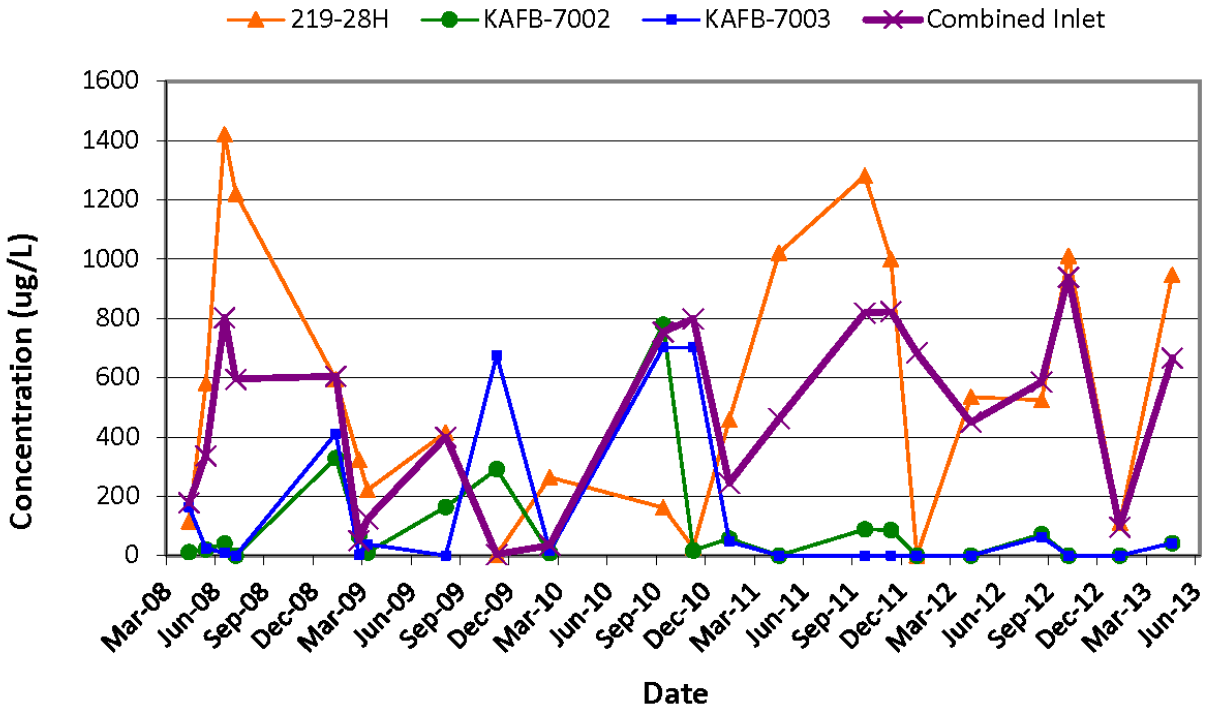

Figure A-7-4. Total Petroleum Hydrocarbon-Gasoline Vapor Concentrations at ST-070E Soil Vapor Extraction Wells.

APPENDIX B

TABULATED HISTORICAL SOIL VAPOR ANALYTICAL DATA

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	Combined Inlet								
	Sample ID	ST70-AR-INLET-240413	ST70-AR-INLET-160113	ST70-AR-Inlet-121012	ST70-AR-Inlet-230812	ST70-AR-Inlet-130412	ST70-AR-Inlet-030112	ST219-AR-INLET-161111	ST70-AR-Inlet-28092011	ST219-AR-INLET-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	not applicable								
VOCs (ppbv)	1,1,1-Trichloroethane	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	4.03 J	< 3.2	< 8.25	2.72 J
Method TO-15[a]	1,1,2,2-Tetrachloroethane	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	297	< 3.2	< 8.25	<0.65
	1,1,2-Trichloroethane	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<1.09
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<2.7
	1,1-Dichloroethane	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<1.2
	1,1-Dichloroethene	6.25J	< 0.24	13.7	< 3.12	<1.83	15.7	9.68 J	19.6 J	12.5
	1,2,4-Trichlorobenzene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<1.34
	1,2,4-Trimethylbenzene	34.9	4.17	226	< 3.12	10.8	154	203	357	49.6
	1,2-Dichloroethane (EDC)	< 3.09	0.31J	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<1.25
	1,2-Dichlorobenzene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<1.21
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<1.27
	1,2-Dichloropropane	< 3.09	38.7	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<1.14
	1,2-Dibromoethane (EDB)	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.9
	1,3,5-Trimethylbenzene	53.2	3.48	229	5.68 J	7.9	186	204	363	25.6
	1,3-Dichlorobenzene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.99
	1,4-Dichlorobenzene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<1.28
	Acetone	17.1J	79.8	32.7	< 3.12	13.5	27.4	15.1 J	< 54.9	379
	Benzene	< 3.09	0.53J	< 4.02	< 3.12	3.25 J	36.1	22.4	98.6	12.7
	Bromomethane	< 3.09	0.85	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	1.2 J
	Carbon tetrachloride	4.03J	< 0.24	5.2 J	< 3.12	<1.83	5.26 J	< 3.2	< 8.25	5.84 J
	Chlorobenzene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.65
	Chloroethane	< 3.09	0.35J	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.77
	Chloroform	5.65J	0.61J	11.6 J	6.03 J	8.24	15.3	8.32 J	16.8 J	12.4
	Chloromethane	< 3.09	3.03	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.47
	cis-1,2-Dichloroethene	51.8	1.8	118	63	54.1	183	117	216	194
	cis-1,3-Dichloropropene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.62
	Dichlorodifluoromethane	< 3.09	0.37J	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.38
	Ethylbenzene	< 3.09	0.27J	6.6 J	< 3.12	<1.83	<3.8	< 3.2	< 8.25	6.58 J
	Hexachlorobutadiene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<1.88
	m,p-Xylene	6.55J	1.17J	31.3	< 6.24	<3.66	24.7 J	25.2	39 J	80.3
	MEK (2-Butanone)	< 3.09	8.4	< 4.02	< 3.12	3.57 J	<3.8	< 3.2	< 8.25	76.9
	Methylene chloride	< 3.09	0.49J	4.13 J	< 3.37	<1.83	<3.8	< 3.2	< 8.25	<1.95
	MTBE (Methyl tert-butyl ether)	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.59
	o-Xylene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	44.7
	Styrene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.94
	TCE (Trichloroethene)	234	12.6	422	209	219	516	346	624	529
	PCE (Tetrachloroethene)	167	103	345	183	287	422	455	727	107
	Toluene	< 3.09	0.72J	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	23.7
	trans-1,3-Dichloropropene	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.49
	Trichlorofluoromethane	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	3.18 J
	Vinyl chloride	< 3.09	< 0.24	< 4.02	< 3.12	<1.83	<3.8	< 3.2	< 8.25	<0.55
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	666	96.6	939	585	449	684	822	818	462
Fixed Gases (%)	Carbon Dioxide	1.74	0.71J	1.4	5.12	9.61	3.08	2.46	2.58	2.55
Method SM2720C[c]	Carbon Monoxide	< 0.14	< 0.13	<0.15	< 0.14	<0.15	<0.14	< 0.15	< 0.12	<0.13
	Methane	< 0.14	< 0.13	<0.15	< 0.14	<0.15	<0.14	< 0.15	< 0.11	<0.11
	Nitrogen	74.6	75	131 UR	76.2	77.3	74.6	75.1	77.5	78.4
	Oxygen	23.7	24.3	15.7	18.7	13.1	22.3	22.4	19.9	19.1

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	Combined Inlet							
	Sample ID	ST70-AR-Inlet-18012011	ST219-AR-INLET-12112010	ST219-AR-Inlet-17092010	ST219-AR-Inlet-101109	ST219-AR-Inlet-070809	ST219-AR-Inlet-14032009	ST219-AR-InletD-14032009 (Duplicate)	ST219-AR-Inlet-10072008
	Sample Date	01/18/11	11/12/10	09/17/10	11/10/09	08/07/09	03/14/09	03/14/09	07/10/08
	Analyte Screen Depth	not applicable							
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	55.3	3.15 J	4.38 J	6.04	< 0.62	2.67 U	2.14 J	3.42 U
	1,1,2,2-Tetrachloroethane	<0.48	<3.31	<2.57	< 5.4	< 1.44	3.55 U	0.47 U	278
	1,1,2-Trichloroethane	1.2 J	<1.79	<4.31	ND	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	4.99 J	3.28 J	<3.94	26.4	2.92 J	5.65 J	5.33 J	2.45 U
	1,1-Dichloroethane	34.4	<1.34	<4.76	2.64 J	1.56 J	2.86 J	2.39 J	3.27 U
	1,1-Dichloroethene	20.6	18.4	29.2	15.8	12.1	2.13 U	1.91 J	5.07 J
	1,2,4-Trichlorobenzene	<0.99	<1.54	<5.31	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	41.2	99.4	334	203	94.2	7.89 J	3.04 J	67
	1,2-Dichloroethane (EDC)	2.85 J	<1.27	<4.94	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	<0.9	<2.1	<4.8	ND	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<0.94	<1.5	<5.02	ND	ND	ND	ND	ND
	1,2-Dichloropropane	<0.85	<1.16	<4.53	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<0.67	<1.46	<3.56	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	45.1	130	331	252	127	6.67 J	3.02 J	158
	1,3-Dichlorobenzene	<0.74	<2.18	<3.94	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	<0.95	<2.07	<5.09	ND	ND	ND	ND	ND
	Acetone	7.26 J	207	36.8 J	30.8	39.4	16.5 J	8.94 J	72.3
	Benzene	6	23.5	33.3 B	< 5.4	5.9 J	3.04 J	2.71 J	8.49 J
	Bromomethane	<0.34	<1.84	<1.8	ND	ND	ND	ND	ND
	Carbon tetrachloride	7.47	7.45 J	9.33 J	9.74	7.71	8.42 J	8.69 J	6.33 J
	Chlorobenzene	<0.48	<1.51	12 J	< 5.4	< 1	2.87 U	1.87 J	4.59 U
	Chloroethane	<0.57	<2.41	<3.05	ND	ND	ND	ND	ND
	Chloroform	14.4	17	24.7 J	18.9	22.3	19.3 J	16.1	24.6
	Chloromethane	1.03 J	<1.6	<1.87	5.39 J	1.9 J	2.45 U	2.68 U	2.31 U
	cis-1,2-Dichloroethene	103	254	491	262	318	384	373	777
	cis-1,3-Dichloropropene	<0.46	<1.63	<2.46	ND	ND	ND	ND	ND
	Dichlorodifluoromethane	0.57 J	<1.84	<1.51	< 5.4	< 7	2.35 U	0.49 J	1.77 U
	Ethylbenzene	2.12 J	14.7	<3.33	14.8	< 0.75	1.99 U	1.75 U	4.9 U
	Hexachlorobutadiene	<0.73	<1.95	<3.89	ND	ND	ND	ND	ND
	m,p-Xylene	6.28	47.5	36.5	19.9	11.6	5.46 U	5.45 U	9.65 U
	MEK (2-Butanone)	5.24 J	65.1	<2.75	21.4	< 0.91	2.01 U	7.12 J	20.8
	Methylene chloride	268	2.36 J	7.91 J	< 27	< 34.8	5.23 J	4.75 J	8.81 J
	MTBE (Methyl tert-butyl ether)	<0.44	<2.33	<4.07	< 10.8	< 1.21	1.91 U	1.26 U	3.43 U
	o-Xylene	7.42	12.7	5.49 J	< 5.4	< 1.67	2.45 U	2.52 U	5.3 U
	Styrene	<0.7	<1.82	<3.73	ND	ND	ND	ND	ND
	TCE (Trichloroethene)	458	567	934	647	1010	1100	921	1,430
	PCE (Tetrachloroethene)	258	607	1,170	781	774	584	413	953
	Toluene	16.8	151	6.68 J	< 5.4	< 2.09	4.47 U	1.23 U	5.2 U
	trans-1,3-Dichloropropene	<0.36	<1.71	<1.94	ND	ND	ND	ND	ND
	Trichlorofluoromethane	2.63 J	3.13 J	9.96 J	22	2.91 J	3.75 J	4.1 J	2.29 U
	Vinyl chloride	<0.41	<1.31	<2.17	< 5.4	< 2.5	2.42 U	1.17 U	3.66 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	244	798	754	< 54	400	124	58.8	595
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	1.39	2.18	2.36	2.81	2.08	4.61	5.15	2.64
	Carbon Monoxide	<0.12	<0.12	<0.06	< 0.08	< 0.07	0.08 U	0.08 U	0.08 U
	Methane	<0.11	<0.11	<0.05	< 0.08	< 0.07	0.08 U	0.08 U	0.09 U
	Nitrogen	65	78.1	77.8	88.1	68.6	83.9	75.2	87.7
	Oxygen	16.6	19.7	19.8	24.7	17.2	15.7	12.6	19.5

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-28H								
	Sample ID	ST70-AR-28H-240413	ST70-AR-28H-160113	ST219-AR-28H-121012	ST219-AR-28H-230812	ST219-AR-28H-130412	ST219-AR-28H-030112	ST219-AR-28H-161111	ST219-AR-28H-28092011	ST219-AR-28H-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	10-35 / 50-90								
VOCs (ppbv)	1,1,1-Trichloroethane	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	109
Method TO-15[a]	1,1,2,2-Tetrachloroethane	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<1.34
	1,1,2-Trichloroethane	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<2.24
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 3.15	< 0.6	1.76 J	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<6.96
	1,1-Dichloroethane	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	33.4
	1,1-Dichloroethene	7.56J	< 0.6	13.4	< 3.21	<1.34	<0.56	12.6	26.6 J	32.8
	1,2,4-Trichlorobenzene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<2.76
	1,2,4-Trimethylbenzene	44.1	4.2	203	4.24 J	6.5	1.12 J	210	474	53
	1,2-Dichloroethane (EDC)	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<2.57
	1,2-Dichlorobenzene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<2.5
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<2.61
	1,2-Dichloropropane	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	7.49 J
	1,2-Dibromoethane (EDB)	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<1.85
	1,3,5-Trimethylbenzene	70.8	3.6	191	6.68 J	5.08	0.74 J	231	548	67
	1,3-Dichlorobenzene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<2.05
	1,4-Dichlorobenzene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<2.64
	Acetone	115	8.86	14	24.1	31	84.4	16.7 J	< 44.9	<96
	Benzene	< 3.15	0.66J	2.37 J	< 3.21	2.77 J	3.9	26.5	77.3	24.4
	Bromomethane	< 3.15	< 0.6	< 1.53	< 3.21	1.35 J	<0.56	< 3.08	< 8.18	2.95 J
	Carbon tetrachloride	< 3.15	< 0.6	3.2 J	< 3.21	<1.34	<0.56	< 3.08	< 8.18	6.43 J
	Chlorobenzene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<1.34
	Chloroethane	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<1.59
	Chloroform	5.85J	< 0.6	10.3	6.06 J	9.88	<0.56	8.5 J	16.2 J	15.7
	Chloromethane	< 3.15	< 0.6	< 1.53	< 3.21	2.25 J	1.34 J	< 3.08	< 8.18	<0.97
	cis-1,2-Dichloroethene	82.4	1.9J	130	67	65.3	0.75 J	158	326	315
	cis-1,3-Dichloropropene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<1.28
	Dichlorodifluoromethane	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<0.79
	Ethylbenzene	< 3.15	< 0.6	5.59	< 3.21	<1.34	1.02 J	4.92 J	9.23 J	10.7 J
	Hexachlorobutadiene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<4.36
	m,p-Xylene	8.15J	< 1.19	31	< 6.42	<2.69	3.09 J	27.7	46.6 J	28.5
	MEK (2-Butanone)	< 3.15	3.8J	4.46 J	< 3.21	7.43 J	4.06	< 3.08	< 8.18	105
	Methylene chloride	< 3.15	< 0.6	1.88 J	< 3.32	1.5 J	1.67 J	< 3.08	< 8.18	196
	MTBE (Methyl tert-butyl ether)	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<1.22
	o-Xylene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	1.06 J	< 3.08	< 8.18	18.1
	Styrene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	0.63 J	< 3.08	< 8.18	<1.94
	TCE (Trichloroethene)	231	13.8	399	210	250	1.74 J	368	690	772
	PCE (Tetrachloroethene)	223	131	401	200	313	1.16 J	567	1,130	266
	Toluene	< 3.15	0.7J	< 1.53	< 3.21	<1.34	22	< 3.08	< 8.18	296
	trans-1,3-Dichloropropene	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<1.01
	Trichlorofluoromethane	< 3.15	< 0.6	2 J	< 3.21	1.4 J	<0.56	< 3.08	< 8.18	5.63 J
	Vinyl chloride	< 3.15	< 0.6	< 1.53	< 3.21	<1.34	<0.56	< 3.08	< 8.18	<1.13
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	946	110	1,010	524	534	<15	998	1,280	1,020
Fixed Gases (%)	Carbon Dioxide	2.6	0.79J	1.9	5.11	8.52	0.19 J	3.38	3.28	3.65
Method SM2720C[c]	Carbon Monoxide	< 0.15	< 0.14	<0.15	< 0.15	<0.16	<0.13	< 0.14	< 0.13	<0.13
	Methane	< 0.15	< 0.14	<0.15	< 0.15	<0.16	<0.13	< 0.14	< 0.12	<0.12
	Nitrogen	74.5	75	129 UR	76.2	76.8	74.2	75	77.5	78.5
	Oxygen	22.9	24.2	16	18.7	14.6	25.6	21.6	19.2	17.8

