DEPARTMENT OF THE AIR FORCE
377TH AIR BASE WING (AFGSC)

NOV 07 2019

Colonel Christopher J. King, USAF
Vice Commander
377th Air Base Wing
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NMED
Hazardous Waste Bureau

Mr. John Kieling, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department (NMED)
2905 Rodeo Park Drive East, Building 1
Santa Fe NM 87505

Dear Mr. Kieling

Please find the *Work Plan (WP) for Shallow Soil Vapor Sampling, Bulk Fuels Facility, Solid Waste Management Units (SWMU) ST-106/SS-111*, Kirtland Air Force Base (AFB), New Mexico dated November 2019. This WP has been revised and updated in response to the New Mexico Environment Department's (NMED's) letter dated July 26 2019.

This WP is submitted in accordance with the requirements in Part 6.2.4.2 of the Kirtland AFB Hazardous Waste Treatment Facility Operating Permit, U.S. Environmental Protection Agency Identification Number NM9570024423, including detailed background information, a description of site conditions, and a signed certification by the responsible official. A Comment Response Worksheet is provided to facilitate NMED's review.

If you have any questions or concerns, please contact Mr. Scott Clark at commercial line (505) 846-9017 or email scott.clark@us.af.mil; or Mr. Sheen Kottkamp at commercial line (505) 846-7674 or email sheen.kottkamp.1@us.af.mil.

Sincerely

CHRISTOPHER J. KING, Colonel, USAF
Vice Commander

Attachments:
1. Work Plan for Shallow Soil Vapor Sampling, Bulk Fuels Facility, November 2019
2. Comment Response Worksheet

cc:
NMED-HWB (Cobrain, Kieling), letter and CD
NMED-OOTS (Pruett), letter
NMED-RPD (Stringer), letter and CD

KAFB4908

Common Comment and Response Worksheet (Version 3)

Date	Reviewer		Document Title (version)	Contract/TO Number
8-Nov-18	NMED HWB		Work Plan for Shallow Soil Vapor Sampling Bulk Fuels Facility Solid Waste Management Unit ST-106/ST-111	W912PP-19-P-0014
Item	**Section**	**Page**	**Comment**	**Response**
1	General Comment Work Plan Format		**NMED Comment:** The Memo was not submitted in a format that is acceptable as a work plan. Section 6.2.4.2 of the KAFB Permit presents the sections required for an Investigation Work Plan. The Permittee provided no title page, no signature block or certification, no executive summary, no table of comments, no introduction, no background information, and no description of site conditions. In addition, the pages of the attachments contain no page numbers making it difficult to reassemble the document in proper order once the pages were separated. In order for NMED to provide comments detailing where issues are found, as well as for the public to be able to review the document in the Administrative Record, every page of every document submitted must be numbered appropriately. The Permittee must submit a work plan in the appropriate format, including addition of the appropriate information in the appropriate required sections, based on the Permit requirements and must sequentially number every page contained in the document.	Work Plan prepared in accordance with the format and content requirements of Hazardous Waste Facility Permit No. NM9570024423 Section 6.2.4.2.
2	General Comment Document Certification		NMED Comment: NMED's February 25, 2019 letter requiring the submittal of a soil vapor sampling work plan specifically states, "(p]ursuant to 40 C.F.R. § 270.ll(d)(l), all corrective action documents, including those outlined in this letter, shall include a certification, signed by a responsible official, stating: *I certify under penalty of Jaw that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person ar persons who manage the system, or those persons directly responsible for gather the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties far submitting false information, including the possibility of fine and imprisonment for knowing violations."* The Permittee did not provide the certification as required. Failure to provide the certification in future documents may result in rejection of the documents. Provide the signed certification in the Work Plan.	Signed certification included in Work Plan as required.
3	Soil Vapor Monitoring Point Locations		NMED Comment: The NMED-HWB has no record of the rationale used for selection of vapor monitoring point locations. The Permittee provided no background information or rationale for choosing the proposed soil vapor monitoring wells. Provide a record of the selection of vapor monitoring locations, as well as background information and the rationale for each soil vapor monitoring point location, in the Work Plan.	Proposed shallow SVMP locations were selected to confirm that there is no VI risk to off-site receptors north of the Base. The proposed locations for shallow SVMPs were selected to provide measurements in off base locations where earlier Detailed soil vapor monitoring point location rationale is included in Work Plan Section 3.1 and Table 1.
			In addition, NMED does not agree with the installation of temporary wells. Soil vapor monitoring related to vapor intrusion will be required of the Permittee for as long as VOCs are present in the subsurface anywhere at the site above the vapor intrusion screening levels and subsurface flow is being manipulated through various SVE, bioventing, or other pilot tests and/or interim measures. In addition, the proposed upside-down buried bucket equipment cover is not appropriate. The Permittee must propose to install permanent surface completions for all new soil vapor monitoring wells. Since these will be permanent for the foreseeable future, NMED recommends using stainless steel tubing instead of the proposed Teflon tubing. Should the Teflon tubing fail, the Permittee may be required to reinstall the affected vapor monitoring wells.	Kirtland AFB has updated the well construction information in the Work Plan to permanent soil vapor monitoring point placement. Teflon tubing has been selected for the proposed sampling train to improve analytical data quality due to its resistance to contaminant adhesion and a detailed description of why Teflon tubing has been selected along with the well construction information is included in Work Plan Section 5.2.

Date	Reviewer		Document Title (version)	Contract/TO Number
8-Nov-18	NMED HWB		Work Plan for Shallow Soil Vapor Sampling Bulk Fuels Facility Solid Waste Management Unit ST-106/ST-111	W912PP-19-P-0014
Item	**Section**	**Page**	**Comment**	**Response**
4	Proposed Temporary Vapor Monitoring Point Construction		NMED Comment: NMED is unclear as to why the Permittee would propose this as part of well construction. It appears to suggest that the soil vapor sampling ports will be encased in bentonite, which is not appropriate. Provide a more detailed and thorough description of the proposed well construction and a discussion of how the Permittee will ensure that the sampling ports are located and screened appropriately in the revised Work Plan. In addition, the Permittee did not provide a description of or specifications for the sampling ports. Provide this information in the Work Plan.	A more detailed description of well construction and vapor port placement is included in Section 5.2.2
5	Decontamination		NMED Comment: These statements contradict each other. In addition, it is unclear why field supplies would require sterilization. Provide a detailed description of the proposed technique to boil fittings in the field and how this nonstandard technique accomplishes decontamination. Resolve the discrepancy and provide the information in the Work Plan.	Discrepancy resolved and decontamination procedures updated in Section 5.3. Soil vapor sampling equipment will consist of single use disposable Teflon tubing and dedicated SVMP single use hose barbs and flow control valves; therefore, no decontamination of soil vapor sampling equipment will be necessary.
6	Proposed Soil Vapor Sampling Equipment, Methods and Purge Paramaters		NMED Comment: The schematic provided for the sample train for collecting soil vapor samples is not adequate. A three-way valve should be included in the Teflon tubing above the Summa canister. The valve must shut off flow to the pump prior to opening the valve to the Summa canister for sample collection. The valve will prevent the Summa canister vacuum from drawing air backwards from the sensors and pump. Revise the figure for the Work Plan to include an appropriate mechanism to ensure soil vapor sample collection procedures are collecting representative samples.	The sampling train is discussed in Section 6.1 paragraph 3 and the sampling train schematic has been updated in Figure 5.
7	Field Instruments		NMED Comment: The Permittee must provide the details ofthe photoionization detector, including the photon energy of the lamp. In addition, the Permittee must provide detailed information on calibration gases for all field instruments and how they are applicable to the contaminants and concentrations expected at the site. Provide this information in the Work Plan.	The details of the photoionization detector including lamp photon energy are included in Section 6.1 paragraph 5. Calibraion gas information for field instruments is included in Section 6.1 paragraph 6.
8	Laboratory Analysis		NMED Comment: The Permittee must utilize a laboratory and analytical methodology that have LOQ and MDL values below the VIS Ls. The Permittee cannot demonstrate that a site requires no further action based on data with LOQs that exceed the screening levels. The Permittee must make a demonstrated effort to find a laboratory and analytical method that can achieve an LOQ below the VISL.	Kirtland AFB has obtained laboratory and analytical methods that have LOQ and MDL values below the VISLs. Updated LOQ and MDL values are included in Table 2 and laboratory information is included in Section 6.3 of the Work Plan.
9	Reporting		NMED Comment: NMED does not accept draft documents. In addition, a memorandum is not the appropriate reporting document. The Permittee must propose to submit a report that summarizes the work conducted that includes descriptions of all work performed and presents the results of the investigation. Propose to submit a report in the Work Plan accordingly.	Kirtland AFB will prepare and submit a an investigation report in accordance with the Hazardous Waste Faclity Permit No. NM9570024423 Part 6.2.4.3 and is included in Section 6.4 of the Work Plan.

Column A:	Comment Identifier Number	Comment Classifications
Column C:	Section Number of Comment	**(C)** Critical: Critical comments will result in a critical issue. Provide convincing support.
Column D:	Page Number of Comment (first page associated with comment)	**(M)** Major: Major comments are significant concerns that may result in a major issue. This category may be used with a general statement of concern followed by a detailed comment on the specific entries in the document that, considered in total, constitute the concern.
Column H:	Comment	**(S)** Substantive: An entry in the document that appears to be or is potentially unnecessary, misleading, incorrect, or confusing.
Column I:	Response	**(A)** Administrative: Administrative comments correct inconsistencies between different sections, typographical and grammatical errors.

Notes: Comments must be actionable ("add the following text:…", "delete…", "change text to:")
Place only one comment per row.
Classify comment as C, M, S, or A.

Column A:	Comment Identifier Number
Column B:	Source (Commenter/Authority)
Column C:	Section Number of Comment Target
Column D:	Page Number of Comment Target (first page associated with comment)
Column E:	Paragragh number, on page, of Comment Target
Column F:	Line Number (within Paragraph above) of Comment Target
Column G:	Comment Classification
	(C) Critical: Critical comments will result in a critical issue. Provide convincing support.
	(M) Major: Major comments are significant concerns that may result in a major issue. This category may be used with a general statement of concern followed by a detailed comment on the specific entries in the document that, considered in total, constitute the concern.
	(S) Substantive: An entry in the document that appears to be or is potentially unnecessary, misleading, incorrect, or confusng.
	(A) Administrative: Administrative comments correct inconsistencies between different sections, typographical and grammatical errors.
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KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

WORK PLAN FOR SHALLOW SOIL VAPOR SAMPLING
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106/SS-111

November 2019

377 MSG/CEI
2050 Wyoming Boulevard Southeast
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KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

WORK PLAN FOR SHALLOW SOIL VAPOR SAMPLING BULK FUELS FACILITY SOLID WASTE MANAGEMENT UNITS ST-106/SS-111

November 2019

Prepared for
U.S. Air Force
Kirtland Air Force Base
2000 Wyoming Blvd SE
Kirtland Air Force Base NM 87117

NOTICE

This Work Plan (WP) is prepared for the U.S. Air Force for the purpose of performing shallow soil vapor sampling associated with the Kirtland Air Force Base (AFB) Bulk Fuels Facility (BFF), Solid Waste Management Units ST-106/SS-111. This work is performed under the U.S. Air Force Environmental Restoration Program, in accordance with the corrective action provisions set forth in Part 6 of the Hazardous Waste Treatment Facility Operating Permit (EPA ID No. NM9570024423) issued to Kirtland AFB (RCRA Permit), with the New Mexico Environment Department (NMED) serving as the lead regulatory agency.

The shallow soil vapor data will be collected to confirm that there are no vapor intrusion (VI) risks to building occupants at the Raymond G. Murphy Veterans Affairs Medical Center (VA Medical Center) or the residential neighborhood north of Bullhead Park. Soil vapor monitoring point samples will be used by Kirtland AFB in the future to inform and update the Risk Assessment for the potential VI exposure pathway as requested in the 19 December 2018 NMED letter (NMED 2018).

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1. REPORT DATE *(08-11-2019)*	**2. REPORT TYPE** Final	**3. DATES COVERED** *(From - To)*
4. TITLE AND SUBTITLE Work Plan for Shallow Soil Vapor Sampling Bulk Fuels Facility, Solid Waste Management Units ST-106/SS-111 Kirtland Air Force Base, New Mexico		**5a. CONTRACT NUMBER** W912PP-19-P-0014 **5b. GRANT NUMBER** **5c. PROGRAM ELEMENT NUMBER**
6. AUTHOR(S) HazAir, Inc		**5d. PROJECT NUMBER** **5e. TASK NUMBER** **5f. WORK UNIT NUMBER**
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) HazAir, Inc 1717 Louisiana Blvd. NE, Suite 116 Albuquerque, New Mexico 87110		**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Corps of Engineers–Albuquerque District 4101 Jefferson Plaza NE Albuquerque, New Mexico 87109-3435		**10. SPONSOR/MONITOR'S ACRONYM(S)** **11. SPONSOR/MONITOR'S REPORT NUMBER(S)**
12. DISTRIBUTION / AVAILABILITY STATEMENT		
13. SUPPLEMENTARY NOTES		

14. ABSTRACT

This Work Plan describes activities associated with the proposed shallow soil vapor investigation conducted by an independent contractor to collect additional shallow soil vapor data to confirm that there are no vapor intrusion (VI) risks to building occupants at the Raymond G. Murphy Veteran Affairs Medical Center or the residential neighborhood north of Bullhead Park. This data will be used by Kirtland Air Force Base to update the Risk Assessment for the vapor intrusion pathway for residential receptors.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT UNCLASSIFIED	**b. ABSTRACT** UNCLASSIFIED	**c. THIS PAGE** UNCLASSIFIED	ABSTRACT		Scott Clark **19b. TELEPHONE NUMBER** *(include area code)* (505)-846-9017

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40 CFR 270.11
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NOVEMBER 2019

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

CHRISTOPHER J. KING, Colonel, U.S. Air Force
Vice Commander, 377th Air Base Wing

7 NOV 2019
Date

This document has been approved for public release.

KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs

11/7/19
Date

PREFACE

This Work Plan (WP) is prepared for the U.S. Air Force for the purpose of performing shallow soil vapor sampling associated with the Kirtland Air Force Base (AFB) Bulk Fuels Facility (BFF), Solid Waste Management Units ST-106/SS-111. This work is performed under the U.S. Air Force Environmental Restoration Program, in accordance with the corrective action provisions set forth in Part 6 of the Hazardous Waste Treatment Facility Operating Permit (EPA ID No. NM9570024423) issued to Kirtland AFB (RCRA Permit), with the New Mexico Environment Department (NMED) serving as the lead regulatory agency.

The objective of the WP is to describe the proposed shallow soil vapor investigation that will be conducted by an independent contractor to collect additional shallow soil vapor data for vapor intrusion (VI) risk evaluation for buildings at the Raymond G. Murphy Veterans Affairs Medical Center or the residential neighborhood north of Bullhead Park. This data will be used by Kirtland AFB in the future to inform and update the Risk Assessment for the potential VI exposure pathway as requested in the 19 December 2018 NMED letter (NMED 2018). The Work Plan provides the technical approach for the installation of soil vapor monitoring points and sampling of these points.

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A Historic Benzene Concentrations in off-Base Shallow Soil Vapor Monitoring Points

B Second Quarter 2019 Soil Vapor Monitoring Results

C Soil Vapor Monitoring Location Maps and Summary Analytical Results, April-June 2019

D Field Forms

E Soil Vapor Well Completion Diagram, 2001

ACRONYMS AND ABBREVIATIONS

%	percent
AFB	Air Force Base
ALS	ALS Global Environmental Laboratory
bgs	below ground surface
BFF	Bulk Fuels Facility
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
COA	City of Albuquerque
COPC	contaminants of potential concern
DoD	Department of Defense
DPT	Direct Push Technology
EDB	ethylene dibromide (also known as 1,2-dibromoethane)
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
ft	feet
HHRA	human health risk assessment
ID	identification
IDW	investigation-derived waste
KAFB	Kirtland Air Force Base
LOQ	limit of quantification
MDL	minimum detection limit
MRL	method reporting limit
NMED	New Mexico Environment Department
No.	number
O_2	oxygen

ACRONYMS AND ABBREVIATIONS (CONCLUDED)

PVC	polyvinyl chloride
Q	quarter
QA	quality assurance
QC	quality control
RA	Risk Assessment
RCRA	Resource Conservation and Recovery Act
RLS	Registered Land Surveyor
Site	Bulk Fuels Facility site
SVE	soil vapor extraction
SVM	soil vapor monitoring
SVMP	soil vapor monitoring point
SWMU	Solid Waste Management Unit
ug/m^3	micrograms per cubic meter
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
VA	Veterans Affairs
VI	vapor intrusion
VISL	vapor intrusion screening level
VOC	volatile organic compound
WP	Work Plan

EXECUTIVE SUMMARY

The Work Plan (WP) is prepared for the purpose of providing additional shallow soil vapor data for vapor intrusion (VI) risk evaluation for buildings at the Raymond G. Murphy Veterans Affairs (VA) Medical Center or the residential neighborhood north of Bullhead Park. This data is being collected in response to the New Mexico Environment Department (NMED) letter dated 25 February 2019. The 25 February NMED letter requested additional shallow soil vapor data to confirm the Risk Assessment (RA) conclusion that there is no risk to off-site receptors. Specific comments regarding the format and content of the Work Plan provided in the NMED letter dated 26 July 2019 are also addressed.

The proposed shallow soil vapor investigation will be conducted by an independent contractor to collect additional shallow soil vapor data. The WP provides a history of the site, current site conditions, and technical approach for soil vapor monitoring point installation. This WP includes a signed certification by the responsible official in accordance with Part 6.2.4.2 of the Kirtland AFB Hazardous Waste Treatment Facility Operating Permit, U.S. Environmental Protection Agency ID No. NM9570024423. The methodology for the selection of soil vapor monitoring point locations is included to ensure representative samples are collected and data gaps eliminated. As required in the 25 February 2019 letter from NMED, the WP includes a proposed schedule for two sampling events, one in the summer and one in the winter. The results of the monitoring point installation and sampling will be summarized in a final investigative report.

1. INTRODUCTION

This Shallow Soil Vapor Monitoring (SVM) Work Plan (WP) was prepared for the U.S. Air Force for the purpose of performing shallow soil vapor sampling associated with the Kirtland Air Force Base (AFB) Bulk Fuels Facility (BFF), Solid Waste Management Units ST-106/SS-111. This work is performed under the U.S. Air Force Environmental Restoration Program, in accordance with the corrective action provisions set forth in Part 6 of the Hazardous Waste Treatment Facility Operating Permit (EPA ID No. NM9570024423) issued to Kirtland AFB (RCRA Permit), with the New Mexico Environment Department (NMED) serving as the lead regulatory agency.

1.1. Overview and Scope of Activities

The WP is prepared for the purpose of providing additional shallow soil vapor data for vapor intrusion (VI) risk evaluation for buildings at the Raymond G. Murphy Veterans Affairs (VA) Medical Center or the residential neighborhood north of Bullhead Park. This data is being collected in response to the NMED letter dated 25 February 2019. The 25 February NMED letter requested additional shallow soil vapor data to confirm the Risk Assessment (RA) conclusion that there is no risk to off-site receptors. The WP and associated activities will be performed in accordance with the 2019 NMED Risk Assessment Guidance for Site Investigations and Remediation, Revision 2, February 2019 (NMED, 2019a).

Existing soil vapor monitoring points (SVMPs) are shown in **Figure 1**. Proposed shallow soil vapor sampling locations are shown on **Figure 2**. SVMPs will be drilled using Direct Push Technology (DPT) when possible. Proposed vapor monitoring point completions are shown on **Figure 3** and **Figure 4**. Proposed soil vapor sampling will be conducted within one week following completion of the proposed vapor monitoring points and perturbed soil vapor conditions have returned to ambient conditions. The results of the monitoring point installation and sampling will be summarized in the final Investigation Report.

1.2. Report Organization

The Site SVM WP is formatted in accordance with the requirements of Part 6.2.4.2 of the RCRA Permit and divided into the following sections:

- **Section 1**—Presents an introduction to the plan, an overview of the project, scope of activities and organization of the WP.
- **Section 2**—Provides background information on the Site.
- **Section 3**—Details the site conditions.
- **Section 4**—Presents the scope of activities to be conducted for this project.
- **Section 5**—Outlines the investigation methods that will be utilized.

- **Section 6**—Refers to the monitoring and sampling protocol.
- **Section 7**—Presents the schedule for this sampling event.

Associated appendices are provided at the end of this WP as follows:

Appendix A: **Historic Benzene Concentrations in off-Base Shallow Soil Vapor Monitoring Points**

Appendix B: **Second Quarter 2019 Soil Vapor Monitoring Results**

Appendix C: **Soil Vapor Monitoring Location Maps and Summary Analytical Results, April-June 2019**

Appendix D: **Field Forms**

Appendix E: **Soil Vapor Well Completion Diagram, 2001**

2. BACKGROUND INFORMATION AND SITE CONDITIONS

2.1. Site Description

Kirtland AFB is located in Bernalillo County, in central New Mexico, southeast of and adjacent to the City of Albuquerque (COA) and the Albuquerque International Sunport. The approximate area of the base is 52,287 acres. The Site is located in the northwestern portion of Kirtland AFB.

2.2. Site History

Kirtland AFB discovered a fuel release in November 1999 at the Former Fuel Offloading Rack at the BFF and determined through environmental investigations that subsurface fuel releases occurred over a period of decades. Kirtland AFB responded by performing interim measures including infrastructure removal, soil removal actions, bioslurping and soil vapor extraction (SVE) in the vicinity of the original release beginning in 2001 (KAFB, 2017a). A groundwater pump and treat interim measure to collapse the ethylene dibromide (EDB) plume north of Ridgecrest Drive began in the summer of 2015.

The SVE and bioslurping interim measures are most relevant to the scope of this WP and operated at the Site from 2003 through 2015. Approximately 775,000 equivalent gallons of jet fuel have been removed from the subsurface by vacuum extraction (SVE and bioslurping combined). Operation of these systems have significantly decreased soil vapor concentrations over time within the system radius of influence (KAFB, 2017a).

Residential receptors may be exposed to volatile compounds vaporized from subsurface media (soil gas and/or groundwater) through pore spaces in the vadose zone and building foundations (or slabs) into indoor air. This pathway is evaluated during a RA if: 1) there are compounds present in subsurface media that are sufficiently volatile and toxic, and 2) there are existing or planned buildings where exposure could occur. NMED has calculated vapor intrusion screening levels (VISLs) for chemicals which are sufficiently volatile and toxic for evaluation of the vapor intrusion pathway. NMED follows the guidance in the "*VISL Calculator User's Guide*" (US EPA, 2014) and NMED-specific input parameters (see Table A-4 in "*Risk Assessment Guidance for Site Investigations and Remediation*" (NMED, 2019a). NMED guidance states "*VISLs are not meant to be used as action standards or cleanup levels. Rather, they should be used as a tool to estimate potential cumulative risks and/or hazards from exposure to volatile and toxic chemicals at a site where the underlying assumptions are deemed appropriate and if further evaluation is required*" (NMED, 2019a).

The July 2017 RA Report evaluated the vapor intrusion pathway for potential on and off-base receptors. It considered both current land use (Air Force owned open space and Bullhead park) and potential future residential use. Samples collected for the evaluation of the vapor intrusion pathway were from depths of 15 to 25 feet below ground surface (bgs), which is deeper than the 10 foot depth used by NMED for VISLs. This imparted a high degree of conservatism to the risk characterization.

In addition, soil gas data from Quarter 3 and Quarter 4 2015 indicated that fuel hydrocarbon rebound was still occurring following SVE shutdown. Well KAFB-106142, where the one EDB detection was found in Quarter 3 2015, had most likely not achieved equilibrium after shutdown

of the SVE system in Quarter 2 2015. To ensure a high degree of protection for this RA, this one detection was used in the risk-screening assessment.

Kirtland AFB has developed this WP to address the 25 February 2019 NMED letter regarding the installation of additional shallow SVPMs beyond the existing network to confirm that there are no vapor intrusion risks to building occupants at the VA Medical Center or the residential neighborhood north of Bullhead Park. Some locations specified in the NMED letter are not accessible or viable for representative sampling and are discussed further in WP Section 3.1.

2.3. Soil Vapor Monitoring Data Summary

2.3.1. Soil Vapor Monitoring and Soil Vapor Extraction History

Semiannual SVM is ongoing and has been performed at SWMUs ST-106/SS-111 since 2001. SVM wells are sampled during the second and fourth calendar quarters of each year and sampling results are presented in the applicable Quarterly Report. SVE was performed from 2003 through first calendar quarter 2015, at which point monitoring was suspended and the active catalytic oxidizer SVE system was shut down in second quarter 2015. Soil vapor rebound and respiration testing was then performed to assess residual contamination in the vadose zone through hydrocarbon rebound trends (KAFB, 2017a).

The current SWMUs ST-106/SS-111 SVM network includes 56 SVM locations (**Figure 1**). SVM locations are nested wells comprised of up to six individual SVMPs that are screened at discrete intervals ranging from approximately 15 ft to 450 ft bgs. Five SVM locations are located off-Base consisting of 28 SVMPs ranging from 25 ft to 450 ft bgs. Each sampling event includes the collection of field parameters including hydrocarbons, carbon dioxide (CO_2), and oxygen (O_2) and samples which are analyzed for EPA Toxic Organics - 15 (Method TO-15). Benzene and EDB are the primary risk drivers for soil vapor. These compounds have been detected historically in off-Base monitoring locations. Historical summary data for these indicator compounds are included in **Appendix A**.

2.3.2. Second Quarter 2019 Soil Vapor Monitoring Data Summary

The most recent data provided in the Quarterly Monitoring Report submitted in September 2019 indicates low contaminant concentrations in the off-Base SVM locations (KAFB, 2019). None of the detections were found above 450 ft bgs, which is well below the 10 ft bgs threshold used for evaluating the vapor intrusion exposure pathway. EDB was detected in two of the 28 off-Base SVMPs, at concentrations of 2.6 ug/m^3 and 1.4 ug/m^3 with both detections occurring at a depth of 450 ft bgs. Benzene was detected in 18 of the 28 SVMPs with 16 of the 18 detections estimated at 1.6 ug/m^3 or less. The remaining two detections were at 2.7 ug/m^3 and 19 ug/m^3 occurring at 450 ft bgs. Even if these detections were present at a depth of 10 ft bgs or shallower, all but one of the sample concentrations are below the VISLs for EDB and benzene, 1.56 ug/m^3 and 120 ug/m^3, respectively. **Appendix B** includes the results of the second quarter 2019 sampling.

