



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

13 January 2021

Colonel David S. Miller, USAF
Commander
377th Air Base Wing
2000 Wyoming Blvd SE
Kirtland Air Force Base New Mexico 87117

Mr. Kevin Pierard
Hazardous Waste Bureau
New Mexico Environment Department
Harold Runnels Building
1190 St. Francis Drive, Suite N2050
Santa Fe New Mexico 87502

Dear Mr. Pierard

The U.S. Air Force (USAF) is submitting this letter with the attached Technical Memorandum regarding the bioventilation pilot (pilot) to notify the New Mexico Environment Department (NMED) that the USAF has temporarily shut down the pilot and to request NMED concurrence to permanently terminate the pilot prior to the planned shutdown date of September 2021. As detailed in the November 2017 work plan, the objective of the pilot was to evaluate the effectiveness of bioventing to support a future corrective measures evaluation of the source area and the soil vapor plume. The long-term bioventing pilot test is suitable for termination because sufficient data has been collected to evaluate feasibility of bioventilation to remediate hydrocarbons in the source area in the Corrective Measures Evaluation. This request to shut down the pilot is further supported by anomalies in soil vapor concentrations observed in the Q2 2020 and Q4 2020 soil vapor monitoring events. While elevated concentrations of ethylene dibromide and benzene do not pose a risk to human health on-Base, the USAF shut down the pilot out of an abundance of caution.

The final results of the pilot study will be presented in the Final Bioventilation Pilot Testing Report and submitted to the New Mexico Environment Department (NMED) after concurrence has been reached for permanent shutdown of the pilot test.

If you have any questions or concerns, please contact Mr. Sheen Kottkamp at commercial line 505-846-7674 or email sheen.kottkamp.1@us.af.mil.

Sincerely

A handwritten signature in blue ink, appearing to read "David S. Miller", is written over the word "Sincerely".

DAVID S. MILLER, Colonel, USAF
Commander

Attachment 1 – Bioventing Technical Memorandum

cc: NMED HWB (Cobrain), letter
NMED GWQB (Pullen), letter
SAF-IEE (Lynnes), electronic only
AFCEC/CZ (Renaghan, Clark, Kottkamp, Segura, Wortman), electronic only
USACE-ABQ District Office (Moayyad, Phaneuf, Kunkel, Dreeland, Cordova, Lovato),
electronic only
Public Info Repository, Administrative Record/Information Repository (AR/IR) and File



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

MEMORANDUM FOR New Mexico Environmental Department
ATTENTION: Hazardous Waste Bureau

FROM: Colonel David S. Miller
Commander
377th Air Base Wing
2000 Wyoming Blvd SE
Kirtland Air Force Base, New Mexico 87117

SUBJECT: Bioventing Pilot Test November 23rd 2020 Shutdown

1. PURPOSE

As discussed in the cover letter, the purpose of this technical memorandum is to notify the New Mexico Environment Department (NMED) that the United States Air Force (USAF) has temporarily shut down the bioventing pilot (pilot) test and to request NMED concurrence to permanently terminate the pilot prior to the planned shutdown date of September 2021 (after two years of pilot operation).

2. BACKGROUND

Interim Measures were implemented for both groundwater and soil in accordance with Part 6.2.2.2.12.1 of the Resource Conservation and Recovery Act Permit NM9570024423. The interim measures for the soil consisted of the removing all soil contamination to below residential screening levels to a depth of 20 feet below ground surface and the operation of a soil vapor extraction (SVE) system. The SVE system was operated for approximately 12 years from 2003 through 2015 (USACE, 2017). It was shut down when it was determined that with only localized vapor concentrations remaining, a large volume of un-impacted air was being pulled through the SVE system. This greatly decreased the influent concentration into the system and required larger quantities of supplemental fuel (USACE, 2017). NMED approved the shutdown of the SVE system as detailed in the February 25, 2015 correspondence (NMED, 2015).

Following SVE, USAF recommended that a pilot study be performed to assess the use of bioventing at the site. This pilot study was performed to assess the potential effectiveness of this technology at the site and provide data for an assessment of bioventing as a remedial strategy to treat soil vapors at within the Corrective Measures Evaluation (CME).

The bioventing pilot test was performed to evaluate the feasibility of this technology to remediate petroleum hydrocarbon concentrations remaining in the vadose zone after soil interim measures were performed. The effectiveness of bioventing was performed by measuring the microbial oxygen utilization rate in the subsurface. The rate of oxygen utilization is directly proportional to the aerobic biodegradation rate of fuel hydrocarbons in the subsurface and is therefore an indication of effectiveness of bioventing to achieve site cleanup in a timely manner. Because soil moisture content is also an important factor in the microbe's ability to degrade hydrocarbons the pilot study included the injection of water into the subsurface to assess the effectiveness of this method to assist with increasing the subsurface moisture content.

The bioventing pilot test is being performed in accordance with the Bioventing Respiration Pilot Testing Procedure (Kirtland AFB, 2018) and the Work Plan for Bioventing and Air-Lift Enhanced Bioremediation Pilot Tests, dated November 2017 (Work Plan [Kirtland AFB, 2017]). These documents were approved by the NMED in letters dated February 25, 2019 (New Mexico Environment Department [NMED], 2019) and April 6, 2018 (NMED, 2018), respectively. The bioventing area and well locations are shown on Figure 1 (Attachment 1).

The bioventing blowers were operated continuously for approximately 1 year between the fourth quarter (Q4) 2019 and the third quarter (Q3) 2020. Bioventing was conducted in both dry and moisture added (wet) conditions, water injection was performed at wells SVMW-10-100, SVMW-10-150, SVMW-10-250, SVMW-11-100, SVMW-11-250, and SVMW-11-260 at the beginning of the second quarter (Q2), Q3, and Q4 2020. Field parameters collected throughout the first year of bioventing are provided in Tables 1 through 12 (Attachment 2). Oxygen utilization rates and corresponding biodegradation rates were calculated using the obtained field parameters.

3. EVALUATION OF BIOVENTING PILOT DATA TO DATE

Operation of the bioventing pilot test began without the introduction of moisture. Dry bioventing was performed for Q4 2019 and the first quarter (Q1) 2020 of the pilot study. However, the data during these quarters did not indicate significant biodegradation and water was added in subsequent quarters (Q2 and Q3 2020).

During pilot testing, data to estimate oxygen utilization and biodegradation rates were collected. The calculated oxygen utilization and corresponding biodegradation rates for each quarter are presented in Table 13 (Attachment 2). The site-wide average oxygen utilization rate decreased from 0.17 percent (%) per day in Q4 2019 to 0.09% per day in Q3 2020 and has generally decreased through the first year of the bioventing pilot test. When comparing soil vapor relative humidity data from Q4 2019 and Q1 2020 to Q2 and Q3 2020, the relative humidity does not appear to have increased after the addition of moisture, indicating that moisture addition method specified in the approved work plan was not effective at increasing subsurface humidity (Tables 1 through 12, Attachment 2).

Oxygen utilization and biodegradation rate trends for each monitoring point are shown on the graphs provided in Attachments 3 and 4. The site-wide average oxygen utilization rate has varied between 0.08 and 0.18% per day while the biodegradation rate has varied between 0.05 and 0.10 milligrams per kilogram per day Table 13 (Attachment 2).

Operation of the bioventing system has been continuous throughout the first year of long-term bioventing. Sufficient oxygen was being supplied to the subsurface as is evident by elevated oxygen concentration observed throughout all of the monitoring points (Attachment 2, Tables 1-12). However, oxygen utilization rates remained low and appears to have stabilized over the first year of long-term bioventing averaging approximately 0.1 % per day over the final 3 quarters of operation. This average oxygen utilization rate was approximately one order of magnitude below the 1% per day utilization rate determined by Leeson and Hinchee, 1996, to demonstrate the feasibility of bioventing technology as a final remedy.

The data collected during the bioventing pilot test will be summarized in a final report and used during the vadose zone remedy evaluation in the CME.

4. OPERATIONAL CONCERNS

Soil vapor concentration anomalies were observed in Q2 and Q4 2020 in the immediate vicinity of the bioventing pilot testing area. The anomalies included benzene and ethylene dibromide soil vapor concentrations that were elevated as compared to historical values in 16 SVMP located on base and around the bioventing system (see the list of SVMPs provided in Figure 2 in Attachment 1 and Table 14 in Attachment 2). The concentration increases occurred within the Kirtland AFB boundary and at depths of 50 feet below ground surface or deeper.

Elevated soil vapor benzene concentrations were observed within multiple wells located radially surrounding the bioventing system at significant distances varying from the bioventing testing area. The most likely cause of the anomalies is that soil vapors are migrating radially away from the bioventing testing area by continued operation of the bioventing system. This advection of soil vapor, coupled with low oxygen utilization/biodegradation and the observed anomalies, suggests that migration and not degradation of the soil vapor concentrations is occurring.

The majority of these anomalies were located adjacent to the bioventing testing area. The reported anomalies were generally observed at depths closely associated with the injection intervals (air injection was performed at depths of 100, 105, 160, 250, 260, and 313 ft bgs). All observed anomalies occurred at depths of 50 ft below ground surface (bgs) or deeper, except for the one anomaly observed at KAFB-106118-025. Based on the observed bioventing data there does not appear to be a vapor migration risk for on-Base receptors under the industrial land use scenario. No off-base vapor migration was measured.

Due to the potential of soil vapor migration resulting from continuous bioventing operations, the bioventing system was shut down on November 23, 2020. This Technical Memorandum was prepared and submitted after the anomalous data was validated as part of the routine Q4 2020 monitoring event. All soil vapor monitoring analytical data and validation of that data will be discussed within the Q4 2020 monitoring report.

5. CONCLUSIONS AND RECOMMENDATIONS

Given the length of the bioventing pilot study operation (1 year) and the operation of the system in both dry and wet modes, it is unlikely that additional operation of the bioventing system under current conditions will yield any new information regarding this technology. These results combined with the migration of soil vapors that appears to be caused by the operation of the pilot, the Air Force requests approval from NMED to conclude the pilot. The final results of the pilot study would then be submitted to NMED after concurrence has been reached for the termination of the pilot test. The Air Force would still appreciate the opportunity to meet with NMED in the near future to discuss the notice of deficiency on the Bioventilation Construction and Initiation Report (NMED, 2020) and this request to terminate the pilot.

References

Kirtland Air Force Base (AFB). 2017. *Work Plan for Bioventing and Air-Lift Enhanced Bioremediation Pilot Tests, BFF, SWMU ST-106/SS-111*. Prepared by EA Engineering, Science, and Technology, Inc., PBC for Kirtland AFB under USACE–Albuquerque District Contract Number W9128F-13-D-0006. November.

Kirtland AFB. 2018. *Bioventing Respiration Pilot Testing Procedure Bulk Fuels Facility, Solid Waste Management Unit (SWMU) ST-106/SS-111, Kirtland Air Force Base, New Mexico*. Prepared by EA Engineering, Science, and Technology, Inc., PBC for Kirtland AFB under USACE–Albuquerque District Contract Number W9128F-13-D-0006. September.

Leeson, A. and R.E. Hinchee. 1996. *Soil Bioventing, Principles and Practice*. CRC, Lewis Publishers, Boca Raton.

New Mexico Environment Department (NMED). 2015. February 25, 2015 correspondence from Ms. Kathryn Roberts, Director of Resource Protection Division New Mexico Environmental Department to Colonel Tom D. Miller, Base Commander, 377 AB/CC, Kirtland AFB, NM, *re: Pilot Soil Vapor Extraction Shutdown Test Workplan Bulk Fuels Facility, Solid Waste Management Unit ST-106/SS-111, Kirtland Air Force Base, EPA ID# NM9570024423, HWB-KAFB-19-MISC*.

NMED. 2018. April 6, 2018 correspondence from Mr. Juan Carlos Borrego, Deputy Secretary to Colonel Richard W. Gibbs, Base Commander, 377 AB/CC, Kirtland AFB, NM and Mr. Chris Segura, Chief, Installation Support Section, AFCEC/CZOW, Kirtland AFB, NM, *re: Work Plan for Bioventing and Air-Lift Enhanced Bioremediation Pilot Tests, Bulk Fuels Facility, Solid Waste Management Unit ST-106/SS-111, Kirtland Air Force Base, EPA ID# NM9570024423, HWB-KAFB-19-MISC*.

NMED. 2019. February 25, 2019 correspondence from Mr. John Keiling, Bureau Chief to Colonel Richard W. Gibbs, Base Commander, 377 AB/CC, Kirtland AFB, NM and Mr. Chris Segura, Chief, Installation Support Section, AFCEC/CZOW, Kirtland AFB, NM, *re: Pilot Soil Vapor Extraction Shutdown Test Workplan, Bulk Fuels Facility Spill, Solid Waste Management Unit ST-106/SS-11, Kirtland Air Force Base, EPA ID# NM9570024423, HWB-KAFB-19-MISC*.

NMED. 2020. September 23, 2020 correspondence from Mr. Kevin Pierard Chief hazardous Waste Bureau New Mexico Environmental Department to David S. Miller, Base Commander, 377 AB/CC, Kirtland AFB, NM *re: Disapproval Bioventilation Construction and Initiation Report Bulk Fuels Facility Spill, Solid Waste Management Unit ST-106/SS-11, Kirtland Air Force Base, EPA ID# NM9570024423, HWB-KAFB-19-MISC*.

A document certification page is included as Attachment 5. If you have any questions or concerns, please contact Mr. Sheen Kottkamp at commercial line 505-846-7674 or email sheen.kottkamp.1@us.af.mil.



