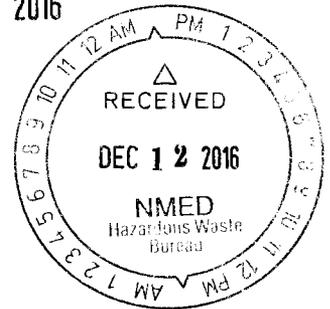


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**DEPARTMENT OF THE AIR FORCE**  
377TH AIR BASE WING (AFGSC)

NOV 22 2016



Colonel Eric H. Froehlich  
377 ABW/CC  
2000 Wyoming Blvd SE  
Kirtland AFB NM 87117-5000

Mr. John Kieling, Bureau Chief  
Hazardous Waste Bureau (HWB)  
New Mexico Environment Department (NMED)  
2905 Rodeo Park Drive East, Building 1  
Santa Fe NM 87505-6303

Dear Mr. Kieling

As presented at the November 9, 2016 Vadose Zone Working Group meeting, the attached Technical Memorandum provides the soil vapor monitoring optimization recommendations to begin first quarter of calendar year 2017 for the Kirtland Air Force Base (AFB) Bulk Fuels Facility (BFF) release site (Solid Waste Management Unit ST-106/SS-111). The Vadose Zone Working Group identified the need to evaluate and optimize the current monitoring and reporting practices with the goal of achieving a more effective monitoring and reporting program that aligns with NMED guidance requirements and industry standards. The Memorandum provides the technical basis for semi-annual sampling and reduced quantity of analytical methods and reporting. This optimization will drive project decisions, reduce data redundancy, minimize safety risks, reduce cost to the public, and improve program sustainability.

If you have any questions or concerns, please contact Mr. Scott Clark at (505) 846-9017 or at [scott.clark@us.af.mil](mailto:scott.clark@us.af.mil) or Ms. Adria Bodour at (210) 748-4035 or at [adria.bodour.1@us.af.mil](mailto:adria.bodour.1@us.af.mil).

Sincerely

ERIC H. FROEHLICH, Colonel, USAF  
Commander

Attachment:  
Technical Memo Requesting the Optimization of Soil Vapor Monitoring

cc:  
NMED-EHD (Roberts, McQuillan), letter  
NMED-HWB (Agnew), letter  
EPA Region 6 (King, Ellinger), letter  
SAF-IEE (Lynnes), electronic only  
AFCEC/CZ (Bodour, Clark), electronic only  
USACE-ABQ District Office (Simpler, Phaneuf, Dreeland, Sanchez, Salazar), electronic only  
Public Info Repository, Administrative Record/Information Repository (AR/IR) and File, hard copy

KAFB4465



**Technical Memorandum:  
Requested Optimization of Soil Vapor Monitoring Program**

This Technical Memorandum presents recommendations for optimization of soil vapor monitoring activities for the Kirtland Air Force Base (AFB) Bulk Fuels Facility (BFF) release site (Solid Waste Management Unit ST-106/SS-111). The objective of the optimization initiative and recommendations described below is to reduce unnecessary sampling, while maintaining the data necessary to ensure protectiveness and drive remediation decisions at the BFF site. The following changes have been identified by collaborative efforts of the Vadose Zone Working Group technical team and are supported by utilization of the Air Force Civil Engineer Center Geostatistical Temporal-Spatial (GTS) Optimization software program for monitoring optimization. GTS employs statistical and geostatistical methods to optimize groundwater and soil vapor monitoring networks. The GTS software, specific BFF Soil Vapor Monitoring Program analyses, and results were presented to the Vadose Zone Working Group on November 9, 2016.