3. SAMPLING LOCATIONS

SVMP locations have been selected within the residential area north of Ridgecrest, within the VA Medical Center campus, and in the utility easement south of Gibson Boulevard Southeast.

3.1. Soil Vapor Monitoring Locations

Proposed shallow SVMP locations were selected to confirm that there is no VI risk to off-site receptors north of the Base. The July 2017 Vapor Risk Assessment (KAFB, 2017) was performed using existing data from the SVPMs located at depths of 25 and 50 ft bgs. The NMED Risk Assessment Guidance for Site Investigations and Remediation sets forth maximum acceptable VISLs for volatile compounds in soils which are less than 10 feet below grade for comparison and evaluation of risk to human and ecological receptors at land surface (NMED, 2019a). Construction and sampling of new monitoring point locations is proposed in this WP to supplement the off-Base monitoring network and provide data at depths of less than 25 ft.

The proposed locations for shallow SVMPs were selected to provide measurements in off base locations where earlier (i.e. before the SVE system was shut off and rebound was complete) soil vapor samples collected from deeper soil horizons had detected volatile compounds, and in locations where no SVMPs are present within the area of potential impact. Four monitoring points were selected to complement data from existing nearby SVM wells where benzene and EDB were previously detected. Off-Base historical benzene and EDB detections are included in **Appendix A**. Second quarter 2019 SVM results for off-base SVM wells are included in **Appendix B**. A detailed listing of each SVMP location, sample depths and analytical methods are provided in **Table 1**.

Proposed SVMP locations include Bullhead Park, located immediately north of Kirtland AFB property, the VA Medical Center and parking areas north of Bullhead Park, vacant land north of Bullhead Park and the City of Albuquerque Lasseter Park, located north of Ridgecrest Drive. These sites range from 550 ft north to approximately 2600 ft northeast of the facility.

Locations of the existing on base and off-Base soil vapor extraction wells and monitoring network wells are shown on the Soil Vapor Monitoring Locations Map on **Figure 1**. This map and other maps including the results of the Second quarter 2019 soil vapor monitoring event are included with this WP as **Appendix C** (Figures 2-1 through 2-8, Quarterly Monitoring Report April-June 2019, [KAFB, 2019])**.** Five existing off-Base SVMP locations are shown on the existing and proposed soil vapor monitoring locations and depth of completions map in **Figure 2**. Four of the proposed SVMP locations (KAFB-SV-01, KAFB-SV-02, KAFB-SV-03, and KAFB-SV-07) were selected to provide shallow soil vapor sample data at sites adjacent to existing vapor point nests having deeper completions. Proposed SVMP locations for monitoring points KAFB-SV-04, KAFB-SV05, KAFB-SV-06 and KAFB-SV08 were selected to provide shallow soil vapor data near VA Medical Center facilities and near the residential area north of Ridgecrest as requested by NMED in the 25 February 2019 letter. Proposed vapor point depth settings were selected to provide representative shallow soil vapor samples from depths of 5 ft, 10 ft, 15 ft and 25 ft bgs. The 15 and 25 ft depths were included for consistency with existing SVM wells. Proposed locations were limited to VA Medical Center and City of Albuquerque

property to facilitate prompt implementation of WP activities and accessibility for future sampling.

Proposed SVMP locations were selected carefully to avoid areas in roadways and parking lots with heavy vehicular traffic for the following reasons:

- Potential sources of benzene, toluene, ethylbenzene, and xylenes may exist in shallow soils beneath roadways that could interfere with the objectives of this sampling event.
- Interference from vehicular traffic during the sampling may impact vapor concentrations in shallow soils under certain barometric conditions giving potential false positive results.

In addition, the proposed soil vapor sampling protocol includes the collection and analysis of ambient air samples during soil vapor sample collection to evaluate the potential for volatile organic compound (VOCs) present in ambient air. This could bias soil vapor sample results as discussed further in WP Section 6.2.

Once final sampling locations and schedule are approved by NMED, Kirtland AFB will coordinate with the City of Albuquerque and the Department of Veterans Affairs. A list of permits and access agreements include, but are not limited to, the list below.

1. COA Noise Control Permit.
2. COA Excavation Permit.
3. NM 811 Damage Prevention Center - Dig Permitting/Clearance
4. COA Right-of-Way License expires September 2026.
5. Department of Veterans Affairs Permit for right of entry expires January 2021.

4. SCOPE OF ACTIVITIES

4.1. Soil Vapor Monitoring Point Installation and Sampling

The scope of this WP includes the installation of SVMPs and collection of shallow soil vapor samples. Installation of SVMPs will be conducted using DPT where possible; detailed drilling and SVMP installation methodology is described further in Section 5. Shallow soil vapor samples will be collected from SVMPs utilizing the methodology described in Section 6.

4.2. Mobilization/Demobilization

Because all proposed drilling and SVMP installation sites are located off- Base and in non-secure areas all equipment and personnel will be mobilized to and from the drilling locations daily. At the end of each working day all investigation derived waste will be removed and SVMPs will be covered and secured. All work sites will be restored to initial conditions and documented with pre- and post-work photographs in compliance with the COA Construction Services permit and the VA Right of Entry.

4.3. Site Security

Safe and secure construction sites will be maintained during the execution of all activities pursuant to off-site SVMP installation and sampling. Site and safety personnel will conduct work activities in accordance with USAF safety standards and practices. Plans to control public access and reduce interference with monitoring point sites (traffic control, noise control, and site security) will be implemented and a safe work environment for the field teams and the surrounding community will be established.

4.4. Barricading/Traffic Control

Work areas for SVMP drilling and installation will be protected from pedestrian and vehicular access. Barricades, temporary traffic control measures, and detour routes will be established where necessary in accordance with COA Construction Services Division requirements and in coordination with the VA Right of Entry. Kirtland AFB will comply with the COA's Construction Coordination Section for work within the public right-of-way, including barricade and excavation permits and fees, and providing data for traffic reports and any requirements established by the VA during work activities on the VA property.

5. INVESTIGATION METHODS

5.1. Drilling Equipment and Methods

SVMPs will be drilled using DPT when possible. Where DPT methods cannot penetrate to design depths, 6 in. hollow-stem auger methods will be used to complete the installations. Proposed drilling equipment is a Geoprobe 7822DT drilling rig. The drilling rig is rubber tracked and designed to traverse variable terrain with minimal surface disturbance. The rig employs hydraulic ram and percussion hammer technology to advance hollow steel tubing to collect core samples in acetate core tubes and to allow vapor points, tubing, gravel packs and annular seals to be deployed to precise depths. The drilling rig is also equipped to drill with 6 in. hollow-stem augers to be used only if necessary, to advance borings.

Proposed DPT drilling will be performed in two penetration passes. Where DPT methods are successful, an initial penetration will be made to total depth (15 ft or 25 ft) using 2.25 in. outside diameter x 48 in. length rods to capture 1.5 in. diameter soil cores in acetate tubes. A second pass will be made to total depth using 3.5 in. outside diameter x 48 in. length rods, to widen the hole and allow deployment of soil vapor probes to the proposed depths and construction of multiple ports, tubing strings, gravel packs and annular seals in the borings. During advancement of the DPT tools, cores will be collected in the lead rod in acetate core tubes on 4 ft intervals and brought to land surface. Acetate core tubes will be cut longitudinally such that retrieved cores may be inspected for lithologic logging and visual inspection. Documentation for logging as well as collection of other field parameters will be conducted using the field forms included in **Appendix D**.

Where DPT methods cannot penetrate to design depths, partial DPT cores will be retained and hollow stem auger cuttings will be collected to complete descriptions of penetrated sediments. Soil cores will be visually inspected and logged in accordance with American Society of Testing and Materials (ASTM) methods by a geologist. Soil core descriptions will include mineralogy, texture, sorting, rounding, degree of induration, plasticity, moisture content and USCS and Munsell Soil Chart color.

5.2. Proposed Vapor Monitoring Point Construction

SVMP completions are proposed in accordance with previously approved Kirtland AFB Site SVM well design. SVMPs will be consistent with the seal and completion of previously approved monitoring points. Permanent SVMPs will be completed to accommodate additional future sampling events and will be repaired or replaced as necessary to maintain compliance with regulatory monitoring requirements. SVMP installations will be equipped with permanent flush to grade traffic rated vault and concrete slab surface completions.

In the 26 July 2019 letter, NMED recommended the use of stainless steel tubing, however conditions warrant the use of Teflon tubing to complete the SVMPs. Teflon tubing was selected to improve analytical data quality and repeatability due to its resistance to contaminant adhesion and constructability considerations. The proposed DPT drilling methodology will require that the SVMPs be built in slender open holes after the DPT drilling tools are withdrawn. Hole diameters will be small (3.5 in.) and hole stability will be an issue with stainless steel tubing, which is delivered in coiled segments and requires extensive handling to straighten. This has the

propensity to excessively contact and abrade the open holes, risking hole caving and collapse. Teflon tubing is light and flexible, requires minimal handling and provides the best opportunity to complete the SVMP nests with minimal risk of hole sloughing or introduction of contaminants by excessive handling.

A completion diagram for well SVMW-03 installed in 2001 is included as **Appendix E.** Details of proposed soil vapor well completions are shown on **Figure 3** (15 ft depth) and **Figure 4** (25 ft depth)**.**

5.2.1 Proposed Well Construction Materials

Proposed soil vapor monitoring points materials include:

- Soil Vapor Probes - Geoprobe 6 in. AT86 Series double woven stainless wire screen
- Well Tubing - 1/4 in. Teflon tubing
- Pervious Annular Fills - 10/20 grade silica sand (opposite wire screen probes)
- Annular Seals - 3/8 in. granular bentonite, placed, hydrated (between screened zones)
- Tubing Vault Seals - SWAGELOK quick connect sample connection fittings, or equivalent (part no. SS-QC4-B-2PM)
- Well Vault - 12 in. x 12 in. cast iron flush to grade traffic rated vault with tamper proof security bolts and waterproof seals on the vault covers and bolts
- Vault Drain Tube - 1/2 in. schedule 40 polyvinyl chloride (PVC) pipe, set through vault concrete to natural materials below
- Concrete Surface Pad - Portland ready concrete mix meeting ASTM C387

5.2.2 Proposed Well Construction

SVMP well construction components are identified in Section 5.2.1 above. Installation methods to ensure the proper positioning of vapor probes, annular gravel packs and annular seals are detailed below and illustrated in **Figures 3 and 4**. Wells will be advanced using DPT and/or a six inch. hollow-stem auger, as required and described in Section 5.1. Well probe and annular fill placements, as well as surface completions will be performed as follows:

- Vapor Probe Placement – Prior to installing the vapor probes at prescribed depths in each well, the well depth will be sounded using a weighted fiberglass or steel tape to tag the bottom of the hole and to verify that the hole depth matches the well design depth for that probe. The probe will then be affixed to a length of Teflon tubing and lowered to the bottom of the hole and the placement depth verified by additional hole depth sounding. Approximately 5 ft of excess Teflon tubing will be placed on each vapor probe to allow the excess tubing to be bundled and positioned away from the hole during annular fill and surface completion operations. Depth stamped quick connect sample connection fittings

will be affixed to each Teflon tubing run to prohibit entry of foreign media into the tubing during well construction operations.

- Pervious Annular Fill Placement – After placing each vapor probe to its prescribed depth, 10/20 silica sand will be incrementally trickled into the hole from land surface until the annular space opposite the vapor probe is flooded with sand. The level of the annular sand fill will be verified by continuous sounding with the weighted tape as incremental filling progresses to ensure that overfilling or bridging does not occur.

- Annular Seal Placement – After the annular sand fill opposite each vapor probe has been placed, 3/8 in. granular bentonite will be placed by incrementally trickling the granular bentonite into the hole from land surface until annulus above the probe/sand interval has been flooded with granular bentonite up to the bottom of the next probe/sand interval, or (for the shallowest probe in each well) to approximately 4 in. below the projected base of the well vault on the completed installation. The bentonite fill will be continuously sounded with the weighted tape to ensure that bridging or overfilling does not occur. After the granular bentonite has been placed for each annular seal, potable water will be poured into the hole from land surface such that the bentonite is hydrated to form an annular seal between probes and between the upper probe and land surface.

- Well Vault and Concrete Surface Slab Placement – After probes, Teflon tubing and annular fills have been placed in each well, the ground (turf or unimproved dirt) will be excavated around the well to a depth of 6-inches and width of 4 ft x 4 ft. A square concrete form constructed of 2 x 6 in. lumber will be placed in the excavation and centered on well boring such that the top of the form is roughly level to adjacent grade. The 12 in. vault will be pushed into the well boring hole until its upper ring surface is approximately one inch higher than the lumber concrete form. Ready mix concrete will be mixed and flooded inside the form and around the well vault until an adequate volume of concrete has been placed to flood to the top of the form and to the upper surface of the well vault.

  A drain tube consisting of an 8 in. length of 1/2 in. PVC tubing will placed inside the well vault and pushed into the soil until its upper terminus is approximately 5 in. above the bottom of the well vault. The well vault will then be flooded with concrete until it nearly tops the PVC tube. The Teflon tubing for each vapor probe with affixed depth stamped quick connect sample connection fittings will be coiled and placed into the well vault and the well vault cover will be placed and security bolts fastened. The concrete slab will be floated and surfaced such that a smooth surface sloping radially from the upper well vault ring to the concrete form results. Finally, the concrete slab will be broom finished.

5.3. Decontamination

All the DPT and drilling tools and equipment that are used to penetrate below grade will be decontaminated prior to arriving on site and will be decontaminated after use at each SVMP location.

Soil vapor sampling equipment will consist of single use disposable Teflon tubing and dedicated SVMP single use hose barbs and flow control valves; therefore, no decontamination of soil vapor sampling equipment will be necessary.

Decontamination of drilling tools will take place in designated decontamination areas specific to the work activity and approved by Kirtland AFB. All decontamination wastewater will be managed in accordance with Kirtland AFB waste containment and disposal procedures. The objective of field decontamination is to remove contaminants of concern from the drilling tools to minimize risks of cross contamination and negative impact on study objectives. Specifications for decontamination materials are as follows:

1. Use a standard brand of phosphate-free laboratory detergent, preferably either liquid Liquinox® or powder Alconox®.
2. Use tap water from a municipal water treatment system. Detergent and tap water will remove the gross contamination from the sampling equipment.
3. Use deionized water for the final rinse of sampling equipment that has direct contact to the sampling medium.

5.4. Drilling Investigation Derived Waste

The DPT drilling method proposed for SVMP installations will not penetrate saturated soils, and will require no liquids to advance. DPT soil coring will produce small amounts of IDW, up to 3.5 gal. of soil core per monitoring point and 15 to 25 lineal ft of acetate core barrel per monitoring point. Derived soil will be captured and contained within plastic sheeting or in sealed 5 gal. containers pending receipt of waste characterization profiling results. It is not anticipated that soils will contain any level of contamination, however, IDW samples will be screened for fuel components and toxic metals using totals analysis. Based on the totals analysis screening results, additional testing will be conducted using Toxicity Characteristic Leaching Procedure methodology if needed.

Once the analytical results for soil tests are received and reviewed, a Request for Disposal letter will be provided to Kirtland AFB for approval to dispose of the soil in the Kirtland Construction and Demolition Landfill assuming it meets waste acceptance criteria. All documentation regarding waste characterization and disposal will be provided in the appendices of the document describing the activities during which waste was generated.

5.5. Borehole Logging

During drilling, each boring will be fully described by a geologist on the boring log form in accordance with ASTM International D5434 and will include the following, when applicable:

1. Identification number and location of each boring
2. A general description of the drilling equipment used that includes such information as rod size, bit type, pump type, rig manufacturer, and model
3. Date and time of start and completion of boring
4. Name of contractor, driller, and drill site geologist

5. Size and length of casing (soil vapor port and tubing type) used in each borehole
6. Soil classification in accordance with the United Soil Classification System, color, relative density and consistency, soil components, soil moisture, stratification, hardness, grain size and size distribution, and odor will be logged.
7. Mineralogical content of the core (for correlation)
8. Observations during drilling, such as bit chatter, rod binding and rod drops
9. Depth limits, type, and number of each sample taken
10. Observations of visible contamination for each sample

5.6. Site Restoration

Site restoration will consist of backfilling and compaction, surface restoration/resurfacing, and landscaping restoration. Work areas will be restored to original conditions; and, in the areas where pavement is disturbed, pavement of the type and thickness meeting COA Department of Municipal Development or VA Right of Entry requirements will be replaced as applicable.

5.7. Soil Vapor Monitoring Point Survey

Upon completion, each SVMP will be surveyed by a Registered Land Surveyor (RLS). The surveys will establish northings, eastings, and elevations within 0.01 ft accuracy at all soil vapor monitoring point locations, referenced as follows:

1. New Mexico State Plane Coordinate System, Central Zone, North American Datum of 1983
2. North American Vertical Datum 1988

A tabular summary of the XYZ coordinates for each monitoring point, as well as a map showing the locations of the monitoring points and bearing the RLS seal will be prepared and included in the Final Investigation Report.

6. MONITORING AND SAMPLING

6.1. Soil Vapor Sample Collection and Analysis

Proposed soil vapor sampling will be conducted after each of the proposed SVMPs have been completed and adequate time has elapsed to allow perturbed soil vapor conditions from monitoring point installation to return to ambient conditions (proposed one week minimum). Barometric pressures and trends will be noted during sample collection to assess propensity for air to move into or out of shallow soils during soil vapor sampling. Two sampling events will be conducted, one in winter and one in summer based on NMED approval of this WP. Sampling will be conducted to determine if seasonal changes will affect sampling results. However, it is unlikely to be conducted during bioventing pilot testing as described in the NMED letter dated 25 February 2019 due to the length of time required for review and approval of this WP. Any new SVM wells that exceed a VISL after the first two samples are collected will be added to the semiannual soil vapor monitoring schedule.

Proposed sampling train and equipment are depicted on **Figure 5**. Proposed equipment includes a vacuum pump and vapor ports for production of formation-representative soil vapor samples. Additionally, sensitive vacuum/pressure gauges to assess pre-purging and pre-sampling subsurface soil pressure/vacuum conditions and to evaluate vacuum propagation during monitoring point purging and evaluation for possible interference between vapor ports in the monitoring point nest. Teflon tubing has been selected for the proposed sampling train to improve analytical data quality due to its resistance to contaminant adhesion. SVMPs will be sealed when not in use and as such will not be able to off gas soil vapor or allow infiltration of the atmosphere.

The proposed sampling train includes connections to allow collection of vapor streams during monitoring point purging for testing of volatile and fixed gases using field instruments, as well as for collection of SUMMA® canister samples at the conclusion of monitoring point purging. The vacuum pump is equipped with a check valve to prevent backflow through the pump during non-operation. The sampling train will also be equipped with an isolation valve positioned between the vacuum pump/field sensors and the SUMMA® canister that will be open during purging to allow for monitoring of purge vapors. This valve will be closed prior to sample collection to ensure that vapor taken into the SUMMA® canister does not flow backwards through the vacuum pump or field sensors. All Teflon tubing and connections proposed for the sample train upstream from the isolation valve will be new single-use disposable for each individual port at each monitoring point.

Vapor samples will be collected and analyzed for VOCs using EPA Method TO-15 and for fixed gases oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO), and methane (CH_4) using EPA Method 3C. The following paragraphs are included to provide specific information regarding sampling procedures to include pre-sampling steps for the maintenance and calibration of field instruments, sample train procedures to prevent cross contamination, and leak checking of the sample chain. Also detailed below are specific sampling activities to include static pressure measurements, vapor monitoring point purging, and SUMMA® canister sample collection.

During purging prior to sampling each soil vapor monitoring point, purge influent vapor streams will be screened for composition to ensure that vapors have been fully evacuated from the monitoring points, tubing and annular sand packs and that formation-representative samples are collected for laboratory analysis. Influent purge vapor streams will be field screened for total ionizable volatile hydrocarbons, oxygen, and methane using an RKI Instruments GX6000 gas monitor equipped with an 11.7 electron-volt ionizer lamp. Carbon dioxide, oxygen and methane will be measured using a Landtec GEM 2000 gas detector utilizing a dual beam infrared absorption sensor.

Prior to beginning soil vapor sampling each day, the field instruments will be calibrated for ionizable petroleum hydrocarbons and oxygen, methane and carbon dioxide against calibration standards of known concentrations in premixed gas cylinders. Calibration gases will include 100 parts per million isobutylene for volatile hydrocarbons, and methane 50 percent (%), carbon dioxide 35% and oxygen 0%.

At the middle of each workday, a calibration check will be performed on each instrument to determine whether the calibration of any of the parameters drifted since the morning calibration. If the calibration check results are outside of 5% of the calibration gas standards, then the instrument will be recalibrated prior to additional purging and sampling.

The proposed sampling train shown in **Figure 5** will consist of new Teflon tubing, hose barb t-connections, and an isolation valve positioned between the SUMMA® canister and the vacuum pump and field gas sensors. Teflon tubing and t-connector upstream of the isolation valve will be disposed upon completion of sampling at each port and each monitoring point. Each gas field instrument will be completely purged with atmospheric air after sampling each soil vapor monitoring port.

Prior to beginning purging, static vapor pressures will be measured in each soil vapor port with magnehelic gauges. Monitoring point purging, field data and SUMMA® canister sample collection will be completed in accordance with the proposed parameters and estimated schedules shown on **Figure 5**. Proposed soil vapor point purging and SUMMA® canister sample collection methodology is as follows:

1. Connect the Teflon tubing to the monitoring point port, the SUMMA® canister, the isolation valve the field gas detectors and the vacuum pump as shown on **Figure 5**.
2. Read static vacuum/pressures on the magnehelic gauges in the vapor port that is being sampled, as well as the other two or three vapor ports and record the values.
3. Ensure that the isolation valve is in the open position prior to initiating purge pump operation.
4. Turn on the vacuum purging pump, verify proper operation by monitoring pump exhaust flow.
5. Start timing the purge cycle. Based upon calculated volume of the deepest tubing set and sampling train (25 ft x 1/4 in. diameter) and the flow rate of the proposed vacuum pump (0.75 cfm) required to fully purge one bore volume of the tubing is less than one minute. Therefore, the proposed ten minutes of purge time is adequate to purge many bore volumes of the tubing and sample train.

6. Measure and record the O_2, CO_2, and photoionization detector readings during purging to ensure that a stable formation-representative soil vapor stream is being produced prior to vapor sample collection in the SUMMA® canister.
7. Close the isolation valve between the SUMMA® canister and the vacuum pump and turn off the vacuum pump. Open the valve on the SUMMA® canister and allow soil vapor stream to enter the SUMMA® canister for two minutes.
8. Prior to closing the valve on the SUMMA® canister, check and record the vacuum/pressure in the SUMMA® canister and sample train tubing. Ensure that SUMMA® canister has fully filled and that there is no residual vacuum in the canister or sample train.
9. Close the valve on the SUMMA® canister tightly to ensure sample integrity.
10. Ship SUMMA® canisters to the specified laboratory and analyze the samples for the analytical methods listed in the WP.

6.2. Quality Assurance/Quality Control (QA/QC) Samples

In addition to SVMP sampling, additional QA/QC samples will be collected over the duration of the sampling event. Two blind duplicate samples will be taken during the sampling event to identify potential sampling or laboratory error or contamination. A time-weighted atmospheric sample will be taken for each day SVMP sampling is conducted to determine if potential interference from outside sources such as vehicular exhaust, runoff or asphalt may affect the sampling results. Two trip blanks will be submitted to the laboratory for analysis for the sampling event.

6.3. Laboratory Analysis

Analytical services will be provided by ALS Global Environmental Laboratory (ALS) located in Semi Valley, California. ALS laboratory is accredited under the Department of Defense (DoD) Environmental Laboratory Accreditation Program.

Proposed six-liter SUMMA® canister samples will be used to analyze for volatile organic compounds and for fixed gases of each sample. Samples will be analyzed for the fixed gases oxygen, carbon dioxide, carbon monoxide, and methane using ASTM Method D1945/D1946, Environmental Protection Agency (EPA) Method 3C. Samples will be analyzed for VOCs by method TO15. The target analyte list was developed in the Risk Assessment Report (KAFB, 2017) based on vapor monitoring conducted between 2001 and 2015. The COPCs are listed in **Table 2** along with the laboratory detection limits and the residential VI screening limits as included in NMED's "*Risk Assessment Guidance for Site Investigations and Remediation*", February 2019 (NMED 2019a).

Table 2 shows the limit of quantification (LOQ) and minimum detection limit (MDL) values for samples collected in six-liter canisters. After the pressurization dilution factor is applied to the base LOQ and MDL, these values are expected to increase by approximately 1.5 times for six-liter samples. Consequently, six-liter SUMMA® canister samples are proposed to be collected and analyzed to ensure that minimum detection and concentration quantitation levels for EDB will be below the NMED residential VISL screening level.

Additionally, soil gas samples typically have elevated VOC concentrations as compared to ambient air samples. In the unlikely event that high-level VOCs are present, a secondary dilution may be required, which would result in elevated LOQ for the sample. Where possible, laboratory processes will be used to minimize dilution for any non-COPC analytes so that the COPCs maintain the lowest possible LOQs.

6.4. Reporting

Following data validation, a technical report will be prepared and submitted in accordance with the requirements of RCRA Permit Section 6.2.4.3 for Investigative Reports. Data validation and summary tables will be prepared for ease of data review. A summary of field activities and screening data will be included in the final report. An electronic copy of the validated analytical data will be included. The final report will include:

- Certification by a Facility representative
- Executive Summary, Introduction, and Background Information
- Description of the scope of field sampling activities
- Sampling results included in tables with identifier, date and time of all samples. Tables shall also include quality control/quality assurance designation for each sample
- Results of field screening data, in tabular format
- Regulatory criteria
- Description of vapor point construction and lithologic description
- Text summary of data validation procedures and results
- Soil boring logs, as an attachment/appendix
- Specifications for vapor probe construction, as an attachment/appendix
- Survey data, as an attachment/appendix
- Waste disposal documentation, as an attachment/appendix
- Validated analytical data deliverable in electronic format as Microsoft Excel, Microsoft Access database, or other compatible format.
- Tables, Figures, and Appendices as appropriate
- Conclusions and recommendations

7. SCHEDULE

See schedule of activities included in **Table 3**.