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-28H								
	Sample ID	ST219-AR-28H-18012011	ST219-AR-28H-12112010	ST219-AR-28H-17092010	ST219-AR-28H-17022010	ST219-AR-28H-101109	ST219-AR-28H-070809	ST219-AR-28H-140309	ST219-AR-28HD-140309 (Duplicate)	ST219-AR-219-28H-10072008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	03/14/09	07/10/08
	Analyte Screen Depth	10-35 / 50-90								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	65.7	<0.15	0.42 J	< 6.4	9.61	< 0.64	2.31 J	2.62 U	5.21 U
	1,1,2,2-Tetrachloroethane	<0.63	<0.38	<0.1	< 6.4	< 0.72	< 1.49	0.54 U	3.49 U	246
	1,1,2-Trichloroethane	<1.05	<0.21	<0.17	< 6.4	ND	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	10.1	0.32 J	0.28 J	< 6.4	32	2.77 J	5.59 J	6.63 J	3.73 U
	1,1-Dichloroethane	14.7	<0.15	<0.19	< 6.4	3.41 J	1.34 J	2.43 J	3.77 J	4.98 U
	1,1-Dichloroethene	29.7	<0.3	0.36 J	< 6.4	17.1	11.1	2.12 J	2.18 J	3.68 U
	1,2,4-Trichlorobenzene	<1.29	<0.18	<0.21	< 6.4	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	109	9.49	74.6	8.65	200	102	6.29 J	8 J	60.6
	1,2-Dichloroethane (EDC)	<1.2	<0.15	<0.2	< 6.4	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	<1.17	<0.24	<0.19	< 6.4	ND	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<1.22	0.3 J	<0.2	< 6.4	ND	ND	ND	ND	ND
	1,2-Dichloropropane	<1.1	<0.13	<0.18	< 6.4	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<0.87	<0.17	<0.14	< 6.4	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	121	9.57	51.1	18.9	244	110	5.31 J	7.05 J	128
	1,3-Dichlorobenzene	<0.96	<0.25	<0.16	< 6.4	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	<1.24	<0.24	<0.21	< 6.4	ND	ND	ND	ND	ND
	Acetone	18	18.7	12.3	83.3	36	69.9	5.19 J	10.6 J	28
	Benzene	8.36	1.76	5.87	3.51 J	< 0.51	8.99	4.07 J	4.36 J	6.89 U
	Bromomethane	0.88 J	<0.21	0.25 J	1.24 J	ND	ND	ND	ND	ND
	Carbon tetrachloride	1.95 J	0.21 J	0.2 J	3.37 J	14.3	6.96 J	8.59 J	9.41 J	4.06 U
	Chlorobenzene	<0.63	<0.17	<0.1	< 6.4	< 0.47	< 1.03	0.33 U	2.82 U	6.98 U
	Chloroethane	<0.74	<0.28	<0.12	< 6.4	ND	ND	ND	ND	ND
	Chloroform	6.44 J	<0.41	0.3 J	17.3	22.2	19.5	16.1 J	22.9	9.67 J
	Chloromethane	1.06 J	1	0.75 J	< 6.4	< 0.45	3.08 J	3.09 U	2.41 U	3.51 U
	cis-1,2-Dichloroethene	160	2.54	8.87	75.4	273	285	444	503	464
	cis-1,3-Dichloropropene	<0.6	<0.19	<0.1	< 6.4	ND	ND	ND	ND	ND
	Dichlorodifluoromethane	0.56 J	0.78 J	0.57 J	< 6.4	1.03 J	< 7.2	0.6 J	2.31 U	2.69 U
	Ethylbenzene	2.98 J	1.02	3.03	< 6.4	16	< 0.77	2.02 U	1.95 U	7.46 U
	Hexachlorobutadiene	<0.94	<0.22	<0.16	< 6.4	ND	ND	ND	ND	ND
	m,p-Xylene	10.8	3.68	17.8	< 6.4	17.7	32.4	6.31 U	5.36 U	14.68 U
	MEK (2-Butanone)	6.88 J	7.62	1.84 J	24.6	27.1	< 0.93	1.37 U	1.98 U	8.97 J
	Methylene chloride	80.2	0.43 J	0.67 J	4.62 J	< 26.8	< 35.8	4.49 J	5.95 J	20.9 J
	MTBE (Methyl tert-butyl ether)	<0.57	<0.27	<0.16	< 12.7	< 0.76	< 1.24	1.46 U	1.87 U	5.22 U
	o-Xylene	<0.87	1.11	3.65	< 6.4	< 0.61	9.42	2.91 U	2.41 U	8.07 U
	Styrene	<0.91	<0.21	<0.15	< 6.4	ND	ND	ND	ND	ND
	TCE (Trichloroethene)	324	5.61	31	507	664	975	924	1310	1,010
	PCE (Tetrachloroethene)	492	12	30	73.3	791	782	521	839	1,270
	Toluene	3.96 J	5.91	18.8	1.55 J	2.07 J	4.05 J	1.43 U	4.39 U	7.91 U
	trans-1,3-Dichloropropene	<0.47	<0.2	<0.08	< 6.4	ND	ND	ND	ND	ND
	Trichlorofluoromethane	2.2 J	0.44 J	0.53 J	1.17 J	24	2.88 J	4.51 J	4.6 J	3.49 U
	Vinyl chloride	<0.53	0.2 J	<0.09	< 6.4	< 0.39	< 2.57	1.35 U	2.38 U	5.57 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	457	26.1 J	161	263	< 53.5	415	209	220	1220
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	1.25	<0.14	<0.07	1.2	2.6	2.43	5.81	5.81	4.33
	Carbon Monoxide	<0.13	<0.12	<0.06	< 0.5	< 0.07	< 0.08	0.08 U	0.08 U	0.08 U
	Methane	<0.11	<0.11	<0.05	< 0.5	< 0.08	< 0.08	0.08 U	0.08 U	0.09 U
	Nitrogen	69.4	77.9	78.2	77.7	80.8	68.1	74.3	74.9	95.2
	Oxygen	18.3	22.1	21.8	21.1	22.7	16.8	11.7	11.7	17.7

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	70-02								
	Sample ID	ST70-AR-7002-240413	ST70-AR-7002-160113	ST219-AR-7002-121012	ST219-AR-7002-230812	ST219-AR-7002-130412	ST219-AR-7002-030112	ST219-AR-7002-161111	ST219-AR-7002-28092011	ST219-AR-7002-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	85-90								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	2.5 J
	1,1,2,2-Tetrachloroethane	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	15.3	<0.35
	1,1,2-Trichloroethane	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.58
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 1.27	< 0.24	< 0.62	1.75 J	2.89 J	3.1	2.53 J	3.0	<3.53
	1,1-Dichloroethane	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	1.32 J
	1,1-Dichloroethene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	3.41	2.84	3.01	4.14
	1,2,4-Trichlorobenzene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.72
	1,2,4-Trimethylbenzene	4.18J	2.85	4.9	1.9 J	6.11	8.84	21.9	32.7	5.13
	1,2-Dichloroethane (EDC)	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.67
	1,2-Dichlorobenzene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.65
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.68
	1,2-Dichloropropane	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.61
	1,2-Dibromoethane (EDB)	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.48
	1,3,5-Trimethylbenzene	4.17J	2.26	3.68	1.94 J	3.64 J	8.28	20.5	24.5	3.89
	1,3-Dichlorobenzene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.53
	1,4-Dichlorobenzene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.69
	Acetone	19.6	23.3	21	16.6	18	9.47	14.6	11.1	<8.45
	Benzene	< 1.27	0.56J	0.67 J	< 1.29	2.63 J	2.15 J	1.12 J	1.67 J	4.1
	Bromomethane	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.24
	Carbon tetrachloride	< 1.27	< 0.24	1.07 J	2.97 J	4.18 J	12.8	10.6	12.9	9.48
	Chlorobenzene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.35
	Chloroethane	< 1.27	1.27	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.41
	Chloroform	7.3	< 0.24	11	12.8	16.3	9.03	7.64	9.05	6.98
	Chloromethane	< 1.27	0.91	0.64 J	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.25
	cis-1,2-Dichloroethene	9.78	< 0.24	8	14	19.5	6.54	6.77	8.62	6.12
	cis-1,3-Dichloropropene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.33
	Dichlorodifluoromethane	< 1.27	0.36J	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.2
	Ethylbenzene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.45
	Hexachlorobutadiene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<1
	m,p-Xylene	< 2.54	0.74J	< 1.25	< 2.58	<2.58	2.49 J	3.79 J	3.29 J	<0.93
	MEK (2-Butanone)	5.71J	12.6	3.96 J	2.06 J	4.14 J	<0.87	2.44 J	2.06 J	11.4
	Methylene chloride	< 1.27	0.32J	0.71 J	< 1.53	1.39 J	1.51 J	< 1.26	1.09 J	<8.45
	MTBE (Methyl tert-butyl ether)	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.32
	o-Xylene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	0.95 J
	Styrene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.5
	TCE (Trichloroethene)	138	1.14	213	408	557	365	332	352	286
	PCE (Tetrachloroethene)	15.1	1.07	13.3	23	43.4	8	13.1	15	9.26
	Toluene	< 1.27	0.62J	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	2.01 J
	trans-1,3-Dichloropropene	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.26
	Trichlorofluoromethane	< 1.27	< 0.24	0.78 J	1.83 J	2.75 J	2.32 J	1.98 J	2.3	1.62 J
	Vinyl chloride	< 1.27	< 0.24	< 0.62	< 1.29	<1.29	<0.87	< 0.82	< 0.64	<0.29
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	41.7J	< 20.9	< 41.4	71.8	<32.2	<41.5	85.5	87.5	<76
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	0.9J	< 0.13	0.7	1.34	1.85	0.29 J	0.34 J	0.34 J	0.32 J
	Carbon Monoxide	< 0.15	< 0.13	< 0.15	< 0.15	<0.15	<0.15	< 0.14	< 0.13	<0.13
	Methane	< 0.15	< 0.13	< 0.15	< 0.15	<0.15	<0.15	< 0.14	< 0.11	<0.12
	Nitrogen	74.3	74.4	132 UR	74.6	75.8	75.2	75.9	78.2	78.2
	Oxygen	24.8	25.5	16.7	24	22.4	24.5	23.8	21.4	21.5

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	70-02							
	Sample ID	ST219-AR-7002-18012011	ST219-AR-7002-12112010	ST219-AR-7002-17092010	ST219-AR-7002-17022010	ST219-AR-7002-101109	ST219-AR-7002-070809	ST219-AR-7002-14032009	ST219-AR-7002-10072008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	07/10/08
	Analyte / Screen Depth	85-90							
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	0.77 J	<0.39	4.36 J	< 4.4	< 0.16	< 0.61	2.19 J	4.15 U
	1,1,2,2-Tetrachloroethane	<0.32	<0.96	<2.48	< 4.4	< 0.24	< 1.42	0.64 U	5.63 U
	1,1,2-Trichloroethane	<0.54	<0.52	<4.15	< 4.4	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	1.09 J	0.88 J	4.31 J	0.66 J	< 0.17	3.17 J	2.1 J	2.97 U
	1,1-Dichloroethane	<0.6	<0.39	<4.58	< 4.4	< 0.21	1.45 J	0.59 J	3.96 U
	1,1-Dichloroethene	<0.7	<0.74	27	< 4.4	< 0.14	10.2	0.98 U	2.93 U
	1,2,4-Trichlorobenzene	<0.66	<0.44	<5.11	< 4.4	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	11.2	22	293	4.49	146 J	46.6	2.91 U	6.34 U
	1,2-Dichloroethane (EDC)	<0.62	<0.37	<4.76	< 4.4	ND	ND	ND	ND
	1,2-Dichlorobenzene	<0.6	<0.61	<4.62	< 4.4	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<0.63	<0.43	<4.83	< 4.4	ND	ND	ND	ND
	1,2-Dichloropropane	<0.57	<0.33	<4.36	< 4.4	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<0.45	3.09	<3.43	< 4.4	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	9.6	9.84	287	2.68 J	150 J	51.6	3.33 U	6.45 U
	1,3-Dichlorobenzene	<0.49	<0.63	<3.79	< 4.4	ND	ND	ND	ND
	1,4-Dichlorobenzene	<0.64	<0.6	<4.9	< 4.4	ND	ND	ND	ND
	Acetone	39.8	28.4	80.6	8.07 J	77.1	45.2	9.39 J	19 J
	Benzene	4.35	85.8	37.9 B	2.75 J	1.37 J	40.5	2.34 J	5.49 U
	Bromomethane	0.55 J	2.19 J	<1.73	0.88 J	ND	ND	ND	ND
	Carbon tetrachloride	2.33 J	4.94	8.34 J	3.71 J	< 0.13	10.1	3.57 U	3.23 U
	Chlorobenzene	<0.32	<0.44	<2.48	< 4.4	< 0.16	< 0.99	0.39 U	5.56 U
	Chloroethane	<0.38	<0.69	<2.94	< 4.4	ND	ND	ND	ND
	Chloroform	14.6	24.6	22.4 J	20.4	0.94 J	21.4	14.2 J	22.1
	Chloromethane	0.7 J	1.72 J	<1.8	< 4.4	0.94 J	4.3 J	3.67 U	2.79 U
	cis-1,2-Dichloroethene	40.9	39.3	425	64	19.8	257	135	167
	cis-1,3-Dichloropropene	<0.31	<0.47	<2.37	< 4.4	ND	ND	ND	ND
	Dichlorodifluoromethane	0.52 J	1.1 J	<1.46	< 4.4	0.67 J	< 6.9	0.6 U	2.14 U
	Ethylbenzene	<0.42	53.2	8.76 J	< 4.4	1.38 J	< 0.74	2.4 U	5.94 U
	Hexachlorobutadiene	<0.49	<0.56	<3.74	< 4.4	ND	ND	ND	ND
	m,p-Xylene	2.45 J	118	44.6	< 4.4	6.81	10.5	7.48 U	11.69 U
	MEK (2-Butanone)	3.64 J	9.25	<2.65	5.4 J	24.2	< 0.89	1.62 U	6.39 J
	Methylene chloride	2.04 J	<0.49	12 J	3.85 J	< 8.9	< 34.3	16.6 J	4.91 J
	MTBE (Methyl tert-butyl ether)	<0.29	<0.67	<3.92	< 8.8	0.99 J	< 1.19	2.18 J	4.15 U
	o-Xylene	<0.45	27.6	9.09 J	< 4.4	0.64 J	< 1.65	3.45 U	6.42 U
	Styrene	<0.47	<0.52	<3.59	< 4.4	ND	ND	ND	ND
	TCE (Trichloroethene)	373	420	839	559	72.4	972	883	1,540
	PCE (Tetrachloroethene)	47	40.7	1,040	67.3	123	541	130	212
	Toluene	<0.57	163	44.4	0.93 J	4.01	< 2.06	1.69 U	6.3 U
	trans-1,3-Dichloropropene	<0.24	<0.49	<1.87	< 4.4	ND	ND	ND	ND
	Trichlorofluoromethane	1.35 J	1.43 J	9.39 J	1.28 J	< 0.09	2.88 J	1.64 J	2.78 U
	Vinyl chloride	<0.27	<0.38	<2.09	< 4.4	< 0.13	< 2.46	1.6 U	4.44 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	57	17 J	778	8.17 J	291	163	10.6 J	ND
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	1.4	1.29	1.61	1.28	< 0.06	1.91	1.57	1.63
	Carbon Monoxide	<0.13	<0.12	<0.06	< 0.5	< 0.08	< 0.07	0.08 U	0.08 U
	Methane	<0.12	<0.11	<0.05	< 0.5	< 0.08	< 0.07	0.08 U	0.09 U
	Nitrogen	63.1	77.6	76.8	77.9	88.6	71.7	75.6	91.1
	Oxygen	16.6	21.1	21.6	20.9	25.1	17.9	18.1	20.4

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	70-03								
	Sample ID	ST70-AR-7003-240413	ST70-AR-7003-160113	ST219-AR-7003-121012	ST219-AR-7003-230812	ST219-AR-7003-130412	ST219-AR-7003-030112	ST219-AR-7003-161111	ST219-AR-7003-28092011	ST219-AR-7003-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	315-330								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	0.6 J
	1,1,2,2-Tetrachloroethane	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	9.19	< 1.22	< 0.68	<0.34
	1,1,2-Trichloroethane	< 0.84	0.85J	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.57
	1,1,2-Trichloro-1,2,2-trifluoroethane	3.73	< 0.4	2.61 J	1.89 J	2.01	<0.93	< 1.22	0.72 J	<0.7
	1,1-Dichloroethane	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.63
	1,1-Dichloroethene	3.69	< 0.4	2.96 J	1.77 J	2.04	<0.93	< 1.22	< 0.68	<0.74
	1,2,4-Trichlorobenzene	4.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.7
	1,2,4-Trimethylbenzene	3.56	1.41	4.4	2.45	3.66	8.49	12.1	21.1	3.42 J
	1,2-Dichloroethane (EDC)	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.65
	1,2-Dichlorobenzene	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.63
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.66
	1,2-Dichloropropane	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.6
	1,2-Dibromoethane (EDB)	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.47
	1,3,5-Trimethylbenzene	3.4	1.01J	3.17 J	2.29	2.25	7.61	11.3	14.8	2.05 J
	1,3-Dichlorobenzene	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.52
	1,4-Dichlorobenzene	1.48J	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.67
	Acetone	28	29.5	8.36	8.98	36	26.4	8.66	7.15	44
	Benzene	1.69J	0.54J	3.1 J	0.65 J	1.3 J	2 J	< 1.22	1.54 J	4.63
	Bromomethane	0.95J	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	0.35 J
	Carbon tetrachloride	14.4J	< 0.4	11	6.92	8.33	1.51 J	2.14 J	2.23 J	1.59 J
	Chlorobenzene	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.34
	Chloroethane	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.4
	Chloroform	7.56	< 0.4	7.48	5.82	6.36	17.5	14.9	17.7	10.9
	Chloromethane	1.43J	0.56J	< 1.01	< 0.64	0.71 J	<0.93	< 1.22	< 0.68	<0.25
	cis-1,2-Dichloroethene	5.93	< 0.4	6.04	8.15	4.29	13.2	15	16.9	21.8
	cis-1,3-Dichloropropene	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.32
	Dichlorodifluoromethane	0.89J	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.2
	Ethylbenzene	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	0.66 J
	Hexachlorobutadiene	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.97
	m,p-Xylene	< 1.68	0.94J	< 2.02	1.37 J	<1.03	2.29 J	2.79 J	2.4 J	<0.91
	MEK (2-Butanone)	5.23J	19.7	< 1.01	< 0.64	4.97	4.56 J	< 1.22	1.64 J	78.1
	Methylene chloride	1.46J	0.45J	1.45 J	< 1.37	1.05 J	1.32 J	< 1.34	< 0.68	<0.97
	MTBE (Methyl tert-butyl ether)	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.31
	o-Xylene	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.47
	Styrene	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	3.15 J
	TCE (Trichloroethene)	283	0.55J	330	255	200	187	391	338	298
	PCE (Tetrachloroethene)	10.7	1.45	4.26	19	3.86	22.4	21.9	26.9	27.1
	Toluene	1.04J	1.17J	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	0.7 J
	trans-1,3-Dichloropropene	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.26
	Trichlorofluoromethane	2.33J	< 0.4	1.88 J	1.53 J	1.42 J	<0.93	1.25 J	1.04 J	<1.11
	Vinyl chloride	< 0.84	< 0.4	< 1.01	< 0.64	<0.51	<0.93	< 1.22	< 0.68	<0.29
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	41.9J	< 22.9	< 36.3	62.8	<24.8	<30.4	< 54.8	< 50.1	<44
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	0.29J	< 0.13	0.2	0.3 J	0.28 J	1.71	1.53	1.49	1.75
	Carbon Monoxide	< 0.15	< 0.13	<0.15	< 0.15	<0.15	<0.15	< 0.14	< 0.14	<0.12
	Methane	< 0.15	< 0.13	<0.15	< 0.15	<0.15	<0.15	< 0.14	< 0.12	<0.11
	Nitrogen	75.1	74.5	130 UR	74.9	75	74	74.8	77.1	77.6
	Oxygen	24.6	25.5	17.2	24.8	24.7	24.3	23.6	21.5	20.6