GTS uses both non-linear trend estimation and locally weighted spatial mapping to optimize sampling frequencies and support identification of essential or redundant sampling locations. GTS analyses were run to evaluate the current network of 284 soil vapor monitoring points (SVMPs) sampled quarterly at the BFF site, and using analytical data from 2007 through quarter (Q)3 2016. The results of the GTS analyses for the BFF soil vapor network were reviewed with subject matter experts within the Vadose Zone Working Group and have been incorporated to design a revised monitoring program for the site. Based on the results of the GTS analysis, it is recommended that sampling frequency be reduced to semi-annual for all site constituents. The analyses consistently showed that reducing the sampling frequency has no impact on the ability to ensure protectiveness, assess overall contaminant trends, and provide sufficient data to meet the objectives of the monitoring program—to track contaminant concentrations and stability, and monitor contaminants of concern.

**1. Optimization of Sampling Frequency**

To date, soil vapor monitoring has been conducted quarterly at all 284 SVMPs in the soil vapor network. The GTS analyses examined the SVMPs across six depth intervals associated with the network to evaluate their spatial distribution, contaminant results and trends, and any redundant sampling frequency and locations. The empirical data and GTS analyses indicated that at this point in the project, little to no redundancy exists in the soil vapor monitoring network; therefore, the working group team recommends retaining all 284 SVMPs in the soil vapor network. The spatial distribution of the SVMPs represents an effective monitoring network for the evaluation of soil vapor contamination at the site.

The GTS results indicated that a sampling frequency of once per year is optimal for benzene and a sampling frequency of twice per year is optimal for EDB. The team recommended retaining semi-annual sampling for all analytes, maintaining more than adequate sampling frequency to track contaminant trends, while reducing redundancy and monitoring costs. The timing of the sampling events would correspond with semi-annual groundwater sampling events to support site-wide, multi-media evaluation, and be performed in Q2 and Q4 of each year.

## 2. Review of Analytical Program

Analytical data for all SVMPs in the soil vapor network from the last 8 quarters (Q4 2014 through Q3 2016) were evaluated to assess the dataset, and further assess data redundancies. Based on this evaluation, the Vadose Zone Working Group identified multiple analytes that could be removed from the sampling program and reporting documents while still maintaining the necessary data to evaluate soil vapor contamination at the site.

- A. **Removal of Laboratory Total Petroleum Hydrocarbon (TPH) Analysis:** Results of the laboratory TPH analysis (air-phase petroleum hydrocarbons [HC]) are not used to assess site conditions or drive site decisions. The sampling and reporting of both laboratory TPH and field HC each quarter is redundant. TPH in soil vapor is currently analyzed at all 284 SVMPs each quarter by method MA APH 1.0. Total HC are measured at each SVMP in the field using a Horiba MEXA 584L auto emissions analyzer (Horiba), as described in the *Soil Vapor Monitoring and Drinking Water Monitoring Work Plan* (USACE, 2016a). Quarterly reports have demonstrated the close correlation between laboratory TPH results and HC results (USACE, 2016b). Although both HC and TPH results are reported in the Quarterly Reports, only HC is discussed in the text and figures to evaluate areas of relative higher or lower concentrations. The Vadose Zone Working Group determined that removing laboratory analysis of TPH from the analytical suite and continuing to collect HC data with the Horiba would be the most useful and effective method of evaluating HC concentrations.
- B. **Removal of Laboratory Fixed Gasses Analysis:** Results of the laboratory fixed gasses analysis are not used to assess site conditions or drive site decisions. Fixed gasses including nitrogen, methane, carbon dioxide, carbon monoxide, and oxygen in soil vapor are currently analyzed at all 284 SVMPs each quarter by modified EPA Method 3C. Oxygen and carbon dioxide are measured at each SVMP in the field using the Horiba, as described in the *Soil Vapor Monitoring and Drinking Water Monitoring Work Plan* (USACE, 2016a). Previous comparison of field measured gasses and laboratory measured gasses has shown a good correlation between the two methods. Nitrogen data are not used to drive site decisions. Methane has not been detected at any of the SVMPs over the past eight quarters; though if determined that it may be useful for the future implementation of the bioventing interim measure, methane can be measured in the field if necessary. Similarly, carbon monoxide has not been detected at any of the SVMPs over the past eight quarters and is not used to drive site decisions. Although both field and laboratory gas results are reported in the Quarterly Reports, only field results are used to evaluate the presence of active biodegradation of site contaminants and used to support discussion in the text and figures. The Vadose Zone Working Group determined that removing laboratory analysis of fixed gasses from the analytical suite and continuing to monitor oxygen and carbon dioxide with the Horiba would be the most effective method of evaluating these parameters, while continuing to provide adequate data to drive site decisions.
- C. **Discontinuation of Sampling of TO-15 Analytes Detected 20 Times or Fewer:** All 284 SVMPs are sampled quarterly for VOCs by EPA Method TO-15. The TO-15 method includes analysis of 61 analytes. Nineteen analytes have been detected fewer than 20 times