8. REFERENCES

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TABLES

Table 1: Soil Vapor Monitoring Point Locations, Depth and Analytical Methods

Vapor Point ID	Sample Port Depth Intervals (ft) Below Ground Surface				Analyses/Methods		Rationale for Location
	5	10	15	25	VOCs TO-15	Fixed Gases EPA - 3C	
KAFB-106-SV01	X	X	X		X	X	Provide shallow data to compliment data from KAFB-106141
KAFB-106-SV02	X	X	X		X	X	Provide shallow data to compliment data from KAFB-106138
KAFB-106-SV03	X	X	X		X	X	Provide shallow data to compliment data from KAFB-106142
KAFB-106-SV04	X	X	X	X	X	X	Provide shallow data in Bullhead Park
KAFB-106-SV05	X	X	X	X	X	X	Provide shallow data in Bullhead Park/VA campus area
KAFB-106-SV06	X	X	X	X	X	X	Provide shallow data in Lassetter Park
KAFB-106-SV07	X	X	X	X	X	X	Provide shallow data to compliment data from KAFB-106028
KAFB-106-SV08	X	X	X	X	X	X	Provide shallow data in vacant area north of Bullhead Park

Table 2: Contaminants of Potential Concern

Analyte	Residential VISL (ug/m3)	MRL/LOQ (ug/m3)**	MDL (ug/m3)***
Benzene	1.20E+02	0.53	0.077
tert-Butyl methyl ether (MTBE)	3.60E+03	0.54	0.063
1,2-Dibromoethane	1.56E+00	0.53	0.062
1,2-Dichloroethane	3.60E+01	0.51	0.078
Ethylbenzene	3.74E+02	0.53	0.075
n-Hexane	2.43E+04	0.53	0.11
Naphthalene	2.75E+01	0.53	0.13
Toluene	1.74E+05	0.53	0.065
m-Xylene	3.48E+03	1.1	0.14
o-Xylene	3.48E+03	0.53	0.077
p-Xylene	3.48E+03	1.1	0.14
Xylenes*	3.48E+03	2.73	NA
1,2,4-Trimethylbenzene	NA	0.53	0.074
Cyclohexane	NA	1.1	0.15
n-Heptane	NA	0.53	0.085

MRL Method reporting limit
LOQ Limit of quantification
MDL Minimum Detection limit
ug/m^3 micrograms per cubic meter
NA Not applicable
* Total Xylenes will be reported as the sum of m, p-xylene and o-xylene. No MDL or limit of detection evaluation is performed for Total Xylenes.
** Actual reporting limits will be higher depending on the canister pressurization dilution factor and/or sample matrix effects. Typical canister pressurization dilution factors are between 1.5-2.0.
*** MRLs assume a standard sample analysis volume (one liter for six-liter canister) canister.

Table 3: Field Sampling Schedule

Activity	Schedule
WP delivered to NMED	8 November 2019
NMED Comments	To be determined
Response to Comments	30 days from receipt of NMED letter
Field Mobilization	14 days from notice to proceed and NMED approval of WP
Drilling	Complete within 14 days of mobilization
1st Sampling	Complete within 14 days of drilling
2nd Sampling	Complete within 6 months of 1st sampling
Laboratory Analytical and Validation	60 days from 2nd sample collection
Final Report to NMED	60 days from data validation

FIGURES

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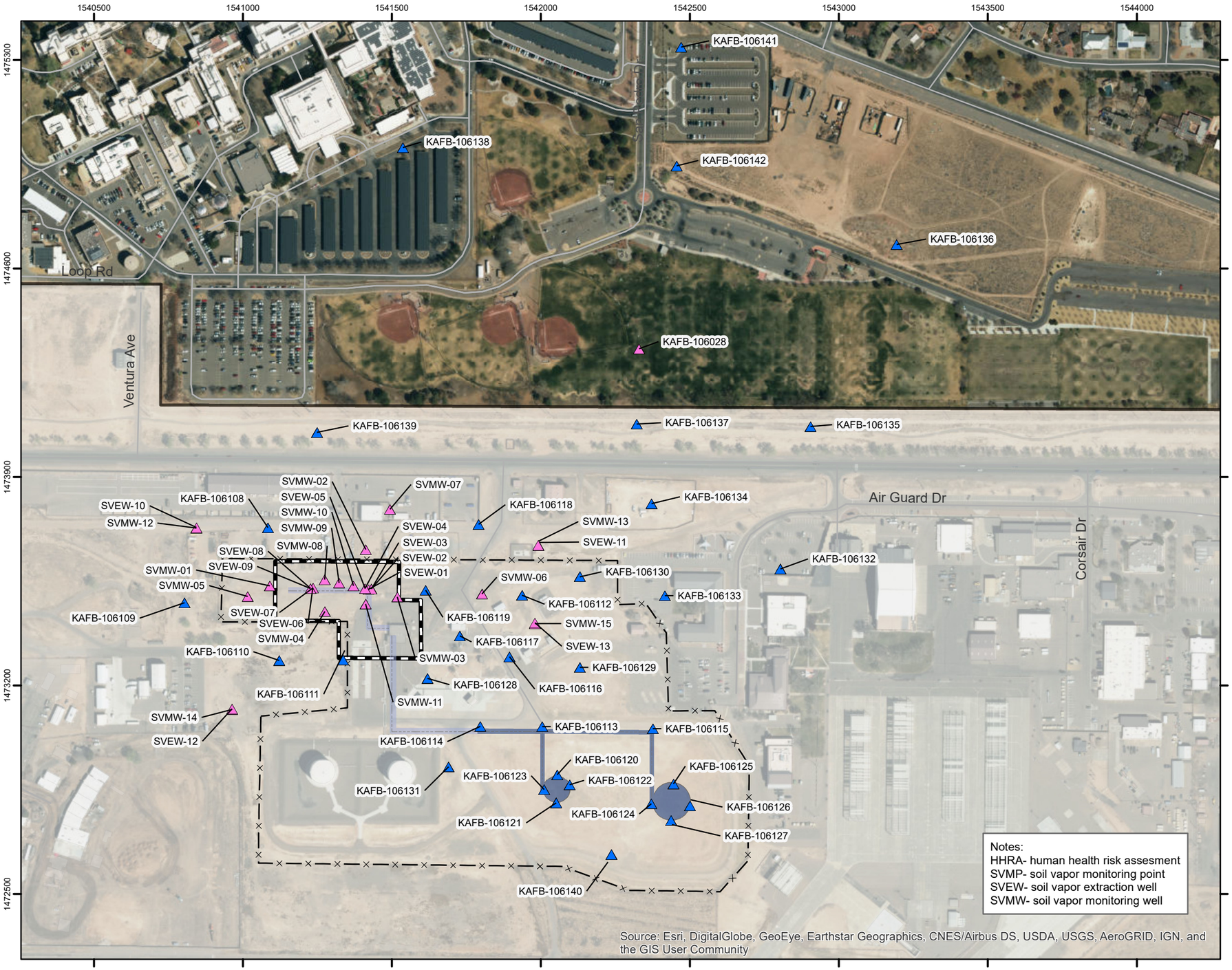


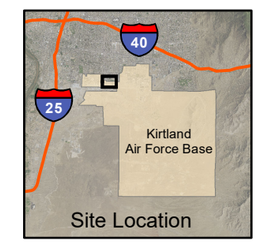
Notes:
HHRA- human health risk assesment
SVMP- soil vapor monitoring point
SVEW- soil vapor extraction well
SVMW- soil vapor monitoring well

Legend

- Kirtland Air Force Base Installation Area
- Source Area
- Bulk Fuels Facility Area
- Road
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Former Aboveground Storage Tank

Soil Vapor Monitoring Point

- Location with shallow SVMP (15-25ft) evaluated in the HHRA for potential vapor intrusion
- Location without shallow SVMP (15-25ft) not evaluated in the HHRA for potential vapor intrusion



Imagery Source: National Agricultural Imagery Program June 2014

Revision Date: 9/24/2019

N

0 200 400 800
Feet
1 inch = 350 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

SOIL VAPOR SAMPLING WORK PLAN
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT, ST-106/SS-111

FIGURE 1

SOIL VAPOR MONITORING LOCATIONS

Document Path: N:\Kirtland\GIS\GIS_Projects\HHRA\01_01_monitoring_locations.mxd

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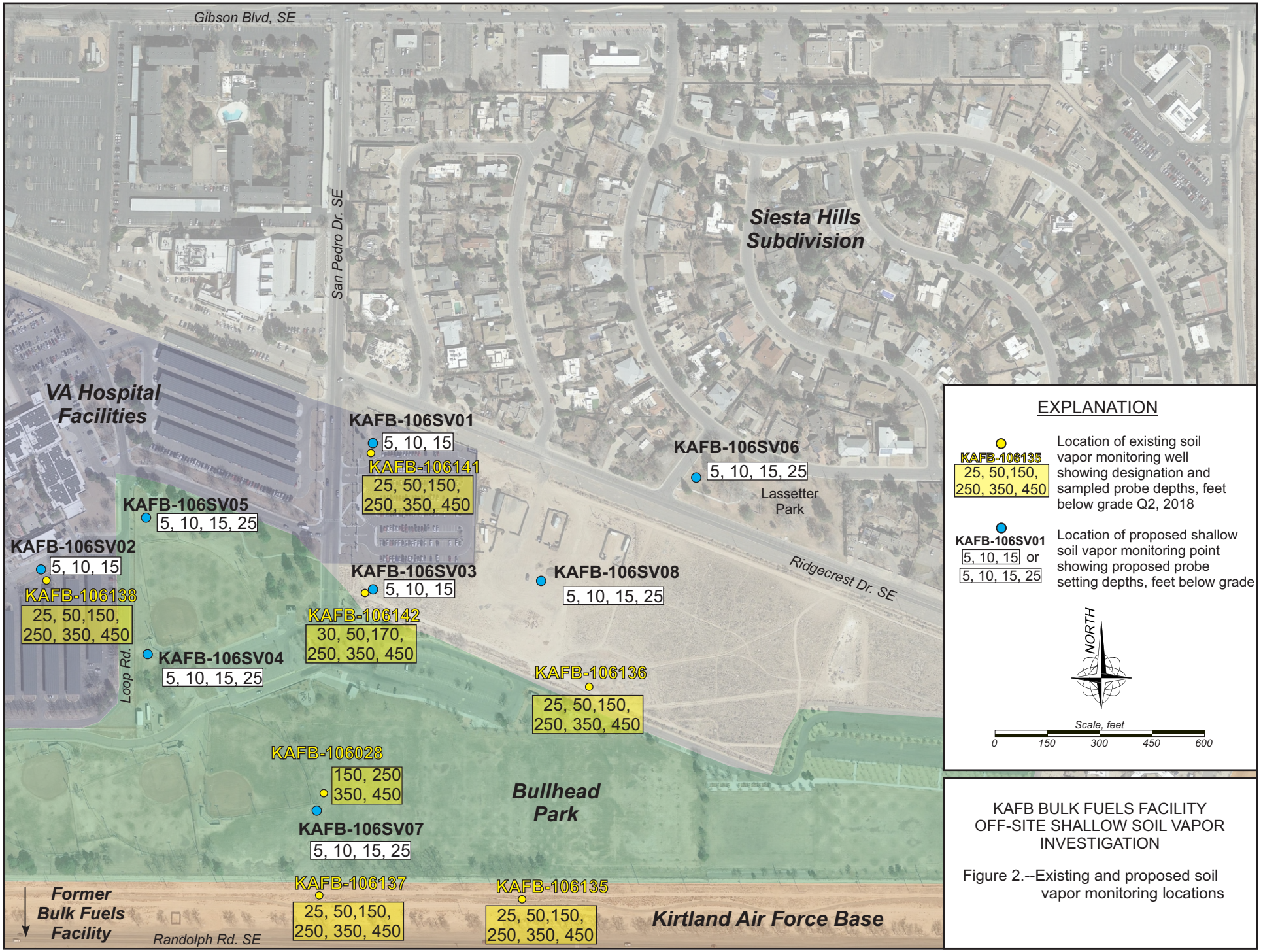
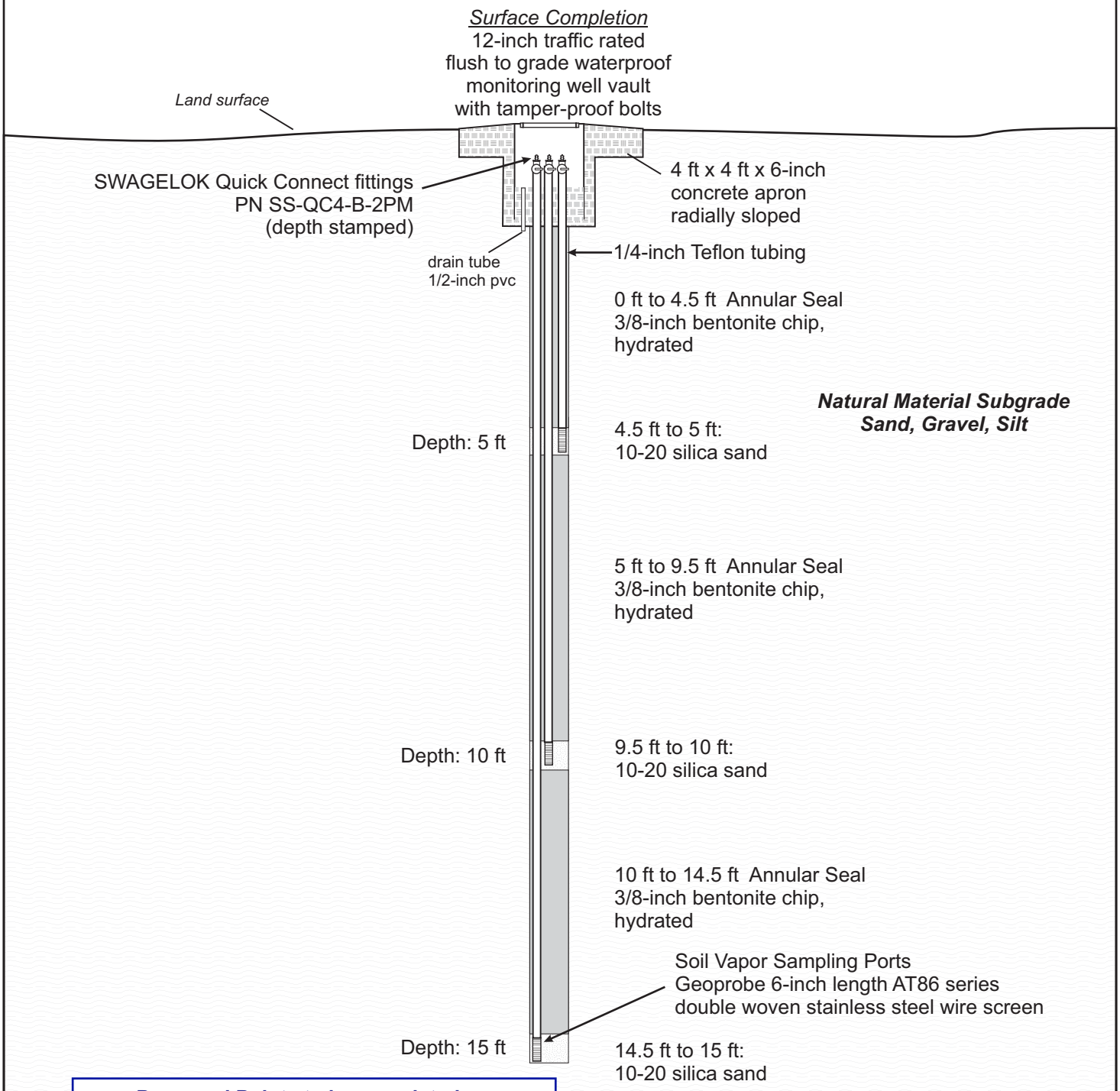


KAFB BULK FUELS FACILITY
OFF-SITE SHALLOW SOIL VAPOR
INVESTIGATION

Figure 2.--Existing and proposed soil vapor monitoring locations

PROPOSED SHALLOW SOIL VAPOR SAMPLING POINT CONSTRUCTION
15 FOOT DEPTH
KAFB BFF OFF SITE INVESTIGATION



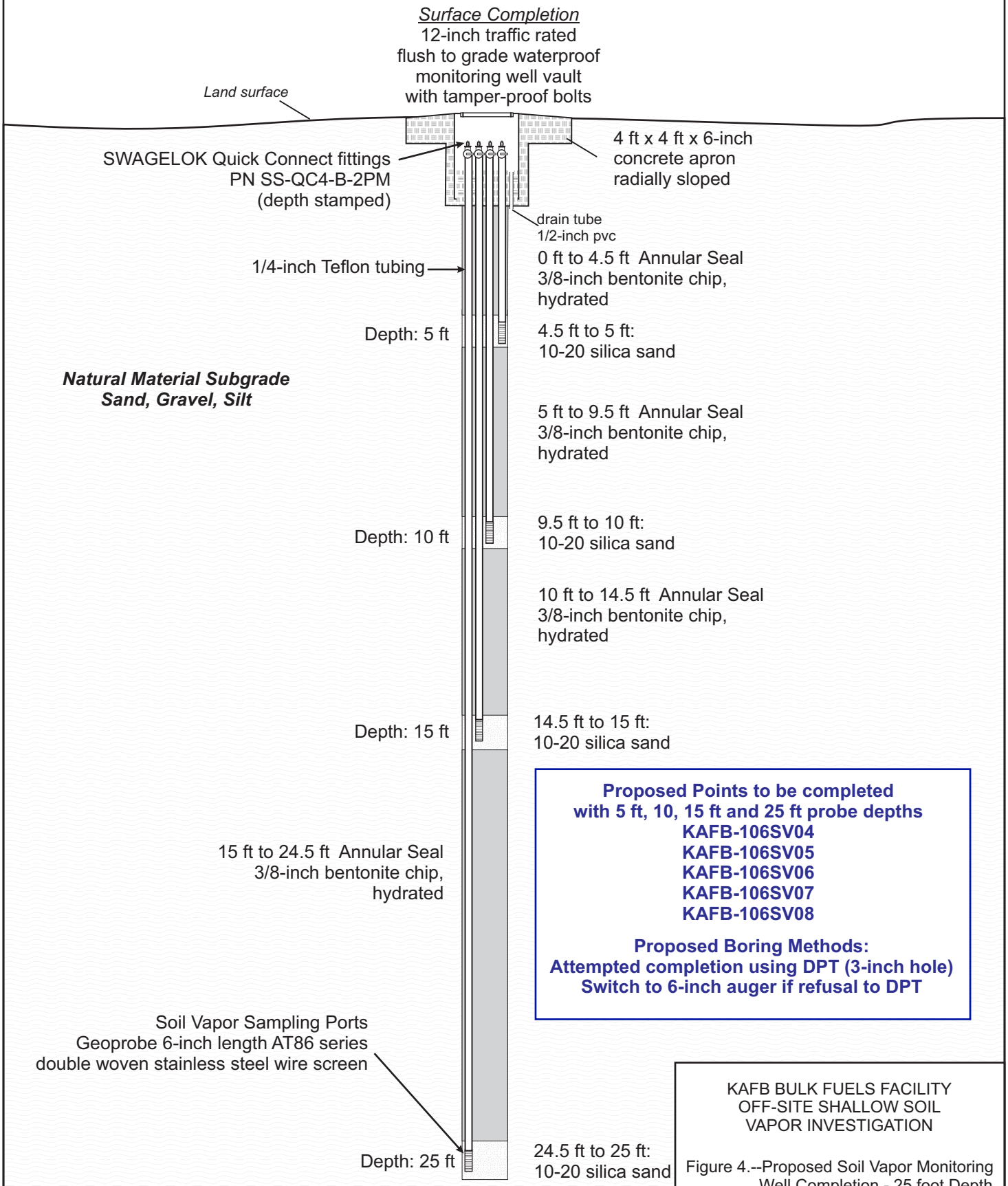
Proposed Points to be completed
with 5 ft, 10 and 15 ft probe depths
KAFB-106SV01
KAFB-106SV02
KAFB-106SV03

Proposed Boring Methods:
Attempted completion using DPT (3-inch hole)
Switch to 6-inch auger if refusal to DPT

KAFB BULK FUELS FACILITY
OFF-SITE SHALLOW SOIL
VAPOR INVESTIGATION

Figure 3.--Proposed Soil Vapor Monitoring Well Completion - 15 foot Depth

PROPOSED SHALLOW SOIL VAPOR SAMPLING POINT CONSTRUCTION
25 FOOT DEPTH
KAFB BFF SITE INVESTIGATION

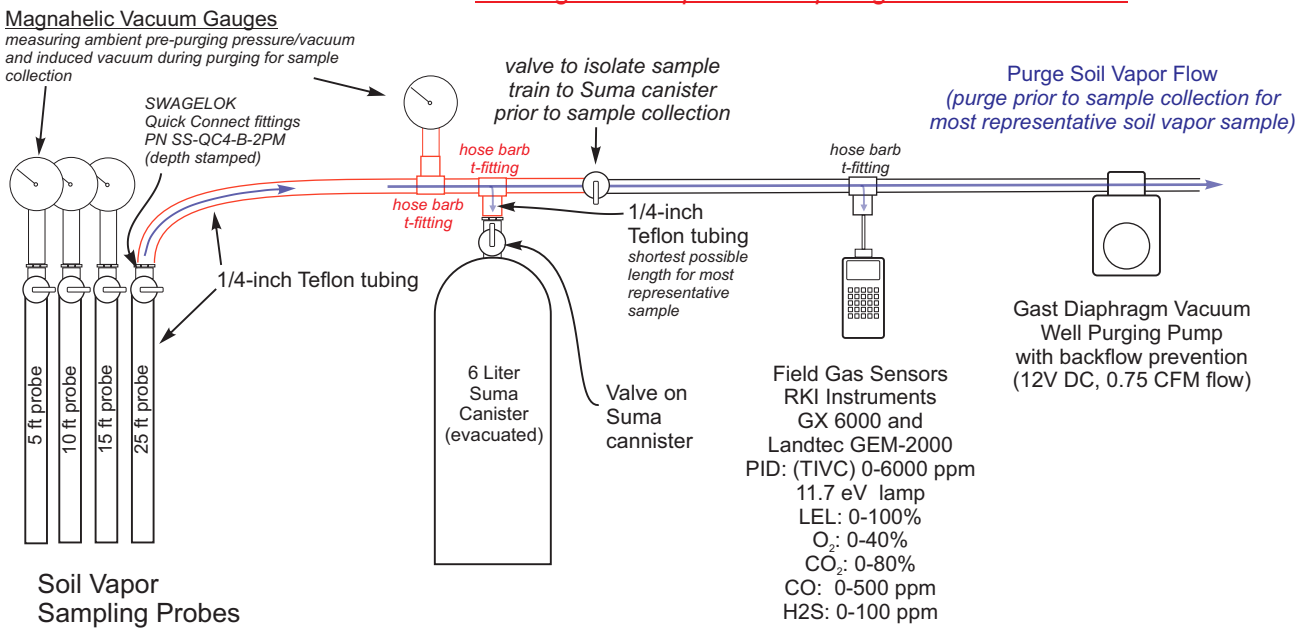


KAFB BULK FUELS FACILITY
OFF-SITE SHALLOW SOIL
VAPOR INVESTIGATION

Figure 4.--Proposed Soil Vapor Monitoring Well Completion - 25 foot Depth

PROPOSED SOIL VAPOR SAMPLING EQUIPMENT AND SETUP
KAFB BFF OFF-SITE SHALLOW SOIL VAPOR INVESTIGATION

Proposed sampling train tubing and fittings shown in red are single use disposable requiring no decontamination



PROPOSED SOIL VAPOR PURGING PARAMETERS

Probe Depth (ft)	Date-Time	Elapsed Purge Time (min)	Purge Duration (min)	Pre-Purge Ambient Well Pressure (vacuum) Inches H_2O				Induced Vacuum During Well Purge (Inches H_2O)				Field Vapor Screening Parameters				Comments
				5 ft probe	10 ft probe	15 ft probe	25 ft probe	5 ft probe	10 ft probe	15 ft probe	25 ft probe	PID (ppm)	CO_2 (%)	O_2 (%)	CH_4 (%)	
15-Foot Completions																
5 ft		-5.0														Pre-purge pressure/vacuum
5 ft		0.0														Begin Purge
5 ft		5.0														
5 ft		10.0														Collect Sample
10 ft		-5.0														Pre-purge pressure/vacuum
10 ft		0.0														Begin Purge
10 ft		5.0														
10 ft		10.0														Collect Sample
15 ft		-5.0														Pre-purge pressure/vacuum
15 ft		0.0														Begin Purge
15 ft		5.0														
15 ft		10.0														Collect Sample
Add For 25-Foot Completions																
25 ft		-5.0														Pre-purge pressure/vacuum
25 ft		0.0														Begin Purge
25 ft		5.0														
25 ft		10.0														Collect Sample

KAFB BULK FUELS FACILITY
OFF-SITE SOIL VAPOR INVESTIGATION

Figure 5.--Proposed Soil Vapor Sampling Equipment, Methods and Purge Parameters

APPENDIX A

Historic Benzene Concentrations in off-Base Shallow Soil Vapor Monitoring Points

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Historic Benzene Concentrations in off Base Shallow Soil Vapor Monitoring Points
Analytical Method TO-15