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	70-03							
	Sample ID	ST219-AR-7003-18012011	ST219-AR-7003-12112010	ST219-AR-7003-17092010	ST219-AR-7003-17022010	ST219-AR-7003-101109	ST219-AR-7003-070809	ST219-AR-7003-14032009	ST219-AR-7003-10072008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	07/10/08
	Analyte / Screen Depth	315-330							
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	1.34 J	2.19 J	2.36 J	< 4.5	11	< 0.4	1.54 J	2.06 U
	1,1,2,2-Tetrachloroethane	36.5	<3.27	450	5.34	< 0.75	< 0.93	1.67 U	2.8 U
	1,1,2-Trichloroethane	154	<1.76	<3.35	< 4.5	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	2.46 J	2.77 J	<3.06	1.28 J	37.4	2.55 J	4.84 J	2.68 J
	1,1-Dichloroethane	<2.22	<1.33	<3.7	< 4.5	3.89 J	< 0.52	1.35 J	1.97 U
	1,1-Dichloroethene	11.2 J	16.3	16.7 J	< 4.5	19.6	2 J	3.16 J	1.46 U
	1,2,4-Trichlorobenzene	<2.48	<1.52	<4.13	< 4.5	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	8.14 J	82.2	220	0.58 J	193	1.13 J	4.87 J	3.15 U
	1,2-Dichloroethane (EDC)	88.6	<1.25	<3.84	< 4.5	ND	ND	ND	ND
	1,2-Dichlorobenzene	<2.24	<2.08	<3.74	< 4.5	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<2.35	<1.49	<3.91	< 4.5	ND	ND	ND	ND
	1,2-Dichloropropane	1,310	<1.14	<3.52	< 4.5	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<1.66	<1.44	<2.77	< 4.5	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	6.98 J	109	221	0.98 J	260	< 1.24	3.54 J	3.21 U
	1,3-Dichlorobenzene	<1.84	<2.16	<3.06	< 4.5	ND	ND	ND	ND
	1,4-Dichlorobenzene	<2.38	<2.04	<3.96	< 4.5	ND	ND	ND	ND
	Acetone	19.6 J	37.8	46	12	49.8	35.6	12.4	27.5
	Benzene	12.3 J	5.34 J	24.4 B	2.82 J	5.76	13.2	2.9 J	9.29 J
	Bromomethane	<0.84	<1.82	<1.4	< 4.5	ND	ND	ND	ND
	Carbon tetrachloride	9.36 J	6.62 J	5.57 J	4.39 J	16.1	16.8	14.6	20.1
	Chlorobenzene	<1.2	<1.49	<2	< 4.5	< 0.49	< 0.65	1.35 U	2.77 U
	Chloroethane	<1.43	<2.38	<2.37	< 4.5	ND	ND	ND	ND
	Chloroform	13.5	14.6	14.7 J	17.7	26.1	12.5	20.8	15.7
	Chloromethane	<0.88	4.55 J	<1.46	< 4.5	< 0.47	< 0.67	1.15 U	1.39 U
	cis-1,2-Dichloroethene	11.4 J	212	276	54.9	316	10.8	131	15.3
	cis-1,3-Dichloropropene	<1.15	<1.61	<1.92	< 4.5	ND	ND	ND	ND
	Dichlorodifluoromethane	<0.71	<1.82	1.37 J	0.7 J	< 5.6	< 4.5	1.11 U	1.07 U
	Ethylbenzene	<1.55	11	10.7 J	< 4.5	15.5	< 0.48	0.94 U	2.95 U
	Hexachlorobutadiene	<1.82	<1.93	<3.02	< 4.5	ND	ND	ND	ND
	m,p-Xylene	<3.24	<4.19	36.9	< 4.5	17.7	< 1	2.57 U	5.82 U
	MEK (2-Butanone)	3.69 J	6.48 J	<2.14	5.18 J	20.8	< 0.58	2.1 J	7.58 J
	Methylene chloride	7.9 J	2.36 J	11.3 J	4.16 J	< 27.8	< 22.4	4.39 J	4.72 J
	MTBE (Methyl tert-butyl ether)	<1.1	<2.3	<3.17	< 9	< 0.79	< 0.78	0.9 U	2.07 U
	o-Xylene	<1.66	<2.19	<2.77	< 4.5	< 0.63	< 1.08	1.15 U	3.2 U
	Styrene	<1.74	<1.8	<2.9	< 4.5	ND	ND	ND	ND
	TCE (Trichloroethene)	341	486	569	506	795	535	816	788
	PCE (Tetrachloroethene)	18.5	496	745	50.1	864	11.3	323	14.3
	Toluene	2.15 J	4.78 J	22.2	< 4.5	1.34 J	< 1.35	2.1 U	3.13 U
	trans-1,3-Dichloropropene	<0.91	<1.69	<1.51	< 4.5	ND	ND	ND	ND
	Trichlorofluoromethane	<3.94	2.95 J	7.22 J	1.23 J	26	2.54 J	2.72 J	1.38 U
	Vinyl chloride	<1.02	<1.29	<1.69	< 4.5	< 0.4	< 1.61	1.14 U	2.21 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	45.7 J	702	701	15.7 J	675	< 53.8	37.6 J	ND
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	0.23 J	1.97	0.59	1.1	2.2	0.28 J	0.56 J	0.26
	Carbon Monoxide	<0.12	<0.12	<0.06	< 0.5	< 0.08	< 0.08	0.08 U	0.08 U
	Methane	<0.11	<0.11	<0.05	< 0.5	< 0.08	< 0.08	0.08 U	0.09 U
	Nitrogen	72.1	76.4	77.1	77.9	89.5	70.8	73.1	95.4
	Oxygen	19.5	21.7	22.3	21	25.3	18.9	18.4	19.2

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-29H								
	Sample ID	ST70-AR-29H-240413	ST70-AR-29H-160113	ST219-AR-29H-121012	ST219-AR-29H-230812	ST219-AR-29H-130412	ST219-AR-29H-030112	ST219-AR-29H-161111	ST219-AR-29H-28092011	ST219-AR-29H-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	50-90								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	< 0.24	< 1.18	< 3.9	1.58	1.73 J	0.49 J	0.36 J	1.53	0.35 J
	1,1,2,2-Tetrachloroethane	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.09
	1,1,2-Trichloroethane	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.16
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 0.24	< 1.18	< 3.9	2.99	2.88	<0.29	0.29 J	< 0.41	0.48 J
	1,1-Dichloroethane	< 0.24	< 1.18	< 3.9	0.36 J	0.65 J	<0.29	< 0.24	< 0.41	0.33 J
	1,1-Dichloroethene	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.21
	1,2,4-Trichlorobenzene	< 0.24	< 1.18	7.85 J	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.2
	1,2,4-Trimethylbenzene	1.96	2.79J	1,060	1.37	<0.64	<0.29	< 0.24	3.87	0.33 J
	1,2-Dichloroethane (EDC)	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.18
	1,2-Dichlorobenzene	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.18
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.19
	1,2-Dichloropropane	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.17
	1,2-Dibromoethane (EDB)	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.13
	1,3,5-Trimethylbenzene	1.49	11.6	948	5.05	0.8 J	<0.29	< 0.24	1.27 J	0.38 J
	1,3-Dichlorobenzene	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.15
	1,4-Dichlorobenzene	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.19
	Acetone	29.3	7.2J	< 3.9	14.8	7.37	9.17	8.18	7.34	19
	Benzene	0.26J	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	2.94	0.7 J
	Bromomethane	0.49J	< 1.18	< 3.9	0.59 J	<0.64	<0.29	< 0.24	< 0.41	<0.07
	Carbon tetrachloride	< 0.24	< 1.18	< 3.9	2.17	1.82 J	<0.29	< 0.24	< 0.41	0.14 J
	Chlorobenzene	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.09
	Chloroethane	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.11
	Chloroform	< 0.24	< 1.18	< 3.9	6.64	3.01	<0.29	0.27 J	< 0.41	0.32 J
	Chloromethane	1.22	< 1.18	< 3.9	0.68 J	<0.64	0.31 J	0.37 J	< 0.41	<0.07
	cis-1,2-Dichloroethene	0.33J	6.94	47.9	3.37	7.64	1.39	1.52	5.24	6.41
	cis-1,3-Dichloropropene	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.09
	Dichlorodifluoromethane	0.45J	< 1.18	< 3.9	0.43 J	<0.64	0.58 J	< 0.24	< 0.41	<0.06
	Ethylbenzene	< 0.24	< 1.18	18	0.68 J	<0.64	<0.29	< 0.24	23.1	0.26 J
	Hexachlorobutadiene	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.29
	m,p-Xylene	0.55J	< 2.36	163	2.71	<1.28	<0.59	< 0.48	23	<0.26
	MEK (2-Butanone)	3.13	< 1.18	< 3.9	4.41	1.33 J	2.71	0.9 J	1.85 J	3.73
	Methylene chloride	0.39J	< 1.18	4.91 J	< 1.09	0.68 J	0.68 J	< 0.26	2.81 J	<0.25
	MTBE (Methyl tert-butyl ether)	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.09
	o-Xylene	< 0.24	< 1.18	< 3.9	0.83 J	<0.64	<0.29	< 0.24	9.46	<0.13
	Styrene	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	8.93	<0.14
	TCE (Trichloroethene)	1.18	27.3	10 J	84	106	5.54	9.53	38.9	16.9
	PCE (Tetrachloroethene)	0.81	25.5	8.47 J	59.8	56.5	1.04	8.91	13.5	8.41
	Toluene	0.4J	< 1.18	< 3.9	0.28 J	<0.64	<0.29	< 0.24	18	0.44 J
	trans-1,3-Dichloropropene	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.07
	Trichlorofluoromethane	< 0.24	1.23J	< 3.9	3.98	3.31	1.34	1.17	0.79 J	0.71 J
	Vinyl chloride	< 0.24	< 1.18	< 3.9	< 0.27	<0.64	<0.29	< 0.24	< 0.41	<0.08
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	17.8J	122	911	< 40.9	<14.7	<11.2	< 11.5	< 17.7	<22.4
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	0.32J	8.28	3.8	7.41	7.83	3.76	6.43	5.17	8.5
	Carbon Monoxide	< 0.14	< 0.13	<0.15	< 0.16	<0.15	<0.13	< 0.14	< 0.12	<0.15
	Methane	< 0.14	< 0.13	<0.15	< 0.16	<0.15	<0.13	< 0.14	< 0.11	<0.14
	Nitrogen	74.3	78	128 UR	75.6	77.2	75.6	76.4	78	80.9
	Oxygen	25.3	13.7	13.8	17	15	20.7	17.2	16.8	10.6

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-29H								
	Sample ID	ST219-AR-29H-18012011	ST219-AR-29H-12112010	ST219-AR-29H-17092010	ST219-AR-29H-17022010	ST219-AR-29H-101109	ST219-AR-29H-070809	ST219-AR-29H-14032009	ST219-AR-219-29H-10072008	ST219-AR-219-29H-27032008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	07/10/08	03/27/08
	Analyte Screen Depth	50-90								
VOCs (ppbv)	1,1,1-Trichloroethane	1.92	0.83 J	1.18 J	0.84 J	3.48	< 0.43	2.18 J	1.28 J	2.01 U
Method TO-15[a]	1,1,2,2-Tetrachloroethane	<0.12	<0.37	10.8	< 1.1	6.09	< 1.01	0.61 U	0.56 U	20.3
	1,1,2-Trichloroethane	<0.2	<0.2	<0.2	< 1.1	ND	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	5.05	1.38	0.27 J	1.33	2.89	< 0.75	5.16	1.3 J	2.71 J
	1,1-Dichloroethane	0.53 J	0.43 J	<0.22	2	1.55	3.69 J	4	1.62 J	12.7
	1,1-Dichloroethene	1.62	<0.29	0.32 J	1.46	0.99 J	< 0.98	0.36 U	1.02 J	2.93 U
	1,2,4-Trichlorobenzene	<0.25	<0.17	<0.24	< 1.1	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	0.35 J	12.1	3.79	< 1.1	69.7	453	2.31 J	58.3	26
	1,2-Dichloroethane (EDC)	<0.23	<0.14	<0.23	< 1.1	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	<0.23	<0.23	<0.22	< 1.1	ND	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<0.24	<0.17	<0.23	< 1.1	ND	ND	ND	ND	ND
	1,2-Dichloropropane	<0.21	<0.13	<0.21	< 1.1	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<0.17	0.71 J	<0.16	< 1.1	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	0.23 J	6.01	4.78	0.6 J	46.9	571	4.48	29.1	28.9
	1,3-Dichlorobenzene	<0.19	<0.24	<0.18	< 1.1	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	<0.24	<0.23	<0.23	< 1.1	ND	ND	ND	ND	ND
	Acetone	<0.45	21.9	19 B	3.63	20.1	72.4	8.01	18.6	78.9
	Benzene	0.34 J	23.5	6.42	1.07 J	< 0.14	< 0.68	0.3 U	3.85	2.99 J
	Bromomethane	<0.08	<0.2	<0.08	0.43 J	ND	ND	ND	ND	ND
	Carbon tetrachloride	1.75	0.25 J	<0.09	< 1.1	0.35 J	< 0.39	1.88 J	0.32 U	2.18 U
	Chlorobenzene	<0.12	<0.17	<0.12	< 1.1	< 1.5	< 0.7	0.49 U	0.55 U	1.87 U
	Chloroethane	<0.14	<0.27	<0.14	< 1.1	ND	ND	ND	ND	ND
	Chloroform	1.73	0.78 J	<0.18	0.83 J	0.81 J	< 0.3	5.22	1.06 J	7.41 J
	Chloromethane	0.2 J	<0.18	0.44 J	< 1.1	< 0.12	3.36 J	0.47 J	0.28 U	2.74 U
	cis-1,2-Dichloroethene	14.4	8.52	3.41	104	14.6	330	29.7	68.4	118
	cis-1,3-Dichloropropene	<0.12	<0.18	<0.11	< 1.1	ND	ND	ND	ND	ND
	Dichlorodifluoromethane	0.58 J	0.65 J	0.52 J	0.58 J	0.83 J	< 4.9	0.94 J	0.21 U	3.04 U
	Ethylbenzene	<0.16	12.1	5.67	< 1.1	1.46 J	18.3	0.34 U	1.68 J	2.19 J
	Hexachlorobutadiene	<0.18	<0.22	0.24 J	< 1.1	ND	ND	ND	ND	ND
	m,p-Xylene	<0.33	31.3	24.3	< 1.1	12.5	212	1.07 J	11.7	9.69 J
	MEK (2-Butanone)	<0.13	3.03	5.13	< 2.2	14.5	< 0.63	0.55 J	0.56 U	30.5
	Methylene chloride	0.77 J	<0.19	0.68 J	1.55 J	7.34	< 24.3	5.31	4.37	12.2
	MTBE (Methyl tert-butyl ether)	<0.11	<0.26	<0.19	< 2.2	1.88 J	< 0.84	0.58 J	0.41 U	5.11 U
	o-Xylene	<0.17	11.6	18	< 1.1	< 0.17	< 1.17	0.42 U	0.64 U	2.46 U
	Styrene	<0.18	<0.2	<0.17	< 1.1	ND	ND	ND	ND	ND
	TCE (Trichloroethene)	69.6	33	11.1	60.2	78.1 J	43.6	267	117	538
	PCE (Tetrachloroethene)	40.4	20.7	8.34	16.6	39.5	14.8	33.8	34	91.1
	Toluene	<0.21	87.9	16.6	0.44 J	0.98 J	< 1.46	0.76 U	0.91 J	6.93 J
	trans-1,3-Dichloropropene	<0.09	<0.19	<0.09	< 1.1	ND	ND	ND	ND	ND
	Trichlorofluoromethane	4.98	2.14	1.23	1.93	2.56	1.44 J	3.92	4.34	3.34 U
	Vinyl chloride	<0.1	<0.15	<0.1	< 1.1	< 0.11	< 1.74	0.41 U	1.29 J	2.39 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	15.1 J	10.7 J	19.7 J	18.1 J	< 58.5	530	8.1 J	17.5	76.4
Fixed Gases (%)	Carbon Dioxide	4.85	5.02	4.04	7.34	7.2	8.28	7.34	7.37	13.2
Method SM2720C[c]	Carbon Monoxide	<0.12	<0.11	<0.06	< 0.5	< 0.09	< 0.07	0.07 U	0.08 U	0.1 U
	Methane	<0.11	<0.1	<0.05	< 0.5	< 0.09	< 0.07	0.07 U	0.09 U	0.09 U
	Nitrogen	69.9	78.8	78.5	79.7	87.3	70.4	76.2	75.7	73.5
	Oxygen	12.5	16.2	17.4	12.9	16.4	11.7	10.4	11.8	6.55

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-38-41								
	Sample ID	ST70-AR-38-41-240413	ST70-AR-38-41-160113	ST219-AR-38-41-121012	ST219-AR-38-41-230812	ST219-AR-38-41-130412	ST219-AR-38-41-030112	ST219-AR-38-41-161111	ST219-AR-38-41-28092011	ST219-AR-38-41-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	38-43								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<13.8
	1,1,2,2-Tetrachloroethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	5,470	<12.9
	1,1,2-Trichloroethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<21.6
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<19.7
	1,1-Dichloroethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<23.8
	1,1-Dichloroethene	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<28.1
	1,2,4-Trichlorobenzene	< 30.3	< 1.18	3.28 J	< 33.3	<153	<20.1	< 31.4	< 111	<26.6
	1,2,4-Trimethylbenzene	385	65.1	501	504	8,410	1,140	1,630	3,370	9,970
	1,2-Dichloroethane (EDC)	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<24.8
	1,2-Dichlorobenzene	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<24.1
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<25.2
	1,2-Dichloropropane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<22.7
	1,2-Dibromoethane (EDB)	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<17.8
	1,3,5-Trimethylbenzene	454	72.4	384	561	6,120	1,510	1,930	3,570	8,390
	1,3-Dichlorobenzene	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<19.7
	1,4-Dichlorobenzene	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<25.5
	Acetone	63.6J	8.12	32.5	< 33.3	<153	<20.1	< 31.4	< 137	<48.2
	Benzene	54.6J	1.36J	< 3.02	< 33.3	227 J	113	144	386	158
	Bromomethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<9.01
	Carbon tetrachloride	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<9.74
	Chlorobenzene	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<12.9
	Chloroethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<15.3
	Chloroform	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<19.4
	Chloromethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<9.38
	cis-1,2-Dichloroethene	3,270	172	667	5,770	4,820	5,110	4,420	6,450	9,730
	cis-1,3-Dichloropropene	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<12.3
	Dichlorodifluoromethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<7.58
	Ethylbenzene	103	7.57	25.9	< 33.3	306 J	177	166	250	332
	Hexachlorobutadiene	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<36.2
	m,p-Xylene	402	40.8	168	411	1,550	954	909	1,520	2,170
	MEK (2-Butanone)	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	103 J	<13.8
	Methylene chloride	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<33.3
	MTBE (Methyl tert-butyl ether)	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<11.8
	o-Xylene	< 30.3	3.65J	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<17.8
	Styrene	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<18.7
	TCE (Trichloroethene)	1,070	14.7	67	1,040	346 J	363	409	707	387
	PCE (Tetrachloroethene)	87.5J	1.57J	7.35 J	68.4 J	<153	32.2 J	< 31.4	45.9 J	58 J
	Toluene	< 30.3	1.68J	3.47 J	< 33.3	<153	24.8 J	< 31.4	58.7 J	40.5 J
	trans-1,3-Dichloropropene	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<9.74
	Trichlorofluoromethane	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<42.3
	Vinyl chloride	< 30.3	< 1.18	< 3.02	< 33.3	<153	<20.1	< 31.4	< 38.7	<10.9
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	3,910	435	2,120	4,000	8,320	4,220	3,800	5,970	8,300
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	13.7	0.95J	3.2	12.5	14.8	18.7	16.6	15.7	15.5
	Carbon Monoxide	< 0.14	< 0.13	< 0.15	< 0.15	<0.15	<0.14	< 0.14	< 0.13	<0.13
	Methane	0.77J	< 0.13	0.2	1.07	1.69	1.75	1.56	1.32	2.1
	Nitrogen	76.6	74.5	125 UR	75.4	75.7	76.5	77.2	81	80.3
	Oxygen	8.97	24.5	17.2	11	7.78	3.07	4.63	2.08	2.16

