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

DEC 23 2014

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Mr. Butch Tongate
Deputy Secretary
New Mexico Environment Department (NMED)
1190 St. Francis Drive, Suite N-4050
Santa Fe, New Mexico 87502

Dear Mr. Tongate

Attached please find the *Pilot SVE Shutdown Test Work Plan*. This letter WP will address the respiration and short-term testing, along with the long-term rebound testing, on selected soil vapor monitoring (SVM) wells. Data from this shutdown test will be used in the design of SVE expansion at the BFF site.

Please contact Mr. L. Wayne Bitner at (505) 853-3484 or at ludie.bitner@us.af.mil or Mrs. Victoria Branson at (505) 846-6362 or at victoria.branson@us.af.mil if you have questions.

Sincerely

TOM D. MILLER, Colonel USAF
Commander

Attachment: Pilot SVE Shutdown Test Work Plan

cc:
NMED-HWB (Kieling, Cobrain, Moats, McDonald, Brandwein) w/attch
NMED (McQuillan, Longmire) w/attch
NMED-GWQB (Schoeppner) w/attch
NMED-PSTB (Reuter) w/attch
NMED-OGC (Kendall) w/o attch
EPA Region 6 (King) w/o attch
AFCEC-CZRY (Bodour) w/ attch
Public Info Repository, AR/IR, and File w/attch

40 CFR 270.11
DOCUMENT CERTIFICATION
DECEMBER 2014

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to 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.

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

This document has been approved for public release.

KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs

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Subject: **Kirtland Air Force Base Bulk Fuel Facility – Pilot Soil Vapor Extraction Shutdown Test Work Plan**

This Kirtland Air Force Base (KAFB) Bulk Fuel Facility (BFF) Soil-Vapor Extraction (SVE) Shutdown Testing Letter Work Plan (WP) has been prepared by CB&I Federal Services LLC (CB&I) for the U.S. Army Corps of Engineers (USACE), Albuquerque District, under Contract No. W912DY-10-D-0014. This letter WP will address the respiration and short-term testing, along with the long-term rebound testing, on selected soil vapor monitoring (SVM) wells. Data from this shutdown test will be used in the design of SVE expansion at the BFF site.

1. SVE SHUTDOWN TESTING

During the shutdown test, respiration and rebound monitoring will be performed in tandem on select existing SVM wells. Respiration testing will provide data that will be used for accurate calculation of biodegradation rates in the vadose zone. Rebound testing is being conducted to evaluate soil vapor concentration recovery following the shutting down of the catalytic oxidizer (CATOX) system. The current CATOX system will be shut down for the approximate 3-month duration of rebound testing.

Due to the potential for regular SVM activities to impact the quality and accuracy of the data collected during shutdown testing, KAFB is requesting no quarterly SVM samples be collected in First Quarter and Second Quarter Calendar Year (CY) 2015. The data that will be collected during the proposed shutdown testing will facilitate an in-depth analysis of the remaining contamination in the vadose zone and the biodegradation rates associated with that contamination. The extended data set from the SVE shutdown test will advance our understanding of the conditions in the BFF vadose zone and will add value to the soil vapor data that are normally collected during the quarterly sampling events. That enhanced understanding of subsurface conditions will facilitate effective SVE expansion design and optimal SVE system operation. As such, it would be extremely beneficial to avoid interferences with the tests to ensure that the collected data are of the highest quality possible.

1.1 Baseline Sampling

Baseline measurements will be collected from each of the 287 SVM ports. Soil vapor baseline measurements will be collected in accordance with the methodologies outlined in Section 5.3 of the Vadose Zone Investigation Work Plan (USACE, 2011a) and Section 3.0 of the Quality Assurance Project Plan (QAPjP) (USACE, 2011b). The following parameters will be measured:

- Total hydrocarbons in parts per million by volume (ppmv)
- Percent oxygen (O_2)
- Percent carbon dioxide
- Vacuum/pressure (inches of water column [in. WC])

The CATOX system will be shut down using normal shutdown procedures outlined in Section 6.0 of the SVE System Operations and Maintenance Plan (August 2013). The wells currently connected to the CATOX system (KAFB-106149, KAFB-106150, KAFB-106154, KAFB-106160, and KAFB-106161) will be closed at the well heads prior to shutdown of the treatment system to prevent atmospheric air from

entering the wells and interfering with the initial measurements during the in situ respiration and short-term rebound testing.

1.2 In Situ Respiration and Short-Term Rebound Testing

The objective of the in situ respiration and short-term rebound testing is to provide an accurate representation of the biological activity and the residual contamination distribution in the BFF vadose zone. A total of 60 SVM wells will be included in the respiration and short-term rebound testing. All 30 of the SVM wells selected for the long-term rebound testing will be included in the respiration testing (see Section 1.3). An additional 30 SVM wells will be selected based on the results from the baseline testing. Candidate SVM wells will be selected to represent areas of high total petroleum hydrocarbon (TPH) [i.e., greater than 1,000 ppmv] and depressed oxygen concentrations (i.e., less than 19 percent), as well as areas with low TPH (i.e., less than 1,000 ppmv) and elevated oxygen concentrations (i.e., closer to ambient).

Following SVE shutdown, soil vapor will be sampled from the selected 60 SVM wells using the current sampling method in Section 5.3 of the Vadose Zone Investigation Work Plan (USACE, 2011a) and Section 3.0 of the QAPjP (USACE, 2011b). The initial sampling will be initiated 2 hours after SVE shutdown. Subsequent sampling frequencies for each SVM well will be determined based on the observed oxygen utilization rate. Any SVM wells demonstrating a higher oxygen utilization rate will be sampled on a more frequent basis. During the initial 24 hours of post-shutdown monitoring, a crew of three individuals will monitor the SVM wells during the day and night. Respiration monitoring will continue until oxygen concentrations decrease to less than 5 percent or 2 weeks is reached, whichever comes first.