Quarter (Month-Year)	Screening Level[a]	106136-025 Graphed Conc. in ug/m3[b]	106136-025 Validation Qualifier	106136-025 MDL[c]	106136-025 LOQ	106138-025 Graphed Conc. in ug/m3[b]	106138-025 Validation Qualifier	106138-025 MDL[c]	106138-025 LOQ	106141-025 Graphed Conc. in ug/m3[b]	106141-025 Validation Qualifier	106141-025 MDL[c]	106141-025 LOQ	106142-030 Graphed Conc. in ug/m3[b]	106142-030 Validation Qualifier	106142-030 MDL[c]	106142-030 LOQ
Apr-11	1.20E+02	NA	NA	NA	NA	2.65E+03		3.19E+02	2.56E+03	3.19E+02	U	3.19E+02	2.56E+03	6.07E+02		1.60E+01	1.28E+02
Jul-11	1.20E+02	5.75E+02		3.19E+00	2.56E+01	1.60E+01	U	1.60E+01	1.28E+02	4.79E+01		4.15E+00	3.19E+01	1.69E+02		3.83E+00	2.56E+01
Oct-11	1.20E+02	7.67E+01		3.19E+00	2.56E+01	1.60E+01	U	1.60E+01	1.28E+02	1.05E+02		3.19E+00	2.56E+01	3.13E+02		1.60E+01	1.28E+02
Jan-12	1.20E+02	4.79E+03		1.60E+02	1.28E+03	2.11E+03		1.60E+02	1.28E+03	1.09E+04		3.19E+02	2.56E+03	2.78E+04		1.60E+02	1.28E+03
Apr-12	1.20E+02	9.90E+03		3.19E+02	2.56E+03	1.47E+03		1.60E+01	1.28E+02	3.19E+00	U	3.19E+00	2.56E+01	3.51E+03		3.19E+02	2.56E+03
Jul-12	1.20E+02	1.12E+04		3.19E+02	2.56E+03	5.75E+04		3.19E+02	2.56E+03	1.02E+04		3.19E+02	2.56E+03	4.47E+03		1.60E+02	1.28E+03
Oct-12	1.20E+02	2.01E+04		3.19E+02	2.56E+03	1.73E+04		3.19E+02	2.56E+03	2.01E+04		3.19E+02	2.56E+03	4.47E+03		3.19E+02	2.56E+03
Jan-13	1.20E+02	1.28E+03		1.60E+01	1.28E+02	1.63E+05		3.19E+03	2.56E+04	4.47E+03		7.99E+01	6.39E+02	4.79E+03		7.99E+01	6.39E+02
Apr-13	1.20E+02	1.18E+03		1.60E+01	1.28E+02	8.31E+02		1.60E+01	1.28E+02	1.34E+03		7.99E+01	6.39E+02	1.12E+03		7.99E+01	6.39E+02
Jul-13	1.20E+02	1.37E+01		1.28E+00	3.83E+00	1.05E+03		2.24E+00	7.03E+00	3.83E+02		1.25E+00	3.83E+00	1.12E+03		1.28E+01	4.15E+01
Oct-13	1.20E+02	6.07E+04		6.39E+02	1.98E+03	1.82E+04		2.81E+02	8.63E+02	1.82E+04		3.13E+02	9.90E+02	3.19E+04		2.78E+02	8.63E+02
Jan-14	1.20E+02	1.15E+03		6.07E+00	1.88E+01	1.12E+03		8.63E+00	2.68E+01	1.21E+03		6.07E+00	1.92E+01	4.47E+03		2.56E+01	7.99E+01
Apr-14	1.20E+02	2.52E+02		1.34E+00	4.15E+00	1.76E+02		1.31E+00	4.15E+00	2.91E+02		2.14E+00	6.71E+00	2.30E+02		1.25E+00	3.83E+00
Jul-14	1.20E+02	1.98E+02		1.69E+00	5.11E+00	3.07E+01		1.28E+00	3.83E+00	2.08E+02		2.52E+00	7.99E+00	1.09E+02		1.31E+00	4.15E+00
Oct-14	1.20E+02	4.15E+02		2.56E+00	7.99E+00	9.26E+03		1.21E+02	3.83E+02	1.21E+03		5.11E+00	1.57E+01	4.15E+02		2.04E+00	6.39E+00
Jan-15	1.20E+02	6.71E+00	U	6.71E+00	2.08E+01	1.28E+01	U	1.28E+01	3.83E+01	1.76E+01	U	1.76E+01	5.43E+01	5.75E+00	U	5.75E+00	1.79E+01
Jul-15	1.20E+02	5.75E+00		1.34E+00	4.15E+00	5.75E+00	J	2.04E+00	6.39E+00	1.09E+01	U	1.09E+01	3.51E+01	2.62E+01		1.79E+00	5.43E+00
Oct-15	1.20E+02	1.79E+00	J	1.31E+00	4.15E+00	1.85E+00	J	1.34E+00	4.15E+00	3.83E+00	J	1.31E+00	4.15E+00	3.51E+00	J	1.34E+00	4.15E+00
Jan-16	1.20E+02	1.31E+00	U	1.31E+00	4.15E+00	1.50E+00	J	1.31E+00	4.15E+00	2.04E+00	J	1.28E+00	3.83E+00	1.28E+00	U	1.28E+00	3.83E+00
Apr-16	1.20E+02	6.07E+00		1.25E+00	3.83E+00	1.44E+00	J	1.28E+00	4.15E+00	1.98E+00	J	1.34E+00	4.15E+00	4.79E+00		1.28E+00	4.15E+00
Jul-16	1.20E+02	2.14E+00	J	1.41E+00	4.47E+00	1.28E+00	U	1.28E+00	3.83E+00	1.34E+00	U	1.34E+00	4.15E+00	1.50E+00	J	1.37E+00	4.15E+00
Oct-16	1.20E+02	1.37E+00	U	1.37E+00	4.15E+00	1.31E+00	U	1.31E+00	4.15E+00	1.28E+00	U	1.28E+00	4.15E+00	1.28E+00	U	1.28E+00	4.15E+00
Apr-17	1.20E+02	2.27E+00	J	1.31E+00	4.15E+00	1.31E+00	U	1.31E+00	4.15E+00	1.28E+00	U	1.28E+00	4.15E+00	1.98E+00	J	1.31E+00	4.15E+00
Oct-17	1.20E+02	1.57E+00	J	1.28E+00	3.83E+00	5.75E+00		1.31E+00	4.15E+00	6.39E+00		1.25E+00	3.83E+00	2.91E+00	J	1.28E+00	3.83E+00
Apr-18	1.20E+02	7.03E+00		7.67E-01	2.36E+00	6.71E-01	J	6.71E-01	2.08E+00	7.67E-01	U	7.67E-01	2.40E+00	9.26E-01	J	7.03E-01	2.20E+00

a. NMED residential soil gas VISLs are used except where noted (NMED, 2017 Revised).
b. Value is either the detected concentration or the MDL for samples qualified as non-detect (U).
c. The method detection limit (MDL) was used to evaluate nondetects in the Risk Assessment, and is used in the benzene graphs when the analyte was not detected.

In addition, the use of the MDL for non-detects is appropriate according to NMED March 2017 guidance. NMED guidance states, "Non-detects (censored datasets) should be evaluated following the appropriate methodology outlined in the most recent version of US EPA's ProUCL Technical Guide." The ProUCL Technical Guide states, "For NDs, the user enters the associated DLs (detection limits [or MDL]) or RLs (reporting limits [or LOQ]) (and not zeros or half of the detection limits)."

Shading indicates value was a detection or a J-flagged (estimated detection)
No shading indicates a nondetect value
Acronyms and Abbreviations:

µg/m3 = microgram per cubic meter
J = estimated detection
LOQ = Limit of Quantification
MDL = Method detection Limit
NMED = New Mexico Environment Department
TO-15 = EPA Air Method Toxic Organics-15
U = nondetect
VISL = vapor intrusion screening level

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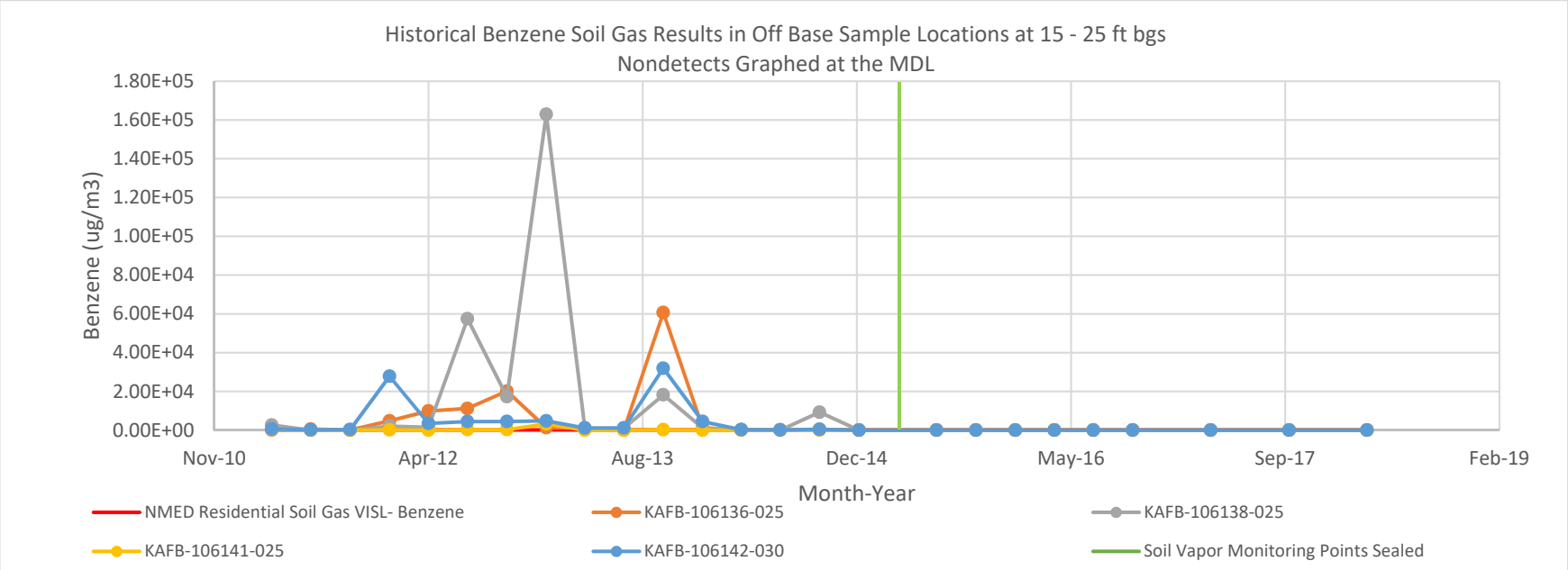
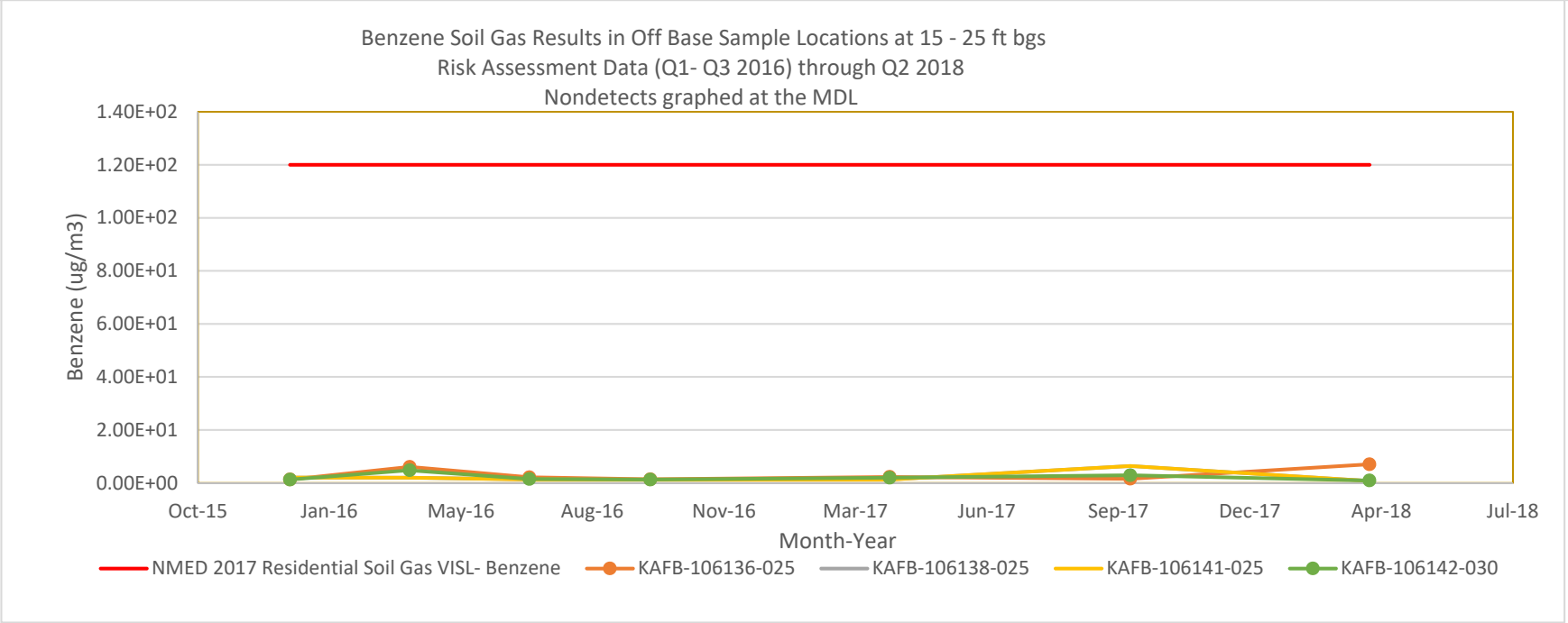

Historical Benzene Soil Gas Results in Off Base Sample Locations at 15 - 25 ft bgs
Nondetects Graphed at the MDL
Benzene (ug/m3)
1.80E+05
1.60E+05
1.40E+05
1.20E+05
1.00E+05
8.00E+04
6.00E+04
4.00E+04
2.00E+04
0.00E+00
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Feb-19
Month-Year
NMED Residential Soil Gas VISL- Benzene
KAFB-106136-025
KAFB-106138-025
KAFB-106141-025
KAFB-106142-030
Soil Vapor Monitoring Points Sealed


Benzene Soil Gas Results in Off Base Sample Locations at 15 - 25 ft bgs
Risk Assessment Data (Q1- Q3 2016) through Q2 2018
Nondetects graphed at the MDL
Benzene (ug/m3)
1.40E+02
1.20E+02
1.00E+02
8.00E+01
6.00E+01
4.00E+01
2.00E+01
0.00E+00
Oct-15
Jan-16
May-16
Aug-16
Nov-16
Mar-17
Jun-17
Sep-17
Dec-17
Apr-18
Jul-18
Month-Year
NMED 2017 Residential Soil Gas VISL- Benzene
KAFB-106136-025
KAFB-106138-025
KAFB-106141-025
KAFB-106142-030

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Historic EDB Concentrations in off Base Shallow Soil Vapor Monitoring Points
Analytical Method TO-15

Quarter (Month-Year)	Screening Level[a]	106136-025 Graphed Conc. in ug/m3[b]	106136-025 Validation Qualifier	106136-025 MDL[c]	106136-025 LOQ	106138-025 Graphed Conc. in ug/m3[b]	106138-025 Validation Qualifier	106138-025 MDL[c]	106138-025 LOQ	106141-025 Graphed Conc. in ug/m3[b]	106141-025 Validation Qualifier	106141-025 MDL[c]	106141-025 LOQ	106142-030 Graphed Conc. in ug/m3[b]	106142-030 Validation Qualifier	106142-030 MDL[c]	106142-030 LOQ
Apr-11	1.56E+00	NA	NA	NA	NA	1.15E+03	U	1.15E+03	6.15E+03	1.15E+03	U	1.15E+03	6.15E+03	5.69E+01	U	5.69E+01	3.07E+02
Jul-11	1.56E+00	1.15E+01	U	1.15E+01	6.15E+01	5.69E+01	U	5.69E+01	3.07E+02	1.46E+01	U	1.46E+01	7.68E+01	9.22E+00	U	9.22E+00	6.15E+01
Oct-11	1.56E+00	1.15E+01	U	1.15E+01	6.15E+01	5.69E+01	U	5.69E+01	3.07E+02	1.15E+01	U	1.15E+01	6.15E+01	5.69E+01	U	5.69E+01	3.07E+02
Jan-12	1.56E+00	5.69E+02	U	5.69E+02	3.07E+03	5.69E+02	U	5.69E+02	3.07E+03	1.15E+03	U	1.15E+03	6.15E+03	5.69E+02	U	5.69E+02	3.07E+03
Apr-12	1.56E+00	1.15E+03	U	1.15E+03	6.15E+03	5.69E+01	U	5.69E+01	3.07E+02	1.15E+01	U	1.15E+01	6.15E+01	1.15E+03	U	1.15E+03	6.15E+03
Jul-12	1.56E+00	1.15E+03	U	1.15E+03	6.15E+03	1.15E+03	U	1.15E+03	6.15E+03	1.15E+03	U	1.15E+03	6.15E+03	5.69E+02	U	5.69E+02	3.07E+03
Oct-12	1.56E+00	1.15E+03	U	1.15E+03	6.15E+03	1.15E+03	U	1.15E+03	6.15E+03	1.15E+03	U	1.15E+03	6.15E+03	1.15E+03	U	1.15E+03	6.15E+03
Jan-13	1.56E+00	5.69E+01	U	5.69E+01	3.07E+02	1.15E+04	U	1.15E+04	6.15E+04	2.84E+02	U	2.84E+02	1.54E+03	5.69E+01	U	5.69E+01	3.07E+02
Apr-13	1.56E+00	5.69E+01	U	5.69E+01	3.07E+02	5.69E+01	U	5.69E+01	3.07E+02	2.84E+02	U	2.84E+02	1.54E+03	2.84E+02	U	2.84E+02	1.54E+03
Jul-13	1.56E+00	1.23E+00	U	1.23E+00	3.92E+00	1.38E+01		2.23E+00	6.99E+00	2.54E+00	J	1.23E+00	3.92E+00	2.15E+01		1.31E+00	4.00E+00
Oct-13	1.56E+00	7.68E+02	J	6.38E+02	2.00E+03	3.46E+02	J	2.84E+02	8.45E+02	3.15E+02	U	3.15E+02	9.99E+02	3.38E+02	J	2.77E+02	8.45E+02
Jan-14	1.56E+00	9.22E+00	J	5.99E+00	1.84E+01	9.22E+00	J	8.45E+00	2.69E+01	7.15E+00	J	6.15E+00	1.92E+01	3.00E+01	J	2.54E+01	7.68E+01
Apr-14	1.56E+00	2.61E+01		1.31E+00	4.15E+00	1.38E+01		1.31E+00	4.15E+00	1.61E+01		2.15E+00	6.68E+00	2.54E+01		1.23E+00	3.92E+00
Jul-14	1.56E+00	2.77E+00	J	1.69E+00	5.22E+00	1.23E+00	U	1.23E+00	3.92E+00	9.22E+00		2.54E+00	7.68E+00	2.61E+00	J	1.31E+00	4.07E+00
Oct-14	1.56E+00	8.45E+00		2.54E+00	7.68E+00	3.15E+02	J	1.23E+02	3.76E+02	3.15E+01		5.07E+00	1.61E+01	9.99E+00		2.07E+00	6.45E+00
Jan-15	1.56E+00	6.61E+00	U	6.61E+00	2.07E+01	1.23E+01	U	1.23E+01	3.92E+01	1.77E+01	U	1.77E+01	5.46E+01	5.76E+00	U	5.76E+00	1.77E+01
Jul-15	1.56E+00	1.31E+00	U	1.31E+00	4.15E+00	2.00E+00	U	2.00E+00	6.38E+00	1.08E+01	U	1.08E+01	3.38E+01	4.30E+00	J	1.77E+00	5.53E+00
Oct-15	1.56E+00	1.31E+00	U	1.31E+00	4.07E+00	1.31E+00	U	1.31E+00	4.15E+00	1.31E+00	U	1.31E+00	4.07E+00	1.31E+00	U	1.31E+00	4.15E+00
Jan-16	1.56E+00	1.31E+00	U	1.31E+00	4.07E+00	1.31E+00	U	1.31E+00	4.07E+00	1.31E+00	U	1.31E+00	4.00E+00	1.31E+00	U	1.31E+00	4.00E+00
Apr-16	1.56E+00	1.23E+00	U	1.23E+00	3.92E+00	1.31E+00	U	1.31E+00	4.00E+00	1.31E+00	U	1.31E+00	4.15E+00	1.31E+00	U	1.31E+00	4.00E+00
Jul-16	1.56E+00	1.38E+00	U	1.38E+00	4.38E+00	1.31E+00	U	1.31E+00	4.00E+00	1.31E+00	U	1.31E+00	4.23E+00	1.38E+00	U	1.38E+00	4.30E+00
Oct-16	1.56E+00	1.38E+00	U	1.38E+00	4.23E+00	1.31E+00	U	1.31E+00	4.07E+00	1.31E+00	U	1.31E+00	4.00E+00	1.31E+00	U	1.31E+00	4.00E+00
Apr-17	1.56E+00	1.31E+00	U	1.31E+00	4.07E+00	1.31E+00	U	1.31E+00	4.07E+00	1.31E+00	U	1.31E+00	4.00E+00	1.31E+00	U	1.31E+00	4.07E+00
Oct-17	1.56E+00	1.31E+00	U	1.31E+00	4.00E+00	2.38E+00	J	1.31E+00	4.07E+00	1.31E+00	J	1.23E+00	3.92E+00	1.23E+00	U	1.23E+00	3.92E+00
Apr-18	1.56E+00	7.61E-01	U	7.61E-01	2.38E+00	6.61E-01	U	6.61E-01	2.07E+00	7.68E-01	U	7.68E-01	2.38E+00	7.07E-01	U	7.07E-01	2.23E+00

a. NMED residential soil gas VISLs are used except where noted (NMED, 2017 Revised).
b. Value is either the detected concentration or the MDL for samples qualified as non-detect (U).

c. The method detection limit (MDL) was used to evaluate nondetects in the Risk Assessment, and is used in these graphs when the analyte was not detected. When evaluating the detection limits (in comparison to NMED VISLs for EDB in soil gas samples, the only detection limit that is below the VISL is the MDL (as demonstrated by the figure that graphs nondetects at the LOQ). However, since the MDL is less than the NMED VISLs this limit can be used to quantify the risk of vapor intrusion for samples that are non-detect (NDs), as discussed in Section 5.2 of the Risk Assessment.

In addition, the use of the MDL for non-detects is appropriate according to NMED March 2017 guidance. NMED guidance states, "Non-detects (censored datasets) should be evaluated following the appropriate methodology outlined in the most recent version of US EPA's ProUCL Technical Guide." The ProUCL Technical Guide states, "For NDs, the user enters the associated DLs (detection limits [or MDLs]) or RLs (reporting limits [or LOQs]) (and not zeros or half of the detection limits)."

Shading indicates value was a detection or a J-flagged (estimated detection)
No shading indicates a nondetect value

Acronyms and Abbreviations:

µg/m3 = microgram per cubic meter
J = estimated detection
LOD = Limit of Detection
LOQ = Limit of Quantification
MDL = Method detection Limit
NMED = New Mexico Environment Department
TO-15 = EPA Air Method Toxic Organics-15
U = nondetect
VISL = vapor intrusion screening level