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-38-41								
	Sample ID	ST219-AR-38-41-18012011	ST219-AR-38-41-12112010	ST219-AR-38-41-17092010	ST219-AR-38-41-17022010	ST219-AR-38-41-101109	ST219-AR-38-41-070809	ST219-AR-38-41-140309	ST219-AR-219-38-41-10072008	ST219-AR-219-38-41-27032008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	07/10/08	03/27/08
	Analyte / Screen Depth	38-43								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	<15.8	<10.1	<18.2	< 160.5	< 5.07	< 0.44	11.74 U	75.29 U	98.37U
	1,1,2,2-Tetrachloroethane	<14.8	<24.9	<17	< 160.5	< 7.71	< 1.02	11.25 U	102.15 U	102.9U
	1,1,2-Trichloroethane	<24.8	<13.4	<28.5	< 160.5	ND	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	<22.7	<11.1	<26.1	< 160.5	< 5.36	3.42 J	8.02 U	53.84 U	120.5U
	1,1-Dichloroethane	<27.4	<10.1	<31.5	< 160.5	< 6.82	< 0.56	8.02 U	71.95 U	89.87U
	1,1-Dichloroethene	<32.3	<19.4	<37.2	23.6 J	14.9 J	< 0.99	50.5 J	53.16 U	142.9U
	1,2,4-Trichlorobenzene	<30.6	<11.6	<35.1	< 160.5	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	5,910	1,240	12,200	1720	3830 J	430	1350	3,200	397 J
	1,2-Dichloroethane (EDC)	<28.4	<9.54	<32.7	< 160.5	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	<27.7	<15.8	<31.8	< 160.5	ND	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<28.9	<11.3	<33.2	< 160.5	ND	ND	ND	ND	ND
	1,2-Dichloropropane	<26.1	<8.7	<30	< 160.5	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<20.5	<11	<23.6	< 160.5	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	5,750	1,440	9,260	2070	3930 J	340	1620	2,570	435 J
	1,3-Dichlorobenzene	<22.7	<16.4	<26.1	< 160.5	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	<29.3	<15.6	<33.7	< 160.5	ND	ND	ND	ND	ND
	Acetone	<55.3	281	138 J	104 J	< 6.78	11.7	49.66 U	87.84 U	220 J
	Benzene	272	52 J	261	330	42.3 J	4.81 J	121 J	99.6 U	79.52U
	Bromomethane	<10.4	<13.8	<11.9	< 160.5	ND	ND	ND	ND	ND
	Carbon tetrachloride	<11.2	<10.5	<12.9	< 160.5	< 4.07	< 0.39	62.57 U	58.65 U	106.4U
	Chlorobenzene	<14.8	<11.4	<17	< 160.5	< 5.01	< 0.71	6.88 U	129 J	91.18U
	Chloroethane	<17.6	<18.1	<20.2	< 160.5	ND	ND	ND	ND	ND
	Chloroform	<22.3	<26.8	<25.6	< 160.5	< 6.82	3.29 J	8.44 U	68.9 U	98.59U
	Chloromethane	<10.8	<12.1	<12.4	< 160.5	< 4.82	< 0.73	64.31 U	50.72 U	133.8U
	cis-1,2-Dichloroethene	13,200	7,160	14,200	20000	11,100	482	31000	16,100	8,210
	cis-1,3-Dichloropropene	<14.2	<12.3	<16.3	< 160.5	ND	ND	ND	ND	ND
	Dichlorodifluoromethane	<8.72	<13.8	<10	< 160.5	< 4.07	< 0.43	10.51 U	38.92 U	148.7U
	Ethylbenzene	397	204	341	< 160.5	< 8.25	< 0.53	176 J	138 J	102.9U
	Hexachlorobutadiene	<22.4	<14.7	<25.7	< 160.5	ND	ND	ND	ND	ND
	m,p-Xylene	1,980	1,060	1,750	1330	1050	82.7	681 J	681 J	218 J
	MEK (2-Butanone)	<15.8	<8.29	<18.2	< 321	< 7.86	< 0.64	28.41 U	102.79 U	203.1U
	Methylene chloride	82 J	14.7 J	58.4 J	107 J	< 285	< 24.5	94.6 J	369 J	333 J
	MTBE (Methyl tert-butyl ether)	<13.5	<17.5	<26.9	< 321	< 8.13	< 9.8	30.33 U	75.4 U	249.5 U
	o-Xylene	<20.5	<16.7	<23.6	< 160.5	< 6.45	3.69 J	60.48 U	116.58 U	120.3U
	Styrene	<21.5	<13.7	<24.7	< 160.5	ND	ND	ND	ND	ND
	TCE (Trichloroethene)	446	487	490	665	578 J	130	677	329 J	134 J
	PCE (Tetrachloroethene)	<18.4	41.1 J	37.6 J	45.9 J	30.2 J	5.14	62.3 J	70.07 U	116.7U
	Toluene	36.2 J	147	52.4 J	65.2 J	< 9.46	4.1 J	29.67 U	114.33 U	116.5U
	trans-1,3-Dichloropropene	<11.2	<12.9	<12.9	< 160.5	ND	ND	ND	ND	ND
	Trichlorofluoromethane	<48.6	<14.1	<55.8	< 160.5	< 2.93	< 0.46	3.67 U	50.38 U	162.9 U
	Vinyl chloride	<12.5	<9.86	<14.4	< 160.5	< 4.14	< 1.76	57.5 J	80.55 U	116.9U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	6,300	6,530	7,020	5030	4,660	2650	1920	5320	1,530
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	13.5	13.8	11.6	14.2	11.2	11.4	14.8	9.42	5.79
	Carbon Monoxide	<0.13	<0.11	<0.06	< 0.5	< 0.08	< 0.07	0.08 U	0.08 U	0.09 U
	Methane	1.97	1.28	0.95	1.32	1.21	1.4	1.81	1.36	0.75 J
	Nitrogen	69.9	80.5	79.7	79.1	106 R	70.6	74.8	73.6	69.6
	Oxygen	3.59	4.47	7.69	5.37	16.3	6.3	2.83	11.2	14.2

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-38-99								
	Sample ID	ST70-AR-38-99-240413	ST70-AR-38-99-160113	ST219-AR-38-99-121012	ST219-AR-38-99-230812	ST219-AR-38-99-130412	ST219-AR-38-99-030112	ST219-AR-38-99-161111	ST219-AR-38-99-28092011	ST219-AR-38-99-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	98-103								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<13.7
	1,1,2,2-Tetrachloroethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<12.8
	1,1,2-Trichloroethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<21.4
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<19.6
	1,1-Dichloroethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<23.7
	1,1-Dichloroethene	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<27.9
	1,2,4-Trichlorobenzene	< 15.5	< 18.9	31.2 J	175 J	<381	<30.3	< 20.1	< 22.8	<26.4
	1,2,4-Trimethylbenzene	263	1,910	4,270	772	44,400	1,950	2,580	6,120	6,210
	1,2-Dichloroethane (EDC)	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<24.6
	1,2-Dichlorobenzene	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<23.9
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<25
	1,2-Dichloropropane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<22.5
	1,2-Dibromoethane (EDB)	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<17.7
	1,3,5-Trimethylbenzene	297	1,800	2,630	773	26,700	2,020	2,390	4,470	4,000
	1,3-Dichlorobenzene	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<19.6
	1,4-Dichlorobenzene	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<25.3
	Acetone	142	153	149 J	314	542 J	<307	144	< 164	<136
	Benzene	41.4J	21.1J	< 22.7	36.1 J	638 J	187	123	275	115 J
	Bromomethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	9.48 J
	Carbon tetrachloride	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<9.67
	Chlorobenzene	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<12.8
	Chloroethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<15.2
	Chloroform	48.5J	94.2	61.3 J	97.7 J	704 J	128	113	123	103 J
	Chloromethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<9.31
	cis-1,2-Dichloroethene	2,600	1,010	569	2,550	16,000	1,430	1,030	1,050	1,090
	cis-1,3-Dichloropropene	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<12.3
	Dichlorodifluoromethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<7.53
	Ethylbenzene	70	104	110	167	1110 J	140	123	160	163
	Hexachlorobutadiene	< 15.5	< 18.9	< 22.7	136	<381	<30.3	< 20.1	< 22.8	<37.3
	m,p-Xylene	279	429	343	633	3,850	542	489	638	527
	MEK (2-Butanone)	71.6J	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<13.7
	Methylene chloride	16.6J	21.6J	24.4 J	< 45.2	<381	31.2 J	< 20.1	28.5 J	<38
	MTBE (Methyl tert-butyl ether)	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<11.7
	o-Xylene	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	42.5 J	<17.7
	Styrene	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<18.5
	TCE (Trichloroethene)	5,400	8,800	7,370	8,530	64,100	10,800	10,600	12,000	10,700
	PCE (Tetrachloroethene)	122	168	110	146	1,450	182	172	208	195
	Toluene	26.6J	22J	< 22.7	39.4 J	<381	31.8 J	31.6 J	45.5 J	40.6 J
	trans-1,3-Dichloropropene	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<9.67
	Trichlorofluoromethane	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<41.9
	Vinyl chloride	< 15.5	< 18.9	< 22.7	< 30.6	<381	<30.3	< 20.1	< 22.8	<10.8
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	1,990	2,410	3,470	3,490	2,540	2,130	2,560	3,470	3,530
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	12.2	11.5	7.5	15.9	13.1	17.9	18.3	16.1	15.4
	Carbon Monoxide	< 0.14	< 0.13	< 0.16	< 0.16	<0.16	<0.14	< 0.14	< 0.12	<0.13
	Methane	< 0.14	< 0.13	< 0.16	< 0.16	<0.16	<0.14	< 0.14	< 0.11	<0.12
	Nitrogen	76	76.7	130 UR	77.2	77.6	78.5	78.9	82	81.4
	Oxygen	11.8	11.7	15.8	6.87	9.33	3.58	2.75	1.87	3.14

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-38-99								
	Sample ID	ST219-AR-38-99-18012011	ST219-AR-38-99-12112010	ST219-AR-38-99-17092010	ST219-AR-38-99-17022010	ST219-AR-38-99-101109	ST219-AR-38-99-070809	ST219-AR-38-99-140309	ST219-AR-219-38-99-10072008	ST219-AR-219-38-99-27032008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	07/10/08	03/27/08
	Analyte Screen Depth	98-103								
VOCs (ppbv)	1,1,1-Trichloroethane	31.8 J	<10.8	<6.06	< 77.5	< 58.5	< 5.38	58.9 J	20.84 U	12.3 U
Method TO-15[a]	1,1,2,2-Tetrachloroethane	<6.15	<26.5	<5.67	< 77.5	< 58.5	< 12.6	22.67 U	28.28 U	12.87 U
	1,1,2-Trichloroethane	<10.3	<14.3	<9.51	< 77.5	ND	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	<9.42	12.4 J	16.3 J	< 77.5	9.18 J	19.4 J	12.9 U	14.9 U	15.06 U
	1,1-Dichloroethane	25.2 J	<10.7	<10.5	< 77.5	< 58.5	12 J	16.24 U	19.92 U	11.23 U
	1,1-Dichloroethene	<13.4	<20.6	<12.4	< 77.5	< 58.5	< 12.2	13.56 U	14.72 U	17.87 U
	1,2,4-Trichlorobenzene	<12.7	<12.3	<11.7	< 77.5	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	3,420	1,280	3,730	308	2,410	4100	1890	31.83 U	1,190
	1,2-Dichloroethane (EDC)	<11.8	<10.1	<10.9	< 77.5	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	<11.5	<16.8	<10.6	< 77.5	ND	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<12	<12	<11.1	< 77.5	ND	ND	ND	ND	ND
	1,2-Dichloropropane	<10.8	<9.24	<9.99	< 77.5	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<8.52	<11.7	<7.86	< 77.5	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	3,420	1,110	2,410	342	2,290	2620	1390	32.4 U	945
	1,3-Dichlorobenzene	<9.42	<17.4	<8.69	< 77.5	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	<12.2	<16.6	<11.2	< 77.5	ND	ND	ND	ND	ND
	Acetone	131	748	241	72.1 J	344	231	203	111	137
	Benzene	147	84.5	<9.99	140	32.5 J	39 J	54 J	27.57 U	9.94 U
	Bromomethane	<4.3	<14.7	<3.97	< 77.5	ND	ND	ND	ND	ND
	Carbon tetrachloride	<4.65	<11.2	<4.29	< 77.5	< 58.5	< 4.84	14.26 U	16.23 U	13.3 U
	Chlorobenzene	<6.15	<12.1	<5.67	< 77.5	< 58.5	< 8.71	87.7 J	27.93 U	11.4 U
	Chloroethane	<7.3	<19.3	<6.73	< 77.5	ND	ND	ND	ND	ND
	Chloroform	139	137	185	125	158	179	149	78.8 J	51.9 J
	Chloromethane	<4.48	<12.8	<4.13	< 77.5	< 58.5	12.5 J	15.65 U	14.04 U	16.73 U
	cis-1,2-Dichloroethene	1,620	1,960	2,660	2360	2,040	1720	2670	2,280	1,140
	cis-1,3-Dichloropropene	<5.9	<13	<5.44	< 77.5	ND	ND	ND	ND	ND
	Dichlorodifluoromethane	<3.62	<14.7	<3.34	< 77.5	< 58.5	< 60.5	15.02 U	10.77 U	18.59 U
	Ethylbenzene	185	122	133	57.6 J	106	163	142	72.2 J	81.2
	Hexachlorobutadiene	<9.3	<15.6	<8.57	< 77.5	ND	ND	ND	ND	ND
	m,p-Xylene	785	492	488	207	471	605	684	58.74 U	246
	MEK (2-Butanone)	<6.58	200	<6.06	< 155	88.5 J	< 121	47.4 J	42.1 J	25.39 U
	Methylene chloride	79.4 J	24.4 J	<14.6	53.8 J	< 292.5	< 302.5	184	175	45 J
	MTBE (Methyl tert-butyl ether)	<5.63	<18.6	<8.98	< 155	< 117	< 10.5	13.8 J	20.87 U	31.19 U
	o-Xylene	<8.52	36.8 J	34.6 J	< 77.5	< 58.5	30.9 J	15.63 U	32.27 U	15.04 U
	Styrene	<8.92	<14.6	<8.22	< 77.5	ND	ND	ND	ND	ND
	TCE (Trichloroethene)	11,000	7,750	10,900	6950	8,290	10400	9170	5,750	2,690
	PCE (Tetrachloroethene)	366	145	238	129	172 J	229	176	85.9 J	83.9
	Toluene	175	269	51.3 J	41.1 J	39 J	53.7 J	67.5 J	31.65 U	19.5 J
	trans-1,3-Dichloropropene	<4.65	<13.7	<4.29	< 77.5	ND	ND	ND	ND	ND
	Trichlorofluoromethane	<20.2	<15	26.8 J	< 77.5	7.71 J	12.2 J	19.54 U	13.95 U	20.36 U
	Vinyl chloride	<5.2	<10.5	<4.79	< 77.5	< 58.5	< 21.7	15.45 U	22.3 U	14.61 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	2,790	2,600	2,330	1960	2,090	1580	1770	2050	119
Fixed Gases (%)	Carbon Dioxide	10.9	9.41	17.4	9.45	16.2	13.4	14.7	7.97	7.15
Method SM2720C[c]	Carbon Monoxide	<0.12	<0.12	<0.06	< 0.5	< 0.08	< 0.07	0.09 U	0.08 U	0.09 U
	Methane	<0.11	<0.1	<0.05	< 0.5	< 0.08	< 0.07	0.09 U	0.09 U	0.09 U
	Nitrogen	76.9	79.7	80.9	79.8	92.3	75	77.9	78.7	70.6
	Oxygen	8.69	10.9	1.69	10.7	6.1	4.33	4.3	16.3	13.3

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-39-42								
	Sample ID	ST70-AR-39-42-240413	ST70-AR-39-42-160113	ST219-AR-39-42-121012	ST219-AR-39-42-230812	ST219-AR-39-42-130412	ST219-AR-39-42-030112	ST219-AR-39-42-161111	ST219-AR-39-42-28092011	ST219-AR-39-42-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	40-45								
VOCs (ppbv)	1,1,1-Trichloroethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<17.3
Method TO-15[a]	1,1,2,2-Tetrachloroethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	1,330	< 31.2	640	<16.2
	1,1,2-Trichloroethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<27.2
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<24.8
	1,1-Dichloroethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	15.2 J	<30
	1,1-Dichloroethene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<35.4
	1,2,4-Trichlorobenzene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 22.2	<33.5
	1,2,4-Trimethylbenzene	119	67.4	164NR	57.3 J	591	147	104	163	692
	1,2-Dichloroethane (EDC)	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<31.1
	1,2-Dichlorobenzene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<30.3
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<31.6
	1,2-Dichloropropane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<28.5
	1,2-Dibromoethane (EDB)	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<22.4
	1,3,5-Trimethylbenzene	142	85.7	127NR	55.8 J	480	193	127	143	655
	1,3-Dichlorobenzene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<24.8
	1,4-Dichlorobenzene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<32.1
	Acetone	147J	< 18.9	<18NR	< 41.7	<49.2	<202	158 J	< 7.73	<60.6
	Benzene	292	194	64NR	348	325	502	367	423	758
	Bromomethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<11.3
	Carbon tetrachloride	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<12.2
	Chlorobenzene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<16.2
	Chloroethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<19.2
	Chloroform	39.2J	32J	<18NR	62.4 J	50.8 J	69.2 J	50.9 J	65.6	104 J
	Chloromethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	10.2 J	<11.8
	cis-1,2-Dichloroethene	7,980	5,030	1700NR	11,900	8,200	12,400	9,460	< 7.73	18,100
	cis-1,3-Dichloropropene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<15.5
	Dichlorodifluoromethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<9.54
	Ethylbenzene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	17.4 J	31 J
	Hexachlorobutadiene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<45
	m,p-Xylene	91.5J	58.5J	<35NR	< 83.4	102 J	96.8 J	< 62.4	78.9	142 J
	MEK (2-Butanone)	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	265	<17.3
	Methylene chloride	< 28.2	< 18.9	<18NR	47.8 J	51.2 J	29.6 J	< 31.2	15.1 J	<51.6
	MTBE (Methyl tert-butyl ether)	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<14.8
	o-Xylene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	13.9 J	28.5 J
	Styrene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<23.5
	TCE (Trichloroethene)	13,900	10,800	4000NR	20,600	10,200	16,400	12,700	13,200E	23,900
	PCE (Tetrachloroethene)	3,360	1,940	731NR	3,560	1,170	3,740	2,530	3,830	4,030
	Toluene	94.7	55.5J	18NR	114 J	64.9 J	80.8 J	67.2 J	109	125 J
	trans-1,3-Dichloropropene	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<12.2
	Trichlorofluoromethane	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<53.1
	Vinyl chloride	< 28.2	< 18.9	<18NR	< 41.7	<49.2	<26.9	< 31.2	< 7.73	<13.7
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	1,670	1,360	704NR	709	1,270	969	1,410	1,000	3,100
Fixed Gases (%)	Carbon Dioxide	14.7	15.2	2.8NR	18.2	11.8	19.1	20.0	6.39	15.6
Method SM2720C[c]	Carbon Monoxide	< 0.15	< 0.14	<0.2NR	< 0.15	<0.16	<0.14	< 0.15	< 0.13	<0.14
	Methane	< 0.15	< 0.14	<0.2NR	< 0.15	<0.16	<0.14	< 0.15	< 0.12	<0.12
	Nitrogen	77.3	77.1	129 UR	76.9	74.9	77.1	78.4	78.7	80.1
	Oxygen	7.99	7.6	15NR	4.94	13.3	3.81	1.65	14.9	4.3