The measured O_2 concentration will be used to create an oxygen utilization curve. An accurate biodegradation rate can then be calculated for the vadose zone. The TPH data from the short-term rebound will be utilized in the long-term rebound assessment (see Section 1.3).

1.3 Long-Term Rebound Testing

The objective of the long-term rebound testing is to allow sufficient time for contaminant concentrations in soil vapor to equilibrate from lower permeability lithology to provide accurate representation of the residual contamination distribution in the BFF vadose zone. A network of 30 SVM wells (Table 1) has been selected for the long-term rebound testing. The SVM wells were selected based on vapor data collected during Fourth Quarter CY 2012 and Second Quarter CY 2014, as these quarters represent the highest historical vapor data and the most recent vapor data, respectively. The SVE system area of influence is defined as the area within the 0.5-in. WC) vacuum isopleths, as reported in Appendix L of the Pre-Remedy Quarterly Monitoring Reports.

Table 1. Soil Vapor Monitoring Wells for Long-Term Rebound Testing

Well Number	Zone	Monitoring Depths
SVMW-03	Near edge of area influenced by soil vapor extraction (SVE)	100
		250
		350
SVMW-06	Inside area influenced by SVE	100
		252
		302
SVMW-10	Outside area influenced by SVE	100
		150
		250
KAFB-106112	Inside area influenced by SVE	250
		350
		450
KAFB-106113	Probably outside area influenced by SVE	350
		450
KAFB-106114	Near edge of area influenced by SVE	350
		450
KAFB-106116	Inside area influenced by SVE	350
		450
KAFB-106117	Inside area influenced by SVE	350
		450
KAFB-106119	Inside area influenced by SVE	150
		250
		350
		450
KAFB-106128	Inside area influenced by SVE	350
		450
KAFB-106129	Possibly influenced by SVE	250
		350
		450
KAFB-106130	Possibly influenced by SVE	350
		450

Following the short-term rebound test, long-term rebound SVM wells will be monitored daily for 1 week, weekly for 5 weeks and then biweekly until TPH concentrations become asymptotic or for three biweekly sampling events, whichever comes first. These samples will be analyzed for TPH (ppmv) using a Horiba Model MEXA 584 L portable auto emissions analyzer using the current sampling method in the Vadose Zone Investigation Work Plan (USACE, 2011a) and Section 3.0 of the QAPjP (USACE, 2011b). During the final bi-weekly monitoring event, soil vapor samples will be collected from each of the wells being monitored. Samples will be submitted to a laboratory for Method TO-15 analysis.

2. DATA ANALYSIS AND REPORTING

Biodegradation rates in the vadose zone are based on oxygen utilization rates, hydrocarbon oxidation stoichiometry, and relevant soil properties. Following the Bioventing Principles and Practice, Volume II (EPA, 1995), the oxygen utilization rate calculated from the field monitoring data is expressed as a percentage of oxygen as a function of time. Oxygen utilization rates will only be calculated for the linear portion of the curve, as it is an indicator that oxygen is not limiting, and is therefore indicative of active biodegradation.

Since the contamination at the BFF project site is hydrocarbons, hexane is used as the representative hydrocarbon for rate calculations. The stoichiometric relationship used for determination of degradation rates is therefore (EPA, 1995):

$$C_6H_{14} + 9.5O_2 \rightarrow 6CO_2 + 7H_2O$$

Based on the utilization rates, the biodegradation rate is estimated using the following equation (EPA, 1995):

$$-k_b = \frac{-\frac{k_o}{100}\theta_a \frac{1L}{1{,}000cm^3}\rho_{O_2}C}{\rho_K\left\{\frac{1kg}{1{,}000g}\right\}} = \frac{-kO\theta_a\rho_{O_2}C(0.01)}{\rho_k}$$

Where:

k_b = biodegradation rate (milligrams/kilogram-day)
k_o = oxygen utilization rate (percent/day)
θ_a = gas-filled pore space (volumetric content at the vapor phase, cubic meters gas/cubic centimeter soil)
ρ_{O_2} = density of oxygen (milligrams/liter)
C = mass ratio of hydrocarbons to oxygen required for mineralization (1:3.5)
ρ_k = soil bulk density (grams/cubic centimeter)

The value for k_o will be directly measured during the respiration monitoring as described in Section 1.2. The remaining input values will be based on data obtained from the site, if available, or from industry standards and approved literature. The value for θ_a has the most variability; however, since the respiration testing will be conducted at a low gas-filled porosity, the value can be estimated in accordance with the steps outlined in the EPA manual for Bioventing Principles and Practice, Volume II (EPA, 1995)

3. SCHEDULE

The anticipated dates for shutdown testing are as follows:

- Respiration and short-term rebound testing (begin mid-February 2015)
- Long-term rebound testing (March through June 2015)

4. REFERENCES

EPA. 1995. *Manual, Bioventing Principles and Practice, Volume II: Bioventing Design*. September.

USACE. 2011a. *Vadose Zone Investigation Work Plan, Bulk Fuels Facility (BFF) Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, Albuquerque, New Mexico.* Prepared by Shaw Environmental & Infrastructure, Inc., for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. March.

USACE. 2011b. *Quality Assurance Project Plan, Bulk Fuels Facility (BFF) Spill, Solid Waste Management Units ST-106 and SS-111, Kirtland Air Force Base, Albuquerque, New Mexico.* Prepared by Shaw Environmental & Infrastructure, Inc., for the USACE Albuquerque District under USACE Contract No. W912DY-10-D-0014, Delivery Order 0002. April.