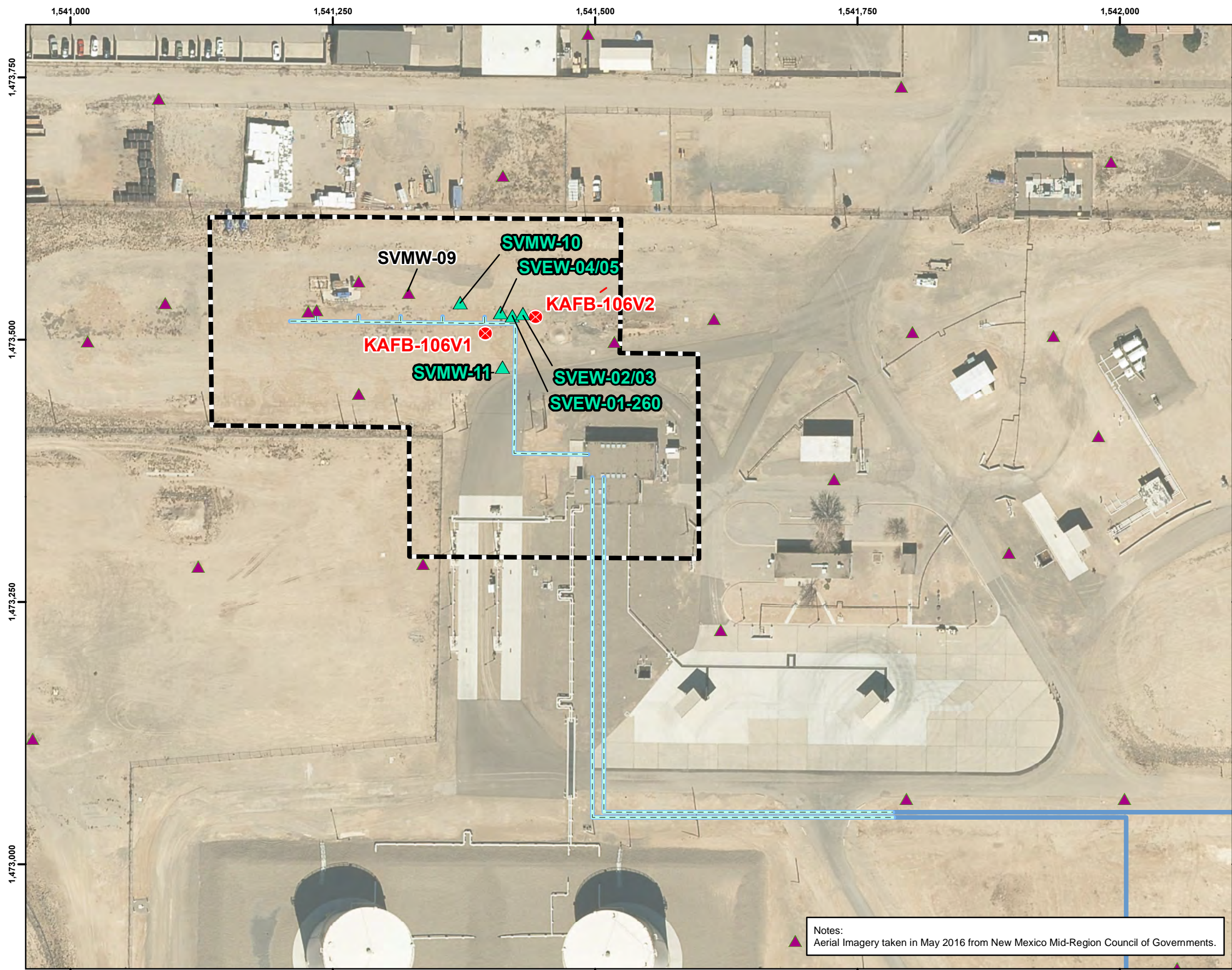
DAVID S. MILLER, Colonel, USAF
Commander

Attachments:

1. Figures
2. Tables
3. Oxygen Utilization Rates
4. Biodegradation Graphs
5. Document Certification Page

Attachment 1

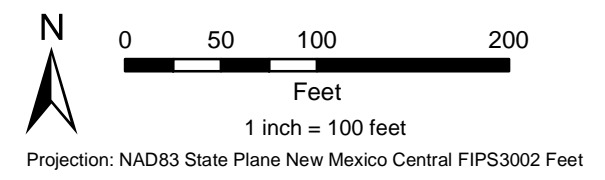
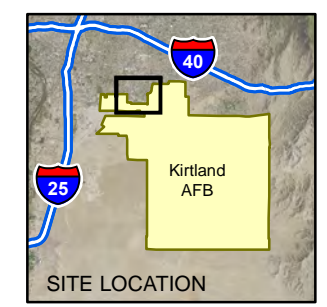
Figures



Notes:
Aerial Imagery taken in May 2016 from New Mexico Mid-Region Council of Governments.

Legend

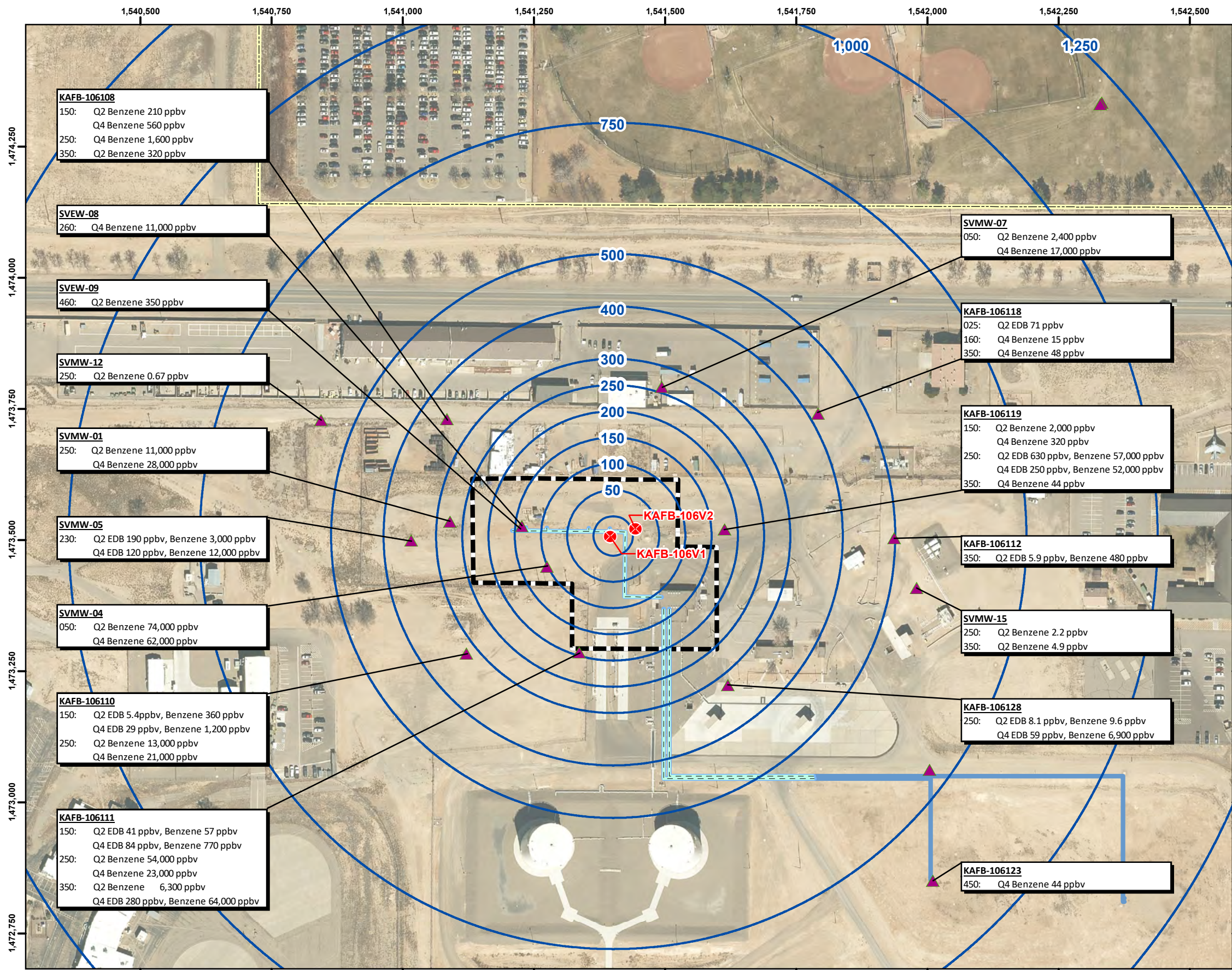
- Existing Soil Vapor Well
- Bioventing Observation Well
- Bioventing Air Injection Well
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- Bulk Fuels Facility (SWMU ST-106/SS-111)



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

FIGURE 1

BIOVENTING PILOT TEST AREA

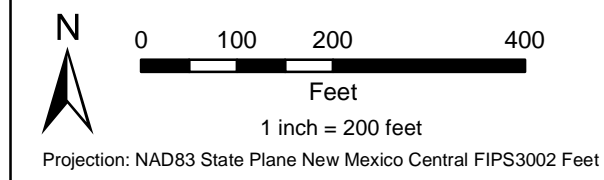
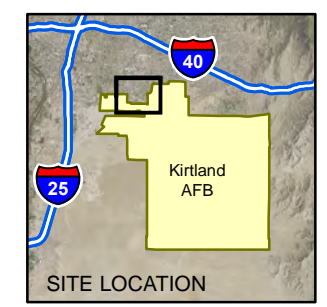


Legend

- ▲ Soil Vapor Monitoring Well
- ⊗ Bioventing Observation Well
- Former Buried Fuel Transfer Line
- Former Aboveground Fuel Transfer Line
- ▭ Bulk Fuels Facility (SWMU ST-106/SS-111)
- Radius (ft)

Well Identification
 Depth(s): Quarter, Analyte, Result ppbv

Notes:
 Aerial Imagery taken in May 2016 from New Mexico Mid-Region Council of Governments.
 EDB = ethylene dibromide
 ppbv = parts per billion by volume
 Q2 = 2020 calendar quarter 2 monitoring period
 Q4 = 2020 calendar quarter 4 monitoring period



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

FIGURE 2

SOIL VAPOR MONITORING ANOMALIES

Attachment 2

Tables

Table 1
KAFB-106V1-102 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 12:42	0.8/0.9	2	42.1	18,690	35.6	75.7	66	30.35	4.20	9.60	NM
10/8/2019 12:21	0.0/0.0	2	44.1	18,440	47.2	72.9	72	30.13	4.18	9.50	NM
10/9/2019 12:03	0.8/0.9	2	41	19,430	52.1	79.0	70	30.10	4.09	9.58	NM
10/15/2019 9:23	0.0/0.0	2	44.5	19,440	52.2	65.8	56	30.07	12.18	7.32	NM
10/22/2019 8:25	0.0/0.0	2	44.3	18,260	69.4	45.4	36	30.27	16.80	3.96	NM
10/31/2019 8:09	0.0/0.0	2	46.3	17,380	52.0	24.5	22	30.51	18.65	2.42	NM
11/5/2019 8:13	0.0/0.0	2	46.5	18,820	59.0	44.5	41	30.22	19.06	1.88	NM
1/6/2020 9:00	-0.6	2	-40.3	19,590	47.0	48.2	36	30.51	19.99	0.96	NM
1/7/2020 8:15	-0.3	2	-42.3	18,640	57.5	31.1	21	30.52	19.52	0.86	NM
1/8/2020 8:27	0.5	2	-39.1	19,340	49.5	37.6	22	30.15	19.54	0.84	NM
1/9/2020 8:13	0.1	2	-43.9	19,200	60.9	36.7	33	30.02	19.69	0.72	NM
1/10/2020 8:34	0.1	2	-37.7	19,120	65.3	39.5	34	29.95	19.02	0.74	NM
1/13/2020 8:49	0.0/0.0	2	42.3	18,110	60.1	34.7	32	30.11	19.73	0.50	NM
2/18/2020 11:43	0.5/0.6	2	41.5	18,690	60.5	56.6	52	30.10	19.05	0.60	NM
3/30/2020 10:20	0.0/0.0	2	43.3	19,600	50.0	61.4	52	30.03	19.41	0.56	NM
3/31/2020 7:55	-0.5/-0.60.5/0.6	2	41.5	19,030	60.0	42.3	36	30.19	19.59	0.52	NM
4/1/2020 7:59	0.0/0.0	2	43.0	19,900	66.6	57.7	52	29.77	19.28	0.66	NM
4/2/2020 7:58	-0.5/-0.5	2	43.7	20,610	54.7	53.0	49	29.82	19.07	0.68	NM
4/3/2020 8:04	0.0/0.0	2	43.7	20,180	59.0	50.3	47	29.88	19.07	0.66	NM
4/6/2020 8:12	0.0/0.0	2	43.0	19,500	60.5	56.6	50	29.92	18.93	0.70	NM
5/5/2020 7:47	-0.7/-0.7	2	103.8	19,440	45.4	57.9	56	30.16	19.91	0.48	NM
5/28/2020 7:56	0.0/0.0	2	44.2	20,590	52.8	77.4	68	29.93	19.29	0.48	NM
6/22/2020 7:50	0.0/0.0	2	43.2	21,050	50.7	79.5	72	29.87	19.04	0.48	NM
6/23/2020 7:33	0.0/0.0	2	43.3	20,580	53.4	78.5	71	29.97	19.21	0.48	NM
6/23/2020 7:37	0.0/0.0	2	43.3	21,000	53.4	78.5	71	29.97	19.29	0.48	NM
6/24/2020 7:43	-0.5/-0.6	2	47.4	20,380	53.2	74.6	65	29.91	19.27	0.48	NM
6/25/2020 7:32	0.0/0.0	2	64.0	20,460	45.3	77.9	68	29.87	19.11	0.48	NM
6/26/2020 7:45	-0.8/-0.8	2	51.7	20,500	49.4	77.8	70	29.89	19.32	0.46	NM
6/26/2020 7:47	-0.8/-0.8	2	51.5	20,520	49.4	77.8	70	29.89	19.35	0.46	NM
6/30/2020 8:01	-0.7/-0.8	2	47.9	20,790	60.5	71.7	69	29.86	18.69	0.64	NM
7/31/2020 8:18	0.0/0.0	2	44.9	20,960	53.1	79.9	73	30.03	19.37	0.52	NM