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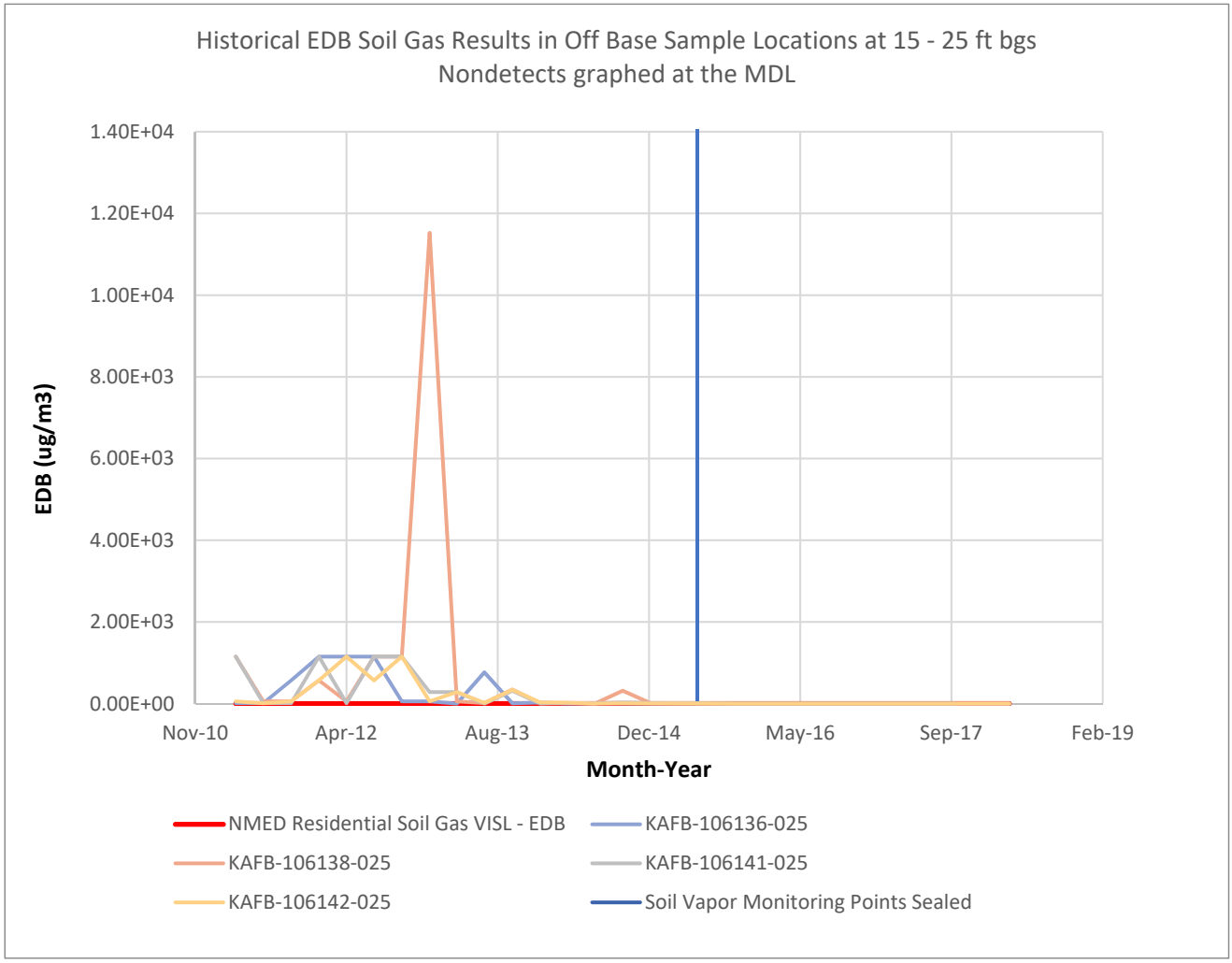
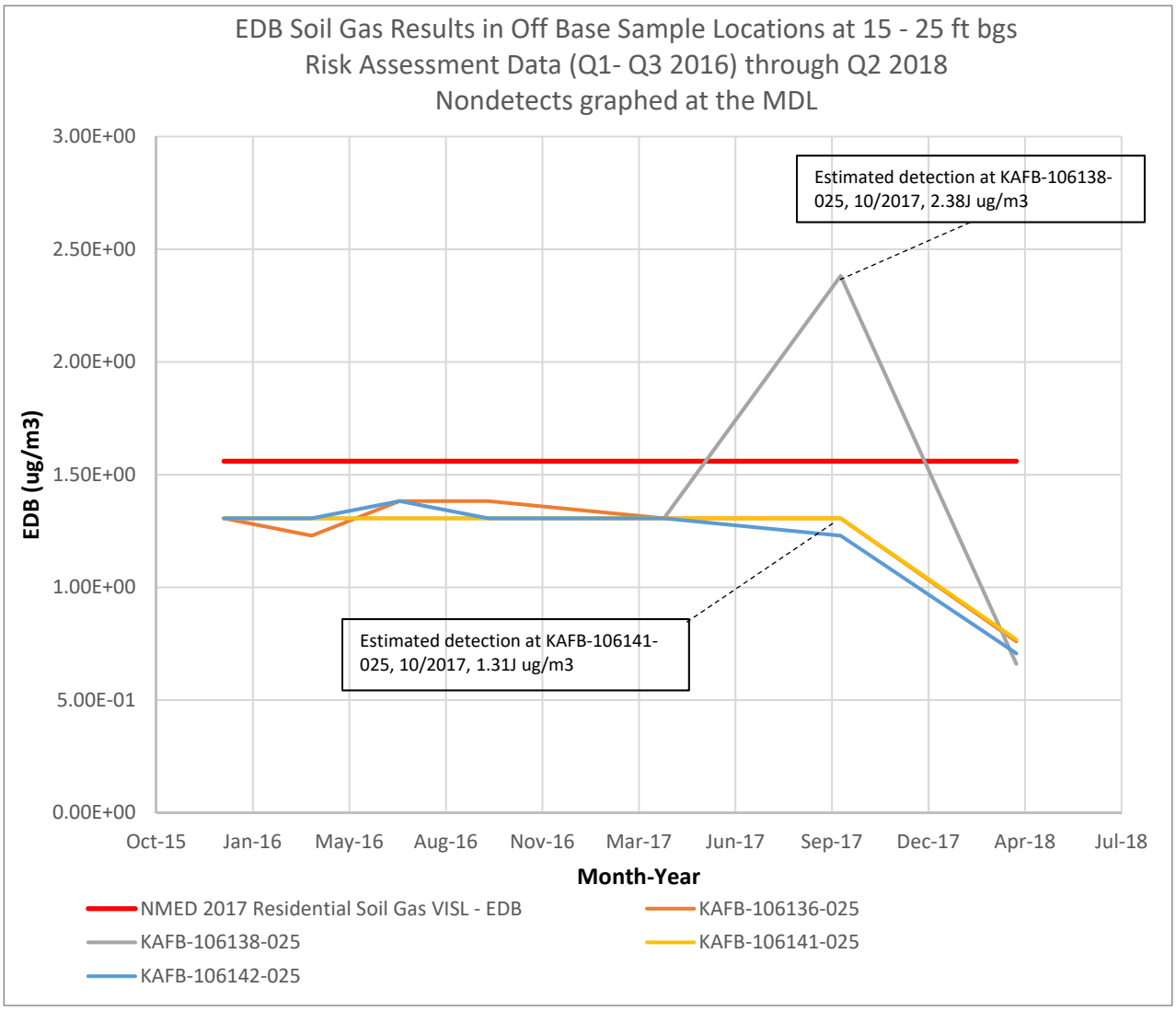
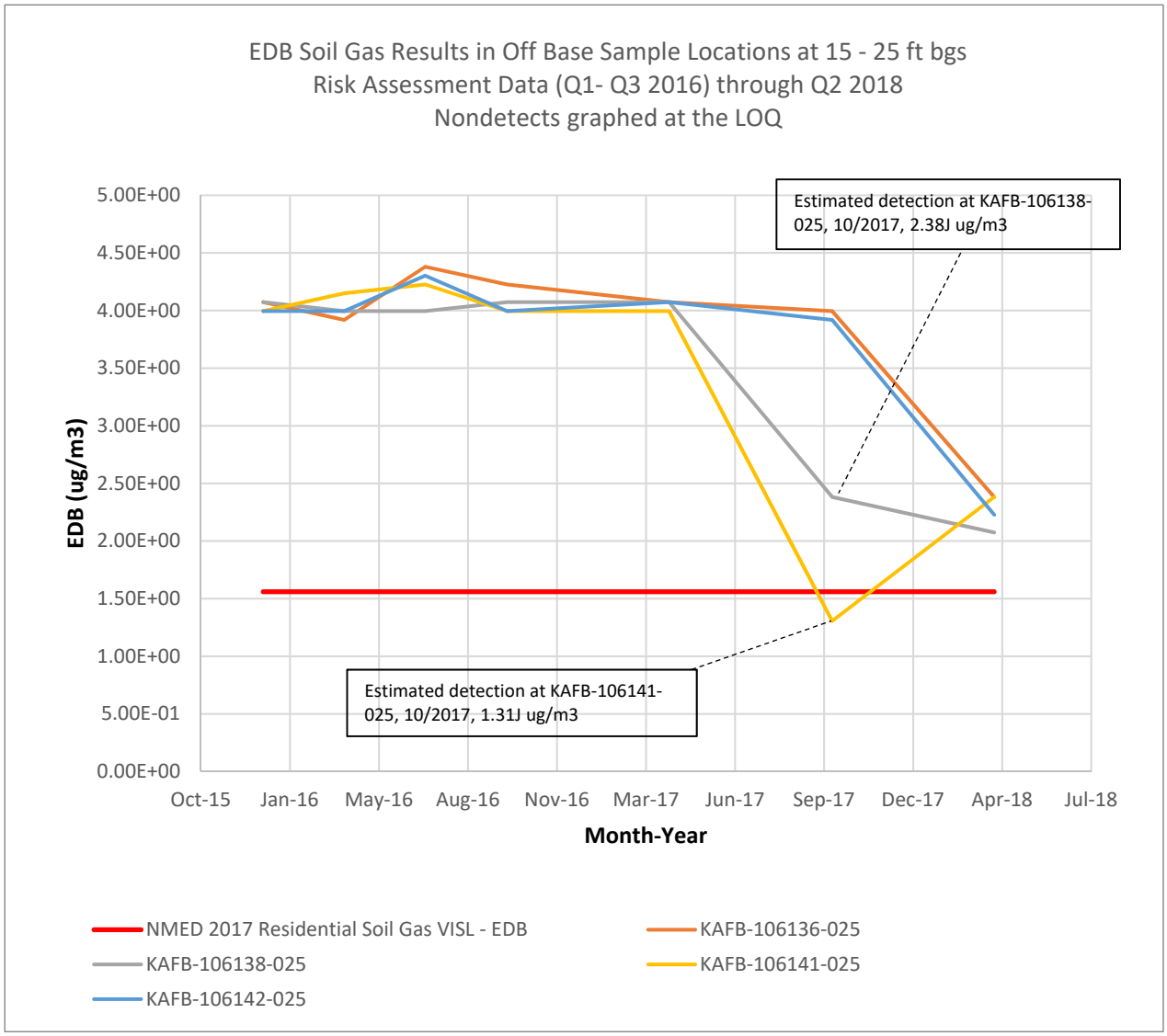

Historical EDB Soil Gas Results in Off Base Sample Locations at 15 - 25 ft bgs
Nondetects graphed at the MDL
EDB (ug/m3)
1.40E+04
1.20E+04
1.00E+04
8.00E+03
6.00E+03
4.00E+03
2.00E+03
0.00E+00
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Feb-19
Month-Year
NMED Residential Soil Gas VISL - EDB
KAFB-106136-025
KAFB-106138-025
KAFB-106141-025
KAFB-106142-025
Soil Vapor Monitoring Points Sealed


EDB Soil Gas Results in Off Base Sample Locations at 15 - 25 ft bgs
Risk Assessment Data (Q1- Q3 2016) through Q2 2018
Nondetects graphed at the MDL
3.00E+00
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
EDB (ug/m3)
Estimated detection at KAFB-106138-025, 10/2017, 2.38J ug/m3
Estimated detection at KAFB-106141-025, 10/2017, 1.31J ug/m3
Oct-15
Jan-16
May-16
Aug-16
Nov-16
Mar-17
Jun-17
Sep-17
Dec-17
Apr-18
Jul-18
Month-Year
NMED 2017 Residential Soil Gas VISL - EDB
KAFB-106136-025
KAFB-106138-025
KAFB-106141-025
KAFB-106142-025


EDB Soil Gas Results in Off Base Sample Locations at 15 - 25 ft bgs
Risk Assessment Data (Q1- Q3 2016) through Q2 2018
Nondetects graphed at the LOQ
Estimated detection at KAFB-106138-025, 10/2017, 2.38J ug/m3
Estimated detection at KAFB-106141-025, 10/2017, 1.31J ug/m3
EDB (ug/m3)
5.00E+00
4.50E+00
4.00E+00
3.50E+00
3.00E+00
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
Oct-15
Jan-16
May-16
Aug-16
Nov-16
Mar-17
Jun-17
Sep-17
Dec-17
Apr-18
Jul-18
Month-Year
NMED 2017 Residential Soil Gas VISL - EDB
KAFB-106136-025
KAFB-106138-025
KAFB-106141-025
KAFB-106142-025

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APPENDIX B

Second Quarter 2019 off-Base Soil Vapor Monitoring Results

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Table 2-1
Soil Vapor Well Construction Parameters and Pre-Calculated Purge Volumes

AOI	Sample Location	Location ID	Screened Interval (ft bgs)		Well Diameter (in)	Casing Area (ft^2)	Filter Pack Volume[a] (ft^3)	Purge Volume (ft^3)
			Top	Bottom				
Off Base	KAFB-106028	KAFB-106028-150	148.75	151.25	1/2	0.00136	0.409	0.615
		KAFB-106028-250	248.75	251.25	1/2	0.00136	0.409	0.752
		KAFB-106028-350	348.75	351.25	1/2	0.00136	0.409	0.888
		KAFB-106028-450	448.75	451.25	1/2	0.00136	0.409	1.024
	KAFB-106136	KAFB-106136-025	15	25	3/4	0.00307	1.636	1.713
		KAFB-106136-050	40	50	3/4	0.00307	1.636	1.789
		KAFB-106136-150	140	150	3/4	0.00307	1.636	2.096
		KAFB-106136-250	240	250	3/4	0.00307	1.636	2.403
		KAFB-106136-350	340	350	3/4	0.00307	1.636	2.710
		KAFB-106136-450	440	450	3	0.04909	1.636	23.725
	KAFB-106138	KAFB-106138-025	15	25	3/4	0.00307	1.636	1.713
		KAFB-106138-050	40	50	3/4	0.00307	1.636	1.789
		KAFB-106138-150	140	150	3/4	0.00307	1.636	2.096
		KAFB-106138-250	240	250	3/4	0.00307	1.636	2.403
		KAFB-106138-350	340	350	3/4	0.00307	1.636	2.710
		KAFB-106138-450	440	450	3	0.04909	1.636	23.725
	KAFB-106141	KAFB-106141-025	15	25	3/4	0.00307	1.636	1.713
		KAFB-106141-050	50	60	3/4	0.00307	1.636	1.820
		KAFB-106141-170	160	170	3/4	0.00307	1.636	2.158
		KAFB-106141-250	240	250	3/4	0.00307	1.636	2.403
		KAFB-106141-350	340	350	3/4	0.00307	1.636	2.710
		KAFB-106141-450	440	450	3	0.04909	1.636	23.725
	KAFB-106142	KAFB-106142-030	20	30	3/4	0.00307	1.636	1.728
		KAFB-106142-050	40	50	3/4	0.00307	1.636	1.789
		KAFB-106142-170	160	170	3/4	0.00307	1.636	2.158
		KAFB-106142-250	240	250	3/4	0.00307	1.636	2.403
		KAFB-106142-350	340	350	3/4	0.00307	1.636	2.710
		KAFB-106142-450	440	450	3	0.04909	1.636	23.725

Table 2-1
Soil Vapor Well Construction Parameters and Pre-Calculated Purge Volumes

[a] Filter Pack Volume (V) was calculated using the following equation: $((\pi * d^2) / 4) * P * L = V$

$\pi \approx 3.14159$
d = Diameter of the borehole casing (0.833 ft)
P = Porosity of sand (assumed 0.3)
L = Length of the screened interval (ft)

[b] Measurements at SVMW-08-266 cannot be obtained because SVMW-08-266 is clogged.

AOI = area of interest
bgs = below ground surface
ft = feet
ft^2 = square feet
ft^3 = cubic feet
ID = identification
in = inch
KAFB = Kirtland Air Force Base
SVEW = soil vapor extraction well
SVMW = soil vapor monitoring well
SWMU = solid waste management unit

Table 2-2
Field Measurements for Soil Vapor Monitoring, Q2 2019

AOI	Sample Location	Location ID	Date	Sample ID	Static Pressure (inWC)	CO_2 (%)	O_2 (%)	HC (ppmv)	Volume Purged (ft^3)	Purge Rate (cfm)
Off Base	KAFB-106028	KAFB-106028-150	4/23/19	SV028-150-192	-0.1	0.12	20.41	0	0.633	2.0
		KAFB-106028-250	4/23/19	SV028-250-192	-0.2	0.20	21.01	0	0.767	2.0
		KAFB-106028-350	4/23/19	SV028-350-192	-0.3	0.12	20.66	0	0.900	2.0
		KAFB-106028-450	4/23/19	SV028-450-192	-0.3	0.30	20.68	0	1.033	2.0
	KAFB-106136	KAFB-106136-025	4/23/19	SV136-025-192	0.0	0.26	20.85	1	1.733	4.0
		KAFB-106136-050	4/23/19	SV136-050-192	0.0	0.28	20.84	0	1.800	4.0
		KAFB-106136-150	4/23/19	SV136-150-192	-0.3	0.12	20.78	0	2.133	4.0
		KAFB-106136-250	4/23/19	SV136-250-192	-0.6	0.18	20.99	1	2.467	4.0
		KAFB-106136-350	4/23/19	SV136-350-192	-0.7	0.18	21.01	0	2.733	4.0
		KAFB-106136-450	4/23/19	SV136-450-192	-0.7	0.22	20.83	0	23.733	4.0
	KAFB-106138	KAFB-106138-025	4/23/19	SV138-025-192	-0.1	2.82	19.10	0	1.800	4.0
		KAFB-106138-050	4/23/19	SV138-050-192	-0.3	3.28	18.21	0	1.800	4.0
		KAFB-106138-150	4/23/19	SV138-150-192	-1.2	0.28	19.72	0	2.133	4.0
		KAFB-106138-250	4/23/19	SV138-250-192	-1.2	0.30	20.31	0	2.467	4.0
		KAFB-106138-350	4/23/19	SV138-350-192	-1.3	0.26	20.78	0	2.733	4.0
		KAFB-106138-450	4/23/19	SV138-450-192	-1.2	0.30	20.89	0	23.733	4.0
	KAFB-106141	KAFB-106141-025	4/23/19	SV141-025-192	-0.1	0.60	20.00	0	1.733	4.0
		KAFB-106141-050	4/23/19	SV141-050-192	-0.2	0.28	20.18	3	1.933	4.0
		KAFB-106141-170	4/23/19	SV141-170-192	-1.1	0.20	20.30	1	2.200	4.0
		KAFB-106141-250	4/23/19	SV141-250-192	-1.2	0.20	20.44	2	2.467	4.0
		KAFB-106141-350	4/23/19	SV141-350-192	-1.1	0.22	20.70	4	2.933	4.0
		KAFB-106141-450	4/23/19	SV141-450-192	-1.0	0.30	20.83	4	23.733	4.0
	KAFB-106142	KAFB-106142-030	4/23/19	SV142-030-192	0.0	0.30	20.59	0	1.733	4.0
		KAFB-106142-050	4/23/19	SV142-050-192	0.0	0.32	20.49	0	1.800	4.0
		KAFB-106142-170	4/23/19	SV142-170-192	-0.5	0.14	20.57	0	2.400	4.0
		KAFB-106142-250	4/23/19	SV142-250-192	-0.5	0.14	20.66	0	2.467	4.0
		KAFB-106142-350	4/23/19	SV142-350-192	-0.5	0.20	20.81	1	2.733	4.0
		KAFB-106142-450	4/23/19	SV142-450-192	-0.4	0.26	20.72	0	23.733	4.0

Table 2-2
Field Measurements for Soil Vapor Monitoring, Q2 2019

[a] Purge rate was not recorded; volume purged is estimated.

[b] Measurements at SVMW-08-266 could not be obtained because SVMW-08-266 is clogged.

-- = Parameter or analyte not required for analysis in Q1

AFB = Air Force base

AOI = area of interest

cfm = cubic foot per minute

CO_2 = carbon dioxide

ft^3 = cubic foot

HC = hydrocarbon

ID = identification

in = inch

O_2 = diatomic oxygen

ppmv = part per million by volume

SVEW = soil vapor extraction well

SVMW = soil vapor monitoring well

SWMU = solid waste management unit

WC = water colunm

Table 2-3
Analytical Data in Off-Base Soil Vapor Monitoring Points, Q2 2019

		Location ID:	KAFB-106028-150			KAFB-106028-250			KAFB-106028-350			KAFB-106028-450			KAFB-106136-025		
		Field Sample ID:	SV028-150-192			SV028-250-192			SV028-350-192			SV028-450-192			SV136-025-192		
		Sample Date:	4/23/2019			4/23/2019			4/23/2019			4/23/2019			4/23/2019		
		Sample Type:	REG			REG			REG			REG			REG		
Parameter	**Analytical Method**	**Analyte**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**
VOCs	Method TO-15 (µg/m^3)	1,1,2-Trichloro-1,2,2-Trifluoroethane	ND	U	0.95	ND	U	0.74	0.36	J	0.71	ND	U	0.82	0.37	J	0.63
		1,1-Dichloroethane	ND	U	1.7	ND	U	1.3	1.6	J	1.3	2	J	1.5	ND	U	1.1
		1,2,4-Trichlorobenzene	ND	U	1.8	ND	U	1.4	ND	U	1.3	ND	U	1.6	ND	U	1.2
		1,2,4-Trimethylbenzene	1.5	J	0.95	1.7	J	0.74	3.3	--	0.71	0.4	J	0.82	ND	U	0.63
		1,2-Dibromoethane	ND	U	0.95	ND	U	0.74	ND	U	0.71	2.6	--	0.82	ND	U	0.63
		1,2-Dichlorobenzene	ND	U	0.95	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.63
		1,3,5-Trimethylbenzene	0.91	J	0.95	1.3	J	0.74	2.6	--	0.71	ND	U	0.82	ND	U	0.63
		1,3-Butadiene	ND	U	1.7	ND	U	1.3	ND	U	1.3	ND	U	1.5	ND	U	1.1
		1,4-Dioxane	0.43	J	0.95	ND	U	0.74	0.32	J	0.71	ND	U	0.82	ND	U	0.63
		2-Butanone	1	J	1.7	16	--	1.3	7.1	--	1.3	1	J	1.5	ND	U	1.1
		2-Hexanone	ND	U	0.95	2.2	J	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.63
		4-Methyl-2-Pentanone	ND	U	0.95	0.38	J	0.74	0.47	J	0.71	ND	U	0.82	ND	U	0.63
		Acetone	8.2	J	15	43	--	12	26	--	11	ND	U	13	12	J	10
		Benzene	1.1	J	0.95	0.98	J	0.74	1.6	J	0.71	0.63	J	0.82	ND	U	0.63
		Bromodichloromethane	ND	U	0.95	ND	U	0.74	ND	U	0.71	ND	U	0.82	1.1	J	0.63
		Bromoform	ND	U	1.8	ND	U	1.4	ND	U	1.3	ND	U	1.6	ND	U	1.2
		Carbon Disulfide	ND	U	3	1	J	2.3	2.2	J	2.3	2.6	J	2.6	6.7	--	2
		Carbon Tetrachloride	ND	U	0.95	ND	U	0.74	0.49	J	0.71	ND	U	0.82	ND	U	0.63
		Chloroethane	ND	U	1.7	0.37	J	1.3	3.8	--	1.3	8.9	--	1.5	ND	U	1.1
		Chloroform	ND	U	0.95	0.38	J	0.74	0.42	J	0.71	0.34	J	0.82	5.9	--	0.63
		Chloromethane	ND	U	1.7	ND	U	1.3	1.7	J	1.3	1.9	J	1.5	ND	U	1.1
		Cyclohexane	2.3	J	1.8	5.9	--	1.4	6.9	--	1.4	4.6	J	1.6	ND	U	1.2
		Dibromochloromethane	ND	U	0.95	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.63
		Dichlorodifluoromethane	3.7		1.7	7.5	--	1.3	2.2	--	1.3	1.6	J	1.5	1.7	J	1.1
		Ethanol	ND	U	4.6	3.6	J	3.6	ND	U	3.4	ND	U	4	1.4	J	3
		Ethyl Acetate	ND	U	3.6	ND	U	2.8	ND	U	2.7	ND	U	3.2	ND	U	2.4
		Ethylbenzene	0.78	J	0.95	0.96	J	0.74	2.5	--	0.71	0.53	J	0.82	ND	U	0.63
		Hexane	1.4	J	1.8	1.6	J	1.4	4.1	--	1.3	1.5	J	1.6	ND	U	1.2
		Isopropyl Alcohol	ND	U	3.5	1	J	2.7	ND	U	2.6	ND	U	3	1.4	J	2.3
		m- & p-Xylenes	3.4	J	1.9	3.8	J	1.5	7.1	--	1.4	1.7	J	1.6	ND	U	1.3
		Methylene Chloride	ND	U	1.8	ND	U	1.4	ND	U	1.3	ND	U	1.6	ND	U	1.2
		Naphthalene	ND	U	1.7	ND	U	1.3	ND	U	1.3	ND	U	1.5	ND	U	1.1
		n-Heptane	1.7	J	1.8	2.2	J	1.4	3.6	--	1.3	1.1	J	1.6	ND	U	1.2
		o-Xylene	2.5	J	0.95	3.5	--	0.74	7.6	--	0.71	0.84	J	0.82	ND	U	0.63
		Propylene (Propene)	ND	U	1.7	1.9	J	1.3	1.9	J	1.3	1.8	J	1.5	ND	U	1.1
		Styrene	ND	U	1.8	ND	U	1.4	ND	U	1.3	ND	U	1.6	ND	U	1.2
		Tetrachloroethene	0.71	J	0.95	ND	U	0.74	0.6	J	0.71	1.4	J	0.82	ND	U	0.63
		Tetrahydrofuran	23		0.95	110	--	0.74	4.4	--	0.71	0.79	J	0.82	ND	U	0.63
		Toluene	2.8	J	0.95	3	--	0.74	3.7	--	0.71	1.9	J	0.82	0.47	J	0.63
		Trichloroethene	ND	U	0.95	ND	U	0.74	ND	U	0.71	ND	U	0.82	0.31	J	0.63
		Trichlorofluoromethane	1.4	J	1.8	3	--	1.4	1.6	J	1.3	1	J	1.6	0.9	J	1.2
		Vinyl Chloride	ND	U	0.95	ND	U	0.74	1.9	J	0.71	2.2	J	0.82	ND	U	0.63
		Xylenes, Total	5.9	J	1.9	7.2	--	1.5	15	--	1.4	2.6	J	1.6	ND	U	1.3

Table 2-3
Analytical Data in Off-Base Soil Vapor Monitoring Points, Q2 2019

		Location ID:	KAFB-106136-050			KAFB-106136-150			KAFB-106136-250			KAFB-106136-350			KAFB-106136-450		
		Field Sample ID:	SV136-050-192			SV136-150-192			SV136-250-192			SV136-350-192			SV136-450-192		
		Sample Date:	4/23/2019			4/23/2019			4/23/2019			4/23/2019			4/23/2019		
		Sample Type:	REG			REG			REG			REG			REG		
Parameter	**Analytical Method**	**Analyte**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**
VOCs	Method TO-15 (µg/m^3)	1,1,2-Trichloro-1,2,2-Trifluoroethane	0.46	J	0.74	0.89	J	0.71	1	J	0.82	0.4	J	0.79	0.34	J	0.76
		1,1-Dichloroethane	ND	U	1.4	ND	U	1.3	ND	U	1.5	ND	U	1.4	1	J	1.4
		1,2,4-Trichlorobenzene	ND	U	1.4	ND	U	1.3	ND	U	1.5	ND	U	1.5	ND	U	1.4
		1,2,4-Trimethylbenzene	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	0.66	J	0.76
		1,2-Dibromoethane	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	ND	U	0.76
		1,2-Dichlorobenzene	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	ND	U	0.76
		1,3,5-Trimethylbenzene	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	ND	U	0.76
		1,3-Butadiene	ND	U	1.4	ND	U	1.3	ND	U	1.5	ND	U	1.4	ND	U	1.4
		1,4-Dioxane	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	1	J	0.76
		2-Butanone	ND	U	1.4	ND	U	1.3	ND	U	1.5	0.84	J	1.4	26	--	1.4
		2-Hexanone	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	2.1	J	0.76
		4-Methyl-2-Pentanone	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	0.96	J	0.76
		Acetone	6.6	J	12	ND	U	11	ND	U	13	9.4	J	12	110	--	12
		Benzene	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	1.3	J	0.76
		Bromodichloromethane	1.8	J	0.74	0.34	J	0.71	ND	U	0.82	ND	U	0.79	ND	U	0.76
		Bromoform	ND	U	1.4	ND	U	1.3	ND	U	1.5	ND	U	1.5	ND	U	1.4
		Carbon Disulfide	6	--	2.4	2.4	J	2.3	5.2	J	2.6	7.1	--	2.5	180	--	2.4
		Carbon Tetrachloride	ND	U	0.74	1.7	J	0.71	2.8	--	0.82	1.5	J	0.79	1	J	0.76
		Chloroethane	ND	U	1.4	ND	U	1.3	ND	U	1.5	ND	U	1.4	5.3	--	1.4
		Chloroform	8.9	--	0.74	0.93	J	0.71	ND	U	0.82	ND	U	0.79	0.49	J	0.76
		Chloromethane	ND	U	1.3	ND	U	1.3	ND	U	1.4	ND	U	1.4	22	--	1.3
		Cyclohexane	ND	U	1.4	ND	U	1.4	ND	U	1.6	0.74	J	1.5	1.2	J	1.5
		Dibromochloromethane	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	ND	U	0.76
		Dichlorodifluoromethane	2.1	J	1.4	2.8	--	1.3	2.4	J	1.5	1.3	J	1.4	1.3	J	1.4
		Ethanol	ND	U	3.6	ND	U	3.4	ND	U	4	2	J	3.8	9.6	J	3.6
		Ethyl Acetate	ND	U	2.8	ND	U	2.7	ND	U	3.1	36	--	3	13	--	2.9
		Ethylbenzene	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	0.47	J	0.76
		Hexane	ND	U	1.4	ND	U	1.3	ND	U	1.5	0.78	J	1.5	2.1	J	1.4
		Isopropyl Alcohol	ND	U	2.7	ND	U	2.6	ND	U	3	ND	U	2.9	3.8	J	2.8
		m- & p-Xylenes	ND	U	1.5	ND	U	1.4	1.5	J	1.6	1.6	J	1.6	2.6	J	1.5
		Methylene Chloride	ND	U	1.4	ND	U	1.3	ND	U	1.5	ND	U	1.5	ND	U	1.4
		Naphthalene	ND	U	1.4	ND	U	1.3	ND	U	1.5	ND	U	1.4	ND	U	1.4
		n-Heptane	ND	U	1.4	1	J	1.3	1.2	J	1.5	1.1	J	1.5	4.8	--	1.4
		o-Xylene	ND	U	0.74	ND	U	0.71	0.42	J	0.82	0.48	J	0.79	0.83	J	0.76
		Propylene (Propene)	ND	U	1.4	ND	U	1.3	ND	U	1.5	ND	U	1.4	6.4	--	1.4
		Styrene	ND	U	1.4	ND	U	1.3	ND	U	1.5	ND	U	1.5	ND	U	1.4
		Tetrachloroethene	ND	U	0.74	0.95	J	0.71	1	J	0.82	0.35	J	0.79	3.6	--	0.76
		Tetrahydrofuran	ND	U	0.74	3.6	--	0.71	3.8	--	0.82	21	--	0.79	70	--	0.76
		Toluene	ND	U	0.74	0.45	J	0.71	1.2	J	0.82	5.1	--	0.79	5.7	--	0.76
		Trichloroethene	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	ND	U	0.76
		Trichlorofluoromethane	1.2	J	1.4	2.3	--	1.3	2.6	--	1.5	1.2	J	1.5	1	J	1.4
		Vinyl Chloride	ND	U	0.74	ND	U	0.71	ND	U	0.82	ND	U	0.79	8.8	--	0.76
		Xylenes, Total	ND	U	1.5	ND	U	1.4	1.9	J	1.6	2.1	J	1.6	3.4	J	1.5