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-39-42									
	Sample ID	ST219-AR-39-42-18012011	ST219-AR-39-42-12112010	ST219-AR-39-42-17092010	ST219-AR-39-42-17022010	ST219-AR-39-42-101109	ST219-AR-39-42-070809	ST219-AR-39-42-140309	ST219-AR-219-39-42-10072008	ST219-AR-219-39-42-10072008DUP (Duplicate)	ST219-AR-219-39-42-27032008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	07/10/08	07/10/08	03/27/08
	Analyte Screen Depth	40-45									
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	31.2 J	<19.6	<14.2	< 205	< 12.4	< 28.4	6.15 U	68.48 U	233	56.86 U
	1,1,2,2-Tetrachloroethane	<24.3	<48.3	<13.3	< 205	< 13.8	< 66.3	5.89 U	92.91 U	56.83 U	59.5 U
	1,1,2-Trichloroethane	<40.7	<26	<22.3	< 205	ND	ND	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	<37.2	<21.5	<20.3	< 205	< 17.7	< 49	4.2 U	48.97 U	29.95 U	69.65 U
	1,1-Dichloroethane	<44.9	<19.6	25 J	54.6 J	43.5 J	< 36.7	32.6 J	65.44 U	40.02 U	56 J
	1,1-Dichloroethene	<53	<37.6	<29	< 205	< 8.88	< 64.2	8.95 U	48.35 U	29.57 U	82.62 U
	1,2,4-Trichlorobenzene	<50.1	<22.5	<27.4	< 205	ND	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	285	152	373	478	183	1250	107 J	145 J	63.97 U	228 J
	1,2-Dichloroethane (EDC)	<46.6	<18.5	<25.5	< 205	ND	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	<45.3	<30.7	<24.8	< 205	ND	ND	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<47.4	<21.9	<25.9	< 205	ND	ND	ND	ND	ND	ND
	1,2-Dichloropropane	<42.7	<16.9	<23.4	< 205	ND	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<33.6	<21.3	<18.4	< 205	ND	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	355	162	336	511	206	1060	103 J	156 J	65.1 U	243 J
	1,3-Dichlorobenzene	<37.2	<31.8	<20.3	< 205	ND	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	<48	<30.2	<26.3	< 205	ND	ND	ND	ND	ND	ND
	Acetone	<90.7	<27.8	<49.6	112 J	< 247	< 55.4	26.02 U	79.89 U	48.86 U	126.9U
	Benzene	802	349	508 B	1000	504	982	292	275 J	349	544
	Bromomethane	<17	<26.8	<9.28	23.2 J	ND	ND	ND	ND	ND	ND
	Carbon tetrachloride	<18.4	<20.4	<10	< 205	< 6.93	< 25.5	32.78 U	53.34 U	32.62 U	61.49 U
	Chlorobenzene	<24.3	<22	<13.3	< 205	< 15.2	< 45.9	3.61 U	91.78 U	56.14 U	52.7 U
	Chloroethane	<28.8	<35.1	<15.7	< 205	ND	ND	ND	ND	ND	ND
	Chloroform	153 J	77.4 J	89.6 J	149 J	98.3 J	225 J	44 J	65.6 J	77.7 J	107 J
	Chloromethane	<17.7	<23.4	<9.66	< 205	< 10.3	< 47.6	33.69 U	46.13 U	28.22 U	77.33 U
	cis-1,2-Dichloroethene	26,600	10,800	15,600	26700	20,800	36300	13000	16,800	18,600	18,400
	cis-1,3-Dichloropropene	<23.3	<23.8	<12.7	< 205	ND	ND	ND	ND	ND	ND
	Dichlorodifluoromethane	<14.3	<26.8	<7.81	< 205	< 18.9	< 27.7	5.5 U	35.4 U	21.65 U	85.93 U
	Ethylbenzene	<31.4	<26.5	18 J	38.8 J	< 16	< 34.5	22.01 U	98 U	59.94 U	59.5 U
	Hexachlorobutadiene	<36.7	<28.4	<20	< 205	ND	ND	ND	ND	ND	ND
	m,p-Xylene	122 J	128	79.7 J	182 J	50.4 J	286 J	68.67 U	192.99 U	118.04 U	120.2 U
	MEK (2-Butanone)	<25.9	<16.1	<14.2	< 410	< 4.91	< 41.5	14.89 U	93.49 U	57.18 U	117.4 U
	Methylene chloride	<62.7	<25	46.3 J	142 J	< 617.5	< 1595	34.6 J	212 J	140 J	250 J
	MTBE (Methyl tert-butyl ether)	<22.2	<34	<21	< 410	< 21.4	< 55.3	15.89 U	68.58 U	41.95 U	144.2U
	o-Xylene	<33.6	<32.3	<18.4	< 205	< 17.3	< 76.8	31.69 U	106.03 U	64.85 U	69.52 U
	Styrene	<35.2	<26.5	<19.2	< 205	ND	ND	ND	ND	ND	ND
	TCE (Trichloroethene)	20,800	10,100	11,900	16900	15,000	25500	5820	10,800	11,400	8,380
	PCE (Tetrachloroethene)	4,310	2,130	3,010	2400	2,650	3560	485	1,260	1,350	882
	Toluene	126 J	90.9 J	96.5 J	150 J	58.4 J	278 J	27 J	103.98 U	63.6 U	73.2 F
	trans-1,3-Dichloropropene	<18.4	<25	<10	< 205	ND	ND	ND	ND	ND	ND
	Trichlorofluoromethane	<79.6	<27.4	<43.5	< 205	< 18.9	< 30	1.92 U	45.82 U	28.03 U	94.15 U
	Vinyl chloride	<20.5	<19.1	<11.2	< 205	< 21.8	< 115	14.72 U	73.26 U	44.81 U	67.54 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	1,740	1,990	2,260	1780	1,350	1430	638	1690	637	2,410
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	13.9	14.9	12.8	14.7	14	14.2	7.73	13.6	13.4	20.4
	Carbon Monoxide	<0.12	<0.12	<0.06	< 0.5	< 0.08	< 0.08	0.08 U	0.08 U	0.08 U	0.11 U
	Methane	<0.11	<0.11	<0.05	< 0.5	< 0.08	< 0.08	0.08 U	0.09 U	0.09 U	0.11 U
	Nitrogen	72.9	81.1	79.6	79.3	90.6	75.1	77.3	90	92.3	74.4
	Oxygen	5.01	4.05	7.69	5.98	9.3	5.7	12.2	6.08	7.13	5.05

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-39-75										
	Sample ID	ST219-AR-39-75-28092011	ST219-AR-39-75-21042011	ST219-AR-39-75-18012011	ST219-AR-39-75-12112010	ST219-AR-39-75-17092010	ST219-AR-39-75-17022010	ST219-AR-39-75-101109	ST219-AR-39-75-070809	ST219-AR-39-75-140309	ST219-AR-219-39-75-10072008	ST219-AR-219-39-75-27032008
	Sample Date	09/28/11	04/21/11	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	07/10/08	03/27/08
	Analyte Screen Depth	73-78										
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	< 2.15	<1.08	3.36 J	<4.12	<1.72	3.12 J	< 3.42	< 2.16	10.7 J	25.93 U	33.84 U
	1,1,2,2-Tetrachloroethane	50.9	<1.01	<2.5	<10.1	<1.61	< 27.1	227	< 5.04	10.09 U	35.18 U	35.42 U
	1,1,2-Trichloroethane	< 2.15	<1.69	<4.19	<5.46	<2.69	< 27.1	ND	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 2.15	<1.55	<3.83	<4.5	<2.46	< 27.1	< 4.6	< 3.72	13.6 J	18.54 U	41.46 U
	1,1-Dichloroethane	3.76 J	<1.87	5.1 J	<4.1	<2.97	6.06 J	< 3.03	7.84 J	15.5 J	24.78 U	30.92 U
	1,1-Dichloroethene	2.49 J	<2.21	<5.46	<7.89	<3.51	< 27.1	< 6.65	< 4.88	6.04 U	18.31 U	49.18 U
	1,2,4-Trichlorobenzene	< 2.15	<2.08	<5.16	<4.71	<3.32	< 27.1	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	162	93	294	127	178	135	47 J	973	165	39.6 U	73.4 J
	1,2-Dichloroethane (EDC)	< 2.15	<1.94	<4.8	<3.88	<3.09	< 27.1	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	< 2.15	<1.89	<4.67	<6.44	<3	< 27.1	ND	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 2.15	<1.97	<4.88	<4.6	<3.14	< 27.1	ND	ND	ND	ND	ND
	1,2-Dichloropropane	< 2.15	<1.78	<4.4	<3.53	<2.83	< 27.1	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	< 2.15	<1.4	<3.46	<4.47	<2.22	< 27.1	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	104	63.2	214	111	125	134	96.2	777	151	40.3 U	97.2 J
	1,3-Dichlorobenzene	< 2.15	<1.55	<3.83	<6.67	<2.46	< 27.1	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	< 2.15	<2	<4.95	<6.33	<3.18	< 27.1	ND	ND	ND	ND	ND
	Acetone	16.3	<3.77	21.3 J	28.5 J	14.3 J	54.9	62 J	72.1	105	38.2 J	75.51 U
	Benzene	30.3	28.9	101	79.6	17.6	165	129	109	155	180	118 J
	Bromomethane	< 2.15	0.97 J	<1.75	<5.62	<1.12	5.74 J	ND	ND	ND	ND	ND
	Carbon tetrachloride	< 2.15	<0.76	<1.89	<4.27	<1.21	< 27.1	< 2.74	2.91 J	6.35 U	20.2 U	36.6 U
	Chlorobenzene	< 2.15	<1.01	<2.5	<4.61	<1.61	< 27.1	< 3.38	< 3.49	8.15 U	34.75 U	31.37 U
	Chloroethane	< 2.15	<1.2	<2.97	<7.37	<1.91	< 27.1	ND	ND	ND	ND	ND
	Chloroform	3.21 J	2.01 J	8.7 J	22.3 J	<2.42	34.7	33.5 J	37.7	41.3 J	40.5 J	33.92 U
	Chloromethane	< 2.15	<0.74	3.04 J	<4.91	2.05 J	6.55 J	< 3.25	< 3.62	7.61 J	17.47 U	46.03 U
	cis-1,2-Dichloroethene	1,040	653	2,030	2,850	712	5090	4,650	3910	5230	8,710	4,910
	cis-1,3-Dichloropropene	< 2.15	<0.97	<2.4	<4.98	<1.54	< 27.1	ND	ND	ND	ND	ND
	Dichlorodifluoromethane	< 2.15	<0.59	<1.47	<5.62	<0.95	< 27.1	< 2.74	< 2.11	6.68 U	13.4 U	51.15 U
	Ethylbenzene	3.64 J	2.08 J	5.94 J	14.1 J	3.72 J	24.1 J	16.8 J	< 2.62	17.8 J	37.11 U	35.42 U
	Hexachlorobutadiene	< 2.15	<2.94	<3.78	<5.96	<2.43	< 27.1	ND	ND	ND	ND	ND
	m,p-Xylene	22.6	11.5	36.6	63.6	22.8	104	47.4	149	70.7 J	73.07 U	71.55 U
	MEK (2-Butanone)	< 2.15	<1.08	<2.67	<3.37	<1.72	< 54.1	< 5.3	< 3.16	12.4 J	35.4 U	69.88 U
	Methylene chloride	3.35 J	<3.31	15.8 J	<5.25	7.87 J	18.3 J	< 192	< 121.3	25.3 J	74.6 J	137 J
	MTBE (Methyl tert-butyl ether)	< 2.15	<0.92	<2.29	<7.12	<2.54	< 54.1	< 5.48	< 4.21	5.41 U	25.97 U	85.84 U
	o-Xylene	< 2.15	<1.4	<3.46	<6.77	<2.22	10 J	< 4.35	13.4 J	6.96 U	40.15 U	41.38 U
	Styrene	< 2.15	<1.46	<3.62	<5.56	<2.33	< 27.1	ND	ND	ND	ND	ND
	TCE (Trichloroethene)	325	257	1,040	2,730	222	3450	3,620	3310	3780	6,190	3,240
	PCE (Tetrachloroethene)	33.2	64.1	211	698	24.1	759	733	703	648	992	3,210
	Toluene	2.54 J	4.95 J	11.2 J	32.9	<2.83	47.4	46.8	45.1	37 J	40.7 J	49.4 J
	trans-1,3-Dichloropropene	< 2.15	<0.76	<1.89	<5.24	<1.21	< 27.1	ND	ND	ND	ND	ND
	Trichlorofluoromethane	< 2.15	<3.31	<8.2	<5.74	<5.27	< 27.1	< 1.97	2.76 J	8.7 U	17.35 U	56.04 U
	Vinyl chloride	< 2.15	<0.85	<2.11	<4.01	<1.36	< 27.1	< 2.79	< 8.72	6.88 U	27.74 U	40.2 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	178	147	146	725	235	858	783	958	667	214	1,440
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	1.64	1.71	1.3	3.15	0.82	5.97	3.7	3.09	12.7	3.47	18.7
	Carbon Monoxide	< 0.13	<0.12	<0.12	<0.11	<0.06	< 0.5	< 0.1	< 0.07	0.08 U	0.08 U	0.13 U
	Methane	< 0.11	<0.11	<0.11	<0.1	<0.05	< 0.5	< 0.1	< 0.07	0.09 U	0.09 U	0.13 U
	Nitrogen	77.4	77.8	70.2	77.6	77.9	79.4	86.7	88.3	77.5	88.4	72.8
	Oxygen	21.0	20.5	18.6	19.3	21.3	14.6	21.2	22.3	3.11	20.3	3.02

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-40-20								
	Sample ID	ST70-AR-40-20-240413	ST70-AR-40-20-160113	ST219-AR-40-20-121012	ST219-AR-40-20-230812	ST219-AR-40-20-130412	ST219-AR-40-20-030112	ST219-AR-40-20-161111	ST219-AR-40-20-28092011	ST219-AR-40-20-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	18-23								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<26.7
	1,1,2,2-Tetrachloroethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<25
	1,1,2-Trichloroethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<41.9
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<38.3
	1,1-Dichloroethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<46.3
	1,1-Dichloroethene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<54.6
	1,2,4-Trichlorobenzene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	56.3 J
	1,2,4-Trimethylbenzene	5,740	5,070	19,900	5,090	10400	9,020	8,380	19,000	30,100
	1,2-Dichloroethane (EDC)	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<48
	1,2-Dichlorobenzene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<46.7
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<48.8
	1,2-Dichloropropane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<44
	1,2-Dibromoethane (EDB)	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<34.6
	1,3,5-Trimethylbenzene	4,560	4,140	12,000	4,350	6,960	7,020	6,430	12,500	19,700
	1,3-Dichlorobenzene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<38.3
	1,4-Dichlorobenzene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<49.5
	Acetone	59J	< 30.3	< 53.6	< 40.5	<37.5	<33	171 J	< 165	<134
	Benzene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	172	155	259	157 J
	Bromomethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<17.5
	Carbon tetrachloride	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<18.9
	Chlorobenzene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<25
	Chloroethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<29.7
	Chloroform	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<37.6
	Chloromethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<18.2
	cis-1,2-Dichloroethene	342	445	159 J	551	378	535	486	525	700
	cis-1,3-Dichloropropene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<24
	Dichlorodifluoromethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<14.7
	Ethylbenzene	358	293	386	372	375	422	392	463	849
	Hexachlorobutadiene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<76.3
	m,p-Xylene	2,640	2,300	3,200	4,180	2,920	3,570	3,310	4,850	7,890
	MEK (2-Butanone)	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	63.3 J	<26.7
	Methylene chloride	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<76.3
	MTBE (Methyl tert-butyl ether)	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<22.9
	o-Xylene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	107 J	< 40.1	< 38.6	<34.6
	Styrene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<36.2
	TCE (Trichloroethene)	222	203	87.9 J	247	220	242	227	252	503
	PCE (Tetrachloroethene)	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	35.9 J
	Toluene	57.4J	34.9J	< 53.6	65.1 J	<37.5	43 J	55.6 J	70.9 J	52.1 J
	trans-1,3-Dichloropropene	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<18.9
	Trichlorofluoromethane	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<82
	Vinyl chloride	< 45.2	< 30.3	< 53.6	< 40.5	<37.5	<33	< 40.1	< 38.6	<21.1
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	6,080	4,190	9,160	6,590	5,940	4,070	5,080	6,750	8,020
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	13.4	13.4	11.5	12.8	13.8	16.8	18.5	8.54	12.4
	Carbon Monoxide	< 0.14	< 0.13	<0.15	< 0.16	<0.15	<0.51	< 0.14	< 0.12	<0.12
	Methane	< 0.14	0.21J	<0.15	0.36 J	0.21 J	<0.51	0.26 J	< 0.11	0.22 J
	Nitrogen	79.1	78.7	128 UR	74.8	79.1	79.3	78.3	78.7	81.3
	Oxygen	7.36	7.7	5.3	12.1	6.86	3.9 J	2.9	12.7	6.07

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-40-20								
	Sample ID	ST219-AR-40-20-18012011	ST219-AR-40-20-12112010	ST219-AR-40-20-17092010	ST219-AR-40-20-17022010	ST219-AR-40-20-101109	ST219-AR-40-20-070809	ST219-AR-40-20-140309	ST219-AR-219-40-20-10072008	ST219-AR-219-40-20-27032008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	07/10/08	03/27/08
	Analyte Screen Depth	18-23								
VOCs (ppbv)	1,1,1-Trichloroethane	<13.1	<32.3	<12.9	< 160.5	< 14.2	< 6	5.97 U	47.64 U	19.95 U
Method TO-15[a]	1,1,2,2-Tetrachloroethane	<12.3	<79.5	<12.1	< 160.5	3,930	< 14	7.95 U	64.63 U	20.87 U
	1,1,2-Trichloroethane	<20.6	<42.8	<20.3	< 160.5	ND	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	<18.8	<35.3	<18.6	< 160.5	< 20.3	< 10.4	5.59 J	34.06 U	24.43 U
	1,1-Dichloroethane	<22.7	<32.2	<22.4	< 160.5	< 19.6	11.8 J	17.2 J	45.52 U	18.22 U
	1,1-Dichloroethene	<26.8	<61.9	<26.5	< 160.5	< 10.2	< 13.6	16.7 J	33.63 U	28.98 U
	1,2,4-Trichlorobenzene	<25.3	<36.9	<25	< 160.5	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	20,800	13,700	7,680	11500	14,500	10300	3700	7,560	8,680
	1,2-Dichloroethane (EDC)	<23.6	<30.4	<23.3	< 160.5	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	<22.9	<50.5	<22.6	< 160.5	ND	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<23.9	<36.1	<23.7	< 160.5	ND	ND	ND	ND	ND
	1,2-Dichloropropane	<21.6	<27.7	<21.3	< 160.5	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<17	<35.1	<16.8	< 160.5	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	13,900	9,970	5,390	7640	8,680	7110	2880	4,830	6,310
	1,3-Dichlorobenzene	<18.8	<52.3	<18.6	< 160.5	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	<24.3	<49.7	<24	< 160.5	ND	ND	ND	ND	ND
	Acetone	<45.8	<45.7	104 J	111 J	< 284	142	76.4	64.9 J	52.9 J
	Benzene	<21.6	<28.1	109 J	175	< 142	494	63.5	63.01 U	44.2 J
	Bromomethane	<8.58	<44.1	<8.47	21.6 J	ND	ND	ND	ND	ND
	Carbon tetrachloride	<9.27	<33.5	<9.16	< 160.5	< 7.97	< 5.4	5 U	37.1 U	21.57 U
	Chlorobenzene	<12.3	<36.2	<12.1	< 160.5	< 17.5	< 9.72	347	183 J	18.49 U
	Chloroethane	<14.5	<57.8	<14.4	< 160.5	ND	ND	ND	ND	ND
	Chloroform	<18.4	<85.3	<18.2	< 160.5	< 19.8	< 4.14	4.95 U	43.59 U	19.99 U
	Chloromethane	<8.93	<38.5	<8.82	< 160.5	< 11.8	< 10.1	8.12 J	32.09 U	27.13 U
	cis-1,2-Dichloroethene	863	626	900	1720	1,270	2100	3940	2,290	4,250
	cis-1,3-Dichloropropene	<11.7	<39.1	<11.6	< 160.5	ND	ND	ND	ND	ND
	Dichlorodifluoromethane	<7.22	<44.1	<7.13	< 160.5	< 21.7	< 5.86	9.5 J	24.63 U	30.14 U
	Ethylbenzene	740	554	343	< 160.5	277	470	408	322	749
	Hexachlorobutadiene	<18.5	<46.8	<18.3	< 160.5	ND	ND	ND	ND	ND
	m,p-Xylene	6,990	5,320	2,690	5000	4810	4920	3490	4,270	6,960
	MEK (2-Butanone)	<13.1	<26.4	<12.9	< 321	< 5.65	96.6 J	44.2 J	65.03 U	41.18 U
	Methylene chloride	71.1 J	41.9 J	40 J	124 J	102 J	290 J	46.9 J	160 J	52.9 J
	MTBE (Methyl tert-butyl ether)	<11.2	<55.9	<19.2	< 321	< 24.6	62.9 J	8.43 J	47.71 U	50.59 U
	o-Xylene	<17	<53.1	<16.8	< 160.5	125 J	< 16.2	47.5 J	73.76 U	24.39 U
	Styrene	<17.8	<43.7	<17.6	< 160.5	ND	ND	ND	ND	ND
	TCE (Trichloroethene)	324	269	294	663	474	974	1480	600	1,030
	PCE (Tetrachloroethene)	<15.3	26 J	22.6 J	< 160.5	31 J	115	15.6 J	44.33 U	23.67 U
	Toluene	36.3 J	<39.2	67.5 J	66.3 J	40.6 J	151	65.3	72.33 U	23.62 U
	trans-1,3-Dichloropropene	<9.27	<41.1	<9.16	< 160.5	ND	ND	ND	ND	ND
	Trichlorofluoromethane	<40.2	<45	<39.7	< 160.5	< 21.7	< 6.35	6.85 U	31.88 U	33.03 U
	Vinyl chloride	<10.4	<31.4	<10.2	< 160.5	< 25.1	< 24.3	9.79 J	50.96 U	23.69 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	5,430	7,500	4,720	4400	6,500	4100	4950	6910	9,980
Fixed Gases (%)	Carbon Dioxide	11.6	13.9	16.5	13.3	14.1	16.8	13.1	11.8	16.2
Method SM2720C[c]	Carbon Monoxide	<0.12	<0.11	<0.06	< 0.5	< 0.08	< 0.08	0.08 U	0.08 U	0.09 U
	Methane	<0.11	<0.1	<0.05	0.32 J	< 0.08	0.4 J	0.4 J	0.39	0.73 J
	Nitrogen	72.3	81.3	78.9	82	84.8	83.6	82.1	78	69.4
	Oxygen	4.51	4.78	4.67	4.34	7.2	7.48	4.62	9.41	2.2