total across all 284 SVMPs in the network over the past eight quarters, which represents less than 1 percent detection. Additionally, the working group team recognized that these analytes are not used to assess site impacts, do not drive risk, and are often found at low levels in the environment or as field/lab cross-contaminants. Table 1 lists each analyte, the number of times it has been detected during soil vapor monitoring, and a detection comment field denoting the working group team's professional judgement and rationale for removing the analyte. It is requested that while VOC analysis via TO-15 will continue under the soil vapor monitoring program, these analytes will be removed from the analyte list and reporting documents.

## **References**

USACE, 2016a. *Work Plan for Soil Vapor Monitoring and Drinking Water Monitoring Solid Waste Management Unit ST-106/SS-111*. Prepared by Sundance Consulting Inc. for the USACE Albuquerque District under USACE Contract No. W912PP-16-C-0002. August.

USACE, 2016b. *Quarterly Pre-Remedy Monitoring and Site Investigation Report for October - December 2015*. Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, Albuquerque, New Mexico. Prepared by CB&I Federal Services LLC for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. March.

Table 1. TO-15 Soil Vapor Analytes Detected Fewer Than 20 Times

EPA Method	Analyte	Samples in Last 8 Quarters (Q4-2014 to Q3-2016)	Has the Analyte Been Detected in Soil Vapor Over Last 8 Quarters?	Number of Detections	SME Professional Judgment Comments	Working Group Recommendation
VOCs - TO15	1,1,2-TRICHLOROETHANE	2022	NO	0		Remove Analyte
VOCs - TO15	1,2,4-TRICHLOROBENZENE	2022	NO	0		Remove Analyte
VOCs - TO15	1,4-DICHLOROBENZENE	2022	NO	0		Remove Analyte
VOCs - TO15	BENZENE, (CHLOROMETHYL)-	2017	NO	0		Remove Analyte
VOCs - TO15	METHYL TERT-BUTYL ETHER	2022	NO	0		Remove Analyte
VOCs - TO15	TRANS-1,2-DICHLOROETHENE	2022	NO	0		Remove Analyte
VOCs - TO15	TRANS-1,3-DICHLOROPROPENE	2022	NO	0		Remove Analyte
VOCs - TO15	CHLOROBENZENE	2022	YES	1	One detection of 0.0079-ppmv at KAFB-106131-055 on November 13, 2014	Remove Analyte
VOCs - TO15	CIS-1,3-DICHLOROPROPENE	2022	YES	1	One J-flagged detection of 0.00037-ppmv at KAFB-106139-150 on August 2, 2016	Remove Analyte
VOCs - TO15	1,1,2,2-TETRACHLOROETHANE	2022	YES	2	One J flagged detection of 0.00041-ppmv at KAFB-106113-020 on July 13, 2016; one detectoin of 2.3-ppmv at KAFB-106117-450 on July 26, 2016	Remove Analyte
VOCs - TO15	1,2-DICHLOROPROPANE	2022	YES	2	One J-flagged detection of 0.00043-ppmv at KAFB-106110-050 on July 26, 2016; one J-flagged detection of 0.00088-ppmv at KAFB-106120-025 on February 24, 2016	Remove Analyte
VOCs - TO15	BROMOMETHANE	2022	YES	2	One J-flagged detection of 0.00059-ppmv at SVEW-09-460 on July 14, 2015; one J-flagged detection of 0.0019-ppmv at SVMW-06-050 on July 13, 2015	Remove Analyte
VOCs - TO15	HEXACHLOROBUTADIENE	2023	YES	2	One J-flagged detection of 0.00012-ppmv at KAFB-106121-350 February 24, 2016; one J-flagged detection of 0.00016-ppmv at KAFB-106125-250 on July 12, 2016	Remove Analyte
VOCs - TO15	1,2-DICHLOROBENZENE	2022	YES	3	One J-flagged detection of 0.00031-ppmv at KAFB-106110-150 on May 2, 2016; one J-flagged detection of 0.00031-ppmv at KAFB-106126-050 on July 12, 2016; one J-flagged detection of 0.0081-ppmv at SVMW-02-150 on July 14, 2015	Remove Analyte
VOCs - TO15	1,3-DICHLOROBENZENE	2022	YES	3	Three J-flagged detections in July 2016 of: 0.00022-ppmv at SVMW-05; 0.00024-ppmv at KAFB-106119; and 0.00021-ppmv at KAFB-106117	Remove Analyte