Table 1
KAFB-106V1-102 Respiration Monitoring

8/31/2020 7:37	0.0/0.0	2	63.4	20,690	55.4	70.2	66	29.80	19.06	0.62	NM
9/21/2020 8:00	0.0/0.0	2	49.8	20,230	64.3	65.1	58	30.07	19.21	0.54	NM
9/22/2020 7:46	0.0/0.0	2	43.7	19,370	56.6	66.0	57	30.06	19.34	0.50	NM
9/22/2020 7:49	0.0/0.0	2	44.0	19,350	57.0	66.1	57	30.06	19.36	0.52	NM
9/23/2020 8:05	0.0/0.0	2	49.0	20,460	78.0	65.3	63	30.01	19.15	0.52	NM
9/24/2020 7:45	0.0/0.0	2	44.2	20,400	64.0	62.6	59	30.01	19.13	0.58	NM
9/25/2020 7:47	0.0/0.0	2	46.3	14,990	72.0	59.3	56	29.95	19.43	0.44	NM
9/25/2020 7:51	0.0/0.0	2	46.0	15,030	72.0	59.0	56	29.95	19.50	0.42	NM
9/29/2020 8:22	-0.6/-0.6	2	45.1	18,720	75.1	51.3	45	30.30	19.09	0.60	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 2
KAFB-106V1-113 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 12:48	1.2/1.2	2	40.3	20,900	58.7	74.5	66	30.35	4.26	9.40	NM
10/8/2019 12:25	0.0/0.0	2	44	20,330	47.2	72.9	72	30.13	4.11	9.38	NM
10/9/2019 12:08	1.0/1.0	2	43.2	21,350	54.3	78.3	70	30.10	3.08	10.36	NM
10/15/2019 9:32	0.0/0.0	2	46.8	21,280	55.5	63.4	56	30.07	12.08	7.90	NM
10/22/2019 8:49	0.0/0.0	2	46.9	20,280	69.9	47.1	36	30.27	15.98	4.96	NM
10/31/2019 8:29	0.0/-0.5	2	45.2	18,710	52.0	24.6	22	30.51	17.77	3.58	NM
11/5/2019 8:29	0.0/0.0	2	45.3	20,760	61.1	45.3	41	30.22	18.30	2.90	NM
1/6/2020 9:04	-0.6	2	-43.5	21,370	46.7	50.1	36	30.51	19.62	1.41	NM
1/7/2020 8:20	-0.3	2	-44.5	20,490	51.8	35.2	21	30.52	19.22	1.26	NM
1/8/2020 8:30	0.4	2	-42.6	21,070	47.2	40.0	22	30.15	19.03	1.34	NM
1/9/2020 8:16	0.1	2	-48.2	20,700	60.4	37.5	33	30.02	18.51	1.68	NM
1/10/2020 8:37	0	2	-43.3	20,700	64.5	37.7	34	29.94	17.89	1.78	NM
1/13/2020 9:07	0.0/0.0	2	43.8	19,360	64.0	35.9	32	30.11	18.89	1.18	NM
2/18/2020 11:48	0.0/0.0	2	42.3	20,530	58.5	57.0	52	30.10	18.47	1.18	NM
3/30/2020 10:25	0.0/0.0	2	43.3	21,150	48.1	61.5	52	30.03	18.97	0.92	NM
3/31/2020 8:03	-.05/-0.06	2	44.5	20,380	64.4	42.4	36	30.19	19.11	0.96	NM
4/1/2020 8:01	0.0/0.0	2	42	21,830	69.5	57.6	52	29.77	18.55	1.24	NM
4/2/2020 8:01	-0.5/-0.5	2	44.3	22,420	57.7	56.6	49	29.82	18.35	1.80	NM
4/3/2020 8:08	0.0/0.0	2	41.6	22,130	63.0	50.2	47	29.88	18.17	1.26	NM
4/6/2020 8:26	0.0/0.0	2	42.9	21,530	51.7	61.7	50	29.92	18.15	1.26	NM
4/6/2020 8:32	NM	NM	NM	21,860	NM	NM	50	29.92	18.16	1.26	NM
5/5/2020 7:51	-0.7/-0.7	2	107.5	21,310	28.0	62.4	56	30.16	19.85	0.84	NM
5/25/2020 8:06	0.0/0.0	2	43	22,380	54.0	76.5	68	29.93	18.88	0.74	NM
5/28/2020 8:08	0.0/0.0	2	43.2	22,360	54.1	76.5	68	29.93	18.97	0.76	NM
6/22/2020 7:53	0.0/0.0	2	45.1	23,140	53.4	79.3	72	29.87	18.54	0.84	NM
6/22/2020 7:56	0.0/0.0	2	44.8	22,940	52.9	79.5	72	29.87	18.61	0.82	NM
6/23/2020 7:39	0.0/0.0	2	43.7	23,060	57.3	77.9	71	29.97	18.68	0.86	NM
6/23/2020 7:42	0.0/0.0	2	43.7	23,100	57.3	77.9	71	29.97	18.77	0.86	NM
6/24/2020 7:46	-0.6/-0.6	2	49.9	22,820	53.1	73.9	65	29.91	18.74	0.84	NM
6/25/2020 7:35	0.0/0.0	2	59.1	22,100	47.3	77.7	68	29.87	18.60	0.90	NM
6/26/2020 7:49	-0.8/-0.8	2	47.2	21,180	55.5	77.1	70	29.89	18.58	0.88	NM
6/30/2020 8:20	-0.8/-0.8	2	44.8	23,430	64.6	73.2	69	29.86	17.81	1.12	NM

Table 2
KAFB-106V1-113 Respiration Monitoring

7/31/2020 8:23	0.0/0.0	2	55.5	22,480	58.0	79.4	73	30.03	18.95	0.76	NM
8/31/2020 7:43	0.0/0.0	2	76.5	23,000	53.4	69.8	66	29.80	18.95	0.82	NM
9/21/2020 8:05	0.0/0.0	2	47.6	22,400	65.1	65.2	58	30.07	18.67	0.86	NM
9/22/2020 7:51	0.0/0.0	2	45.8	22,820	60.0	65.2	57	30.06	18.66	0.92	NM
9/23/2020 8:07	0.0/0.0	2	51.4	23,330	88.3	62.5	63	30.01	18.50	0.96	NM
9/24/2020 7:49	0.0/0.0	2	49.9	23,060	63.6	62.6	59	30.01	18.48	1.00	NM
9/25/2020 7:52	0.0/0.0	2	50.2	22,260	83.1	58.8	56	29.95	18.36	1.04	NM
9/29/2020 8:37	0.0/0.0	2	47.1	21,010	95.3	52.7	45	30.30	18.68	0.92	NM
9/29/2020 8:39	0.0/0.0	2	47.0	20,860	95.0	52.8	45	30.30	18.71	0.92	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 3
KAFB-106V1-160 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 12:51	-1.4/-1.4	2	45.0	21,840	58.2	73.8	66	30.35	0.18	10.94	NM
10/7/2019 12:51	-1.4/-1.4	2	45.0	21,840	58.2	73.8	66	30.35	0.18	10.94	NM
10/8/2019 12:28	0.7/0.7	2	44.5	21,040	47.2	72.9	72	30.13	0.25	10.72	NM
10/9/2019 12:11	2.4/2.3	2	42.7	21,710	55.6	77.8	71	29.77	2.69	10.68	NM
10/15/2019 9:52	-1.4/-1.3	2	44.8	21,150	62.6	62.3	56	30.07	19.16	1.82	NM
10/22/2019 9:00	-2.1/-2.1	2	46.5	19,130	70.0	47.7	36	30.27	19.92	0.46	NM
10/31/2019 8:45	-3.5/-3.5	2	47.6	10,170	55.5	25.4	22	30.51	20.34	0.42	NM
11/5/2019 8:41	-0.9/-0.9	2	45.6	17,560	66.2	46.4	41	30.22	20.00	0.28	NM
1/6/2020 9:08	-2.8	2	-46.6	13,270	43.0	52.0	36	30.10	20.81	0.30	NM
1/7/2020 8:24	-2.7	2	-46.6	12,480	51.0	39.5	21	30.52	19.98	0.34	NM
1/8/2020 8:34	1.3	2	-40.6	13,430	45.5	42.3	22	30.15	19.86	0.30	NM
1/9/2020 8:19	1.8	2	-42.7	14,030	62.5	37.9	33	30.02	19.86	0.30	NM
1/10/2020 8:40	2.0	2	-47.6	13,820	64.2	37.5	34	29.95	20.03	0.30	NM
1/13/2020 9:22	0.5/0.5	2	41.6	13,250	66.5	37.3	32	30.11	19.41	0.32	NM
2/18/2020 11:52	-0.7/-0.7	2	44.5	11,540	60.8	57.7	52	30.10	20.09	0.18	NM
3/30/2020 10:30	-0.6/-0.7	2	42.1	10,370	52.9	60.6	52	30.03	20.10	0.16	NM
3/31/2020 8:08	-1.9/-2.0	2	44.9	9,560	70.0	42.8	36	30.19	20.16	0.24	NM
4/1/2020 8:04	1.2/1.2	2	41.8	10,460	66.9	57.7	52	29.77	19.87	0.22	NM
4/2/2020 8:05	0.5/0.5	2	45.3	11,110	61.8	52.5	49	29.82	19.67	0.28	NM
4/3/2020 8:11	0.0/0.0	2	44.0	10,940	66.6	50.2	47	29.88	19.46	0.30	NM
4/6/2020 8:42	-0.5/-0.5	2	44.6	10,870	60.0	58.0	50	29.92	19.29	0.40	NM
5/5/2020 8:00	-2.3/-2.3	2	159.7	9,700	36.7	60.7	56	30.16	20.17	0.29	NM
5/28/2020 8:11	-1.4/-1.4	2	44.7	9,770	48.5	80.5	68	29.93	19.83	0.20	NM
6/22/2020 7:58	-0.5/-0.5	2	44.0	9,660	57.7	79.0	72	29.87	19.70	0.36	NM
6/23/2020 7:44	-0.8/-0.8	2	45.3	10,070	60.2	77.2	71	29.98	19.69	0.44	NM
6/24/2020 7:52	-0.9/-0.9	2	49.3	9,480	56.4	72.8	65	29.91	19.81	0.48	NM
6/24/2020 8:01	-0.9/-0.9	2	49.0	9,500	56.4	72.8	65	29.91	19.80	0.48	NM
6/25/2020 7:37	-0.6/-0.6	2	56.8	9,730	50.5	77.5	68	29.87	19.53	0.48	NM
6/26/2020 7:52	-1.3/-1.3	2	48.1	9,830	54.7	76.5	70	29.89	19.28	0.54	NM
6/30/2020 8:37	-1.1/-1.1	2	47.7	10,150	62.5	73.7	69	29.86	18.85	0.60	NM
7/31/2020 8:26	-1.5/-1.5	2	47.6	8,810	59.4	79.4	73	30.03	19.88	0.28	NM

Table 3
KAFB-106V1-160 Respiration Monitoring

8/31/2020 7:47	0.6/0.6	2	77.2	8,030	54.0	69.6	66	29.80	20.00	0.24	NM
9/21/2020 8:08	0.0/0.0	2	48.6	7,340	67.0	65.3	58	30.07	20.00	0.26	NM
9/22/2020 7:53	0.0/0.0	2	46.7	5,700	62.4	64.7	57	30.06	19.92	0.30	NM
9/23/2020 8:10	0.0/0.0	2	50.6	7,750	86.7	62.5	63	30.01	19.73	0.36	NM
9/24/2020 7:51	0.0/0.0	2	49.5	7,360	66.6	66.2	59	30.01	19.70	0.38	NM
9/25/2020 7:54	0.0/0.0	2	46.9	7,020	81.2	58.8	56	29.95	19.56	0.40	NM
9/29/2020 8:53	-2.1/-2.1	2	49.6	6,880	94.7	55.8	45	30.30	19.02	0.58	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 4
KAFB-106V1-217 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 12:57	-1.5/-1.5	2	53.9	25,170	61.7	71.6	66	30.35	0.12	12.20	NM
10/8/2019 12:33	0.6/0.6	2	48.2	24,420	55.3	75.1	72	30.13	0.35	11.72	NM
10/9/2019 12:15	2.3/2.3	2	48.1	25,530	57.0	77.4	71	29.77	1.66	11.38	NM
10/15/2019 10:20	-1.2/-1.3	2	48.6	23,160	65.1	62.2	59	30.07	12.96	5.02	NM
10/22/2019 9:20	-2.1/-2.2	2	50.6	9,800	65.6	49.9	44	30.25	18.77	1.42	NM
10/31/2019 9:12	-3.5/-3.5	2	54.2	996	60.7	27.4	27	30.53	20.65	0.18	NM
11/5/2019 9:09	-0.6/-0.6	2	47.6	6,420	69.1	49.3	45	30.20	19.84	0.64	NM
1/6/2020 9:12	-2.9	2	-47.9	20,596	44.7	53.3	36	30.10	19.63	0.88	NM
1/7/2020 8:27	-2.6	2	-44.4	5,700	49.0	40.3	21	30.52	20.10	0.34	NM
1/8/2020 8:37	1.2	2	-47.8	15,850	46.0	43.0	22	30.15	18.79	1.06	NM
1/9/2020 8:22	1.8	2	-44.2	18,670	66.1	38.8	33	30.02	18.79	1.08	NM
1/10/2020 8:43	1.9	2	-44.8	18,760	68.1	37.4	34	24.95	18.99	1.10	NM
1/13/2020 9:43	0.7/0.8	2	45.0	19,080	69.0	35.5	40	30.10	18.53	1.02	NM
2/18/2020 11:57	-0.6/-0.6	2	80.0	2,770	53.2	58.1	52	30.06	20.25	0.30	NM
3/30/2020 10:35	-0.6/-0.7	2	43.7	3,450	56.6	59.8	52	30.03	20.07	0.34	NM
3/31/2020 8:12	-1.9/-1.9	2	43.1	1,201	71.4	43.3	38	30.14	20.78	0.03	NM
4/1/2020 8:07	1.3/1.3	2	42.8	12,780	66.3	57.9	5	29.77	18.95	0.82	NM
4/2/2020 8:08	0.5/0.5	2	43.7	15,740	64.6	52.5	49	29.82	18.60	0.96	NM
4/3/2020 8:15	0.0/0.0	2	45.4	14,110	67.7	50.4	47	29.88	18.49	1.08	NM
4/6/2020 9:04	0.0/0.0	2	43.8	7,970	62.6	59.6	55	29.92	18.81	1.10	NM
4/6/2020 9:07	NM	NM	NM	13,470	NM	NM	55	29.92	18.71	1.10	NM
4/6/2020 9:10	0.0/0.0	2	44.2	18,310	62.8	60.0	55	29.92	18.37	1.20	NM
5/5/2020 8:05	-2.3/-2.4	2	144.0	17,500	41.3	60.2	56	30.09	19.26	0.62	NM
5/5/2020 8:08	-2.3/-2.3	2	138.0	17,400	42.0	60.3	56	30.09	19.30	0.60	NM
5/28/2020 8:15	-1.4/-1.6	2	46.8	18,430	46.4	79.4	70	29.98	19.03	0.58	NM
5/28/2020 8:18	-1.4/-1.4	2	46.4	19,330	46.4	79.4	70	29.98	19.01	0.62	NM
6/22/2020 8:02	-0.5/-0.6	2	46.3	22,600	51.2	78.8	73	29.84	18.36	1.04	NM
6/22/2020 8:05	0.0/0.0	2	46.5	22,580	51.4	78.8	73	29.84	18.31	1.02	NM
6/23/2020 7:47	-0.7/-0.9	2	44.2	18,430	57.8	76.7	72	29.97	18.56	1.00	NM
6/23/2020 7:52	-0.7/-0.7	2	44.2	20,550	57.8	76.7	72	29.97	18.52	1.04	NM
6/24/2020 8:02	-0.8/-0.8	2	58.5	18,130	58.0	71.6	66	29.91	18.40	1.12	NM
6/25/2020 7:41	0.0/-0.6	2	65.0	21,760	47.1	76.9	68	29.87	18.01	1.26	NM
6/26/2020 7:55	-1.1/-1.3	2	48.9	21,000	55.9	76.6	70	29.89	18.12	1.24	NM
6/26/2020 7:58	-1.1/-1.1	2	49.0	20,930	56.0	76.6	70	29.89	18.10	1.24	NM
6/30/2020 9:01	-1.0/-1.1	2	51.0	21,280	57.7	74.0	73	29.81	17.89	1.36	NM
7/31/2020 8:29	-1.5/-1.6	2	55.3	18,580	57.6	79.2	74	30.09	18.90	0.60	NM