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-41								
	Sample ID	ST70-AR-41-240413	ST70-AR-41-160113	ST219-AR-41-121012	ST219-AR-41-230812	ST219-AR-41-130412	ST219-AR-41-030112	ST219-AR-41-161111	ST219-AR-41-28092011	ST219-AR-41-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	10-15								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	< 1.25	< 0.24	< 0.3	< 1.36	0.38 J	<0.3	< 0.35	< 0.74	0.37 J
	1,1,2,2-Tetrachloroethane	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	13.3	3.72
	1,1,2-Trichloroethane	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.13
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.12
	1,1-Dichloroethane	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.15
	1,1-Dichloroethene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.17
	1,2,4-Trichlorobenzene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	1.1 J	< 0.74	<0.17
	1,2,4-Trimethylbenzene	6.95	6.05	17.1	14.5	18.5	17.7	13.5	35.5	14.5
	1,2-Dichloroethane (EDC)	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.15
	1,2-Dichlorobenzene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.15
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.16
	1,2-Dichloropropane	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.14
	1,2-Dibromoethane (EDB)	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.11
	1,3,5-Trimethylbenzene	5.96	5.1	9.63	11.7	11.4	17	11.6	22.5	8
	1,3-Dichlorobenzene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.12
	1,4-Dichlorobenzene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.16
	Acetone	10.7	7.24	4.87	25.8	18.8	6.46	4.08	5.79	<6.66
	Benzene	< 1.25	0.25J	0.56 J	< 1.36	0.66 J	0.59 J	0.37 J	1.95 J	2.45
	Bromomethane	< 1.25	< 0.24	< 0.3	< 1.36	0.31 J	<0.3	< 0.35	< 0.74	0.47 J
	Carbon tetrachloride	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.06
	Chlorobenzene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.08
	Chloroethane	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.09
	Chloroform	< 1.25	0.52J	0.35 J	3.26 J	0.65 J	0.67 J	0.56 J	0.81 J	0.45 J
	Chloromethane	< 1.25	< 0.24	< 0.3	< 1.36	0.27 J	<0.3	< 0.35	< 0.74	<0.06
	cis-1,2-Dichloroethene	1.27J	0.91	1.49	1.78 J	1.85	10.4	4.53	4.36	2.04
	cis-1,3-Dichloropropene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.08
	Dichlorodifluoromethane	< 1.25	0.37J	0.44 J	< 1.36	0.43 J	0.55 J	< 0.35	< 0.74	<0.05
	Ethylbenzene	< 1.25	< 0.24	0.31 J	1.68 J	<0.26	1.33	0.58 J	0.85 J	0.77 J
	Hexachlorobutadiene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.25
	m,p-Xylene	< 2.49	1.15J	1.34 J	6.35 J	1.51 J	7.58	3.21	4.77 J	3.23
	MEK (2-Butanone)	< 1.25	2.67	0.78 J	6.16 J	5.07	4.52	0.63 J	< 0.74	1.88
	Methylene chloride	< 1.25	< 0.24	0.6 J	< 2.92	0.3 J	0.35 J	< 0.42	0.77 J	<0.21
	MTBE (Methyl tert-butyl ether)	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.07
	o-Xylene	< 1.25	< 0.24	< 0.3	< 1.36	0.28 J	<0.3	< 0.35	< 0.74	0.85
	Styrene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.12
	TCE (Trichloroethene)	6.78	4.69	6.08	5.83	4.92	32.6	14.9	10.7	4.47
	PCE (Tetrachloroethene)	15.1	5.78	13.3	39.5	22.4	19.7	17.1	31.6	42.6
	Toluene	< 1.25	0.25J	< 0.3	< 1.36	0.27 J	0.72 J	< 0.35	< 0.74	2.11
	trans-1,3-Dichloropropene	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.06
	Trichlorofluoromethane	1.73J	0.95	1.21	3.39 J	1.75	1.44	3.18	7.91	2.93
	Vinyl chloride	< 1.25	< 0.24	< 0.3	< 1.36	<0.26	<0.3	< 0.35	< 0.74	<0.07
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	36.8J	< 27.1	46.9 J	174	<55	<41.7	< 55.9	< 46.6	<32.9
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	1.13	1.23	0.3	1.31	0.96 J	1.21	1.02 J	1.02	0.88 J
	Carbon Monoxide	< 0.14	< 0.14	<0.15	< 0.16	<0.15	<0.14	< 0.16	< 0.11	<0.12
	Methane	< 0.14	< 0.14	<0.15	< 0.16	<0.15	<0.14	< 0.16	< 0.09	<0.11
	Nitrogen	74.1	74.3	127 UR	74.2	75.2	74	74.8	77	77.3
	Oxygen	24.7	24.5	17.9	24.5	23.8	24.8	24.2	22	21.8

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	219-41								
	Sample ID	ST219-AR-41-18012011	ST219-AR-41-12112010	ST219-AR-41-17092010	ST219-AR-41-17022010	ST219-AR-41-101109	ST219-AR-41-070809	ST219-AR-41-140309	ST219-AR-219-41-10072008	ST219-AR-219-41-27032008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	07/10/08	03/27/08
	Analyte / Screen Depth	10-15								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	6.02	0.79 J	1.94	0.22 J	1.39	3.45	1.18 J	4.14 J	1.48 J
	1,1,2,2-Tetrachloroethane	<0.1	<0.36	<0.11	< 0.8	< 0.16	< 0.28	0.33 U	1.37 U	0.92 U
	1,1,2-Trichloroethane	<0.16	<0.2	<0.19	< 0.8	ND	ND	ND	ND	ND
	1,1,2-Trichloro-1,2,2-trifluoroethane	0.61 J	<0.16	0.48 J	< 0.8	2.52	0.54 J	0.44 J	0.72 U	1.44 J
	1,1-Dichloroethane	1.14	<0.15	0.57 J	0.12 J	< 0.15	0.38 J	1.06 J	2.21 J	3.91 J
	1,1-Dichloroethene	0.48 J	<0.28	0.52 J	< 0.8	< 0.1	< 0.27	0.2 U	0.73 J	1.27 U
	1,2,4-Trichlorobenzene	<0.2	<0.17	0.31 J	< 0.8	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	31.9	31.5	58.1	37.8	16.7 J	16.8	39.2	55.5	1.78 J
	1,2-Dichloroethane (EDC)	<0.19	<0.14	<0.21	< 0.8	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene	1.57	<0.23	<0.21	< 0.8	ND	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<0.19	<0.17	<0.22	< 0.8	ND	ND	ND	ND	ND
	1,2-Dichloropropane	<0.17	<0.13	<0.2	< 0.8	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<0.14	<0.16	0.16 J	< 0.8	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	20.1	25.8	36.6	29.9	11.3 J	6.96	29.3	25.3	0.95 J
	1,3-Dichlorobenzene	<0.15	<0.24	<0.17	< 0.8	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	<0.19	<0.23	<0.22	< 0.8	ND	ND	ND	ND	ND
	Acetone	3.43	25.7	11.9 B	4.08	9.86	14.2	20.4	16.4	21.1
	Benzene	0.3 J	4.06	1.15 J	4.35	< 0.12	1.16 J	2.58	1.76 J	20
	Bromomethane	<0.07	<0.2	0.25 J	0.14 J	ND	ND	ND	ND	ND
	Carbon tetrachloride	<0.07	<0.15	<0.08	< 0.8	< 0.09	0.3 J	0.21 U	1.61 J	0.95 U
	Chlorobenzene	1.36	<0.17	<0.11	< 0.8	< 0.11	< 0.19	0.27 U	1.36 U	0.81 U
	Chloroethane	<0.12	<0.27	<0.13	< 0.8	ND	ND	ND	ND	ND
	Chloroform	0.72 J	1.93	1.58	1.64	3.13	8.33	19.4	112	4.59 J
	Chloromethane	0.29 J	<0.18	0.48 J	< 0.8	< 0.1	2.06	0.54 J	3.23 J	1.19 U
	cis-1,2-Dichloroethene	2.48	37.2	16.6	84.3	4	7.64	50.5	17.1	53.3
	cis-1,3-Dichloropropene	<0.09	<0.18	<0.11	< 0.8	ND	ND	ND	ND	ND
	Dichlorodifluoromethane	0.46 J	<0.2	0.43 J	< 0.8	< 0.09	< 1.3	0.99 J	2.05 J	1.33 U
	Ethylbenzene	0.96 J	3.34	1.19 J	< 0.8	< 0.18	0.38 J	1.27 J	1.45 U	0.92 U
	Hexachlorobutadiene	<0.15	<0.21	0.21 J	< 0.8	ND	ND	ND	ND	ND
	m,p-Xylene	6.87	19.5	8.2	21.4	3	2.12	10.1	7.58 J	1.85 U
	MEK (2-Butanone)	1.22 J	5.44	3.68	< 1.6	1.53 J	4.35	3.6	1.38 U	1.81 U
	Methylene chloride	2.87 J	0.47 J	6.33	2.89 J	< 6.1	13	3.84	0.63 U	3.62 J
	MTBE (Methyl tert-butyl ether)	<0.09	<0.26	<0.18	< 1.6	0.62 J	< 2.7	0.59 J	1.01 U	2.22 U
	o-Xylene	0.55 J	1.61	0.55 J	< 0.8	< 0.14	0.52 J	0.44 J	1.57 U	1.07 U
	Styrene	<0.14	<0.2	<0.16	< 0.8	ND	ND	ND	ND	ND
	TCE (Trichloroethene)	6.08	65.8	33.8	106	20.2	25.3	115	77.1	198
	PCE (Tetrachloroethene)	12.2	59.7	72.5	40.1	70.9	228	144	311	249
	Toluene	0.49 J	4.97	0.96 J	1.5	< 0.2	0.46 J	1.31 J	1.54 U	1.04 U
	trans-1,3-Dichloropropene	<0.07	<0.19	<0.08	< 0.8	ND	ND	ND	ND	ND
	Trichlorofluoromethane	1.76	6.7	7.47	1.71	6.74	10.2	1.83 J	3.56 J	1.45 U
	Vinyl chloride	<0.08	<0.14	<0.09	< 0.8	< 0.09	< 0.48	0.22 U	1.68 J	1.04 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	32.1 J	62.9	73.1	80.7	< 60.5	30.1 J	44.2 J	ND	31.1 J
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	0.87 J	0.91	0.68	1.05	1.07 J	1.44	1.57	1.35	3.29
	Carbon Monoxide	<0.12	<0.11	<0.06	< 0.5	< 0.09	< 0.07	0.08 U	0.08 U	0.1 U
	Methane	<0.11	<0.1	<0.05	< 0.5	< 0.09	< 0.07	0.08 U	0.09 U	0.1 U
	Nitrogen	65.1	82	79.6	77.6	90.5	67.1	70.4	72.8	69.5
	Oxygen	18	17	19.7	21.3	25.1	18.4	17.6	21.4	16.5

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	70-01								
	Sample ID	ST70-AR-7001-240413	ST70-AR-7001-160113	ST219-AR-7001-121012	ST219-AR-7001-230812	ST219-AR-7001-130412	ST219-AR-7001-030112	ST219-AR-7001-161111	ST219-AR-7001-28092011	ST219-AR-7001-21042011
	Sample Date	04/24/13	01/16/13	10/12/12	08/23/12	04/13/12	01/03/12	11/16/11	09/28/11	04/21/11
	Analyte Screen Depth	454-479								
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.13
	1,1,2,2-Tetrachloroethane	1.85	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.12
	1,1,2-Trichloroethane	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.2
	1,1,2-Trichloro-1,2,2-trifluoroethane	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.19
	1,1-Dichloroethane	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.23
	1,1-Dichloroethene	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.27
	1,2,4-Trichlorobenzene	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.25
	1,2,4-Trimethylbenzene	0.63J	0.29J	< 0.38	< 0.26	10.1	4.44	4.76	1.37	3.67
	1,2-Dichloroethane (EDC)	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.23
	1,2-Dichlorobenzene	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.23
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.24
	1,2-Dichloropropane	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.21
	1,2-Dibromoethane (EDB)	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.17
	1,3,5-Trimethylbenzene	0.56J	< 0.24	< 0.38	< 0.26	2.5	4.32	4.3	0.93 J	2.24
	1,3-Dichlorobenzene	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.19
	1,4-Dichlorobenzene	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.24
	Acetone	12.3	6.68	22.1	15.6	370	5.22	3.8	8.97	16.4
	Benzene	< 0.25	0.28J	1.81	< 0.26	16.4	0.53 J	0.41 J	0.81 J	2.4
	Bromomethane	< 0.25	< 0.24	0.95 J	0.55 J	<0.65	<0.31	< 0.3	< 0.33	0.3 J
	Carbon tetrachloride	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	2.22	0.79 J	1.59
	Chlorobenzene	0.32J	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.12
	Chloroethane	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.14
	Chloroform	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	1.9	0.68 J	1.31
	Chloromethane	0.48J	0.42J	2.01	0.3 J	0.83 J	0.57 J	0.45 J	< 0.33	<0.09
	cis-1,2-Dichloroethene	< 0.25	< 0.24	< 0.38	< 0.26	1.26 J	0.58 J	0.79 J	< 0.33	0.49 J
	cis-1,3-Dichloropropene	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.12
	Dichlorodifluoromethane	0.43J	0.38J	0.41 J	0.48 J	0.87 J	0.51 J	< 0.3	< 0.33	<0.07
	Ethylbenzene	0.28J	< 0.24	< 0.38	< 0.26	12.4	0.39 J	< 0.3	< 0.33	<0.16
	Hexachlorobutadiene	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.32
	m,p-Xylene	0.68J	< 0.47	< 0.77	< 0.52	38.7	1.87 J	1.06 J	< 0.65	0.39 J
	MEK (2-Butanone)	2.98	1.65	4.18	2.15	31.3	1.81 J	0.57 J	1.93 J	2.03 J
	Methylene chloride	0.33J	0.27J	0.63 J	< 0.58	0.75 J	0.56 J	< 0.36	0.54 J	<0.37
	MTBE (Methyl tert-butyl ether)	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.11
	o-Xylene	0.3J	< 0.24	< 0.38	< 0.26	13.4	<0.31	< 0.3	< 0.33	<0.17
	Styrene	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.18
	TCE (Trichloroethene)	0.31J	< 0.24	5.35	< 0.26	8.21	3.64	47.4	14.3	30.5
	PCE (Tetrachloroethene)	1.68	< 0.24	0.39 J	< 0.26	0.78 J	2.09	1.32	< 0.33	0.42 J
	Toluene	0.47J	0.44J	0.62 J	< 0.26	84.6	1.26	< 0.3	< 0.33	0.36 J
	trans-1,3-Dichloropropene	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.09
	Trichlorofluoromethane	< 0.25	< 0.24	< 0.38	< 0.26	<0.65	<0.31	< 0.3	< 0.33	<0.4
	Vinyl chloride	< 0.25	< 0.24	0.88 J	< 0.26	2.89	<0.31	< 0.3	< 0.33	<0.1
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	11.4J	< 11	< 15.4	< 15.8	<14.3	<19.5	< 25.6	< 13.7	<20.6
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	< 0.15	< 0.13	< 0.15	< 0.15	<0.15	<0.14	< 0.14	< 0.15	<0.18
	Carbon Monoxide	< 0.15	< 0.13	< 0.15	< 0.15	<0.15	<0.14	< 0.14	< 0.13	<0.15
	Methane	< 0.15	< 0.13	< 0.15	< 0.15	<0.15	<0.14	< 0.14	< 0.12	<0.14
	Nitrogen	74.5	74.4	128 UR	74.5	74.9	74.4	75	77.4	77.8
	Oxygen	25.5	25.6	19.3	25.6	25.1	25.6	24.8	22.6	22.1