Table 1. TO-15 Soil Vapor Analytes Detected Fewer Than 20 Times

EPA Method	Analyte	Samples In Last 8 Quarters (Q4-2014 to Q3-2016)	Has the Analyte Been Detected in Soil Vapor Over Last 8 Quarters?	Number of Detections	SME Professional Judgment Comments	Working Group Recommendation
VOCs - TO15	1,1,1-TRICHLOROETHANE	2022	YES	12	Low level detections; all J-flagged except a detection of 0.37-ppmv at KAFB-106121-025 on March 11, 2015	Remove Analyte
VOCs - TO15	VINYL ACETATE	2022	YES	12	Twelve detections (all J-flagged) at 10 locations between Q1 and Q3 2016. Locations include: KAFB-106108, KAFB-106114, KAFB-106117, KAFB-106118, KAFB-106123, KAFB-106124, KAFB-106125, KAFB-106137, SVMW-01, SVMW-02	Remove Analyte
VOCs - TO15	1,1-DICHLOROETHENE	2022	YES	19	Nineteen detections (12 J-flagged) at six locations between Q4 2014 and Q3 2016. Locations include:  KAFB-106110: Six detections (3 J-flagged) ranging from 0.0011-ppmv to 0.0024J-ppmv  KAFB-106131: Seven detections (5 J-flagged) ranging from 0.00044J-ppmv to 0.0064-ppmv  KAFB-106111, KAFB-106132, SVEW-10, SVMW-14: Each with one to two detections between Q4 2014 and Q3 2016	Remove Analyte
VOCs - TO15	CIS-1,2-DICHLOROETHENE	2022	YES	19	Nineteen detections at 9 locations from Q4 2014 through Q3 2016, 11 J-flagged detections. Locations include:  SVMW-14: 7 detections (3 J-flagged) ranging from 0.0012J-ppmv to 0.0032-ppmv between Q4 2014 and Q3 2016;  SVEW-12: Three J-flagged detections from Q3 2015 through Q1 2016 (0.00073, 0.00078, and 0.00079-ppmv); and  SVEW-07, KAFB-106111, KAFB-106114, KAFB-106116 (J-flagged), KAFB-106129, KAFB-106131 (J-flagged), KAFB-106132 all had one to two detections between Q4 2014 and Q3 2016.	Remove Analyte

**Acronyms and Abbreviations**

EPA	Environmental Protection Agency
J-flagged	estimated detection
ppmv	parts per million by volume
Q	quarter
SME	subject matter expert
TO-15	EPA Method TO-15
VOCs	volatile organic compounds