Table 4
KAFB-106V1-217 Respiration Monitoring

8/31/2020 7:50	0.0/0.0	2	77.5	21,860	54.0	69.3	66	29.81	18.62	1.00	NM
9/21/2020 8:11	0.0/0.0	2	46.3	20,080	66.6	65.0	59	30.06	18.64	1.02	NM
9/22/2020 7:56	-0.5/-0.5	2	66.6	20,050	60.4	63.9	58	30.06	18.51	1.18	NM
9/23/2020 8:13	0.0/0.0	2	51.7	21,520	81.5	64.0	63	30.01	18.19	1.30	NM
9/24/2020 7:55	0.0/0.0	2	46.7	21,300	72.8	62.2	59	30.01	18.15	1.36	NM
9/25/2020 7:57	0.0/0.0	2	47.6	20,950	82.3	58.9	56	29.95	18.14	1.40	NM
9/29/2020 9:12	-2.4/-2.4	2	49.2	15,490	82.6	57.5	51	30.30	18.47	1.26	NM
9/29/2020 9:14	-2.2/-2.2	2	49.0	15,510	83.0	57.5	51	30.30	18.51	1.26	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 5
KAFB-106V1-252 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 13:00	-1.3/-1.3	2	44.0	21,540	63.0	73.3	66	30.35	2.63	9.20	NM
10/8/2019 12:35	0.8/0.7	2	50.8	21,690	54.0	78.7	72	30.13	3.11	8.88	NM
10/9/2019 12:19	2.5/2.5	2	44.9	22,430	57.3	77.0	71	29.77	10.25	7.80	NM
10/15/2019 10:35	-1.2/-1.1	2	47.6	22,350	69.0	62.9	59	30.07	19.60	0.14	NM
10/22/2019 9:33	-2.0/-2.0	2	47.5	19,870	71.4	51.1	44	30.25	20.07	0.00	NM
10/31/2019 9:28	-3.3/-3.3	2	51.4	15,290	64.4	28.8	27	30.53	20.28	0.00	NM
11/5/2019 9:23	-0.9/-0.9	2	47.7	18,990	70.8	51.0	46	30.20	20.04	0.00	NM
1/6/2020 9:16	-2.8	2	-47.9	17,790	42.9	55.8	36	30.51	20.91	0.04	NM
1/7/2020 8:31	-2.8	2	-46.5	15,590	51.2	41.3	21	30.52	20.11	0.18	NM
1/8/2020 8:41	1.2	2	-42.1	16,010	48.0	44.0	22	30.15	19.90	0.16	NM
1/9/2020 8:25	1.9	2	-43.3	16,830	64.7	39.7	33	30.02	19.97	0.16	NM
1/10/2020 8:47	2	2	-44.0	15,870	70.1	37.2	34	29.95	20.29	0.18	NM
1/13/2020 9:58	0.0/0.0	2	43.2	16,380	71.2	41.1	40	30.10	19.86	0.14	NM
2/18/2020 12:02	-0.5/0.0	2	78.0	17,950	50.0	61.1	52	30.06	20.15	0.00	NM
3/30/2020 10:40	-0.7/-0.7	2	44.2	16,620	58.0	59.0	52	30.03	20.17	0.00	NM
3/31/2020 8:18	-1.9/-2.0	2	45.8	14,640	72.0	44.4	38	30.14	20.19	0.00	NM
4/1/2020 8:12	1.2/1.2	2	42.1	17,860	66.6	58.0	53	29.77	19.94	0.00	NM
4/2/2020 8:12	0.5/0.5	2	45.0	13,180	67.0	52.6	49	29.82	19.89	0.04	NM
4/3/2020 8:18	0.0/0.0	2	43.9	17,250	70.2	50.8	47	29.88	19.72	0.04	NM
4/6/2020 9:22	0.0/0.0	2	43.3	17,820	62.6	60.5	55	29.92	19.59	0.10	NM
5/5/2020 8:09	-2.3/-2.3	2	159.2	16,260	39.0	59.7	56	30.09	20.21	0.00	NM
5/28/2020 8:20	-1.4/-1.4	2	44.2	18,930	48.2	80.5	70	29.98	19.91	0.00	NM
6/22/2020 8:08	-0.5/-0.6	2	45.4	19,480	55.6	78.6	73	29.84	19.81	0.00	NM
6/23/2020 7:53	-1.2/-1.2	2	47.7	19,510	61.7	76.4	72	29.97	19.80	0.00	NM
6/24/2020 8:05	-0.9/-0.9	2	46.8	19,210	64.2	74.2	66	29.91	19.99	0.00	NM
6/24/2020 8:17	-0.9/-0.9	2	46.9	19,200	64.0	74.0	66	29.91	20.03	0.00	NM
6/25/2020 7:44	-0.6/-0.6	2	57.2	19,500	52.4	76.5	68	29.87	19.73	0.06	NM
6/26/2020 8:00	-1.3/-1.3	2	51.0	18,780	54.5	76.5	70	29.89	19.65	0.06	NM
6/30/2020 9:17	-1.0/-1.0	2	48.9	20,160	59.3	74.4	73	29.81	19.39	0.20	NM
7/31/2020 8:33	-1.5/-1.5	2	64.6	19,300	51.9	79.0	74	30.09	20.00	0.00	NM
8/31/2020 7:54	0.7/0.7	2	68.0	17,760	58.1	68.9	66	29.81	20.09	0.00	NM

Table 5
KAFB-106V1-252 Respiration Monitoring

9/21/2020 8:15	0.0/0.0	2	47.4	16,810	70.0	65.7	59	30.06	20.08	0.00	NM
9/22/2020 8:00	0.0/0.0	2	47.2	17,110	67.8	63.8	58	30.06	20.06	0.00	NM
9/23/2020 8:17	0.0/0.0	2	50.2	17,810	80.3	64.7	63	30.01	19.91	0.00	NM
9/24/2020 8:00	0.0/0.0	2	45.5	16,940	71.4	62.1	59	30.01	19.89	0.06	NM
9/25/2020 8:01	0.0/0.0	2	47.6	14,300	82.8	59.0	56	29.95	20.02	0.04	NM
9/25/2020 8:04	0.0/0.0	2	48.0	13,970	83.0	59.0	56	29.95	20.01	0.04	NM
9/29/2020 9:28	-2.4/-2.4	2	49.7	14,560	81.4	58.9	51	30.30	19.71	0.18	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 6
KAFB-106V1-263 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 13:05	-1.3/-1.3	2	44.4	22,910	63.6	72.9	66	30.35	3.35	8.38	NM
10/8/2019 12:39	0.6/0.6	2	50.7	22,220	54.0	78.2	72	30.13	3.17	8.36	NM
10/9/2019 12:23	2.5/2.4	2	44.0	22,990	54.7	76.7	71	29.77	5.44	8.36	NM
10/15/2019 10:51	-1.1/-1.0	2	45.3	23,150	70.8	63.8	59	30.07	18.82	1.10	NM
10/22/2019 9:47	-2.0/-2.0	2	47.2	20,650	71.0	54.0	44	30.25	19.96	0.02	NM
10/31/2019 9:50	-3.2/-3.3	2	47.5	16,670	68.0	30.5	30	30.50	20.28	0.00	NM
11/5/2019 9:43	-0.7/-0.7	2	47.1	21,470	70.7	53.5	49	30.18	19.99	0.00	NM
1/6/2020 9:20	-2.9	2	-52.9	19,040	41.2	56.8	36	30.51	20.97	0.02	NM
1/7/2020 8:35	-2.8	2	-44.3	16,690	50.1	43.5	21	30.52	20.45	0.02	NM
1/8/2020 8:44	1.3	2	-45.3	17,210	47.3	45.3	22	30.15	20.00	0.10	NM
1/9/2020 8:28	1.9	2	-40.7	18,190	68.3	40.9	33	30.02	20.03	0.10	NM
1/10/2020 8:51	1.9	2	-43.0	16,960	70.1	37.5	34	29.95	20.23	0.16	NM
1/13/2020 10:15	0.0/0.0	2	43.2	17,600	71.1	42.5	40	30.10	19.90	0.04	NM
2/18/2020 12:17	0.0/0.0	2	76.4	19,420	55.5	60.8	52	30.06	20.10	0.00	NM
3/30/2020 10:45	-0.7/-0.7	2	42.3	18,500	64.5	58.5	52	30.03	20.12	0.00	NM
3/31/2020 8:25	-2.0/-2.0	2	46.7	15,630	70.2	45.1	38	30.14	20.29	0.00	NM
4/1/2020 8:15	1.2/1.2	2	41.7	19,160	68.3	58.3	53	29.77	20.02	0.00	NM
4/2/2020 8:15	0.5/0.5	2	45.4	16,210	66.6	52.7	49	29.82	19.78	0.00	NM
4/3/2020 8:21	0.0/0.0	2	45.3	18,370	68.6	51.3	47	29.88	19.69	0.02	NM
4/6/2020 9:39	0.0/0.0	2	43.8	20,250	65.3	61.4	55	29.92	19.65	0.04	NM
5/5/2020 8:15	-2.3/-2.3	2	148.0	18,730	43.1	59.8	56	30.09	20.22	0.00	NM
5/28/2020 8:25	-1.4/-1.4	2	47.8	20,760	46.5	81.0	70	29.98	19.92	0.00	NM
6/22/2020 8:11	-0.6/-0.6	2	46.0	21,420	53.7	78.5	73	29.84	19.80	0.00	NM
6/23/2020 7:57	-1.2/-1.3	2	44.6	21,360	60.9	76.4	72	29.97	19.90	0.00	NM
6/23/2020 7:59	-1.2/-1.2	2	44.8	21,740	60.9	76.4	72	29.97	19.97	0.00	NM
6/24/2020 8:18	-0.8/-0.8	2	45.3	19,760	66.9	71.3	66	29.91	19.96	0.00	NM
6/25/2020 7:47	-0.6/-0.6	2	67.8	20,820	50.2	76.1	68	29.87	19.84	0.00	NM
6/26/2020 8:03	-1.3/-1.3	2	48.4	21,360	56.1	76.5	70	29.89	19.68	0.00	NM
6/30/2020 9:32	-1.0/-1.0	2	51.0	21,750	56.7	75.0	73	29.81	19.40	0.06	NM
7/31/2020 8:35	-1.5/-1.5	2	62.8	21,350	51.6	71.9	74	30.09	20.03	0.00	NM
8/31/2020 7:58	0.7/0.7	2	71.6	20,180	58.4	69.0	66	29.81	20.07	0.00	NM

Table 6
KAFB-106V1-263 Respiration Monitoring

9/21/2020 8:18	0.0/0.0	2	47.4	18,940	70.6	65.8	59	30.06	20.07	0.00	NM
9/22/2020 8:03	0.0/0.0	2	49.0	19,460	74.6	63.4	58	30.06	20.05	0.00	NM
9/23/2020 8:20	0.0/0.0	2	52.9	19,620	78.0	65.3	63	30.01	19.99	0.00	NM
9/24/2020 8:02	0.0/0.0	2	48.8	19,330	69.8	62.1	59	30.01	19.97	0.00	NM
9/25/2020 8:06	0.0/0.0	2	50.8	19,030	84.5	59.2	56	29.95	19.94	0.02	NM
9/29/2020 9:41	-2.4/-2.4	2	50.4	12,940	77.5	60.1	51	30.30	20.08	0.04	NM
9/29/2020 9:43	-2.4/-2.4	2	50.2	13,050	78.0	60.0	51	30.30	20.05	0.04	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 7
KAFB-106V2-102 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 13:30	0.0/0.0	2	41.3	27,780	61.4	74.2	66	30.35	1.98	10.80	NM
10/8/2019 13:00	0.0/0.0	2	45.9	28,800	49.6	80.0	72	30.13	2.09	10.82	NM
10/9/2019 12:32	0.6/0.5	2	45.7	27,710	52.4	78.0	73	29.72	2.30	10.50	NM
10/15/2019 11:19	0.0/0.0	2	47.7	28,190	69.9	66.3	64	30.03	5.34	9.80	NM
10/22/2019 10:23	0.0/0.0	2	46.1	26,110	52.4	60.0	50	30.23	12.98	6.26	NM
10/31/2019 10:18	0.0/0.0	2	46.2	22,060	62.0	32.5	32	30.47	16.74	4.04	NM
11/5/2019 10:14	0.0/0.0	2	47.8	27,590	63.4	57.9	53	30.19	17.31	2.96	NM
1/6/2020 9:27	-0.7	2	-48.3	24,800	35.6	56.5	36	30.51	19.57	1.42	NM
1/7/2020 8:45	-0.5	2	-38.7	22,980	41.9	45.6	24	30.52	19.17	1.36	NM
1/8/2020 8:53	0.4	2	-47.5	24,580	44.5	44.9	27	30.15	19.13	1.46	NM
1/9/2020 8:35	0.1	2	-43.0	24,640	60.9	42.7	35	30.02	18.95	1.62	NM
1/10/2020 9:03	0.0	2	-42.9	22,610	66.6	36.1	34	29.95	18.82	1.76	NM
1/13/2020 10:42	0.0/0.0	2	44.8	23,520	59.7	44.5	43	30.09	19.02	1.16	NM
2/18/2020 12:28	0.0/0.0	2	92.2	25,880	43.7	60.9	54	30.08	17.70	1.10	NM
3/30/2020 11:00	0.0/0.0	2	44.6	26,420	57.5	58.2	54	30.02	19.15	0.74	NM
3/31/2020 8:33	-0.5/-0.5	2	44.0	24,260	66.6	47.1	44	30.18	19.29	0.78	NM
4/1/2020 8:26	0.0/0.0	2	42.5	28,170	66.6	59.3	55	29.81	18.83	0.80	NM
4/2/2020 8:25	0.0/0.0	2	45.6	28,710	63.8	53.9	52	29.82	18.55	1.00	NM
4/3/2020 8:31	0.0/0.0	2	42.0	27,960	64.0	53.2	51	29.99	18.49	1.02	NM
4/6/2020 10:05	0.0/0.0	2	42.2	28,260	60.1	64.0	61	29.88	18.41	0.92	NM
5/5/2020 8:25	-0.7/-0.7	2	162.1	26,980	39.3	60.6	57	30.09	19.35	0.52	NM
5/5/2020 8:27	-0.6/-0.6	2	168.4	26,920	39.7	60.8	57	30.09	19.37	0.48	NM
5/28/2020 8:35	0.0/0.0	2	43.4	29,570	43.1	82.0	71	29.98	18.98	0.36	NM
5/28/2020 8:37	0.0/0.0	2	43.4	29,600	43.1	82.0	71	29.98	18.96	0.38	NM
6/22/2020 8:26	0.0/0.0	2	43.7	30,540	49.0	79.5	74	29.84	18.81	0.38	NM
6/23/2020 8:05	0.0/0.0	2	43.5	30,400	55.9	76.0	73	29.90	19.27	0.38	NM
6/23/2020 8:10	0.0/0.0	2	43.5	30,730	55.9	76.0	73	29.90	19.31	0.36	NM
6/24/2020 8:28	-0.5/-0.5	2	45.9	29,620	64.3	73.6	67	29.90	19.04	0.38	NM
6/25/2020 7:56	0.0/0.0	2	48.9	29,760	52.6	76.1	69	29.87	18.93	0.40	NM
6/26/2020 8:11	-0.7/-0.7	2	48.8	28,940	50.6	77.8	71	29.87	19.00	0.42	NM
6/26/2020 8:13	-0.7/-0.7	2	49.0	29,000	50.6	77.8	71	29.87	18.99	0.42	NM
6/30/2020 9:47	0.0/0.0	2	63.8	31,000	48.8	76.5	75	30.08	18.61	0.62	NM