Table 2-3

Analytical Data in Off-Base Soil Vapor Monitoring Points, Q2 2019

		Location ID:	KAFB-106138-025			KAFB-106138-050			KAFB-106138-150			KAFB-106138-250			KAFB-106138-350		
		Field Sample ID:	SV138-025-192			SV138-050-192			SV138-150-192			SV138-250-192			SV138-350-192		
		Sample Date:	4/23/2019			4/23/2019			4/23/2019			4/23/2019			4/23/2019		
		Sample Type:	REG			REG			REG			REG			REG		
Parameter	**Analytical Method**	**Analyte**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**
VOCs	Method TO-15 (µg/m^3)	1,1,2-Trichloro-1,2,2-Trifluoroethane	0.46	J	0.58	0.52	J	0.7	6.7	--	0.8	8.7	--	0.75	5	--	0.76
		1,1-Dichloroethane	ND	U	1.1	ND	U	1.3	ND	U	1.5	ND	U	1.4	0.35	J	1.4
		1,2,4-Trichlorobenzene	ND	U	1.1	ND	U	1.3	ND	U	1.5	ND	U	1.4	ND	U	1.4
		1,2,4-Trimethylbenzene	3.3	--	0.58	ND	U	0.7	4.1	--	0.8	2.6	--	0.75	1.3	J	0.76
		1,2-Dibromoethane	ND	U	0.58	ND	U	0.7	ND	U	0.8	ND	U	0.75	ND	U	0.76
		1,2-Dichlorobenzene	ND	U	0.58	ND	U	0.7	ND	U	0.8	ND	U	0.75	ND	U	0.76
		1,3,5-Trimethylbenzene	1.1	J	0.58	ND	U	0.7	2.7	--	0.8	1.5	J	0.75	0.85	J	0.76
		1,3-Butadiene	ND	U	1.1	ND	U	1.3	ND	U	1.5	ND	U	1.4	ND	U	1.4
		1,4-Dioxane	ND	U	0.58	ND	U	0.7	ND	U	0.8	ND	U	0.75	ND	U	0.76
		2-Butanone	4.9	--	1.1	0.91	J	1.3	1.6	J	1.5	4.9	--	1.4	1.2	J	1.4
		2-Hexanone	ND	U	0.58	ND	U	0.7	ND	U	0.8	ND	U	0.75	ND	U	0.76
		4-Methyl-2-Pentanone	2.7	--	0.58	ND	U	0.7	ND	U	0.8	ND	U	0.75	ND	U	0.76
		Acetone	53	--	9.2	17	J	11	19	J	13	23	J	12	26	--	12
		Benzene	0.7	J	0.58	ND	U	0.7	0.43	J	0.8	0.36	J	0.75	0.49	J	0.76
		Bromodichloromethane	ND	U	0.58	ND	U	0.7	6.4	--	0.8	19	--	0.75	19	--	0.76
		Bromoform	ND	U	1.1	ND	U	1.3	ND	U	1.5	ND	U	1.4	ND	U	1.4
		Carbon Disulfide	3.5	J	1.8	3.1	J	2.2	5.2	--	2.5	17	--	2.4	9.3	--	2.4
		Carbon Tetrachloride	ND	U	0.58	ND	U	0.7	2.5	--	0.8	3.7	--	0.75	2.7	--	0.76
		Chloroethane	ND	U	1.1	ND	U	1.3	ND	U	1.5	ND	U	1.4	ND	U	1.4
		Chloroform	0.28	J	0.58	ND	U	0.7	27	--	0.8	78	--	0.75	87	--	0.76
		Chloromethane	ND	U	1	ND	U	1.2	ND	U	1.4	ND	U	1.3	0.52	J	1.3
		Cyclohexane	3.5	--	1.1	ND	U	1.4	2.1	J	1.6	1.1	J	1.5	ND	U	1.5
		Dibromochloromethane	ND	U	0.58	ND	U	0.7	0.65	J	0.8	3.5	--	0.75	2.4	--	0.76
		Dichlorodifluoromethane	2.1	--	1.1	2.4	--	1.3	5.4	--	1.5	4.9	--	1.4	2.7	--	1.4
		Ethanol	55	--	2.8	1.6	J	3.4	ND	U	3.9	8.3	J	3.6	3.4	J	3.6
		Ethyl Acetate	29	--	2.2	ND	U	2.7	ND	U	3.1	ND	U	2.9	ND	U	2.9
		Ethylbenzene	10	--	0.58	ND	U	0.7	2.5	--	0.8	1.4	J	0.75	0.89	J	0.76
		Hexane	7	--	1.1	ND	U	1.3	1.9	J	1.5	1.2	J	1.4	0.96	J	1.4
		Isopropyl Alcohol	47	--	2.1	ND	U	2.6	1.2	J	2.9	1.7	J	2.7	12	J	2.8
		m- & p-Xylenes	34	--	1.2	ND	U	1.4	31	--	1.6	15	--	1.5	9.7	J	1.5
		Methylene Chloride	5.3	--	1.1	ND	U	1.3	ND	U	1.5	ND	U	1.4	ND	U	1.4
		Naphthalene	ND	U	1.1	ND	U	1.3	1.3	J	1.5	0.86	J	1.4	ND	U	1.4
		n-Heptane	3.2	--	1.1	ND	U	1.3	13	--	1.5	6.1	--	1.4	4.9	J	1.4
		o-Xylene	11	--	0.58	ND	U	0.7	9.6	--	0.8	4.8	--	0.75	3	--	0.76
		Propylene (Propene)	5	--	1.1	ND	U	1.3	ND	U	1.5	1.1	J	1.4	2.1	J	1.4
		Styrene	6.9	--	1.1	ND	U	1.3	ND	U	1.5	ND	U	1.4	ND	U	1.4
		Tetrachloroethene	0.49	J	0.58	0.63	J	0.7	1.2	J	0.8	1.2	J	0.75	0.71	J	0.76
		Tetrahydrofuran	1.4	J	0.58	0.84	J	0.7	1.2	J	0.8	1.5	J	0.75	1.2	J	0.76
		Toluene	79	--	0.58	0.42	J	0.7	7.7	--	0.8	5.4	--	0.75	3.7	J	0.76
		Trichloroethene	0.43	J	0.58	ND	U	0.7	3.4	--	0.8	9.2	--	0.75	7.7	J	0.76
		Trichlorofluoromethane	7.7	--	1.1	15	--	1.3	18	--	1.5	18	--	1.4	3.8	--	1.4
		Vinyl Chloride	ND	U	0.58	ND	U	0.7	ND	U	0.8	ND	U	0.75	ND	U	0.76
		Xylenes, Total	45	--	1.2	ND	U	1.4	40	--	1.6	20	--	1.5	13	J	1.5

Table 2-3

Analytical Data in Off-Base Soil Vapor Monitoring Points, Q2 2019

		Location ID:	KAFB-106138-350			KAFB-106138-450			KAFB-106141-025			KAFB-106141-050			KAFB-106141-170		
		Field Sample ID:	SV138-350-592			SV138-450-192			SV141-025-192			SV141-050-192			SV141-170-192		
		Sample Date:	4/23/2019			4/23/2019			4/23/2019			4/23/2019			4/23/2019		
		Sample Type:	Field Duplicate			REG			REG			REG			REG		
Parameter	**Analytical Method**	**Analyte**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**
VOCs	Method TO-15 (µg/m^3)	1,1,2-Trichloro-1,2,2-Trifluoroethane	5	--	0.72	1.5	J	0.8	0.62	J	0.72	0.75	J	0.8	0.95	J	0.75
		1,1-Dichloroethane	0.35	J	1.3	2.5	--	1.5	ND	U	1.3	ND	U	1.5	ND	U	1.4
		1,2,4-Trichlorobenzene	ND	U	1.4	ND	U	1.5	ND	U	1.4	ND	U	1.5	ND	U	1.4
		1,2,4-Trimethylbenzene	4.1	--	0.72	0.73	J	0.8	ND	U	0.72	ND	U	0.8	2.5	--	0.75
		1,2-Dibromoethane	ND	U	0.72	ND	U	0.8	ND	U	0.72	ND	U	0.8	ND	U	0.75
		1,2-Dichlorobenzene	ND	U	0.72	ND	U	0.8	ND	U	0.72	ND	U	0.8	0.5	J	0.75
		1,3,5-Trimethylbenzene	2.6	--	0.72	0.41	J	0.8	ND	U	0.72	ND	U	0.8	1.6	J	0.75
		1,3-Butadiene	ND	U	1.3	ND	U	1.5	ND	U	1.3	ND	U	1.5	ND	U	1.4
		1,4-Dioxane	ND	U	0.72	ND	U	0.8	ND	U	0.72	0.79	J	0.8	ND	U	0.75
		2-Butanone	4.1	J	1.3	2	J	1.5	ND	U	1.3	ND	U	1.5	2.5	J	1.4
		2-Hexanone	ND	U	0.72	ND	U	0.8	ND	U	0.72	ND	U	0.8	ND	U	0.75
		4-Methyl-2-Pentanone	ND	U	0.72	ND	U	0.8	ND	U	0.72	ND	U	0.8	ND	U	0.75
		Acetone	21	J	11	15	J	13	9.1	J	11	6	J	13	15	J	12
		Benzene	1	J	0.72	2.7	--	0.8	ND	U	0.72	ND	U	0.8	0.38	J	0.75
		Bromodichloromethane	20	--	0.72	12	--	0.8	ND	U	0.72	0.77	J	0.8	2.7	--	0.75
		Bromoform	ND	U	1.4	ND	U	1.5	0.76	J	1.4	ND	U	1.5	ND	U	1.4
		Carbon Disulfide	11	--	2.3	110	--	2.6	2.3	J	2.3	ND	U	2.5	3.2	J	2.4
		Carbon Tetrachloride	2.7	--	0.72	4.2	--	0.8	0.37	J	0.72	0.71	J	0.8	0.99	J	0.75
		Chloroethane	ND	U	1.3	3.6	--	1.5	ND	U	1.3	ND	U	1.5	ND	U	1.4
		Chloroform	85	--	0.72	32	--	0.8	3	--	0.72	7.1	--	0.8	19	--	0.75
		Chloromethane	ND	U	1.3	9.9	--	1.4	ND	U	1.3	ND	U	1.4	ND	U	1.3
		Cyclohexane	2.8	J	1.4	ND	U	1.6	ND	U	1.4	ND	U	1.6	ND	U	1.5
		Dibromochloromethane	2.6	--	0.72	2.4	J	0.8	ND	U	0.72	ND	U	0.8	ND	U	0.75
		Dichlorodifluoromethane	2.6	--	1.3	1.4	J	1.5	9.5	--	1.3	16	--	1.5	16	--	1.4
		Ethanol	2.4	J	3.5	ND	U	3.9	2.1	J	3.5	ND	U	3.9	14	J	3.6
		Ethyl Acetate	ND	U	2.7	ND	U	3.1	1.2	J	2.8	ND	U	3.1	ND	U	2.9
		Ethylbenzene	3.2	--	0.72	0.66	J	0.8	ND	U	0.72	ND	U	0.8	1.2	J	0.75
		Hexane	3.7	--	1.4	1	J	1.5	ND	U	1.4	ND	U	1.5	0.64	J	1.4
		Isopropyl Alcohol	0.98	J	2.6	2.7	J	2.9	1.3	J	2.6	ND	U	2.9	2.2	J	2.7
		m- & p-Xylenes	34	J	1.4	6.2	--	1.6	0.9	J	1.4	ND	U	1.6	12	--	1.5
		Methylene Chloride	ND	U	1.4	ND	U	1.5	ND	U	1.4	ND	U	1.5	ND	U	1.4
		Naphthalene	0.61	J	1.3	ND	U	1.5	0.73	J	1.3	ND	U	1.5	ND	U	1.4
		n-Heptane	19	J	1.4	4.1	--	1.5	ND	U	1.4	ND	U	1.5	3.1	--	1.4
		o-Xylene	9.9	--	0.72	1.7	J	0.8	0.33	J	0.72	ND	U	0.8	4.3	--	0.75
		Propylene (Propene)	0.65	J	1.3	1.9	J	1.5	ND	U	1.3	ND	U	1.5	0.69	J	1.4
		Styrene	ND	U	1.4	ND	U	1.5	ND	U	1.4	ND	U	1.5	ND	U	1.4
		Tetrachloroethene	19	J	0.72	0.35	J	0.8	0.85	J	0.72	1.5	J	0.8	2	J	0.75
		Tetrahydrofuran	1.7	J	0.72	1.6	J	0.8	0.57	J	0.72	ND	U	0.8	3.1	--	0.75
		Toluene	14	J	0.72	3.6	--	0.8	4.1	--	0.72	ND	U	0.8	4.1	--	0.75
		Trichloroethene	36	J	0.72	1.6	J	0.8	ND	U	0.72	ND	U	0.8	0.37	J	0.75
		Trichlorofluoromethane	3.8	--	1.4	0.82	J	1.5	9.1	--	1.4	17	--	1.5	22	--	1.4
		Vinyl Chloride	ND	U	0.72	3.5	--	0.8	ND	U	0.72	ND	U	0.8	ND	U	0.75
		Xylenes, Total	44	J	1.4	7.9	--	1.6	1.2	J	1.4	ND	U	1.6	17	--	1.5

Table 2-3
Analytical Data in Off-Base Soil Vapor Monitoring Points, Q2 2019

		Location ID:	KAFB-106141-250			KAFB-106141-350			KAFB-106141-450			KAFB-106142-030			KAFB-106142-050		
		Field Sample ID:	SV141-250-192			SV141-350-192			SV141-450-192			SV142-030-192			SV142-050-192		
		Sample Date:	4/23/2019			4/23/2019			4/23/2019			4/23/2019			4/23/2019		
		Sample Type:	REG			REG			REG			REG			REG		
Parameter	**Analytical Method**	**Analyte**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**
VOCs	Method TO-15 (µg/m^3)	1,1,2-Trichloro-1,2,2-Trifluoroethane	0.91	J	0.75	0.44	J	0.79	ND	U	0.79	0.43	J	0.74	0.47	J	0.58
		1,1-Dichloroethane	ND	U	1.4	ND	U	1.4	2.3	J	1.4	ND	U	1.3	ND	U	1.1
		1,2,4-Trichlorobenzene	ND	U	1.4	ND	U	1.5	ND	U	1.5	ND	U	1.4	ND	U	1.1
		1,2,4-Trimethylbenzene	0.99	J	0.75	1.2	J	0.79	0.91	J	0.79	4	--	0.74	ND	U	0.58
		1,2-Dibromoethane	ND	U	0.75	ND	U	0.79	ND	U	0.79	ND	U	0.74	ND	U	0.58
		1,2-Dichlorobenzene	ND	U	0.75	ND	U	0.79	ND	U	0.79	ND	U	0.74	ND	U	0.58
		1,3,5-Trimethylbenzene	0.55	J	0.75	0.72	J	0.79	0.42	J	0.79	2.2	J	0.74	ND	U	0.58
		1,3-Butadiene	ND	U	1.4	ND	U	1.4	ND	U	1.4	ND	U	1.3	ND	U	1.1
		1,4-Dioxane	2.2	J	0.75	0.7	J	0.79	ND	U	0.79	ND	U	0.74	ND	U	0.58
		2-Butanone	6.7	--	1.4	1.3	J	1.4	12	--	1.4	3.6	J	1.3	4	--	1.1
		2-Hexanone	ND	U	0.75	ND	U	0.79	ND	U	0.79	1.1	J	0.74	1	J	0.58
		4-Methyl-2-Pentanone	0.36	J	0.75	ND	U	0.79	4	--	0.79	ND	U	0.74	ND	U	0.58
		Acetone	28	--	12	13	J	13	55	--	12	25	--	12	15	J	9.2
		Benzene	0.4	J	0.75	0.56	J	0.79	0.99	J	0.79	ND	U	0.74	0.4	J	0.58
		Bromodichloromethane	2.7	--	0.75	1.7	J	0.79	ND	U	0.79	ND	U	0.74	ND	U	0.58
		Bromoform	ND	U	1.4	ND	U	1.5	ND	U	1.5	ND	U	1.4	ND	U	1.1
		Carbon Disulfide	17	--	2.4	74	--	2.5	78	--	2.5	ND	U	2.3	0.99	J	1.8
		Carbon Tetrachloride	1	J	0.75	0.58	J	0.79	0.57	J	0.79	ND	U	0.74	ND	U	0.58
		Chloroethane	ND	U	1.4	ND	U	1.4	2.7	--	1.4	ND	U	1.3	ND	U	1.1
		Chloroform	21	--	0.75	7.7	--	0.79	2.1	J	0.79	1.1	J	0.74	0.9	J	0.58
		Chloromethane	0.51	J	1.3	ND	U	1.4	10	--	1.4	ND	U	1.3	0.29	J	1
		Cyclohexane	ND	U	1.5	ND	U	1.5	ND	U	1.5	ND	U	1.4	1.3	J	1.1
		Dibromochloromethane	0.71	J	0.75	ND	U	0.79	ND	U	0.79	ND	U	0.74	ND	U	0.58
		Dichlorodifluoromethane	11	--	1.4	4.9	--	1.4	3.1	--	1.4	2	J	1.3	2.1	--	1.1
		Ethanol	8.3	J	3.6	ND	U	3.8	ND	U	3.8	2.5	J	3.5	5.3	J	2.8
		Ethyl Acetate	8.7	--	2.9	ND	U	3	ND	U	3	ND	U	2.8	91	--	2.2
		Ethylbenzene	0.79	J	0.75	0.43	J	0.79	0.58	J	0.79	0.95	J	0.74	ND	U	0.58
		Hexane	0.92	J	1.4	0.66	J	1.5	0.88	J	1.5	ND	U	1.4	1.1	J	1.1
		Isopropyl Alcohol	2.5	J	2.7	ND	U	2.9	ND	U	2.9	5.1	J	2.7	2.1	J	2.1
		m- & p-Xylenes	6.3	--	1.5	3.9	J	1.6	4.3	J	1.6	1.6	J	1.5	ND	U	1.2
		Methylene Chloride	1	J	1.4	ND	U	1.5	ND	U	1.5	ND	U	1.4	0.57	J	1.1
		Naphthalene	ND	U	1.4	ND	U	1.4	ND	U	1.4	ND	U	1.3	ND	U	1.1
		n-Heptane	2.3	J	1.4	2.3	J	1.5	2.9	--	1.5	0.58	J	1.4	0.52	J	1.1
		o-Xylene	2	J	0.75	1.3	J	0.79	1.2	J	0.79	1.3	J	0.74	ND	U	0.58
		Propylene (Propene)	1.3	J	1.4	ND	U	1.4	1.6	J	1.4	ND	U	1.3	0.84	J	1.1
		Styrene	ND	U	1.4	ND	U	1.5	ND	U	1.5	ND	U	1.4	ND	U	1.1
		Tetrachloroethene	1.4	J	0.75	0.41	J	0.79	0.48	J	0.79	0.38	J	0.74	0.23	J	0.58
		Tetrahydrofuran	28	--	0.75	13	--	0.79	90	--	0.79	ND	U	0.74	ND	U	0.58
		Toluene	6.3	--	0.75	2.5	--	0.79	3.5	--	0.79	0.72	J	0.74	10	--	0.58
		Trichloroethene	0.61	J	0.75	ND	U	0.79	ND	U	0.79	0.89	J	0.74	0.33	J	0.58
		Trichlorofluoromethane	22	--	1.4	9.2	--	1.5	5.4	--	1.5	1.2	J	1.4	1.3	J	1.1
		Vinyl Chloride	ND	U	0.75	ND	U	0.79	2.9	--	0.79	ND	U	0.74	ND	U	0.58
		Xylenes, Total	8.3	--	1.5	5.3	--	1.6	5.6	--	1.6	2.9	J	1.5	ND	U	1.2

Table 2-3
Analytical Data in Off-Base Soil Vapor Monitoring Points, Q2 2019

		Location ID:	KAFB-106142-050			KAFB-106142-170			KAFB-106142-250			KAFB-106142-350			KAFB-106142-450		
		Field Sample ID:	SV142-050-592			SV142-170-192			SV142-250-192			SV142-350-192			SV142-450-192		
		Sample Date:	4/23/2019			4/23/2019			4/23/2019			4/23/2019			4/23/2019		
		Sample Type:	Field Duplicate			REG			REG			REG			REG		
Parameter	**Analytical Method**	**Analyte**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**	**Result**	**Val Qual**	**LOD**
VOCs	Method TO-15 (µg/m^3)	1,1,2-Trichloro-1,2,2-Trifluoroethane	0.48	J	0.71	0.58	J	0.72	0.64	J	0.72	ND	U	0.7	0.37	J	0.73
		1,1-Dichloroethane	ND	U	1.3	ND	U	1.3	ND	U	1.3	ND	U	1.3	0.47	J	1.3
		1,2,4-Trichlorobenzene	ND	U	1.3	ND	U	1.4	ND	U	1.4	ND	U	1.3	ND	U	1.4
		1,2,4-Trimethylbenzene	ND	U	0.71	0.71	J	0.72	0.4	J	0.72	ND	U	0.7	1.3	J	0.73
		1,2-Dibromoethane	ND	U	0.71	ND	U	0.72	ND	U	0.72	ND	U	0.7	1.4	J	0.73
		1,2-Dichlorobenzene	ND	U	0.71	ND	U	0.72	ND	U	0.72	ND	U	0.7	ND	U	0.73
		1,3,5-Trimethylbenzene	ND	U	0.71	0.37	J	0.72	ND	U	0.72	ND	U	0.7	0.95	J	0.73
		1,3-Butadiene	ND	U	1.3	ND	U	1.3	ND	U	1.3	ND	U	1.3	ND	U	1.3
		1,4-Dioxane	1.4	J	0.71	ND	U	0.72	ND	U	0.72	ND	U	0.7	ND	U	0.73
		2-Butanone	ND	U	1.3	ND	U	1.3	2.9	J	1.3	ND	U	1.3	17	--	1.3
		2-Hexanone	ND	U	0.71	ND	U	0.72	1.9	J	0.72	ND	U	0.7	ND	U	0.73
		4-Methyl-2-Pentanone	ND	U	0.71	ND	U	0.72	0.48	J	0.72	ND	U	0.7	0.62	J	0.73
		Acetone	7.3	J	11	ND	U	11	11	J	11	8.7	J	11	50	--	12
		Benzene	ND	U	0.71	0.78	J	0.72	ND	U	0.72	0.32	J	0.7	19	--	0.73
		Bromodichloromethane	ND	U	0.71	ND	U	0.72	ND	U	0.72	0.34	J	0.7	ND	U	0.73
		Bromoform	ND	U	1.3	ND	U	1.4	ND	U	1.4	ND	U	1.3	ND	U	1.4
		Carbon Disulfide	5.3	--	2.3	6.5	--	2.3	6.6	--	2.3	7.8	--	2.2	39	--	2.3
		Carbon Tetrachloride	ND	U	0.71	1.3	J	0.72	1.5	J	0.72	0.79	J	0.7	0.53	J	0.73
		Chloroethane	ND	U	1.3	ND	U	1.3	ND	U	1.3	ND	U	1.3	0.57	J	1.3
		Chloroform	1.1	J	0.71	0.4	J	0.72	1.5	J	0.72	5.2	--	0.7	2.3	--	0.73
		Chloromethane	ND	U	1.3	ND	U	1.3	ND	U	1.3	ND	U	1.2	1.9	J	1.3
		Cyclohexane	ND	U	1.4	1.4	J	1.4	ND	U	1.4	ND	U	1.4	1.3	J	1.4
		Dibromochloromethane	ND	U	0.71	ND	U	0.72	ND	U	0.72	ND	U	0.7	ND	U	0.73
		Dichlorodifluoromethane	2.2	J	1.3	23	--	1.3	21	--	1.3	4.4	--	1.3	2.9	--	1.3
		Ethanol	ND	U	3.4	ND	U	3.5	1.9	J	3.5	ND	U	3.4	4	J	3.5
		Ethyl Acetate	ND	U	2.7	ND	U	2.8	1.5	J	2.8	ND	U	2.7	6	--	2.8
		Ethylbenzene	ND	U	0.71	0.98	J	0.72	0.37	J	0.72	0.35	J	0.7	2.2	J	0.73
		Hexane	ND	U	1.3	2	J	1.4	ND	U	1.4	0.46	J	1.3	1.9	J	1.4
		Isopropyl Alcohol	ND	U	2.6	ND	U	2.6	ND	U	2.6	ND	U	2.5	1.3	J	2.7
		m- & p-Xylenes	ND	U	1.4	5.4	--	1.4	1.8	J	1.4	1.7	J	1.4	7.6	--	1.5
		Methylene Chloride	ND	U	1.3	ND	U	1.4	ND	U	1.4	ND	U	1.3	ND	U	1.4
		Naphthalene	ND	U	1.3	ND	U	1.3	ND	U	1.3	ND	U	1.3	ND	U	1.3
		n-Heptane	ND	U	1.3	8.6	--	1.4	1.3	J	1.4	1.5	J	1.3	1.6	J	1.4
		o-Xylene	ND	U	0.71	1.5	J	0.72	0.59	J	0.72	0.52	J	0.7	6.2	--	0.73
		Propylene (Propene)	ND	U	1.3	ND	U	1.3	ND	U	1.3	ND	U	1.3	1.3	J	1.3
		Styrene	ND	U	1.3	ND	U	1.4	ND	U	1.4	ND	U	1.3	ND	U	1.4
		Tetrachloroethene	ND	U	0.71	0.53	J	0.72	0.82	J	0.72	0.29	J	0.7	0.35	J	0.73
		Tetrahydrofuran	ND	U	0.71	2.6	--	0.72	5	--	0.72	6.2	--	0.7	14	--	0.73
		Toluene	0.31	J	0.71	7.6	--	0.72	2.4	--	0.72	2.5	--	0.7	23	--	0.73
		Trichloroethene	ND	U	0.71	ND	U	0.72	ND	U	0.72	ND	U	0.7	ND	U	0.73
		Trichlorofluoromethane	1.3	J	1.3	16	--	1.4	18	--	1.4	6.9	--	1.3	3.9	--	1.4
		Vinyl Chloride	ND	U	0.71	ND	U	0.72	ND	U	0.72	ND	U	0.7	0.44	J	0.73
		Xylenes, Total	ND	U	1.4	6.8	--	1.4	2.4	J	1.4	2.3	J	1.4	14	--	1.5

Table 2-3
Analytical Data in Off-Base Soil Vapor Monitoring Points, Q2 2019

µg/m^3 = microgram per cubic meter
AFB = Air Force Base
ID = identification
KAFB = Kirtland Air Force Base
LOD = limit of detection
ND = not detected
REG = normal field sample
Val Qual = validation qualifier
VOC = volatile organic compound
Shading = detected concentrations above the detection limit.
Val Quals based on independent data validation
J = Qualifier denotes the analyte was positively identified, but the associated numerical value is estimated.
U = Qualifier denotes the analyte was analyzed but not detected above the detection limit. The value associated with the U-qualifier is the limit of detection.
-- = Validation qualifier not assigned.