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

Chemical Class & Analytical Method	Location	70-01							
	Sample ID	ST219-AR-7001-18012011	ST219-AR-7001-12112010	ST219-AR-7001-17092010	ST219-AR-7001-17022010	ST219-AR-7001-101109	ST219-AR-7001-070809	ST219-AR-7001-140309	ST219-AR-7001-27032008
	Sample Date	01/18/11	11/12/10	09/17/10	02/17/10	11/10/09	08/07/09	03/14/09	03/27/08
	Analyte / Screen Depth	454-479							
VOCs (ppbv) Method TO-15[a]	1,1,1-Trichloroethane	<0.13	0.24 J	0.16 J	< 0.9	9	< 1	0.26 U	1.62 J
	1,1,2,2-Tetrachloroethane	<0.12	<0.38	<0.11	< 0.9	< 0.15	< 0.21	0.35 U	0.87 U
	1,1,2-Trichloroethane	<0.21	<0.2	<0.19	< 0.9	ND	ND	ND	
	1,1,2-Trichloro-1,2,2-trifluoroethane	<0.19	0.33 J	<0.17	< 0.9	16.5	1.28	0.26 J	1.01 U
	1,1-Dichloroethane	<0.23	0.28 J	<0.21	< 0.9	< 0.13	< 0.12	0.25 U	0.76 U
	1,1-Dichloroethene	<0.27	<0.29	<0.25	< 0.9	0.39 J	< 0.2	0.21 U	1.2 U
	1,2,4-Trichlorobenzene	<0.25	<0.18	<0.23	< 0.9	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	<0.15	10.9	52.5	< 0.9	88.9 J	3.1	5.93	30.6
	1,2-Dichloroethane (EDC)	<0.24	0.24 J	<0.22	< 0.9	ND	ND	ND	ND
	1,2-Dichlorobenzene	<0.23	<0.24	<0.21	< 0.9	ND	ND	ND	ND
	1,2-Dichloro-1,1,2,2-tetrafluoroethane	<0.24	0.28 J	<0.22	< 0.9	ND	ND	ND	ND
	1,2-Dichloropropane	<0.22	<0.13	<0.2	< 0.9	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	<0.17	<0.17	<0.16	< 0.9	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	<0.19	10.1	32.8	< 0.9	64.6 J	1.65	4.15	19.7
	1,3-Dichlorobenzene	<0.19	<0.25	<0.17	< 0.9	ND	ND	ND	ND
	1,4-Dichlorobenzene	0.54 J	<0.24	<0.23	< 0.9	ND	ND	ND	ND
	Acetone	3.95	8.11	11.3 B	0.54 J	13.8 J	38.4	9.18	24.3
	Benzene	0.5 J	2.55	0.79 J	1.81	0.83 J	0.46 J	0.46 J	1.26 J
	Bromomethane	<0.09	0.37 J	<0.08	< 0.9	ND	ND	ND	ND
	Carbon tetrachloride	0.18 J	0.22 J	<0.09	< 0.9	0.38 J	< 0.08	1.81 J	0.89 U
	Chlorobenzene	<0.12	<0.17	<0.11	< 0.9	2.22	< 0.15	0.28 U	1.11 J
	Chloroethane	<0.15	<0.27	<0.14	< 0.9	ND	ND	ND	ND
	Chloroform	0.21 J	<0.4	<0.17	< 0.9	0.28 J	< 0.06	1.34 J	0.83 U
	Chloromethane	0.34 J	1.28	0.58 J	< 0.9	0.95 J	1.01	0.31 J	1.32 J
	cis-1,2-Dichloroethene	0.34 J	6.73	4.89	0.16 J	27.4	2.69	6.3	4.68
	cis-1,3-Dichloropropene	<0.12	<0.19	<0.11	< 0.9	ND	ND	ND	ND
	Dichlorodifluoromethane	0.58 J	0.82 J	0.46 J	< 0.9	0.95 J	< 1	0.66 J	1.25 U
	Ethylbenzene	<0.16	2.47	0.98 J	< 0.9	2.49	0.26 J	0.26 J	2.06 J
	Hexachlorobutadiene	<0.19	<0.22	<0.17	< 0.9	ND	ND	ND	ND
	m,p-Xylene	0.49 J	12.1	6.89	< 0.9	23.5	0.95 J	1.95 J	16.2
	MEK (2-Butanone)	9.52	2.38	64	< 1.7	< 0.15	2.4	1.08 J	3.94 J
	Methylene chloride	0.87 J	0.56 J	1.88 J	3.8 J	6.79	68.7	2.63	15.7
	MTBE (Methyl tert-butyl ether)	<0.11	<0.26	<0.18	1.72	5.63	20.5	0.21 J	9.57
	o-Xylene	<0.17	2.1	0.36 J	< 0.9	0.73 J	< 0.24	0.24 U	1.01 U
	Styrene	<0.18	<0.21	<0.16	< 0.9	ND	ND	ND	ND
	TCE (Trichloroethene)	4.28	16.7	24.7	< 0.9	170	3.01	44.7	13.4
	PCE (Tetrachloroethene)	0.18 J	6.67	7.02	< 0.9	14.4	9.16	2.63	6.46
	Toluene	1.63	6.46	0.86 J	0.47 J	1.44	0.84 J	0.44 U	2.3 J
	trans-1,3-Dichloropropene	<0.09	<0.19	<0.09	< 0.9	ND	ND	ND	ND
	Trichlorofluoromethane	<0.4	0.49 J	0.65 J	< 0.9	0.63 J	0.45 J	0.31 J	1.37 U
	Vinyl chloride	<0.1	0.32 J	<0.1	< 0.9	< 0.08	< 0.36	0.24 U	0.98 U
SW8015M[b] (µg/L)	Gasoline Range Organics (GRO)	11.4 J	31.4 J	40.2 J	5.6 J	11.6 J	< 50.3	20.2 J	74.2
Fixed Gases (%) Method SM2720C[c]	Carbon Dioxide	<0.14	<0.14	<0.07	< 0.5	< 0.06	< 0.06	0.06 U	0.1 U
	Carbon Monoxide	<0.12	<0.12	<0.06	< 0.5	< 0.08	< 0.08	0.08 U	0.1 U
	Methane	<0.11	<0.1	<0.05	< 0.5	< 0.08	< 0.08	0.08 U	0.1 U
	Nitrogen	72.7	27.2	78.5	77.9	77.3	68.7	76.2	77.9
	Oxygen	20.6	7.77	21.5	22.1	22	19.4	19.8	22.1

Appendix B. Soil Vapor Sampling Results at SWMU ST-70
2008 to 2013

[b] EPA, 1996. EPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846) 3rd ed. with updates. U.S. Environmental Protection Agency.

[c] AWWA, 1998. Standard Methods for the Examination of Water and Wastewater, 20th Edition. American Water Works Association.

Shading indicates the analyte was detected

% = percent

ID = identification

J = estimated value, the concentration is less than PQL but greater than Laboratory MDL

UR = rejected value; compoud was introduced at the laboratory during sample extraction

MDL = method detection limit

ND = not detected

NR = Data not representative due to air leaks from sample port; data was invalidated during data validation

ppbv = parts per billion by volume

PQL = practical quantitation limit

TPH = total petroleum hydrocarbons

µg/L = microgram per liter

VOC = volatile organic compound

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

FINAL LONG-TERM MONITORING PLAN
ST-070E – OIL-WATER SEPARATOR (ST-219)

December 2014

377 MSG/CEI
2050 Wyoming Boulevard SE
Kirtland AFB, New Mexico 87117-5270

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

FINAL LONG-TERM MONITORING PLAN FOR SITE ST-070E

December 2014

Prepared for:

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14. ABSTRACT
This Long-Term Monitoring Plan specifies the activities that will be performed in support of the groundwater monitoring, well gauging, and soil vapor monitoring to be conducted at Site ST-070E, Kirtland Air Force Base, New Mexico. The purpose of the plan is to provide guidance for the sampling and gauging of the groundwater monitoring well and sampling of the soil vapor monitoring wells that are installed at the site.

15. SUBJECT TERMS
Site ST-070E, groundwater monitoring, soil vapor monitoring, total petroleum hydrocarbons, volatile organic compounds, trichloroethene

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
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DECEMBER 2014

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

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KIRTLAND AIR FORCE BASE
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PREFACE

This Long-Term Monitoring Plan addresses the groundwater monitoring activities that will be performed for ST-070E, Oil-Water Separator (ST-219), at Kirtland Air Force Base, New Mexico. The purpose of the plan is to provide guidance for the sampling and gauging at the groundwater monitoring well and sampling of the soil vapor monitoring wells that are installed at the site.

This work will be performed under the authority of the requirements of the Air Force Civil Engineer Center Contract No. FA8903-13-C-0008. This program is conducted under the Kirtland Air Force Base Environmental Restoration Section Chief, Mr. Ludie Bitner, and the Kirtland Air Force Base Project Manager, Mr. Cole Crosgrove. URS Group, Inc., as a subcontractor to FPM Remediations, Inc., has prepared this Long-Term Monitoring Plan as defined in the Performance-Based Remediation Contract for Cannon, Holloman, and Kirtland Air Force Bases located in New Mexico, and Luke Air Force Base located in Arizona. Mr. Richard Wells is the URS Group, Inc. Installation Manager for Environmental Restoration Program Sites at Kirtland Air Force Base.

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
FPM	FPM Remediations, Inc.
ft	feet
GWQB	Ground Water Quality Bureau
KAFB	Kirtland Air Force Base
LTM	long-term monitoring
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Criteria
OWS	oil-water separator
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
SOP	standard operating procedure
SVE	soil vapor extraction
URS	URS Group, Inc.
USAF	U.S. Air Force
VOC	volatile organic compound

1.0 INTRODUCTION

This Long-Term Monitoring (LTM) Plan addresses the groundwater monitoring activities that will be performed for the ST-070E Oil-Water Separator (OWS) (ST-219) site at Kirtland Air Force Base (AFB), New Mexico. The site location is shown in Figure 1. This plan was prepared in accordance with the requirements of the Air Force Civil Engineer Center (AFCEC) Contract No. FA8903-13-C-0008. URS Group, Inc. (URS), as a subcontractor to FPM Remediations, Inc. (FPM), has prepared this LTM Plan in accordance within the Performance-Based Remediation Contract for Cannon, Holloman, and Kirtland AFBs located in New Mexico, and Luke AFB located in Arizona. Monitoring requirements are further delineated in the *Draft Uniform Federal Policy Quality Assurance Project Plan, ST-070E – Oil-Water Separator (ST-219)* (U.S. Air Force [USAF], 2014a).

1.1 Purpose and Scope

This plan describes the long-term groundwater monitoring requirements for ST-070E. The purpose of this plan is to provide guidance for the sampling and gauging at the groundwater monitoring well and sampling of the soil vapor monitoring wells that are installed at the site. This plan addresses the following elements:

- General site map showing Kirtland AFB in relation to the State of New Mexico and City of Albuquerque and the location of ST-070E;
- A site map showing the location of the groundwater and soil vapor monitoring wells;
- General site description and history;
- Groundwater monitoring requirements;
- Soil vapor monitoring requirements;
- Quality Assurance/Quality Control (QA/QC) requirements; and
- Documentation and reporting requirements.

The groundwater and soil vapor monitoring activities may be revised to reflect changes in the monitoring scope or schedule upon agreement with the New Mexico Environment Department (NMED).

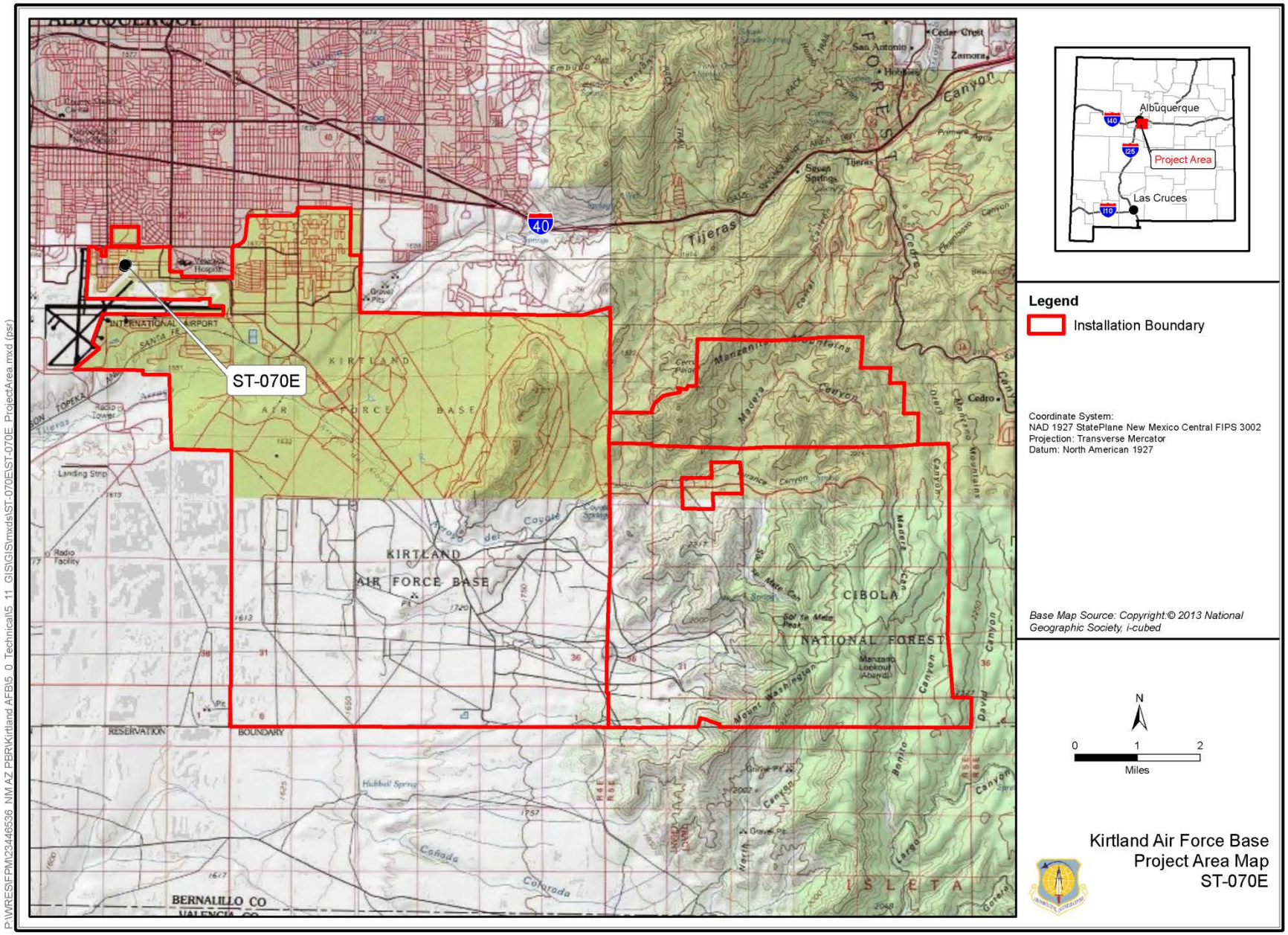

Figure 1. ST-070E Site Location

2.0 BACKGROUND

2.1 Site Description

Three private airfields predate the Kirtland AFB, formerly named Albuquerque Army Air Base, with military operations becoming the primary focus in 1941. The base was renamed in 1942 honoring Col. Roy C. Kirtland, a pioneer in Army aviation. Flight crews were trained in the early 1940s at Kirtland's three schools- advanced flying, bombardier training, and multi-engine school. Later that decade, the focus of base operations shifted to developing aircraft modifications for weapons delivery, researching ballistic characteristics, and testing weapons. Manzano Base was named in 1952 and was located on the former Site Able, created under the Armed Forces Special Weapons Command. Sandia Base began operating as the Albuquerque Airport Training Station in 1942 and served historically as a nuclear weapons installation. In 1971, Kirtland, Manzano, and Sandia bases were merged and were managed under one command.

The Solid Waste Management Unit ST-70 (former ST-219) is located in the northwestern part of Kirtland AFB, southeast of the intersection of Aberdeen Avenue and MacDill Street. The area in which the Site is located 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 the Site have been used as a passenger aircraft terminal. The Department of Energy 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 location of the existing soil vapor extraction (SVE) system, and within the Site investigation boundary. Building 482 is rarely used for aircraft maintenance or parking.

The Site 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 (ft) southeast of the northwestern extent of the two buildings, with asphalt pavement located northwest of the concrete. The Site is located on both the concrete tarmac and the asphalt pavement. A chain-link fence topped with barbed wire serves as the flightline fence, which 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 air passenger terminal operated by a U.S. Department of Energy (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.

As discussed in the *Environmental Restoration Program RCRA Facility Investigation Report, Solid waste Management Unit ST-70 (Former ST-219)* (USAF, 2005), sediments from the OWS were sampled in 1990 and 1992 by Geoscience Consultants Limited. The sediments were found to have cadmium and chromium in excess of the Resource Conservation and Recovery Act (RCRA) toxicity limits. In 1992, the sampling team observed large racks in the north wall of the OWS, which allowed fluids to enter the surrounding soil. The northern portion of the unit had reportedly dropped 3 inches by undermining due to water piping. Consequently, several phases of a RCRA Facility Investigation were performed at the site over subsequent years. Data from these investigations indicated petroleum hydrocarbon contamination was present in soils and soil vapor adjacent to the OWS. The OWS was removed in 1994 and piping was reconfigured to direct drainage to the sanitary sewer.

Contaminants are believed to have been flushed downward through the vadose zone as a result of leaking from failures in the area drain and OWS. Removal of the OWS and repair of the area drain piping eliminated this mechanism for contaminant transport. Infiltration of precipitation is greatly inhibited by

the pavement and the primary mechanism for contaminant transport is currently believed to be vapor-phase transport, although storm water may still infiltrate the subsurface through the area drain. Vertical transport of contaminants is inhibited by low permeability sediments at roughly 25 to 40 feet bgs and 95 to 110 feet bgs. Some of the soil vapor monitoring and extraction wells have screened intervals that appear to overlap the low permeability sediments.

As provided in 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), July 2012 through June 2013* (USAF, 2013), soil sample data from previous investigations indicate TPH impacts are present across the site, primarily at and between the OWS and the area drain represented by TPH soil concentrations above 250 mg/kg (see Figure 2). The figure also shows the anticipated radius of influence for new soil vapor extraction wells that are proposed to be installed as part of the ST-070E site interim measures to address the vadose zone contamination. Vapor and groundwater monitoring data indicate that these low permeability units significantly inhibit TPH migration to the regional groundwater. However, chlorinated solvents are denser and migrate downward through the vadose zone by vapor-phase transport. The chlorinated solvent, TCE, is currently detected in the deeper vadose zone soil vapor as well as in groundwater at the site.

The existing 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 wooded 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, KAFB-7002, and KAFB-7003).

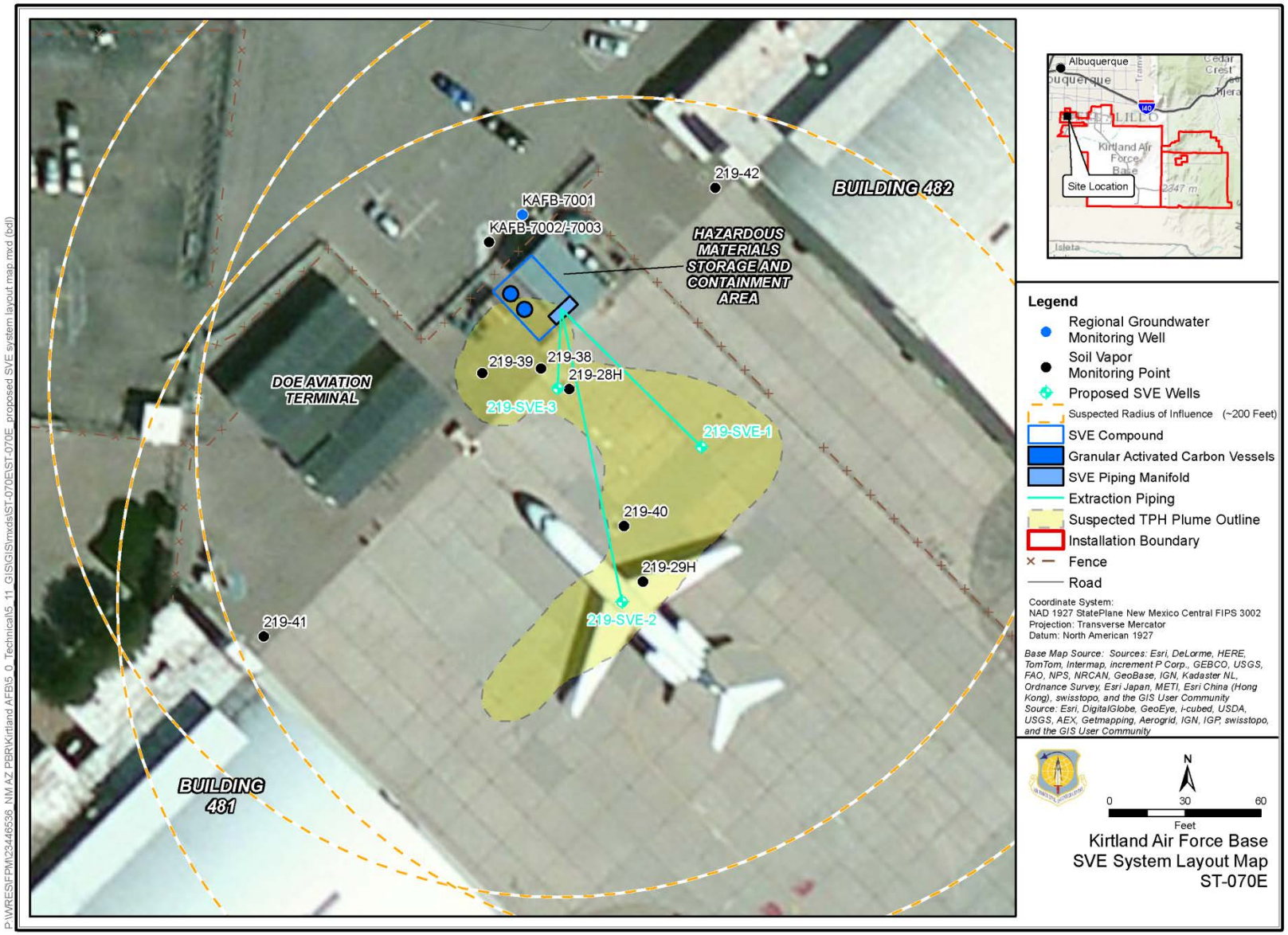

Figure 2. Map View of the Total Petroleum Hydrocarbon Plume.

3.0 LONG-TERM GROUNDWATER MONITORING

3.1 Monitoring Requirements

Groundwater samples will be collected from the single groundwater monitoring well installed in the vicinity of ST-070E. Groundwater sampling and analysis will be conducted quarterly for the suite of analyses provided in Table 1. The location of the monitoring well is shown in Figure 3.