Table 7
KAFB-106V2-102 Respiration Monitoring

7/31/2020 8:49	0.0/0.0	2	62.8	30,980	48.4	80.0	74	30.09	18.92	0.36	NM
8/31/2020 8:10	0.0/0.0	2	55.3	30,360	62.0	68.8	65	29.81	18.81	0.54	NM
9/21/2020 8:25	0.0/0.0	2	50.4	25,830	67.4	67.1	59	30.06	19.06	0.44	NM
9/22/2020 8:14	0.0/0.0	2	47.4	28,330	72.2	64.1	59	30.06	18.76	0.54	NM
9/23/2020 8:30	0.0/0.0	2	47.1	30,600	80.5	66.6	65	30.03	18.65	0.48	NM
9/24/2020 8:10	0.0/0.0	2	48.6	23,700	68.1	62.6	60	30.00	19.50	0.48	NM
9/24/2020 8:16	0.0/0.0	2	49.0	23,700	68.0	62.5	60	30.00	19.43	0.48	NM
9/25/2020 8:18	0.0/0.0	2	50.2	23,950	89.3	60.2	58	29.96	19.18	0.46	NM
9/29/2020 10:04	0.0/0.0	2	50.9	28,560	75.0	61.1	55	30.26	18.64	0.58	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 8
KAFB-106V2-117 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 13:33	0.0/0.0	2	42.5	29,440	58.4	74.8	66	30.35	1.97	10.54	NM
10/8/2019 13:05	0.5/0.5	2	49.1	31,350	48.4	80.1	72	30.13	1.49	10.74	NM
10/9/2019 12:37	0.0/0.0	2	47.2	30,530	50.0	78.9	73	29.72	5.58	8.64	NM
10/15/2019 11:45	0.0/0.0	2	49.4	31,250	66.0	67.5	64	30.03	4.01	9.90	NM
10/22/2019 10:37	0.0/0.0	2	48.5	27,990	55.3	59.0	50	30.23	11.01	7.32	NM
10/31/2019 10:35	0.0/0.0	2	47.4	23,500	58.2	33.0	32	30.47	15.05	5.52	NM
11/5/2019 10:29	0.0/0.0	2	48.3	29,640	65.1	59.1	53	30.19	14.21	5.16	NM
1/6/2020 9:29	-0.8	2	-44.4	26,440	41.3	57.5	36	30.51	18.59	2.54	NM
1/7/2020 8:47	-0.6	2	-45.8	24,670	45.9	42.0	24	30.52	18.19	2.36	NM
1/8/2020 8:56	0.4	2	-44.5	26,770	49.6	42.8	27	30.15	14.55	4.90	NM
1/9/2020 8:38	0.1	2	-45.3	26,160	59.4	42.7	35	30.02	14.70	5.10	NM
1/10/2020 9:08	0	2	-41.1	23,680	65.7	35.6	34	29.95	13.81	5.80	NM
1/13/2020 10:59	0.0/0.0	2	46.1	26,200	56.7	45.3	43	30.09	13.00	6.74	NM
2/18/2020 12:31	0.0/0.0	2	86.6	28,280	45.5	60.2	54	30.08	15.92	3.64	NM
3/30/2020 11:05	0.0/0.0	2	45.5	29,720	59.3	57.8	54	31.02	15.71	4.86	NM
3/31/2020 8:38	-0.5/-0.5	2	45.8	27,560	65.3	48.4	44	31.08	17.71	2.62	NM
4/1/2020 8:28	0.0/0.0	2	46.1	30,950	63.3	59.9	55	29.81	13.59	6.16	NM
4/2/2020 8:27	0.0/0.0	2	47.7	31,280	60.6	54.9	52	29.82	13.48	6.14	NM
4/3/2020 8:33	0.0/0.0	2	45.7	31,740	65.0	54.4	51	29.99	14.78	6.08	NM
4/3/2020 14:11	0.0/0.0	2	46.1	30,880	69.1	68.2	67	29.82	14.85	6.10	NM
4/6/2020 10:17	0.0/0.0	2	47.0	30,850	50.2	68.9	61	29.88	15.14	5.16	NM
4/6/2020 10:21	0.0/0.0	2	47.5	31,700	50.7	71.0	61	29.88	15.37	4.84	NM
5/5/2020 8:31	-0.6/-0.7	2	144.6	30,280	43.7	61.5	57	30.09	18.28	1.70	NM
5/5/2020 8:35	-0.6/-0.6	2	155.0	29,960	43.5	61.5	57	30.09	18.32	1.68	NM
5/28/2020 8:40	0.0/0.0	2	47.3	32,800	41.1	83.0	71	29.98	18.08	1.66	NM
5/28/2020 8:42	0.0/0.0	2	47.3	32,760	41.1	83.0	71	29.98	18.10	1.64	NM
6/22/2020 8:28	0.0/0.0	2	45.8	32,760	48.8	80.7	74	29.84	17.22	2.72	NM
6/22/2020 8:30	0.0/0.0	2	45.8	32,760	48.8	80.7	74	29.84	17.49	2.26	NM
6/23/2020 8:11	0.0/-0.5	2	44.6	32,760	56.0	77.5	73	29.90	17.63	2.32	NM
6/23/2020 8:14	0.0/0.0	2	44.8	32,760	56.0	77.5	73	29.90	17.61	2.34	NM
6/24/2020 8:31	-0.5/-0.6	2	47.2	32,760	62.3	74.9	67	29.90	16.59	3.36	NM
6/25/2020 7:59	0.0/0.0	2	49.9	32,760	53.9	76.3	69	29.87	16.02	4.14	NM
6/26/2020 8:15	-0.7/-0.7	2	50.2	32,760	48.8	78.3	71	29.87	17.00	2.56	NM
6/26/2020 8:17	-0.7/-0.7	2	50.2	32,760	49.0	78.1	71	29.87	17.10	2.54	NM
6/30/2020 10:02	0.0/0.0	2	68.5	32,760	44.0	79.4	75	30.08	16.07	4.02	NM

Table 8
KAFB-106V2-117 Respiration Monitoring

7/31/2020 8:52	-0.5/-0.6	2	52.0	32,800	52.3	80.3	74	30.09	17.83	1.70	NM
7/31/2020 8:55	-0.5/-0.6	2	52.0	32,760	52.3	80.3	74	30.09	17.83	1.70	NM
8/31/2020 8:12	0.0/0.0	2	74.6	32,760	58.1	68.9	65	29.81	14.15	5.28	NM
8/31/2020 8:14	0.0/0.0	2	74.0	32,760	58.1	68.9	65	29.81	14.20	5.30	NM
9/21/2020 8:33	0.0/0.0	2	50.5	32,760	71.8	67.5	59	30.06	15.28	4.02	NM
9/22/2020 8:17	0.0/0.0	2	53.1	32,760	76.8	64.7	59	30.06	15.32	4.26	NM
9/22/2020 8:19	0.0/0.0	2	53.0	32,760	77.0	65.0	59	30.06	15.30	4.26	NM
9/23/2020 8:33	0.0/0.0	2	49.6	32,760	78.0	67.3	65	30.03	14.88	4.48	NM
9/24/2020 8:18	0.0/0.0	2	46.3	32,760	74.2	63.9	60	30.00	16.40	3.76	NM
9/24/2020 8:20	0.0/0.0	2	46.0	32,760	74.0	64.0	60	30.00	16.43	3.80	NM
9/25/2020 8:19	0.0/0.0	2	51.1	28,960	91.3	60.0	58	29.96	15.90	4.04	NM
9/25/2020 8:23	0.0/0.0	2	51.0	29,570	91.0	60.0	58	29.96	15.92	3.98	NM
9/29/2020 10:28	0.0/0.0	2	51.3	31,500	67.8	60.4	55	30.26	18.08	1.34	NM
9/29/2020 10:30	0.0/0.0	2	51.0	31,470	69.0	60.7	55	30.26	18.06	1.34	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 9
KAFB-106V2-160 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 13:37	-1.6/-1.8	2	43.4	11,120	59.0	74.3	66	30.35	13.97	8.40	NM
10/8/2019 13:08	1.1/1.1	2	46.3	11,080	49.2	80.3	72	30.13	19.23	2.32	NM
10/9/2019 12:44	2.6/2.6	2	42.8	9,390	48.7	79.9	73	29.72	19.94	0.48	NM
10/15/2019 12:08	-0.5/-0.5	2	47.2	4,990	65.0	69.4	67	30.04	20.12	0.04	NM
10/22/2019 10:55	-2.0/-1.9	2	46.9	3,470	57.0	59.6	55	30.21	20.40	0.08	NM
10/31/2019 11:00	-2.4/-2.4	2	48.9	2,340	58.2	34.0	35	30.44	20.56	0.16	NM
11/5/2019 10:50	0.0/0.0	2	47.1	2,400	64.4	59.9	57	30.14	20.33	0.10	NM
1/6/2020 9:33	-2.7	2	-44.0	960	47.3	47.7	36	30.51	20.84	0.12	NM
1/7/2020 8:51	-2.7	2	-41.2	1,050	57.1	40.2	24	30.52	20.51	0.26	NM
1/8/2020 8:59	1.3	2	-45.0	1,136	51.8	42.0	27	30.15	20.80	0.26	NM
1/9/2020 8:41	1.9	2	-42.5	1,313	61.2	42.9	35	30.02	20.80	0.26	NM
1/10/2020 9:11	1.9	2	-42.7	1,448	66.3	35.0	34	29.95	20.31	0.26	NM
1/13/2020 11:20	0.5/0.5	2	43.4	1,600	63.1	46.8	43	30.09	19.73	0.52	NM
2/18/2020 12:037	-0.6/-0.6	2	77.4	1,204	48.0	60.7	54	30.08	20.51	0.14	NM
3/30/2020 11:07	-0.6/-0.6	2	43.3	661	64.7	67.6	54	30.02	20.44	0.08	NM
3/31/2020 8:40	-1.5/-1.4	2	44.1	1,231	63.3	49.8	44	30.18	20.39	0.20	NM
4/1/2020 8:32	1.5/1.5	2	41.8	994	64.0	61.0	55	29.81	20.16	0.22	NM
4/2/2020 8:31	1.0/1.0	2	41.3	1,166	68.3	56.3	52	29.82	20.06	0.22	NM
4/3/2020 8:37	0.0/0.0	2	43.0	1,264	63.8	57.2	51	29.99	19.88	0.24	NM
4/6/2020 10:39	-0.5/-0.6	2	43.7	1,213	42.6	73.1	61	29.88	19.73	0.34	NM
5/5/2020 8:37	-1.9/-1.9	2	151.4	858	40.4	62.6	57	30.09	20.33	0.24	NM
5/28/2020 8:44	-1.5/-1.4	2	45.2	897	42.8	81.0	71	29.98	20.26	0.14	NM
6/22/2020 8:35	-0.5/-0.5	2	44.4	1,079	42.4	83.0	74	29.84	20.13	0.16	NM
6/23/2020 8:15	-0.9/-0.9	2	45.1	980	52.6	77.6	73	29.90	20.20	0.24	NM
6/23/2020 8:17	-0.9/-0.9	2	45.0	976	52.6	77.6	73	29.90	20.19	0.26	NM
6/24/2020 8:33	-0.5/-0.5	2	53.0	964	56.1	75.6	67	29.90	20.10	0.26	NM
6/25/2020 8:01	0.0/0.0	2	51.3	1,021	50.6	76.4	69	29.87	19.96	0.32	NM
6/26/2020 8:19	-0.9/-0.8	2	59.1	1,066	44.7	79.5	71	29.87	19.81	0.34	NM
6/30/2020 10:31	0.0/0.0	2	54.0	1,197	40.5	81.9	75	30.08	19.47	0.40	NM
7/31/2020 8:56	-1.4/-1.3	2	50.5	815	49.2	80.7	74	30.09	20.39	0.10	NM
8/31/2020 8:16	0.7/0.7	2	66.8	703	61.7	69.2	65	29.81	20.32	0.16	NM