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APPENDIX C

Soil Vapor Monitoring Location Maps and Summary Analytical Results, April-June 2019

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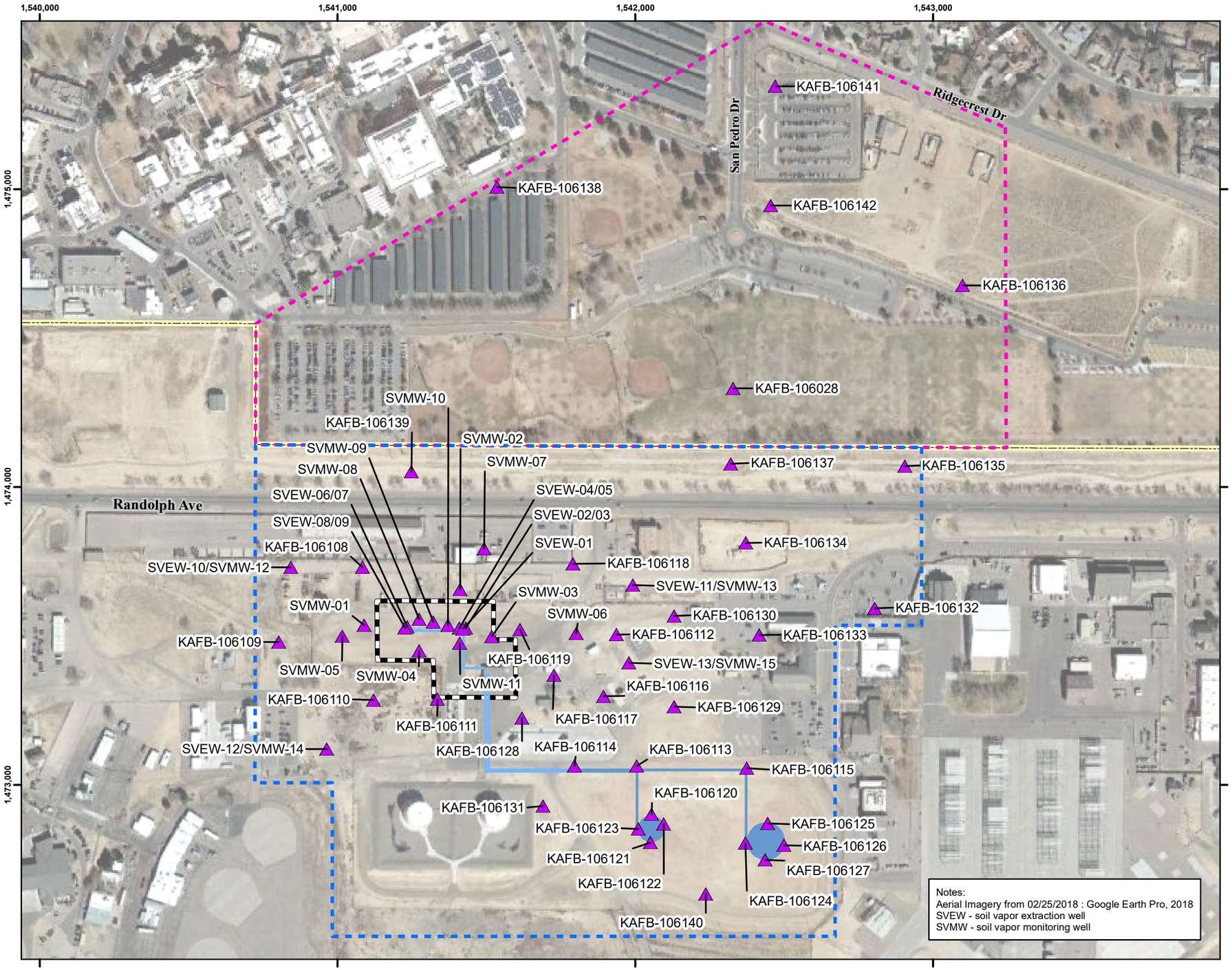
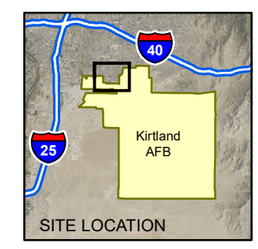


Legend

- Soil Vapor Monitoring Point
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary

Area of Interest

- Off-Base
- On-Base Outside of Source Area
- Source Area



N

0 200 400 800

Feet

1 inch = 350 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE 2-2

SOIL VAPOR MONITORING LOCATIONS

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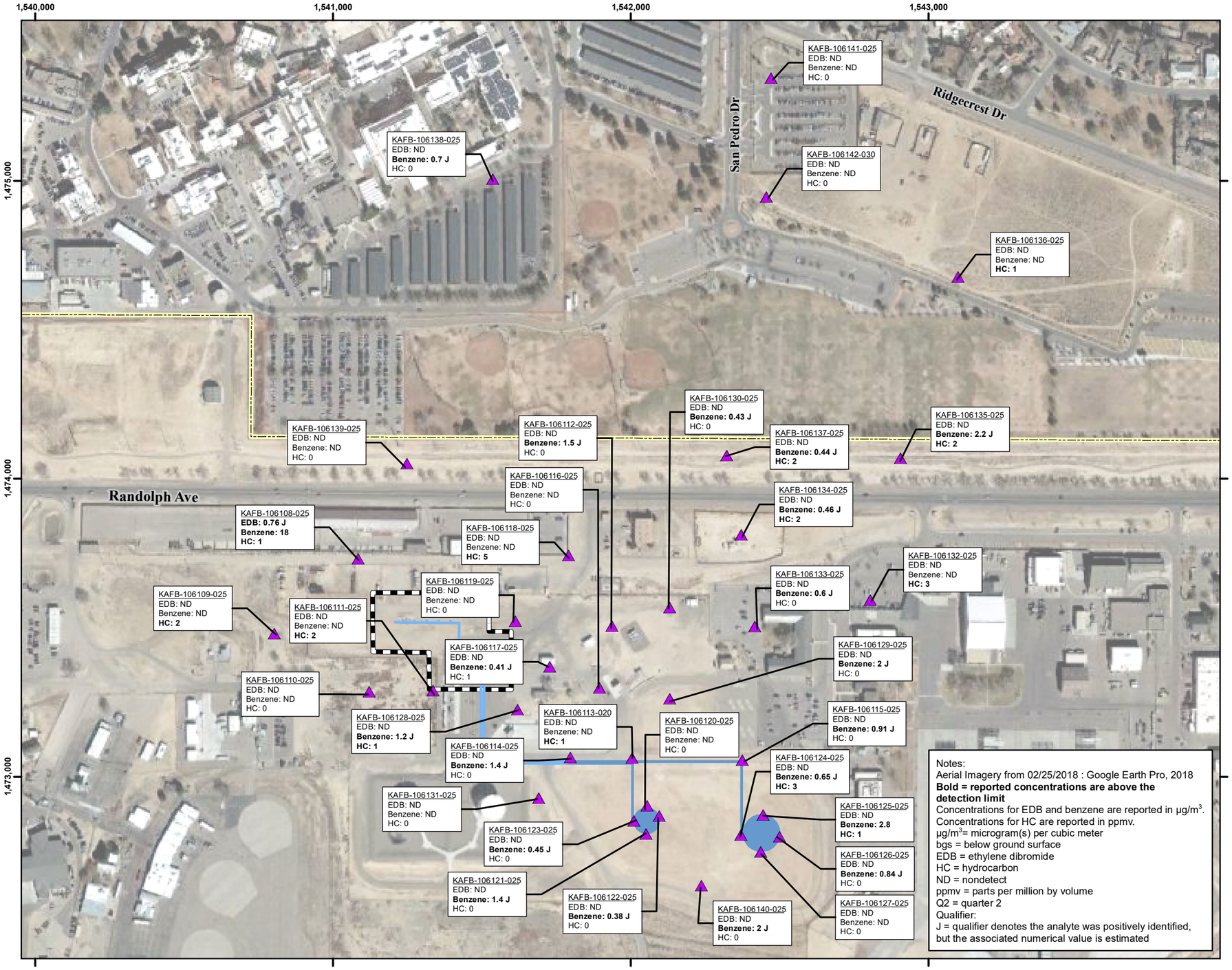
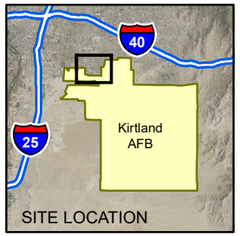


Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Bold = reported concentrations are above the detection limit
Concentrations for EDB and benzene are reported in µg/m^3.
Concentrations for HC are reported in ppmv.
µg/m^3= microgram(s) per cubic meter
bgs = below ground surface
EDB = ethylene dibromide
HC = hydrocarbon
ND = nondetect
ppmv = parts per million by volume
Q2 = quarter 2
Qualifier:
J = qualifier denotes the analyte was positively identified, but the associated numerical value is estimated

Legend

- Soil Vapor Monitoring Point
- Former Aboveground Storage
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Source Area



N

0 175 350 700
Feet
1 inch = 350 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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FIGURE 2-3

BENZENE, EDB, AND HC CONCENTRATIONS IN SOIL VAPOR AT 25 FT BGS, Q2 2019

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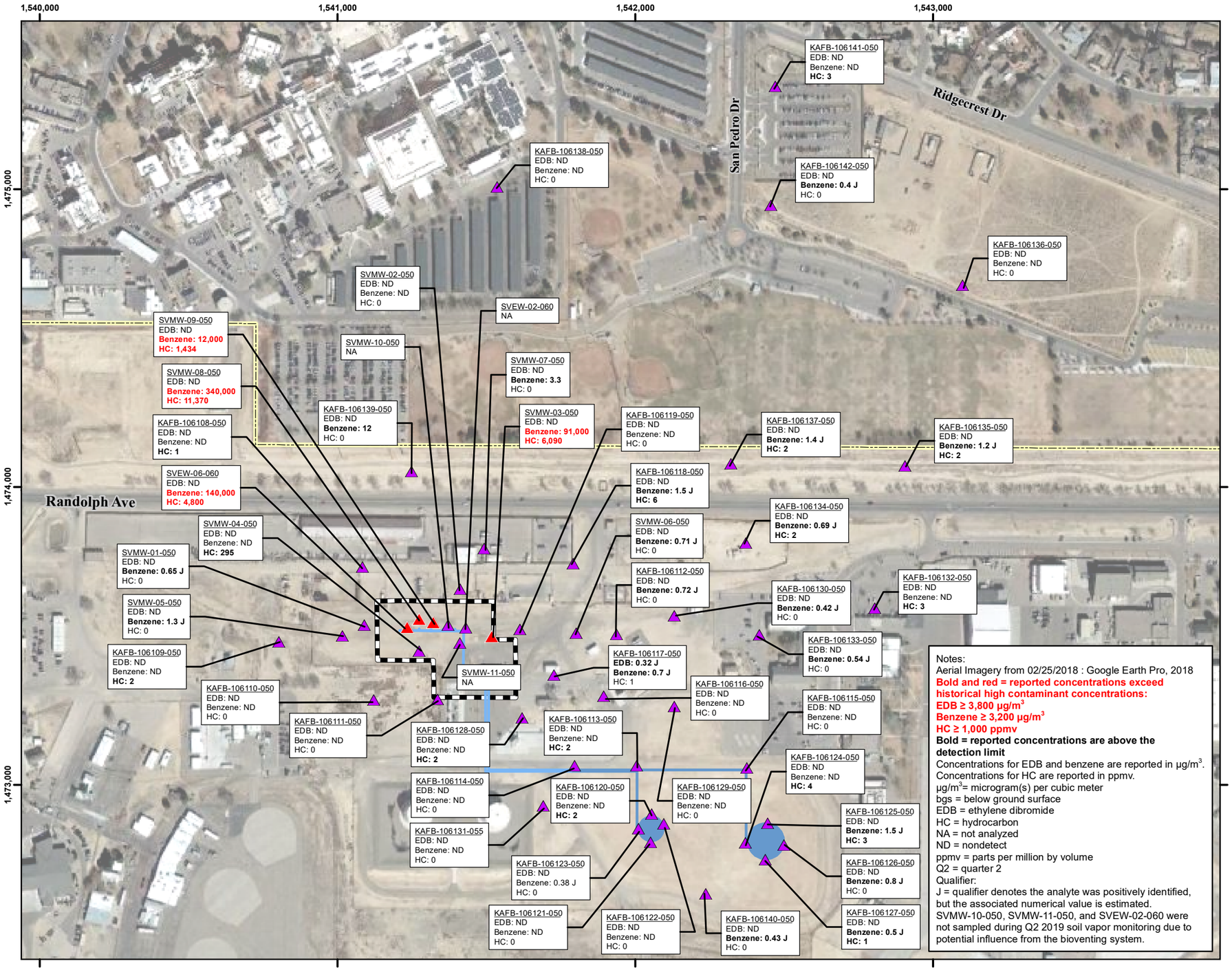
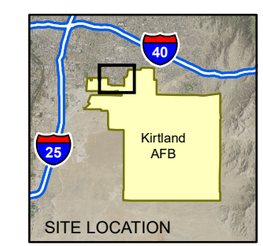


Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Bold and red = reported concentrations exceed historical high contaminant concentrations:
EDB ≥ 3,800 µg/m³
Benzene ≥ 3,200 µg/m³
HC ≥ 1,000 ppmv
Bold = reported concentrations are above the detection limit
Concentrations for EDB and benzene are reported in µg/m³.
Concentrations for HC are reported in ppmv.
µg/m³= microgram(s) per cubic meter
bgs = below ground surface
EDB = ethylene dibromide
HC = hydrocarbon
NA = not analyzed
ND = nondetect
ppmv = parts per million by volume
Q2 = quarter 2
Qualifier:
J = qualifier denotes the analyte was positively identified, but the associated numerical value is estimated.
SVMW-10-050, SVMW-11-050, and SVEW-02-060 were not sampled during Q2 2019 soil vapor monitoring due to potential influence from the bioventing system.

Legend

- Soil Vapor Monitoring Point - No Contaminant Exceedances
- Soil Vapor Monitoring Point - At Least One Contaminant Exceedance
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Source



N

0 175 350 700
Feet
1 inch = 350 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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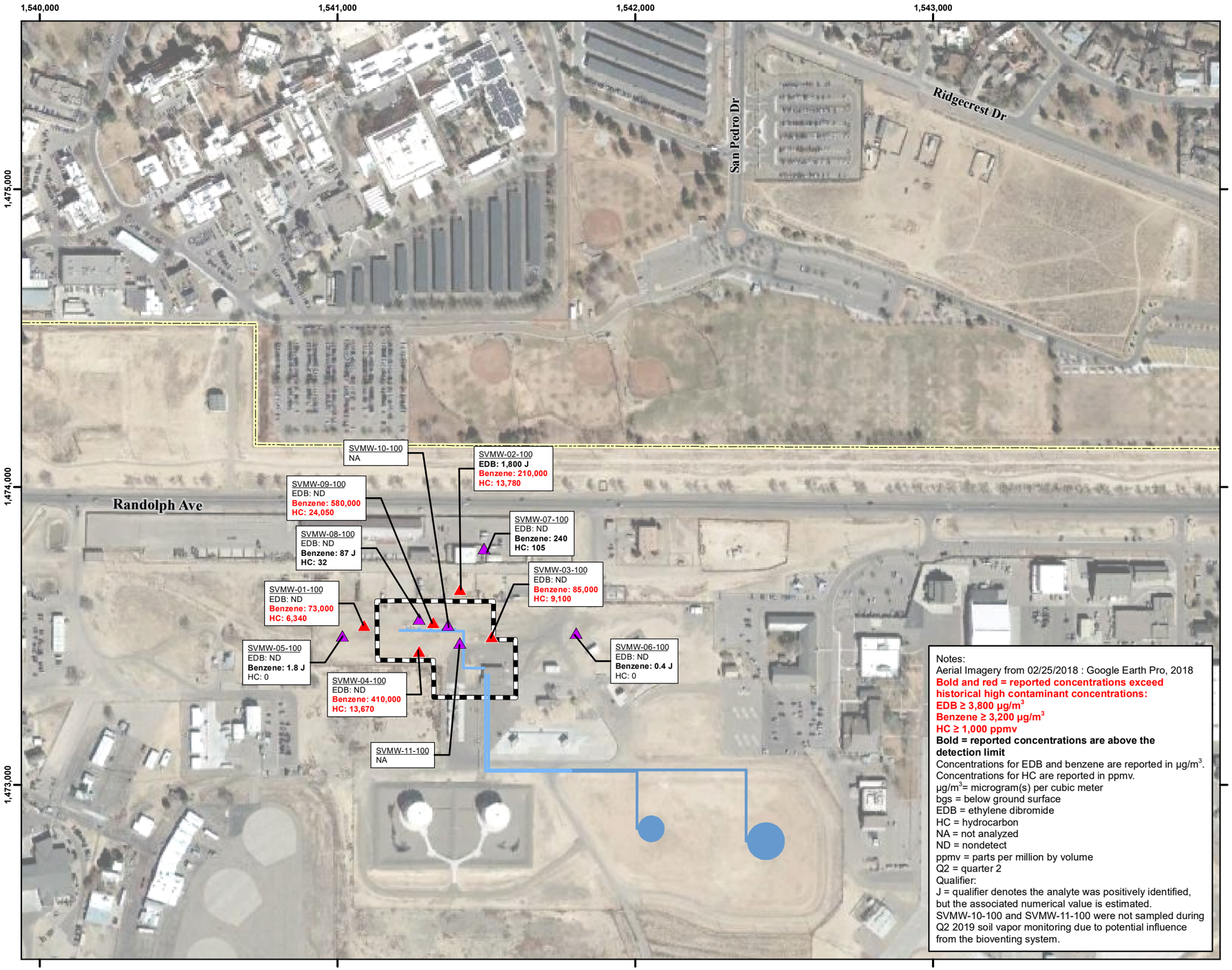
FIGURE 2-4

BENZENE, EDB, AND HC CONCENTRATIONS IN SOIL VAPOR AT 50 FT BGS, Q2 2019

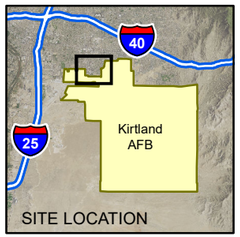
\\ABQ\Projects\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2019_Q2\Section 2\2-4 Benzene_EDB_HC_Conc_50ftQ22019.mxd 7/22/2019 EA ecarpio



Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Bold and red = reported concentrations exceed historical high contaminant concentrations:
EDB ≥ 3,800 µg/m^3
Benzene ≥ 3,200 µg/m^3
HC ≥ 1,000 ppmv
Bold = reported concentrations are above the detection limit
Concentrations for EDB and benzene are reported in µg/m^3.
Concentrations for HC are reported in ppmv.
µg/m^3= microgram(s) per cubic meter
bgs = below ground surface
EDB = ethylene dibromide
HC = hydrocarbon
NA = not analyzed
ND = nondetect
ppmv = parts per million by volume
Q2 = quarter 2
Qualifier:
J = qualifier denotes the analyte was positively identified, but the associated numerical value is estimated.
SVMW-10-100 and SVMW-11-100 were not sampled during Q2 2019 soil vapor monitoring due to potential influence from the bioventing system.

Legend

- Soil Vapor Monitoring Point - No Contaminant Exceedances
- Soil Vapor Monitoring Point - At Least One Contaminant Exceedance
- Former Aboveground Storage
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Source Area



N

0 175 350 700
Feet
1 inch = 350 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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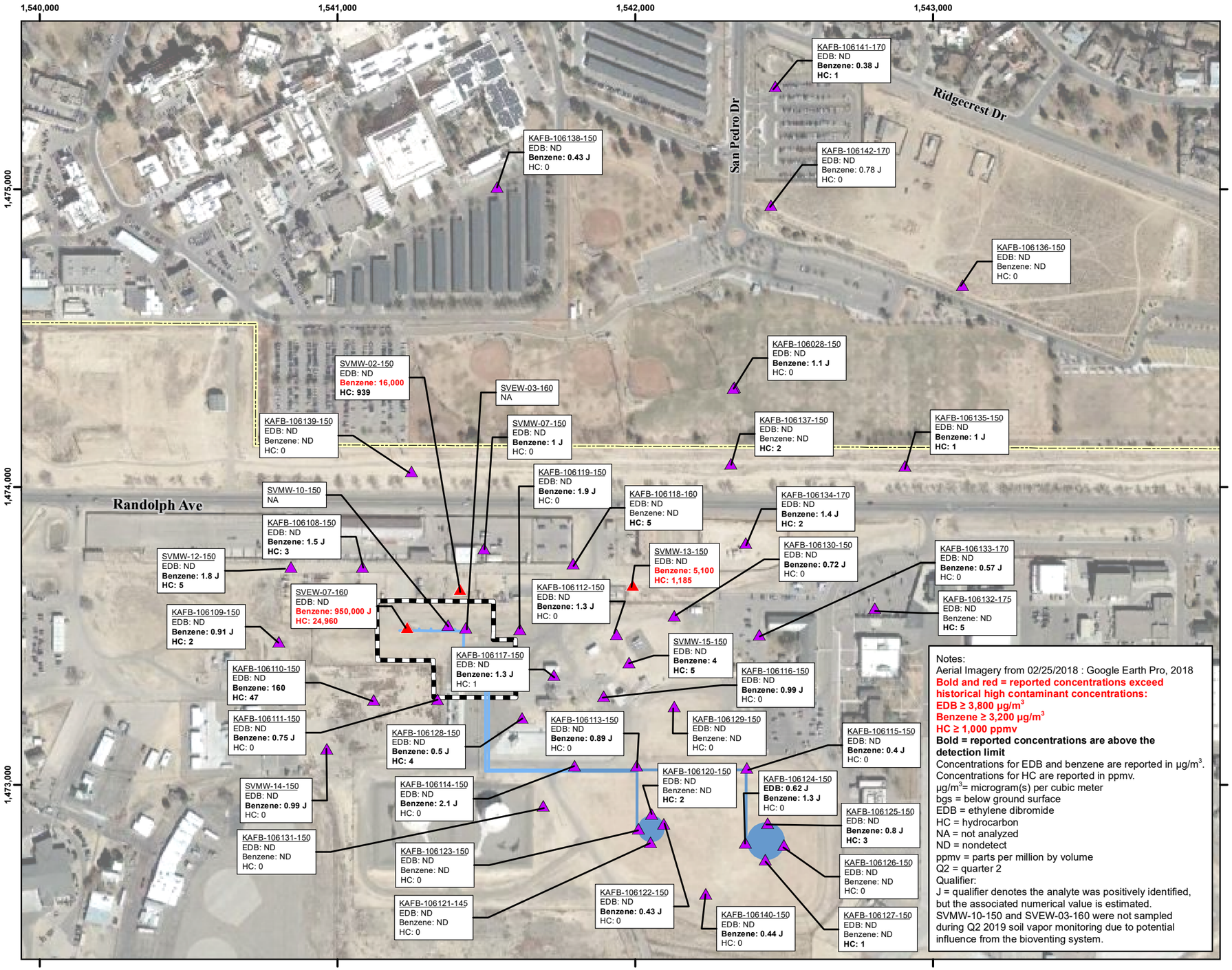
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2-5

BENZENE, EDB, AND HC CONCENTRATIONS IN SOIL VAPOR AT 100 FT BGS, Q2 2019

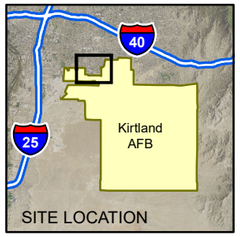
\\ABQ\Projects\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2019_Q2\Section 2\2-5 Benzene_EDB_HC_Conc_100ftQ22019.mxd 7/22/2019 EA ecarpio



Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Bold and red = reported concentrations exceed historical high contaminant concentrations:
EDB ≥ 3,800 µg/m^3
Benzene ≥ 3,200 µg/m^3
HC ≥ 1,000 ppmv
Bold = reported concentrations are above the detection limit
Concentrations for EDB and benzene are reported in µg/m^3.
Concentrations for HC are reported in ppmv.
µg/m^3= microgram(s) per cubic meter
bgs = below ground surface
EDB = ethylene dibromide
HC = hydrocarbon
NA = not analyzed
ND = nondetect
ppmv = parts per million by volume
Q2 = quarter 2
Qualifier:
J = qualifier denotes the analyte was positively identified, but the associated numerical value is estimated.
SVMW-10-150 and SVEW-03-160 were not sampled during Q2 2019 soil vapor monitoring due to potential influence from the bioventing system.