Water level measurements will be taken prior to well purging and sample collection during each sampling event. Well construction information is provided in Table 2. Water quality parameter measurements will be collected during sampling. Sample handling, analyses, and QA/QC procedures will comply with the requirements defined in the *Final Uniform Federal Policy Quality Assurance Project Plan, ST-070E, Oil-Water Separator (ST-219)* (USAF, 2014).

Table 1. Groundwater Sample Analysis and Methods

Analysis	Method
Volatile organic compounds	SW-846 Method 8260B
Total Petroleum Hydrocarbons – Gasoline-Range Organics	SW-846 Method 8015C
Dissolved Metals	SW-846 Method 6010B/6020
Nitrate	EPA Method 300.0
EPA – U. S. Environmental Protection Agency	

Table 2. ST-070E Groundwater Monitoring Well

Well	Diameter (inches)	Total Depth (feet)	Top of Screen (feet)	Bottom of Screen (feet)	Screen Slot Size (inches)	Measuring Point Elevation (feet)[a]
KAFB-7001	4	480	454	479	0.010	5320.2
[a] Measuring point elevation is taken at the top of casing.						

In addition to groundwater, soil vapor samples will be collected from monitoring points installed in the vicinity of ST-070E (see Figure 3), as well as monitoring ports installed at the SVE system. Soil vapor sampling and analysis will also be conducted quarterly for the analyses specified in Table 3. Soil vapor monitoring well construction information is provided in Table 4.

Table 3. Soil Vapor Sample Analysis and Methods

Analysis	Method
Volatile organic compounds	EPA Method TO-15
Total Petroleum Hydrocarbons – Gasoline-Range Organics	EPA Method TO-15
Fixed Gases	ASTM D1946
EPA – U. S. Environmental Protection Agency	

Figure 3. ST-070E Well Locations

Table 4. ST-070E Soil Vapor Monitoring Locations

Well	Diameter (inches)	Total Depth (feet)	Top of Screen (feet)	Bottom of Screen (feet)	Screen Length (feet)	Screen Slot Size (inches)
KAFB-7002	2	95	80	95	15	0.050
KAFB-7003	2	330	315	330	15	0.050
219-28H	8	151.5	10 and 50	35 and 90	25 and 40	0.20
219-29H	2	151.5	10 and 50	35 and 90	25 and 40	0.050
219-38-41	2	44	38	43	5	0.010
219-38-99	2	103	98	103	5	0.010
219-39-42	2	44	38	43	5	0.010
219-39-75	2	78	73	78	5	0.010
219-40	2	24	18	23	5	0.010
219-41	2	15	10	15	5	0.010
219-42	2	15	10	15	5	0.010
Inlet	SVE System Monitoring Port					
Mid-Carbon	SVE System Monitoring Port					
Exhaust	SVE System Monitoring Port					
SVE – soil vapor extraction						

Following the first two full years of sampling, the analyte list may be adjusted to focus on those constituents of interest. An Interim Corrective Measures Completion Report will be prepared following completion of site remediation and two years of post-remediation monitoring. Annual monitoring reports will be submitted following completion of each annual set of monitoring events to present the analytical data collected and provide recommendations as to future monitoring requirements.

3.2 Pre-Sampling Activities

The Kirtland AFB personnel will be contacted, as necessary, prior to each monitoring event to provide notification of impending activities. The NMED will be notified, as required, of groundwater and soil vapor sampling events to allow for coordination of regulatory oversight activities. The project laboratory will also be notified of each sampling event, including the number of samples expected to be collected for each specified analysis.

3.3 Health and Safety

All field work will be completed in accordance with the *Kirtland Air Force Base, Albuquerque, New Mexico, Final Health and Safety Plan – Basewide* (USAF, 2014b). A daily safety tailgate meeting will be conducted at the beginning of each work day. This will include reviewing site-specific safety concerns and the job safety analyses. Personal protective equipment required for this work is not expected to exceed Level D which includes steel-toed boots, nitrile gloves for sample collection, leather gloves, hard hats, safety glasses, and a high-visibility reflective safety vest when on site.

3.4 Groundwater Level Measurements

Groundwater level measurements will be collected in accordance with the requirements delineated in URS standard operating procedure (SOP)-13, "Static Water Level and Total Depth Measurement," provided in Appendix A of the *Final Uniform Federal Policy Quality Assurance Project Plan, ST-070E, Oil-Water Separator (ST-219)* (USAF, 2014a). During the course of collecting water level measurements, observations of well condition will be collected and recorded. Water level measurements will be collected from the groundwater monitoring well located at ST-070E during each groundwater sampling event. Static water levels and total well depth will be measured prior to purging activities.

3.5 Sample Collection Methods

Groundwater samples will be collected in accordance with the requirements delineated in SOP-15, "Groundwater Purging and Sampling," provided in Appendix A of the *Final Uniform Federal Policy Quality Assurance Project Plan, ST-070E, Oil-Water Separator (ST-219)* (USAF, 2014a). The well will be purged and sampled in accordance with the SOP. During the purging of the well, field parameter data will be collected in accordance with SOP-16, "Water Quality Measurements Using a Multiple Parameter Water Quality Meter," also provided in Appendix A of the project quality assurance project plan (QAPP).

Soil vapor samples will be collected in accordance with requirements described in SOP-46, "Soil Vapor Sampling for Remediation Systems," provided in Appendix A of the project QAPP. Samples will be collected in Summa® canister provided by the off-site analytical laboratory.

3.6 Equipment Decontamination

Non-dedicated sampling equipment will be decontaminated between sample locations following the procedures described in SOP-20, "Decontamination," provided in Appendix A of the *Final Uniform Federal Policy Quality Assurance Project Plan, ST-070E, Oil-Water Separator (ST-219)* (USAF, 2014a). Dedicated sampling equipment will not require decontamination.

3.7 Sample Labels

Each sample will be labeled with a unique identifier and recorded in the field logbook (SOP 1, "Use and Maintenance of Field Log Books" provided in Appendix A of the project QAPP) as it is collected. The sample identification will be documented on the chain-of-custody form. Data pertinent to each sample such as sample identification, location, color, time, and date will be recorded on field data sheets. Each analytical sample will be assigned a unique number in the following format:

- Groundwater Sampling Location (i.e., KAFB-7001); or
- Soil Vapor Sampling Location (i.e., 219-39-42); and
- Date sampled (MMDDYY).

Under this sample designation format, sample "KAFB-7001-072514" corresponds to a sample collected from monitoring well KAFB-7001 on July 25, 2014.

3.8 Chain-of-Custody

All samples will be accompanied by a chain-of-custody in accordance with SOP 26, "Chain-of-Custody" provided in Appendix A of the project QAPP. The chain-of-custody form will be completed by the field sampling technician collecting the sample and will accompany each sample cooler. Whenever a sample is

transferred to another responsible party in an unsealed cooler, the receiving party must sign-off on the chain-of-custody form.

The original chain-of-custody form will accompany the samples to the laboratory with a copy retained by field staff, and a final copy will be returned with the analytical results.

4.0 QUALITY ASSURANCE PROJECT PLAN

The objective of this investigation is to provide groundwater sample analytical data of sufficient quality and quantity to adequately characterize and monitor groundwater underlying the ST-070E site. In addition, soil vapor samples will be collected from monitoring wells installed in the vicinity of the site, as well as monitoring ports associated with the SVE system (inlet, mid-carbon, and exhaust). This LTM Plan is used in conjunction with the *Final Uniform Federal Policy Quality Assurance Project Plan, ST-070E, Oil-Water Separator (ST-219)* (USAF, 2014a) to ensure that the functional activities, organization, and quality assurance/quality control protocols are achieved in accordance with the project's data quality objectives.

As outlined in the QAPP, quality assurance objectives are specified to ensure that data produced are of a known and sufficient quality for determining whether a risk to human health or the environment exists. Minimum precision, accuracy, and completeness measurements and minimum detection limits are quantitative objectives specified in the QAPP. Representativeness and comparability are qualitative objectives. During the sampling discussed in this plan, field quality control samples will be collected and analyzed to evaluate the achievement of the precision and accuracy objectives specified in the QAPP. Overall, both field and laboratory precision will be evaluated through the results of duplicate groundwater samples, equipment rinsates, and field blanks. The duplicate samples, equipment rinsates, and field blanks will be analyzed for the same suite of analytes as the regular groundwater samples. For each quarterly groundwater monitoring event, one field duplicate, one equipment rinsate, and one field blank will be collected. Trip blanks to be analyzed for volatile organic compounds (VOC) will be included in each cooler containing VOC samples shipped to the laboratory. For soil vapor samples, field quality control samples will be limited to the collection of duplicate samples to aid in the assessment of field and laboratory precision.

Environmental analyses are critical, because decision-making based on inaccurate measurements or data of unknown quality can have significant economic and health consequences. Data verification and validation will be performed as specified in the QAPP to ensure data meet the project requirements. Method data validation is the process whereby analytical data are reviewed against set criteria to ensure that the results conform to the requirements of the analytical method and any other specified requirements. All laboratory-generated data will be validated in accordance with the requirements of the QAPP. The field-generated data will not be validated, but the quality of the field-generated data will be ensured through adherence to established operating procedures and use of equipment calibration and standardization, as appropriate.

4.1 Duplicate Samples

Field duplicates are samples that are collected at the same time, from the same source, and at the same depth or sample location as the associated field sample. Field duplicates are submitted to the project laboratory as separate samples. The purpose of collecting field duplicates is to assess the consistency of the overall sampling effort, including collection, shipping, and analysis. The purpose of submitting them to the laboratory is to assess the consistency or precision of the laboratory's analytical system. Duplicate samples are collected and analyzed for the same parameters as the primary samples to evaluate sampling and analytical precision. Field duplicates are collected at a frequency of 10 percent of the primary samples collected, with a minimum of one duplicate collected. The precision goal for field duplicate analyses will be plus or minus a 30 relative percent difference.

4.2 Equipment Blanks

Field equipment blanks are samples that are prepared in the field by pouring deionized water over decontaminated sampling equipment and collecting the water in laboratory provided sampling containers. The water is analyzed as a sample. The field equipment blank gives an indication of contamination from field procedures (e.g., improperly cleaned sampling equipment, cross-contamination). One equipment rinsate blank will be collected during each quarterly groundwater monitoring event. If dedicated sampling equipment is used, an equipment blank will not be required.

4.3 Trip Blanks

Trip blanks are used to evaluate if VOCs may have been introduced to the primary samples during shipment, handling, or storage. Trip blanks are prepared by the laboratory, shipped to the project site, and then transported back to the laboratory with the field samples. Trip blanks will be analyzed for VOCs only. Trip blanks will be submitted and analyzed with each cooler containing groundwater VOC samples.

4.4 Data Validation/Verification

The laboratory will provide a minimum of a Level II QC laboratory data package. In addition, URS will request that a minimum of 10 percent of all samples be reported with a Level IV QC laboratory data package. Following receipt of the Level II or Level IV data package from the laboratory, URS will perform data validation and verification to evaluate the reliability and defensibility of the analytical data. This process involves reviewing the data against a known set of criteria to verify data validity prior to URS submitting the data.

5.0 INVESTIGATION-DERIVED WASTE

The investigation-derived waste generated during the long-term monitoring will include spent and unused sample material, personal protective equipment, miscellaneous sampling supplies, decontamination water, and purge water. Waste will be managed in accordance with the *Environmental Restoration Program Investigation-Derived Waste Management Plan* (USAF, 2009). Prior to performing sampling, the field team leader will discuss with the field sampling personnel waste reduction methods. Practices to be instituted to support waste minimization include, but are not limited to, the following:

- Restriction of materials (especially hazardous materials) to those needed for performance of work;
- Substitution of recyclable materials for disposable items;
- Reuse of items, when practical;
- Segregation of contaminated from uncontaminated waste; and
- Segregation of reusable items (such as personal protective equipment and tools).

Waste characterization will be evaluated based on the comparison of analytical results with applicable regulatory levels.

Wastewater from pre-sampling well purging and equipment decontamination will be stored in tanks pending the receipt of the groundwater analytical results. A sign posted on each tank will identify the contents and convey a warning that no material should be added or removed. The tank will be labeled "Investigation-Derived Waste" and will include the date that the purge water was put in the tank. Waste characterization will be performed by reviewing the groundwater sample analytical results from the wells. The detected constituent concentrations will be compared to the New Mexico Water Quality Control Commission Regulations, Part 2, 3103, A, B, and C groundwater quality standards (20 New Mexico Administrative Code 6.2).

A Notice of Intent to discharge purge and decontamination water will be prepared following each annual sampling event and submitted to the Kirtland AFB personnel for submittal to the NMED Ground Water Quality Bureau for approval prior to discharging any groundwater to surface. The maximum concentrations will be used to determine whether purge water meets the discharge requirements. The decision tree provided by the NMED Groundwater Quality Bureau and presented in Figure 4 will be used to aid in determining the disposal requirements. After NMED provides their approval, the water will be discharged to the ground surface at the site. If the results indicate that the water cannot be released to the ground surface, it will be disposed at an appropriate facility.

All personal protective equipment and disposable equipment will be placed in double plastic bags and sealed for disposal in dumpsters at the base.

As part of the contract with the subcontracted laboratories, all laboratory and sample waste is managed in accordance with the subcontract. Analytical waste streams may include unused/unaltered sample material, analytical residues, and sample containers. Unused/unaltered sample material will be generated from the sampling activities in the form of groundwater not required for analysis. Generally, the laboratory will be responsible for disposal of the unused/unaltered sample material. In those cases where samples must be returned from the laboratory, this excess material will be documented and disposed in accordance with the

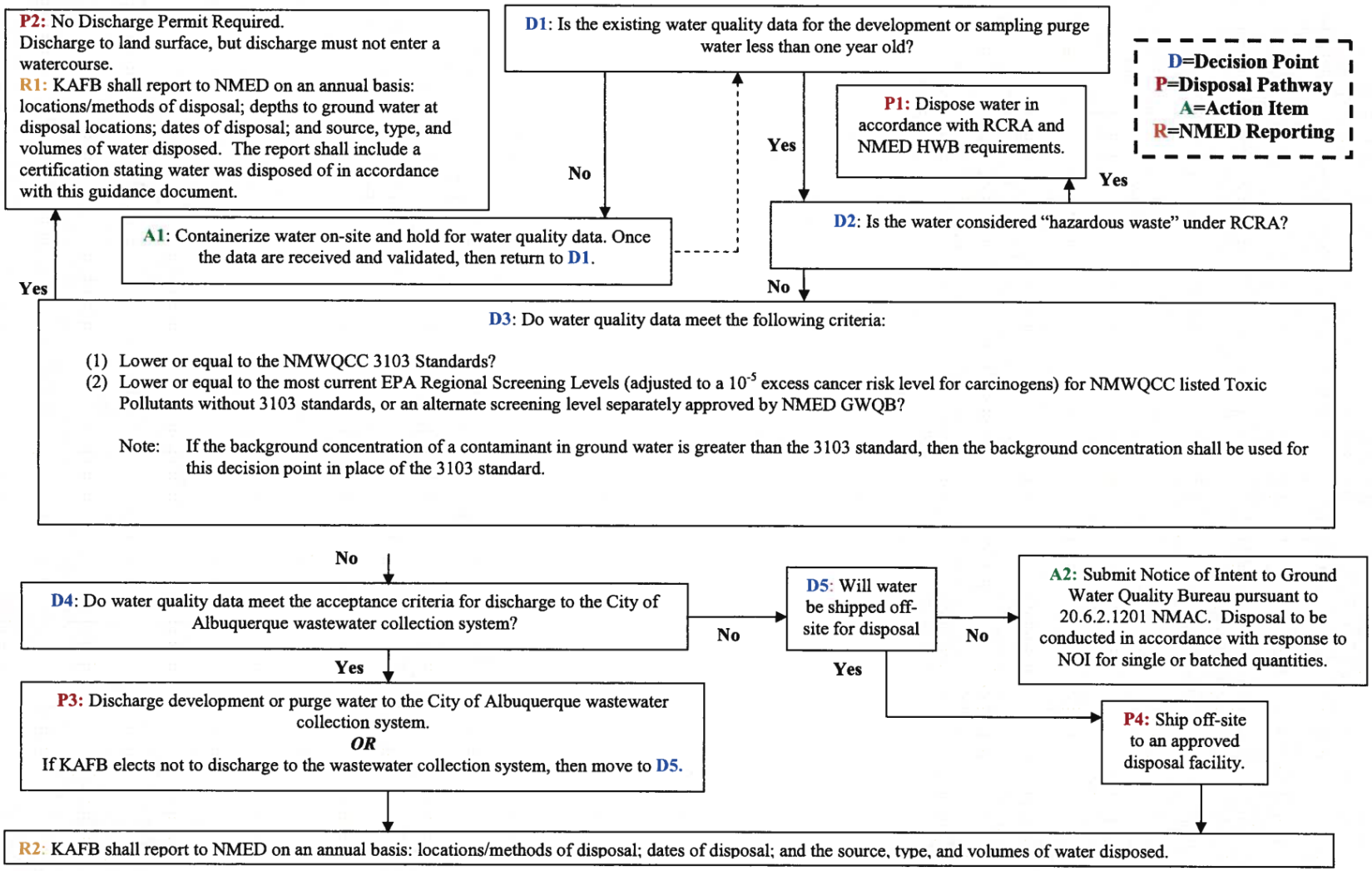

Figure 4. Kirtland AFB Development and Sampling Purge Water Decision Tree

EPA – U.S. Environmental Protection Agency
GWQB – Ground Water Quality Bureau
KAFB – Kirtland Air Force Base
NMAC – New Mexico Administrative Code
NMED – New Mexico Environment Department
NMWQCC – New Mexico Water Quality Control Criteria
RCRA – Resource Conservation and Recovery Act

requirements for disposal of purge and decontamination water. Analytical residues will be generated from the sample analytical activities conducted by the subcontracted laboratories. Although the laboratories are required to dispose of analytical residues under terms of the subcontract, the potential does exist for return of analytical residues. If analytical residues are returned, this will be documented and the waste disposed at an appropriate facility.

Sample containers will become a waste stream following analyses. The laboratories are required to dispose of the sample containers in accordance with established waste management procedures. Sample containers will only be returned to the project should unused/unaltered sample material need to be returned as discussed above.

6.0 RECORDKEEPING

URS will maintain a field logbook in accordance with SOP-1, "Use and Maintenance of Field Log Books," found in Appendix A of the QAPP (USAF, 2014a), which requires that field logbooks be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. The primary document used to record site data is the field logbook. Entries will be made in indelible ink and corrections made by a single stroke through the error with the recorder's initials. All entries to the logbook will include, at a minimum:

- Location, date, start and finish times;
- Names of personnel present;
- Names of visitors;
- General weather conditions;
- Health and safety briefings;
- Details of work performed;
- Summary of samples collected;
- Field measurement readings and field equipment calibration information;
- Photograph log and drawings/sketches; and
- General observations.

7.0 REPORTING

Upon receipt of analytical results from all annually scheduled sampling activities, URS will prepare a written report summarizing the groundwater and soil vapor monitoring activities. The annual monitoring report will summarize field activities, observations, and results. The report will include the evaluation of trends and statistical analysis, as appropriate.

Analytical results will also be presented within the report in a table format, and include sample identifier, date and time of collection, sample location, and concentrations. Analytical results will be compared to the applicable New Mexico Groundwater Quality Control Commission standards. Field notes and laboratory reports will be included as appendices within the report.

In addition, within 90 days of sample collection, all data will be exported for upload to AFCEC's Environmental Restoration Program Information Management System database.

8.0 REFERENCES

USAF. 2014a. *Final Uniform Federal Policy Quality Assurance Project Plan, ST-070E, Oil-Water Separator (ST-219)*. U.S. Air Force, Environmental Restoration Branch, Kirtland Air Force Base, New Mexico. December.

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