Table 9
KAFB-106V2-160 Respiration Monitoring

9/21/2020 8:36	0.0/0.0	2	45.3	689	73.0	68.0	59	30.06	20.25	0.14	NM
9/22/2020 8:20	0.0/0.0	2	47.0	844	75.3	65.2	59	30.06	20.23	0.20	NM
9/23/2020 8:36	0.0/0.0	2	48.8	779	76.2	60.6	65	30.03	20.01	0.24	NM
9/24/2020 8:22	0.0/0.0	2	46.4	978	74.7	64.1	60	30.00	20.00	0.24	NM
9/25/2020 8:24	0.0/0.0	2	46.6	934	91.2	62.2	58	29.96	19.94	0.28	NM
9/29/2020 10:49	-1.9/-1.9	2	50.1	819	59.2	70.2	55	30.26	19.38	0.46	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 10
KAFB-106V2-217 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 13:41	-1.3/-1.4	2	44.5	22,860	62.2	73.6	66	30.35	0.45	12.46	NM
10/8/2019 13:12	0.9/0.9	2	45.7	23,610	55.6	80.2	72	30.13	0.43	12.56	NM
10/9/2019 12:47	2.3/2.3	2	42.1	22,730	55.1	80.7	73	29.72	0.71	12.20	NM
10/15/2019 12:22	-0.8/-0.8	2	48.0	23,450	64.4	71.2	67	30.04	7.00	10.12	NM
10/22/2019 11:08	-2.2/-2.2	2	47.7	21,890	60.4	59.1	55	30.21	12.17	6.80	NM
10/31/2019 11:13	-3.3/-3.4	2	49.6	19,600	64.0	35.0	35	30.44	16.11	4.18	NM
11/5/2019 11:03	-0.5/-0.5	2	48.8	22,840	66.3	60.5	57	30.14	17.33	2.42	NM
1/6/2020 9:37	-3	2	-48.3	20,910	52.9	43.8	36	30.51	19.31	0.96	NM
1/7/2020 8:54	-2.8	2	-45.0	20,170	57.0	38.3	24	30.52	18.89	1.15	NM
1/8/2020 9:02	1.3	2	-40.9	20,960	56.0	41.5	27	30.15	19.11	1.18	NM
1/9/2020 8:44	1.7	2	-40.6	21,010	65.7	43.6	35	30.02	19.19	1.08	NM
1/10/2020 9:14	1.8	2	-45.7	19,270	68.5	34.6	34	29.95	18.75	1.10	NM
1/13/2020 11:30	0.0/0.0	2	46.9	20,640	65.4	48.5	46	30.08	18.47	0.98	NM
2/18/2020 12:39	-0.9/-0.9	2	91.7	20,770	43.3	61.9	53	30.07	18.82	0.72	NM
3/30/2020 11:11	-0.7/-0.7	2	45.6	20,850	63.8	57.1	54	29.99	18.85	0.80	NM
3/31/2020 8:45	-1.9/-1.9	2	46.6	20,080	63.3	50.6	45	31.17	18.86	0.98	NM
4/1/2020 8:36	1.5/1.5	2	43.9	22,130	61.9	62.3	56	29.80	18.61	1.00	NM
4/2/2020 8:35	1.1/1.1	2	43.0	22,810	68.5	57.8	53	29.82	18.49	1.00	NM
4/3/2020 8:42	0.0/0.0	2	45.5	21,850	65.8	58.0	51	29.99	18.31	1.00	NM
4/6/2020 10:51	-0.8/-0.8	2	46.9	22,800	39.3	74.7	64	29.89	18.28	1.02	NM
5/5/2020 8:40	-2.1/-2.1	2	166.0	21,000	36.2	63.2	58	30.16	18.84	0.88	NM
5/5/2020 8:42	-2.1/-2.1	2	167.1	20,900	36.2	63.2	58	30.16	18.85	0.86	NM
5/25/2020 8:47	-1.7/-1.7	2	47.3	22,470	43.8	80.2	72	29.98	18.63	0.82	NM
6/22/2020 8:40	0.0/0.0	2	44.8	23,500	43.0	83.8	76	29.86	18.14	1.14	NM
6/22/2020 8:43	0.0/0.0	2	44.8	23,550	43.0	83.8	76	29.86	18.17	1.12	NM
6/23/2020 8:20	-1.3/-1.4	2	46.2	23,220	54.3	77.6	74	29.96	18.15	1.20	NM
6/24/2020 8:36	0.0/0.0	2	52.4	22,920	56.1	76.3	68	29.90	18.12	1.26	NM
6/25/2020 8:03	0.0/0.0	2	52.0	23,050	52.5	76.4	72	29.85	18.00	1.34	NM
6/26/2020 8:22	-0.9/-0.8	2	50.6	23,510	46.0	80.2	73	29.89	17.86	1.32	NM
6/30/2020 10:43	0.0/0.0	2	62.8	24,250	40.5	82.0	77	29.82	17.57	1.50	NM
7/31/2020 8:59	-1.6/-1.6	2	51.8	23,720	51.4	80.8	75	30.05	18.22	1.30	NM

Table 10
KAFB-106V2-217 Respiration Monitoring

8/31/2020 8:20	0.5/0.5	2	79.1	22,580	59.3	69.5	67	29.80	18.56	1.04	NM
9/21/2020 8:39	0.0/0.0	2	46.9	21,500	70.0	69.1	61	30.06	18.51	1.06	NM
9/22/2020 8:23	0.0/0.0	2	47.9	22,210	76.3	65.8	60	30.05	18.43	1.20	NM
9/23/2020 8:40	0.0/0.0	2	50.0	22,810	74.0	69.9	66	30.03	18.25	1.24	NM
9/24/2020 8:24	0.0/0.0	2	49.6	22,080	72.8	64.0	60	30.00	18.20	1.26	NM
9/25/2020 8:27	0.0/0.0	2	49.8	22,360	87.6	63.1	58	29.96	18.18	1.28	NM
9/29/2020 11:06	-2.1/-2.1	2	50.9	20,250	58.5	72.0	56	30.26	18.02	1.42	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 11
KAFB-106V2-252 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 13:44	-1.0/-1.3	2	44.6	15,100	63.4	73.4	66	30.35	2.00	10.38	NM
10/8/2019 13:15	1.1/1.1	2	46.2	15,590	54.0	79.6	72	30.13	16.15	5.02	NM
10/9/2019 12:51	2.6/2.7	2	41.0	15,190	53.4	81.3	74	29.71	19.50	0.92	NM
10/15/2019 12:35	0.0/0.0	2	48.3	15,360	62.8	72.2	70	30.00	19.90	0.00	NM
10/22/2019 11:22	-1.7/-1.8	2	49.2	14,680	67.0	58.1	55	30.24	20.19	0.00	NM
10/31/2019 11:28	-3.0/-3.1	2	49.2	12,730	66.4	36.2	36	30.41	20.46	0.00	NM
11/5/2019 11:14	0.0/0.0	2	46.7	14,490	67.2	60.9	59	30.16	20.13	0.00	NM
1/6/2020 9:40	-2.8	2	-43.3	10,990	60.2	42.1	36	30.51	20.95	-0.01	NM
1/7/2020 8:57	-2.7	2	-42.9	9,900	60.4	37.7	24	30.52	20.58	0.06	NM
1/8/2020 9:06	1.4	2	-43.2	10,740	53.7	42.5	27	30.15	20.87	0.08	NM
1/9/2020 8:47	2	2	-42.7	11,320	63.2	45.1	35	30.02	20.86	0.10	NM
1/10/2020 9:17	1.9	2	-44.6	10,200	71.3	34.6	34	29.95	20.30	0.10	NM
1/13/2020 11:42	0.0/0.0	2	46.0	11,150	60.5	50.1	46	30.08	20.07	0.04	NM
2/18/2020 12:43	-0.7/-0.7	2	90.4	10,210	42.2	62.2	53	30.07	20.31	0.00	NM
3/30/2020 11:14	-0.6/-0.6	2	43.5	8,620	67.0	57.3	54	29.99	20.33	0.00	NM
3/31/2020 8:49	-1.7/-1.7	2	47.2	7,250	62.2	51.1	45	30.17	20.40	0.04	NM
4/1/2020 8:39	1.6/1.6	2	41.7	8,010	62.1	63.3	56	29.00	20.13	0.08	NM
4/2/2020 8:38	1.3/1.2	2	43.1	8,200	67.0	59.0	5	29.82	19.94	0.10	NM
4/3/2020 8:45	0.0/0.0	2	42.9	8,070	61.4	59.6	51	29.99	19.95	0.10	NM
4/6/2020 11:05	-0.7/-0.7	2	44.8	8,220	41.4	74.7	64	29.89	19.85	0.14	NM
5/5/2020 8:46	-1.9/-1.9	2	191.9	7,160	28.0	63.5	58	30.16	20.36	0.00	NM
5/28/2020 8:51	-1.4/-1.4	2	45.6	7,070	49.2	80.8	72	29.98	20.15	0.00	NM
6/22/2020 8:46	0.0/0.0	2	44.4	6,750	45.0	84.5	76	29.86	19.96	0.00	NM
6/23/2020 8:22	-1.1/-1.1	2	46.1	6,500	59.1	77.7	74	29.96	20.06	0.08	NM
6/23/2020 8:25	-1.1/-1.1	2	46.0	6,500	59.0	77.7	74	29.96	20.08	0.08	NM
6/24/2020 8:39	0.0/0.0	2	68.3	6,580	53.6	76.9	68	29.90	20.10	0.12	NM
6/24/2020 8:43	0.0/0.0	2	68.3	6,580	53.6	76.9	68	29.90	20.14	0.14	NM
6/25/2020 8:07	0.0/0.0	2	52.0	6,590	56.8	76.5	72	29.85	19.98	0.12	NM
6/26/2020 8:24	-0.6/-0.6	2	50.2	6,500	49.3	80.9	73	29.89	19.79	0.16	NM
6/30/2020 10:53	0.0/0.0	2	52.0	6,550	45.2	83.2	77	29.82	19.60	0.22	NM
7/31/2020 9:01	-1.3/-1.3	2	54.3	6,330	55.1	81.2	75	30.05	20.20	0.00	NM

Table 11
KAFB-106V2-252 Respiration Monitoring

8/31/2020 8:22	0.8/0.8	2	78.4	5,490	60.3	70.0	67	29.80	20.27	0.00	NM
9/21/2020 8:42	0.0/0.0	2	47.4	4,680	70.8	70.0	61	30.06	20.25	0.00	NM
9/22/2020 8:26	0.0/0.0	2	48.4	4,660	74.0	66.5	60	30.05	20.18	0.12	NM
9/23/2020 8:43	0.0/0.0	2	48.3	4,900	71.6	71.2	66	30.03	19.98	0.12	NM
9/24/2020 8:29	0.0/0.0	2	46.9	3,600	72.9	65.5	60	30.00	20.24	0.16	NM
9/24/2020 8:33	0.0/0.0	2	47.0	3,540	73.0	66.0	60	30.00	20.21	0.16	NM
9/25/2020 8:31	0.0/0.0	2	50.3	4,770	83.3	64.7	58	29.98	19.95	0.22	NM
9/29/2020 11:18	-1.9/-1.9	2	50.8	4,770	58.2	72.1	56	30.26	19.75	0.28	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

Table 12
KAFB-106V2-270 Respiration Monitoring

Date and Time	Well Head Pressure Pre/Post Purge (in-WC)	Flow Rate (scfm)	Vacuum (in-WC)	VOC (ppmv)	Relative Humidity (%)	Vapor Temperature (°F)	Ambient Temperature (°F)	Barometric Pressure (in-Hg)	O ₂ (%)	CO ₂ (%)	CH ₄ (%)
Long-Term Bioventing											
10/7/2019 13:48	-1.2/-1.3	2	45.4	19,600	63.4	73.5	66	30.35	2.18	9.72	NM
10/8/2019 13:19	1.0/1.0	2	45.3	19,680	52.3	78.5	72	30.13	9.99	8.82	NM
10/9/2019 12:55	2.6/2.6	2	44.1	18,890	46.2	81.7	74	29.71	18.58	2.08	NM
10/15/2019 12:46	0.0/0.0	2	48.8	18,950	60.7	73.0	70	30.00	19.64	0.08	NM
10/22/2019 11:35	-1.7/-1.7	2	49.8	17,420	67.8	58.7	55	30.24	19.99	0.00	NM
10/31/2019 11:36	-3.0/-3.0	2	50.5	14,470	65.1	37.0	36	30.41	20.22	0.00	NM
11/5/2019 11:25	0.0/0.0	2	49.8	17,560	67.5	61.5	59	30.16	19.98	0.00	NM
1/6/2020 9:44	-2.8	2	-46.8	11,340	62.6	41.2	36	30.50	20.88	0.02	NM
1/7/2020 9:00	-2.8	2	-43.2	10,960	61.4	37.5	24	30.52	20.49	0.08	NM
1/8/2020 9:08	1.3	2	-57.8	11,680	53.5	42.3	27	30.15	20.75	0.14	NM
1/9/2020 8:57	2.0	2	-42.6	12,410	64.0	45.7	35	30.02	20.45	0.44	NM
1/10/2020 9:20	2.0	2	-45.0	11,050	71.8	34.6	34	29.95	19.71	0.58	NM
1/13/2020 11:57	0.0/0.0	2	46.8	12,390	62.1	51.6	46	30.08	19.73	0.26	NM
2/18/2020 12:47	-0.7/-0.8	2	86.0	11,230	42.7	62.6	53	30.07	20.28	0.00	NM
3/30/2020 11:18	-0.6/-0.7	2	43.9	6,820	67.7	57.1	54	29.99	20.32	0.00	NM
3/31/2020 8:52	-1.6/-1.6	2	46.6	6,000	63.3	51.1	45	30.17	20.42	0.04	NM
4/1/2020 8:43	1.6/1.6	2	41.7	7,410	60.2	64.4	56	29.80	19.99	0.16	NM
4/2/2020 8:41	1.3/1.3	2	42.2	7,850	65.6	60.3	53	29.82	19.65	0.44	NM
4/3/2020 8:48	0.0/0.0	2	43.1	7,900	60.2	60.5	51	29.99	19.53	0.48	NM
4/6/2020 11:16	-0.7/-0.7	2	46.3	8,590	41.0	74.1	64	29.89	19.47	0.52	NM
5/5/2020 8:50	-1.9/-1.9	2	194.7	7,400	28.4	63.9	58	30.16	20.16	0.20	NM
5/28/2020 8:54	-1.4/-1.4	2	47.5	6,030	43.9	80.5	72	29.98	20.20	0.00	NM
6/22/2020 8:47	0.0/0.0	2	44.6	6,290	39.7	85.5	76	29.86	20.08	0.02	NM
6/23/2020 8:27	-1.2/-1.2	2	47.4	6,070	52.6	77.7	74	29.96	20.06	0.10	NM
6/24/2020 8:44	0.0/0.0	2	61.0	6,250	50.7	77.2	68	29.90	20.17	0.10	NM
6/24/2020 8:47	0.0/0.0	2	61.0	6,260	50.8	77.0	68	29.90	20.24	0.10	NM
6/25/2020 8:10	-0.5/-0.5	2	51.0	6,180	51.8	76.7	72	29.85	19.89	0.16	NM
6/26/2020 8:26	-0.5/-0.5	2	48.7	6,340	44.0	81.5	73	29.89	19.75	0.28	NM
6/30/2020 11:13	0.0/0.0	2	83.4	7,110	45.1	83.5	77	29.82	19.47	0.44	NM
7/31/2020 9:05	-1.2/-1.1	2	53.3	5,800	47.8	81.4	75	30.05	20.28	0.00	NM
8/31/2020 8:25	0.8/0.8	2	73.6	4,430	60.2	70.5	67	29.80	20.32	0.00	NM