Legend

- Soil Vapor Monitoring Point - No Contaminant Exceedances
- Soil Vapor Monitoring Point - At Least One Contaminant Exceedance
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Source Area



N

0 175 350 700
Feet
1 inch = 347 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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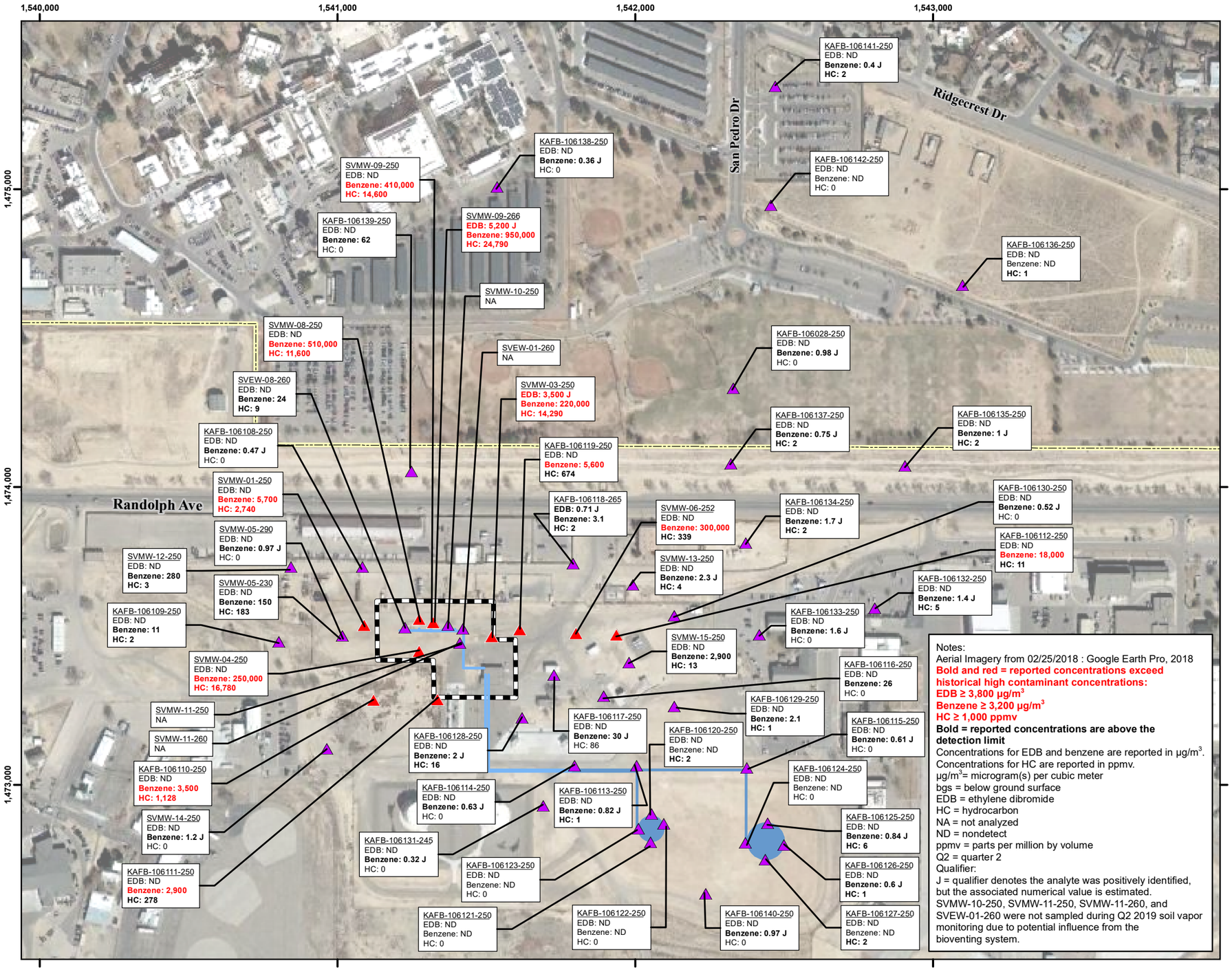
FIGURE 2-6

BENZENE, EDB, AND HC CONCENTRATIONS IN SOIL VAPOR AT 150 FT BGS, Q2 2019

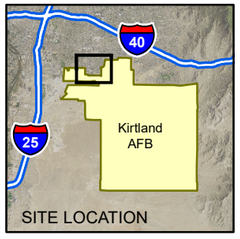
\\ABQ\Projects\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2019_Q2\Section 2\2-6 Benzene_EDB_HC_Conc_150ftQ22019.mxd 7/22/2019 EA ecarpio



Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Bold and red = reported concentrations exceed historical high contaminant concentrations:
EDB ≥ 3,800 µg/m^3
Benzene ≥ 3,200 µg/m^3
HC ≥ 1,000 ppmv
Bold = reported concentrations are above the detection limit
Concentrations for EDB and benzene are reported in µg/m^3.
Concentrations for HC are reported in ppmv.
µg/m^3= microgram(s) per cubic meter
bgs = below ground surface
EDB = ethylene dibromide
HC = hydrocarbon
NA = not analyzed
ND = nondetect
ppmv = parts per million by volume
Q2 = quarter 2
Qualifier:
J = qualifier denotes the analyte was positively identified, but the associated numerical value is estimated.
SVMW-10-250, SVMW-11-250, SVMW-11-260, and SVEW-01-260 were not sampled during Q2 2019 soil vapor monitoring due to potential influence from the bioventing system.

Legend

- Soil Vapor Monitoring Point - No Contaminant Exceedances
- Soil Vapor Monitoring Point - At Least One Contaminant Exceedance
- Former Aboveground Storage Tank
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Source Area



N

0 175 350 700
Feet
1 inch = 350 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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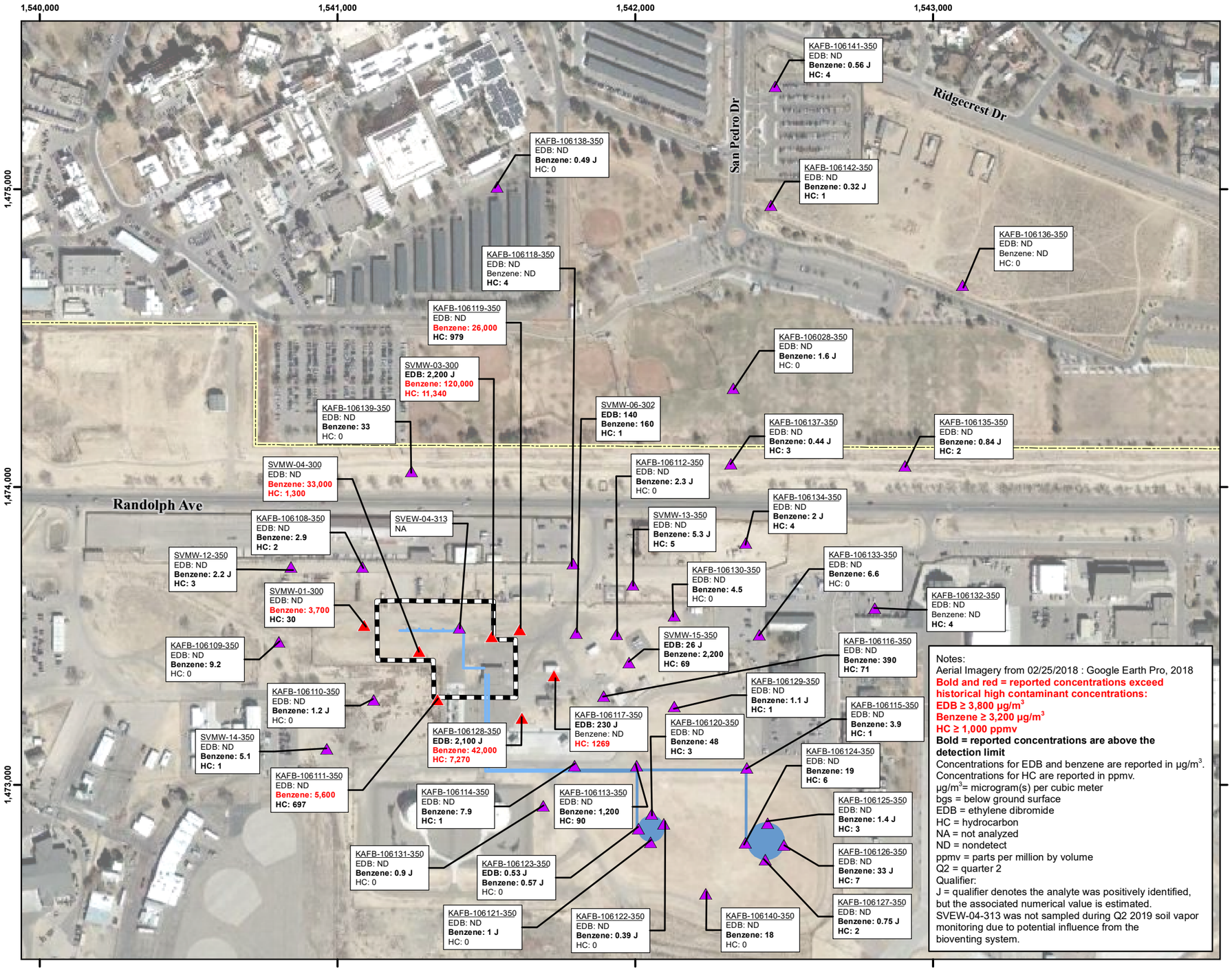
FIGURE 2-7

BENZENE, EDB, AND HC CONCENTRATIONS IN SOIL VAPOR AT 250 FT BGS, Q2 2019

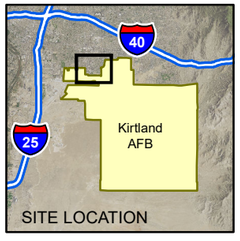
\\ABQ\Projects\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2019_Q2\Section 2\2-7 Benzene_EDB_HC_Conc_250ftQ22019.mxd 7/22/2019 EA ecarpio



Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Bold and red = reported concentrations exceed historical high contaminant concentrations:
EDB ≥ 3,800 µg/m³
Benzene ≥ 3,200 µg/m³
HC ≥ 1,000 ppmv
Bold = reported concentrations are above the detection limit
Concentrations for EDB and benzene are reported in µg/m³.
Concentrations for HC are reported in ppmv.
µg/m³= microgram(s) per cubic meter
bgs = below ground surface
EDB = ethylene dibromide
HC = hydrocarbon
NA = not analyzed
ND = nondetect
ppmv = parts per million by volume
Q2 = quarter 2
Qualifier:
J = qualifier denotes the analyte was positively identified, but the associated numerical value is estimated.
SVEW-04-313 was not sampled during Q2 2019 soil vapor monitoring due to potential influence from the bioventing system.

Legend

- Soil Vapor Monitoring Point - No Contaminant Exceedances
- Soil Vapor Monitoring Point - At Least One Contaminant Exceedance
- Former Aboveground Storage
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Source



N

0 175 350 700
Feet
1 inch = 350 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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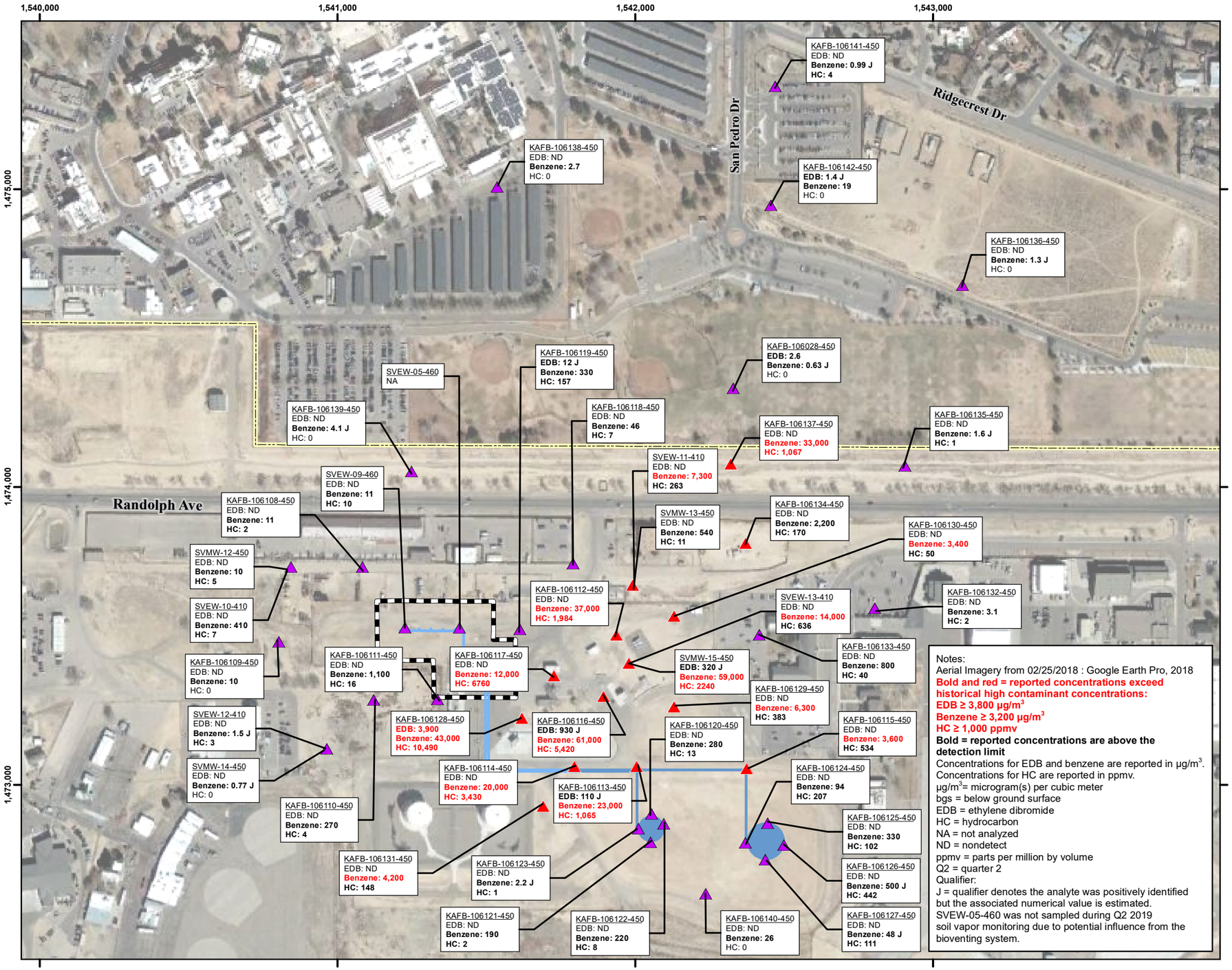
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNIT ST-106/SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2-8

BENZENE, EDB, AND HC CONCENTRATIONS IN SOIL VAPOR AT 350 FT BGS, Q2 2019

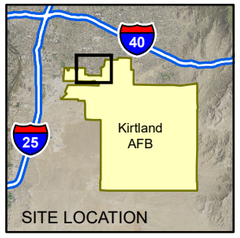
\\ABQ\Projects\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2019_Q2\Section 2\2-8 Benzene_EDB_HC_Conc_350ftQ22019.mxd 7/22/2019 EA ecarpio



Notes:
Aerial Imagery from 02/25/2018 : Google Earth Pro, 2018
Bold and red = reported concentrations exceed historical high contaminant concentrations:
EDB ≥ 3,800 µg/m³
Benzene ≥ 3,200 µg/m³
HC ≥ 1,000 ppmv
Bold = reported concentrations are above the detection limit
Concentrations for EDB and benzene are reported in µg/m³.
Concentrations for HC are reported in ppmv.
µg/m³= microgram(s) per cubic meter
bgs = below ground surface
EDB = ethylene dibromide
HC = hydrocarbon
NA = not analyzed
ND = nondetect
ppmv = parts per million by volume
Q2 = quarter 2
Qualifier:
J = qualifier denotes the analyte was positively identified but the associated numerical value is estimated.
SVEW-05-460 was not sampled during Q2 2019 soil vapor monitoring due to potential influence from the bioventing system.

Legend

- Soil Vapor Monitoring Point - No Contaminant Exceedances
- Soil Vapor Monitoring Point - At Least One Contaminant Exceedance
- Former Aboveground Storage
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Installation Boundary
- Source



N

0 175 350 700
Feet
1 inch = 350 feet

Projection: NAD83 State Plane New Mexico Central FIPS3002 Feet

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BULK FUELS FACILITY
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FIGURE 2-9

BENZENE, EDB, AND HC CONCENTRATIONS IN SOIL VAPOR AT 450 FT BGS, Q2 2019

\\ABQ\Projects\gis\Projects\Kirtland\Figures\BFF Quarterly Report\2019_Q2\Section 2\2-9 Benzene_EDB_HC_Conc_450ftQ22019.mxd 7/22/2019 EA ecarpio

APPENDIX D

Field Forms

HazAir

Field Activity Log

Job Number:	Task Description:	Date:

Weather:	Important Notes:	Onsite Employees:	Visitors:

Name:	Signature:	Date:

HazAir

Field Activity Log (Continuation)

Page_____of _____

Job Number:	Task Description:	Date:

HazAir

Well Integrity Checklist

Well ID: _____
Date:_____
Time: _____

Before Opening Well

1. Is well cement pad in good condition? _____
2. Is lid securely tightened to vault?_____
3. Is well clearly labeled? _____
4. Do wells outside of BFF have security bolts? _____
5. Photograph well.

After Removing Lid Before Sampling Well

1. Is gasket worn or damaged? _____
2. Is vault flooded? _____
3. Are ports capped/labeled?_____
4. Are ports angled correctly? _____
5. Are all fittings and quick connects intact and operational?

   _____

6. Can you hear well breathing? _____
7. Photograph well with lid off.

During Sampling

1. Do all tubing connects fit securely to sample system? _____
2. Does static pressure after purging return to initial static pressure within one minute?

   _____

3. Is well clogged?_____

Comments:_____

_____

Inspector's Name: _____

Inspector's Signature:_____

HazAir

Field Gas Detector Calibration Sheet

Instrument type and ID #: ___

	Known Gas Mixture			Calibrationl Reading			
Date/Time	TIVC(ppm)	% CO2	% O2*	TIVC (ppm)	% CO2	% O2*	Initials
	100	35	20.9				

* = Atmospheric %O2 Concentrations

HazAir

Leak Test Log

Date	Initial Vacuum Reading	Time	Vacuum Reading After 2 Min.*	Time	Initials

*Min   Minutes

HazAir

Sample Collection Log

Date: _____

Time: _____

Project No.: _____

Project Name: _____

Sample No.: _____

Sample Location: _____

Sample Type: _____

Composite: (Y/N) _____

Sample Team: _____

Trip Blank: _____

Sample: _____

Analytical Suite	Preservative	Container	TAT	Initials

Comments: _____

_____

_____

_____

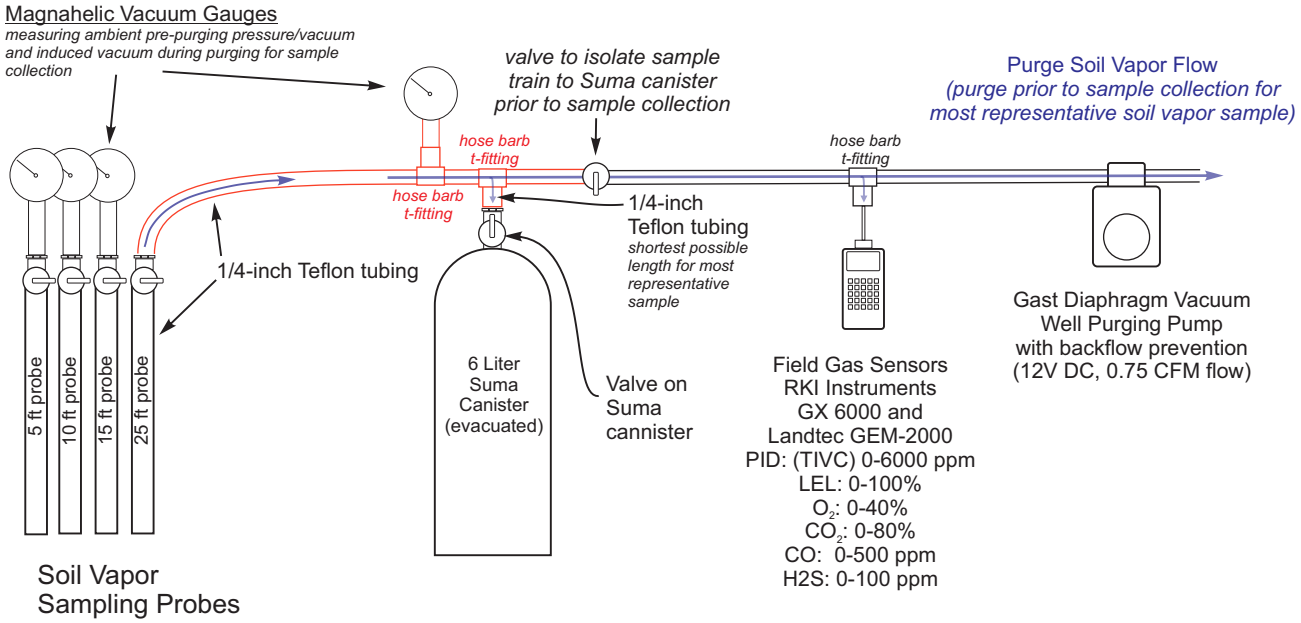
_____

_____

Logged by: _____ Reviewed by: _____

PROPOSED SOIL VAPOR SAMPLING EQUIPMENT AND SETUP
KAFB BFF OFF-SITE SHALLOW SOIL VAPOR INVESTIGATION

Proposed sampling train tubing and fittings shown in red are single use disposable requiring no decontamination



PROPOSED SOIL VAPOR PURGING PARAMETERS

Probe Depth (ft)	Date-Time	Elapsed Purge Time (min)	Purge Duration (min)	Pre-Purge Ambient Well Pressure (vacuum) Inches H_20				Induced Vacuum During Well Purge (Inches H_20)				Field Vapor Screening Parameters				Comments
				5 ft probe	10 ft probe	15 ft probe	25 ft probe	5 ft probe	10 ft probe	15 ft probe	25 ft probe	PID (ppm)	CO_2 (%)	O_2 (%)	CH_4 (%)	
15-Foot Completions																
5 ft		-5.0														Pre-purge pressure/vacuum
5 ft		0.0														Begin Purge
5 ft		5.0														
5 ft		10.0														Collect Sample
10 ft		-5.0														Pre-purge pressure/vacuum
10 ft		0.0														Begin Purge
10 ft		5.0														
10 ft		10.0														Collect Sample
15 ft		-5.0														Pre-purge pressure/vacuum
15 ft		0.0														Begin Purge
15 ft		5.0														
15 ft		10.0														Collect Sample
Add For 25-Foot Completions																
25 ft		-5.0														Pre-purge pressure/vacuum
25 ft		0.0														Begin Purge
25 ft		5.0														
25 ft		10.0														Collect Sample

KAFB BULK FUELS FACILITY
OFF-SITE SOIL VAPOR INVESTIGATION

Figure 5.--Proposed Soil Vapor Sampling Equipment, Methods and Purge Parameters

APPENDIX E

Soil Vapor Well Completion Diagram, 2001

EXAMPLE SPECIFICATIONS FOR SOIL VAPOR MONITORING PROBES

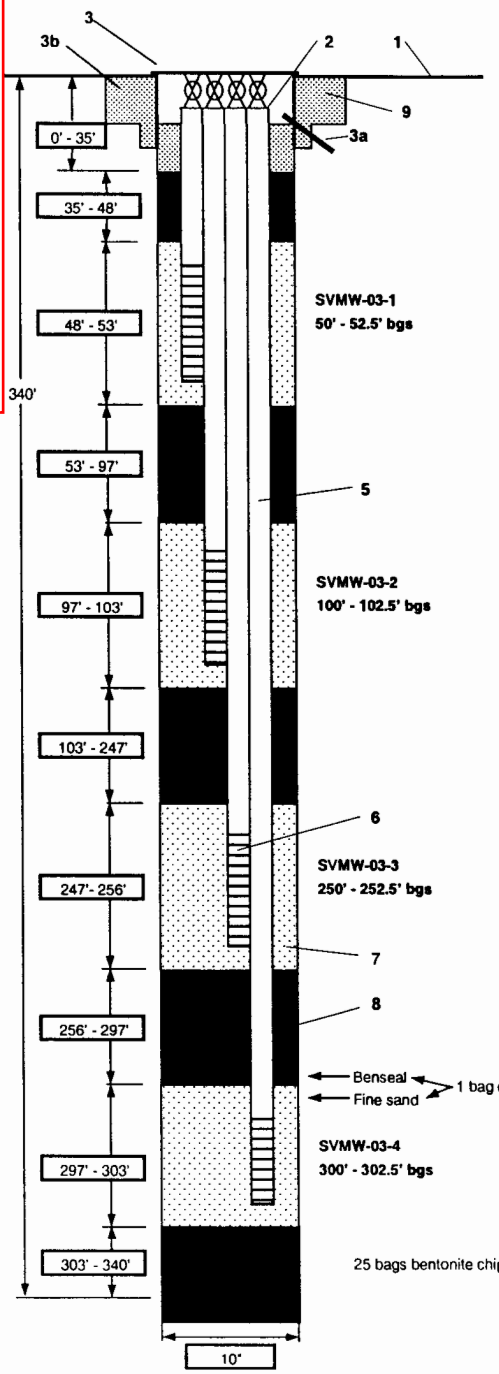
CH2MHILL

PROJECT NUMBER	WELL NUMBER	
146631.BV.IC	SVMW-03	SHEET 1 OF 1

SOIL VAPOR WELL COMPLETION DIAGRAM

PROJECT : KAFB Bulk Fuels Facility (ST-106) LOCATION : SB-28A/ 105' E & 15' S of E end of rack
ELEVATION: Approximately 5339' DRILLING CONTRACTOR : THF/Alton Schoonmaker
DRILLING METHOD AND EQUIPMENT USED: Schram T660W Rotodrill
WATER LEVELS : dry START : 02/12/2001 END : 02/20/2001 LOGGER : BJL

NOTE:
Shallow vapor probes may be constructed with 1/4-inch teflon tubing and aluminum or ceramic screens, or other suitable materials in place of PVC.



1- Ground elevation at well	approximately 5339'
2- Top of casing elevation	NA
3- Wellhead protection cover type	12" flush mount, locking caps
a) drain tube?	None
b) concrete pad dimensions	4' square flush mount
4- Dia./type surface casing	None
5- Dia./type of well casing	1/2" Nom. OD Schedule 80 PVC w/ball valve
6- Type/slot/size of screen	1/2" Nom. OD Schedule 80 PVC 0.050 slot, 2 1/2' long
7- Type screen filter	8 - 12 Oglebay Colorado Silica
quantity used	34 sacks
8- Type of seal	Hydrated 3/8" bentonite chips
quantity used	213 sacks
9- Grout	
a) Grout mix used	
b) Method of placement	
c) Vol.of surface casing grout	
d) Vol. of well casing grout	
Development method	NA
Development time	NA
Estimated purge volume	NA
Comments	

Illustration not to scale.