Table 12
KAFB-106V2-270 Respiration Monitoring

9/21/2020 8:46	0.0/0.0	2	47.2	3,560	69.1	71.7	61	30.06	20.33	0.00	NM
9/22/2020 8:29	0.0/0.0	2	50.1	3,980	71.7	67.2	60	30.05	20.23	0.06	NM
9/23/2020 8:46	0.0/0.0	2	49.8	4,310	68.9	72.1	66	30.03	19.99	0.14	NM
9/24/2020 8:34	0.0/0.0	2	50.5	3,100	70.9	66.5	60	30.00	20.22	0.12	NM
9/24/2020 8:38	0.0/0.0	2	51.0	3,230	71.0	67.0	60	30.00	20.20	0.10	NM
9/25/2020 8:34	0.0/0.0	2	48.7	4,180	81.1	65.5	58	29.98	19.85	0.30	NM
9/29/2020 11:31	-1.8/-1.8	2	52.1	3,700	57.1	73.1	56	30.26	20.01	0.20	NM
9/29/2020 11:33	-1.8/-1.8	2	52.0	3,560	57.0	73.0	56	30.26	20.02	0.20	NM

% = percent

°F = degrees Fahrenheit

CH₄ = methane

CO₂ = carbon dioxide

in-Hg = inches of mercury

in-WC = inches of water column

NM = not measured

O₂ = oxygen

ppmv = parts per million by volume

scfm = standard cubic feet per minute

VOC = volatile organic compound

**Table 13
Respirometry Parameter Assessment**

Respirometry Parameters

Well ID	Oxygen Utilization Rate (% per day)				Biodegradation Rate (mg/kg/day)			
	Dec-19	Mar-20	Jun-20	Sep-20	Dec-19	Mar-20	Jun-20	Sep-20
106V1-102	0.03	0.09	0.05	0.02	0.02	0.05	0.03	0.01
106V1-113	0.13	0.13	0.10	0.08	0.08	0.08	0.06	0.05
106V1-160	0.15	0.13	0.12	0.11	0.09	0.08	0.07	0.07
106V1-217	0.18	0.31	0.08	0.14	0.11	0.18	0.04	0.08
106V1-252	0.09	0.09	0.06	0.03	0.05	0.06	0.04	0.02
106V1-263	0.12	0.09	0.07	0.03	0.07	0.05	0.04	0.02
Average 106V1	0.12	0.14	0.08	0.07	0.14	0.08	0.05	0.04
106V2-102	0.07	0.13	0.05	0.20	0.04	0.08	0.03	0.12
106V2-117	0.81	0.10	0.15	0.20	0.48	0.06	0.09	0.12
106V2-160	0.15	0.11	0.09	0.09	0.09	0.06	0.05	0.05
106V2-217	0.10	0.09	0.08	0.09	0.06	0.06	0.05	0.05
106V2-252	0.12	0.08	0.07	0.05	0.07	0.05	0.04	0.03
106V2-270	0.17	0.14	0.08	0.10	0.10	0.09	0.05	0.06
Average 106V2	0.24	0.11	0.09	0.12	0.14	0.06	0.05	0.07
Site Wide Average	0.17	0.13	0.08	0.09	0.10	0.07	0.05	0.06
kg = kilogram mg = milligram Q1 = first quarter % = percent								

Table 14
Observed Soil Vapor Anomalies

Quarterly Event	KAFB-106108-150		KAFB-106108-150		KAFB-106108-250		KAFB-106108-250		KAFB-106108-350		KAFB-106108-350	
	1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene	
	ppbv		ppbv		ppbv		ppbv		ppbv		ppbv	
	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Q1 2016	0	U	52		3		500		0.21	J	4.3	
Q2 2016	0.24	J	24		2.5		210		0	U	3.6	J
Q3 2016	0	U	1.3	J	3		89		0	U	2.8	J
Q4 2016	0	U	19		1.9		31		0	U	2.3	
Q2 2017	0	U	210		0.36	J	2.6		0	U	3.2	
Q4 2017	0	U	75		0.2	J	0.67	J	0	U	1.8	
Q2 2018	0	U	1.8		0.052	J	1.3		0	U	1.6	
Q4 2018	0	U	0.45	J	0.056	J	0.23	J	0	U	1.8	
Q2 2019	0	U	0.47	J	0	U	0.15	J	0	U	0.91	
Q4 2019	0	U	0.34	J	0.086	J	0.28	J	0	U	1.3	
Q2 2020	0	U	210		0	U	0	U	0.36	J	320	
Q4 2020	0	U	560	J	0	U	1600		0	U	1.1	J

Table 14
Observed Soil Vapor Anomalies

Quarterly Event	KAFB-106110-150		KAFB-106110-150		KAFB-106110-250		KAFB-106110-250		KAFB-106111-150		KAFB-106111-150	
	1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene	
	ppbv		ppbv		ppbv		ppbv		ppbv		ppbv	
	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Q1 2016	0.56	U	3.6		0.28	J	16		0.55	U	0.63	J
Q2 2016	0.51	U	70		0	U	13		0.51	U	1.4	
Q3 2016	0.54	U	4.7		0	U	20		0.58	U	2.3	
Q4 2016	0.54	U	0.97	J	0	U	22		0.53	U	1.1	J
Q2 2017	1.7	U	97		0	U	39	J	0.22	J	2.5	
Q4 2017	0.17	U	24		0	U	75	J	0.17	U	0.44	J
Q2 2018	1	U	5.6	J	0	U	210		0.1	U	1.1	
Q4 2018	0.11	U	10		0	U	430		0.1	U	0.28	J
Q2 2019	1.3	U	51		0	U	1100		0.091	U	0.24	J
Q4 2019	0.47	U	7.7		0	U	2600		0.12	U	0.39	J
Q2 2020	5.4	U	360		0	U	13000		41	U	57	J
Q4 2020	29	U	1200		0	U	21000		84	U	770	

Table 14
Observed Soil Vapor Anomalies

Quarterly Event	KAFB-106111-250		KAFB-106111-250		KAFB-106111-350		KAFB-106111-350		KAFB-106112-350		KAFB-106112-350	
	1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene	
	ppbv		ppbv		ppbv		ppbv		ppbv		ppbv	
	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Q1 2016	55	U	280		12	U	1300		0.19	J	7.9	
Q2 2016	41	U	170		17	U	1500		0.37	J	29	
Q3 2016	19	U	80		2.5	J	990		0.21	J	8.6	
Q4 2016	43	U	180		7.1	U	660		0.34	J	7.8	
Q2 2017	35	U	1100		18	U	920		0	U	10	
Q4 2017	3.5	U	800		6.7	U	330		0	U	8.6	
Q2 2018	4.2	U	850		16	U	1300		0.11	J	11	
Q4 2018	39	U	1900		15	U	1100		0.09	J	7	
Q2 2019	13	U	920		19	U	1800		0	U	0.73	J
Q4 2019	30	U	3100		22	U	2800		0.11	J	4.6	
Q2 2020	150	U	54000		66	U	6300		5.9		480	
Q4 2020	13	U	23000		280	U	64000		0.078	J	3.1	

**Table 14
Observed Soil Vapor Anomalies**

Quarterly Event	KAFB-106118-025		KAFB-106118-025		KAFB-106118-160		KAFB-106118-160		KAFB-106118-350		KAFB-106118-350	
	1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene	
	ppbv		ppbv		ppbv		ppbv		ppbv		ppbv	
	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Q1 2016	0	U	0	U	0	U	0	U	0	U	0.66	J
Q2 2016	0.23	J	3.7		0	U	1.8		0	U	2.8	
Q3 2016	0	U	1.9		0	U	1.8		0	U	2.8	
Q4 2016	0	U	1.3		0	U	0.66	J	0	U	4.9	
Q2 2017	0	U	0.65	J	0	U	0.59	J	0	U	1.1	J
Q4 2017	0	U	0.61	J	0	U	0	U	0	U	5.2	
Q2 2018	0	U	0.79	J	0	U	0.81	J	0	U	0.33	J
Q4 2018	0	U	0.15	J	0	U	0	U	0	U	2.5	U
Q2 2019	0	U	0	U	0	U	0	U	0	U	0.25	U
Q4 2019	0	U	1.1		0	U	0.27	J	0	U	0.33	J
Q2 2020	0	U	71		0	U	0.17	J	0	U	0.28	J
Q4 2020	0	U	0.16	J	0	U	15	J	0	U	48	J

Table 14
Observed Soil Vapor Anomalies

Quarterly Event	KAFB-106119-150		KAFB-106119-150		KAFB-106119-250		KAFB-106119-250		KAFB-106123-450		KAFB-106123-450		KAFB-106128-250	
	1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane	
	ppbv		ppbv		ppbv		ppbv		ppbv		ppbv		ppbv	
	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Q1 2016	0.55	U	2.1		41		1500		0	U	0.97	J	0.55	U
Q2 2016	1.7		20		64	J	6400		0	U	2		0.22	J
Q3 2016	3.8	U	6.2	J	22	J	890		0	U	2.4		0.75	U
Q4 2016	0.41	J	4.7		32	J	1800		0	U	0.88	J	0.51	U
Q2 2017	1.4	U	2.4	J	49	J	12000		0	U	2.2		0.2	J
Q4 2017	0.17	U	1.2	J	35	U	6600		0	U	0.8	J	0.16	U
Q2 2018	0.1	U	2.6		7.4	J	1200		0	U	4.5		0.14	J
Q4 2018	0.11	U	0.89		92	U	4700		0	U	2		0.094	U
Q2 2019	0.11	U	0.58	J	27	U	1700		0	U	0.68	J	0.25	U
Q4 2019	0.095	U	0.55	J	2.4	J	2000		0	U	0.94		0.12	U
Q2 2020	170	U	2000		630	U	57000		0	U	0.83		8.1	U
Q4 2020	24	U	320		250	U	52000		0	U	44		59	U

**Table 14
Observed Soil Vapor Anomalies**

Quarterly Event	KAFB-106128-250		SVEW-08-260		SVEW-08-260		SVEW-09-460		SVEW-09-460		SVMW-01-250		SVMW-01-250	
	Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene	
	ppbv		ppbv		ppbv		ppbv		ppbv		ppbv		ppbv	
	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Q1 2016	1.1	J	0.35	J	71		0	U	88		3.8		110	
Q2 2016	5.1		0.29	J	39		0.2	J	46		7.5	U	86	
Q3 2016	2.8		0	U	20		0	U	7.6		1.9	J	140	
Q4 2016	0.48	J	0	U	10		0.26	J	7.8		17	U	250	
Q2 2017	13		0.2	J	31		0.17	J	36		36	U	420	
Q4 2017	0.4	U	0	U	40	J	0	U	12	J	13	U	610	
Q2 2018	1.8	J	0	U	1.9	J	0	U	0.72	J	76	U	1000	
Q4 2018	0.34	J	0	U	490		0	U	12		81	U	1500	
Q2 2019	0.63	J	0	U	7.4		0	U	3.4		72	U	1800	
Q4 2019	0.21	J	0	U	150		0	U	91		78	U	4100	
Q2 2020	9.6	J	0	U	450		0	U	350		190	U	11000	
Q4 2020	6900		0	U	11000		0	U	48		280	U	28000	

Table 14
Observed Soil Vapor Anomalies

Quarterly Event	SVMW-04-050		SVMW-04-050		SVMW-05-230		SVMW-05-230		SVMW-07-050		SVMW-07-050		SVMW-12-250	
	1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane		Benzene		1,2-dibromoethane	
	ppbv		ppbv		ppbv		ppbv		ppbv		ppbv		ppbv	
	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Q1 2016	0	U	640		0.66		13		0	U	2.4		0.8	
Q2 2016	0	U	220		0.47	J	13		0.2	J	3.1		0.53	U
Q3 2016	0	U	100		0.58	U	120		0.45	J	23		0.55	U
Q4 2016	0	U	36	J	0.63		15		0	U	1.2	J	0.53	U
Q2 2017	0	U	0	U	0.35		9.9		0	U	0.76	J	0.42	U
Q4 2017	0	U	0	U	0.16	U	1.3		0	U	0.72	J	0.32	J
Q2 2018	0	U	20	J	3	U	18	J	0	U	0.34	J	0.1	U
Q4 2018	0	U	57	J	1.4	U	16		0	U	0.95		0.085	U
Q2 2019	0	U	190	U	1.6	U	46		0	U	1		0.1	U
Q4 2019	0	U	63	U	3.7	U	120		0	U	0.47	J	0.11	U
Q2 2020	0	U	74000		190	U	3000		0	U	2400		0.1	U
Q4 2020	0	U	62000		120	U	12000		0	U	17000		0	U

Abnormally high concentration compared to historical.

ppbv = parts per billion by volume

Q1 = first quarter

Q2 = second quarter

Q3 = third quarter

Q4 = fourth quarter

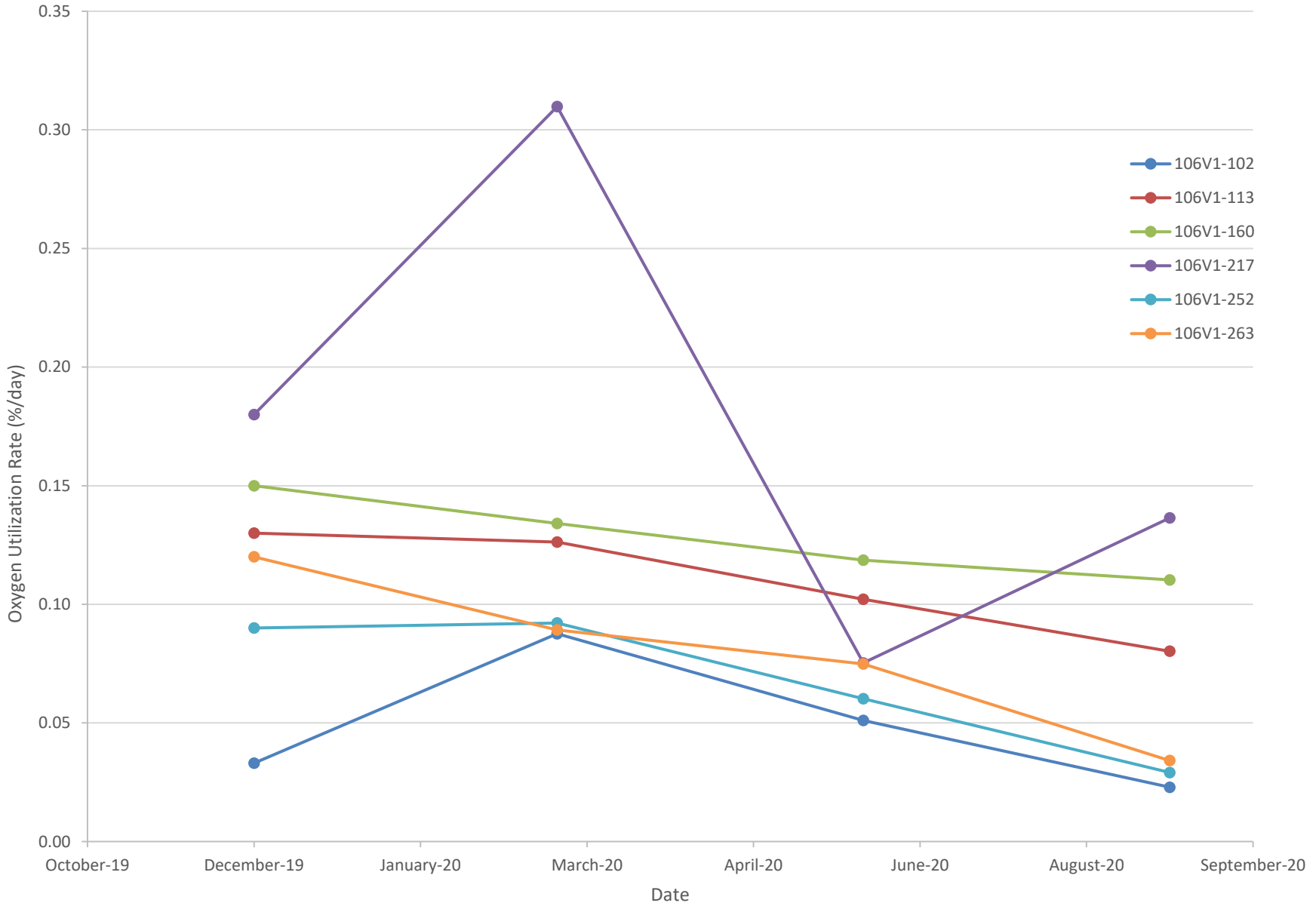
J = Qualifier denotes the analyte was positively identified, but the associated numerical value is estimated.

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.

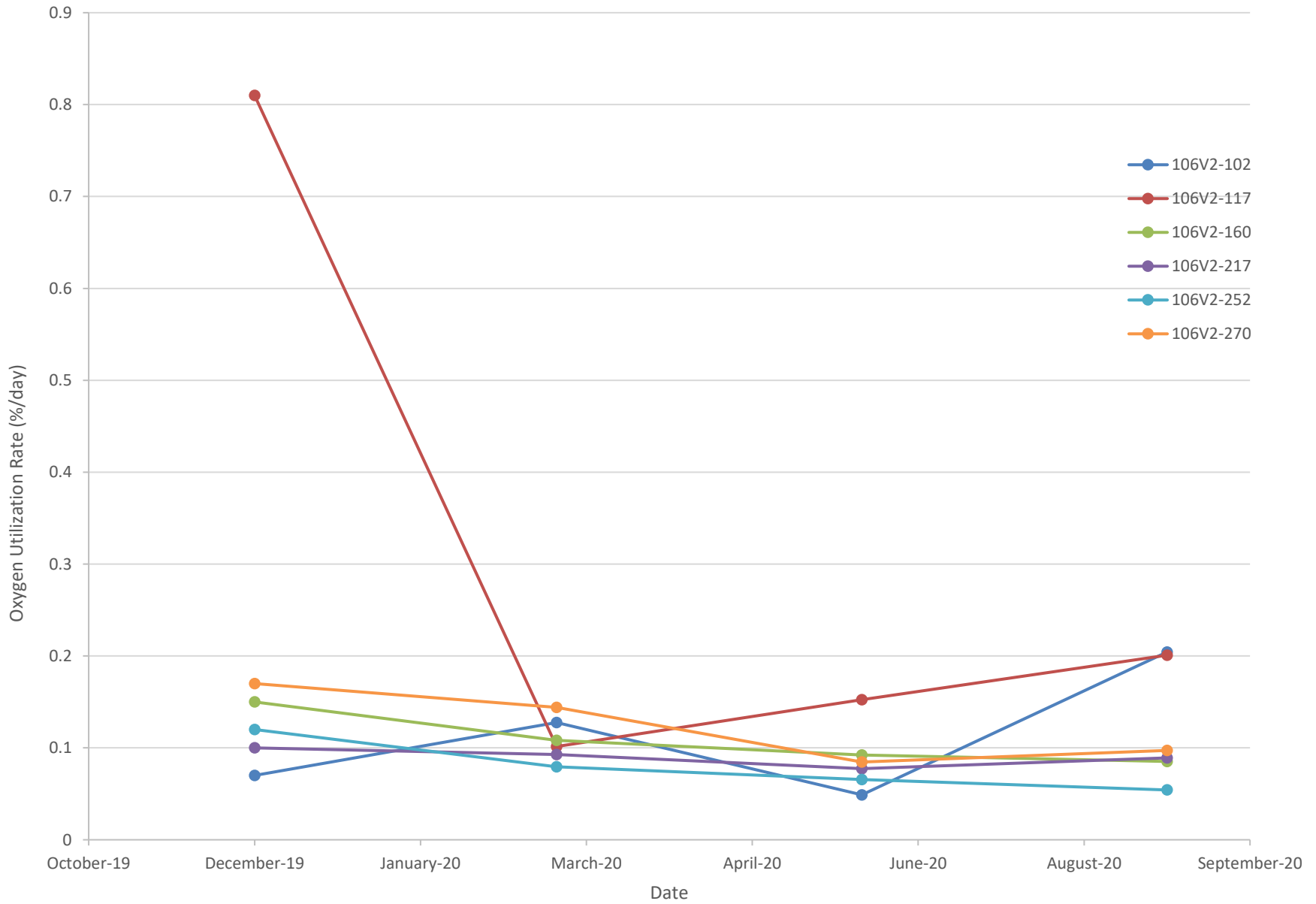
Attachment 3

Oxygen Utilization Rates

KAFB-106V1 Oxygen Utilization Rates

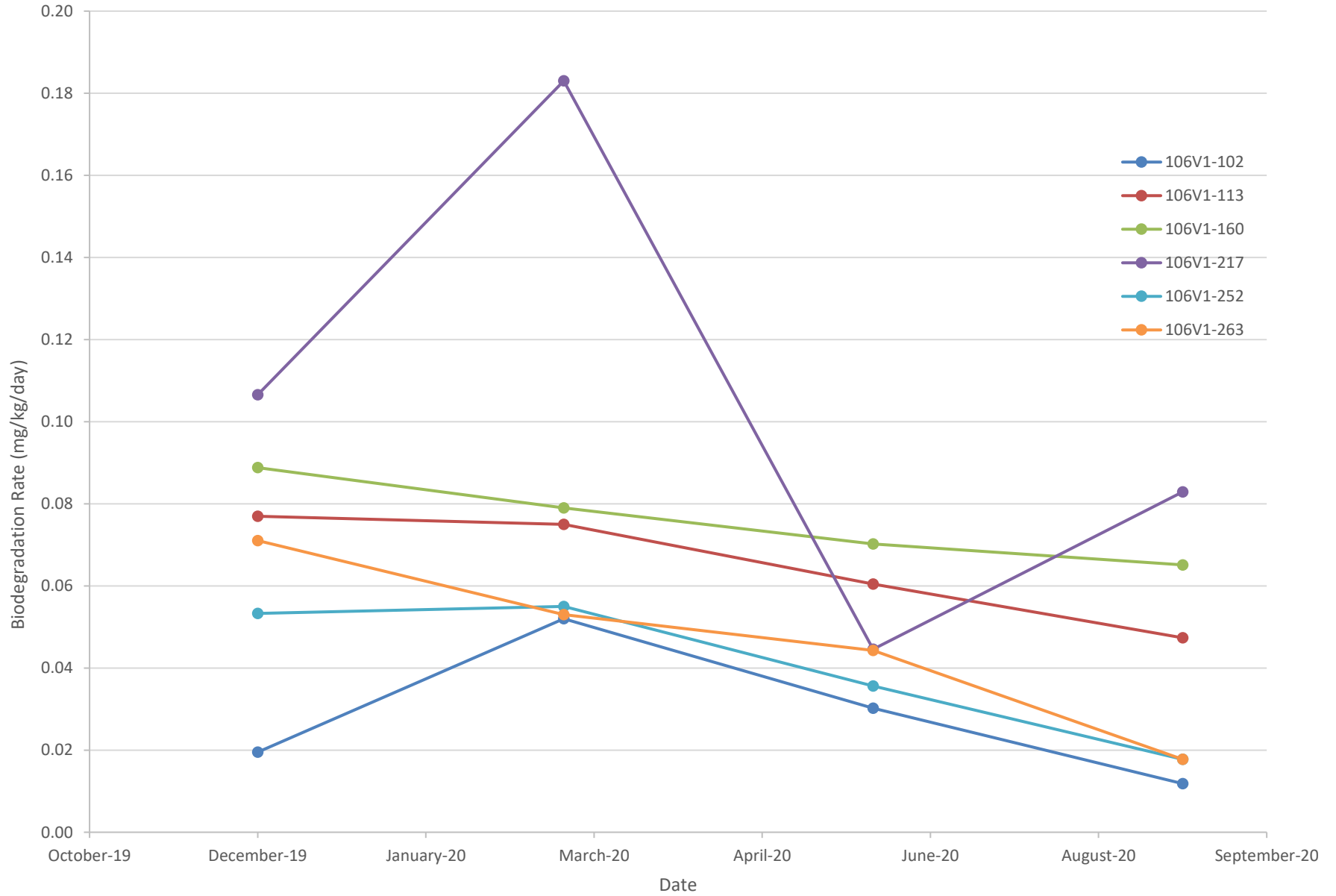


KAFB-106V2 Oxygen Utilization Rates

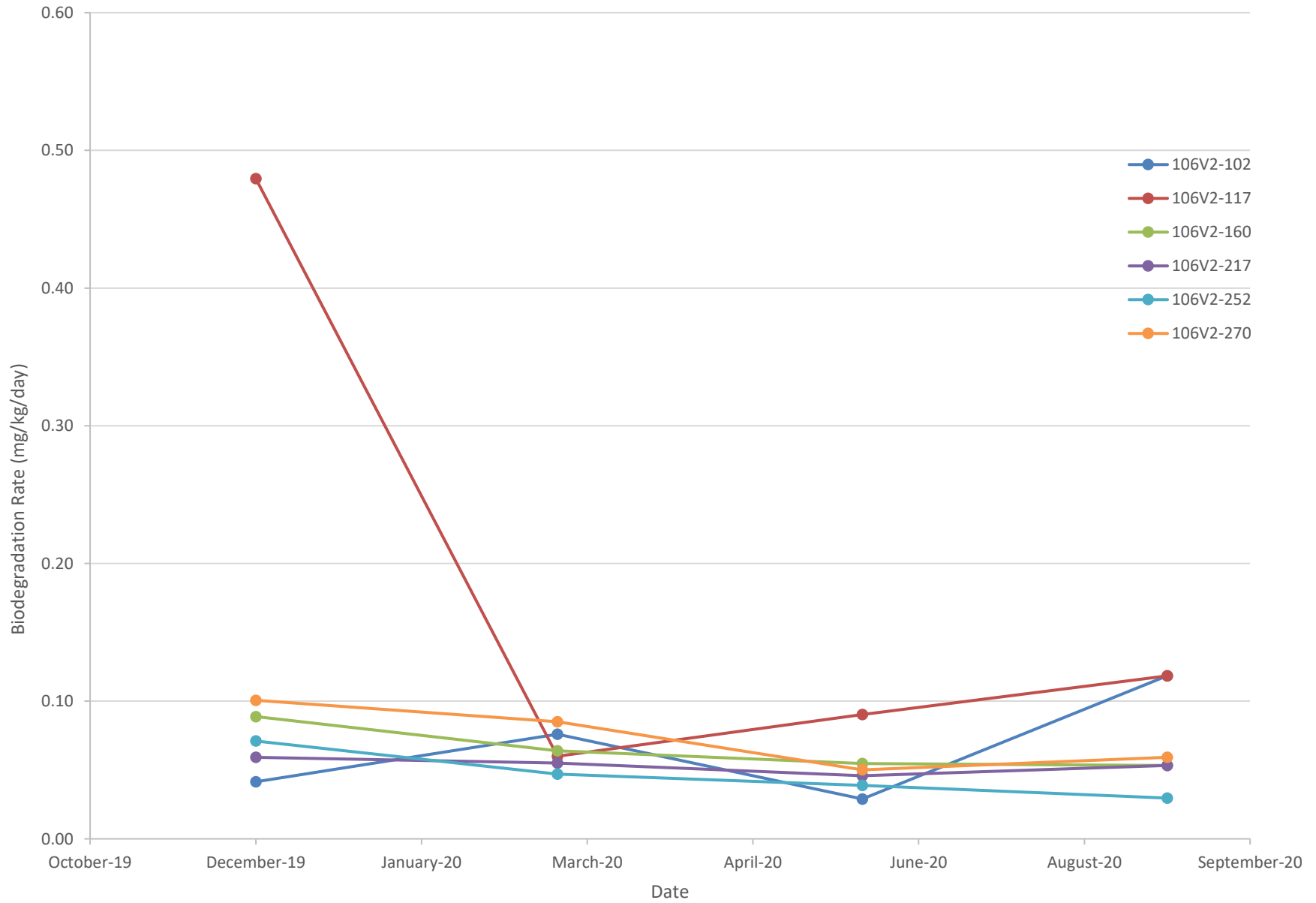


Attachment 4
Biodegradation Graphs

KAFB-106V1 Biodegradation Rates



KAFB-106V2 Biodegradation Rates



Attachment 5
Document Certification Page

**40 CFR 270.11
DOCUMENT CERTIFICATION**

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.

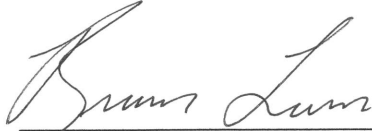


DAVID S. MILLER, Colonel, USAF
Commander, 377th Air Base Wing



Date

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