FINAL REPORT

Natural Attenuation and Biostimulation for *In Situ* Treatment of 1,2-Dibromoethane (EDB)

ESTCP Project ER-201331

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14. ABSTRACT

The goals of this project were to: (1) improve understanding of EDB attenuation, particularly using novel compound specific isotope analysis (CSIA) tools; and (2) determine whether biostimulation or bioaugmentation could effectively enhance in situ treatment of EDB.

Improved CSIA methods for measuring carbon isotope composition with low concentrations of EDB were developed and applied during this project. Differences in the isotopic composition of EDB among field samples provided valuable insights regarding EDB degradation processes.

During this project, a lactate-based anaerobic in situ bioremediation (ISB) approach like that used for many chlorinated VOCs compounds (e.g., TCE) was also applied in a highly impacted source area. The goal of this ISB effort was to demonstrate that higher EDB concentration source areas can be treated for cases when attenuation processes themselves are insufficient to protect receptors.

Application of the improved methods for examining EDB attenuation and source zone treatment demonstrated during this project may result in significant cost savings when EDB is a significant driver of remediation costs.

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EDB, ISB, MNA, attenuation, bioremediation, CSIA, groundwater tracers, groundwater recirculation, anaerobic biodegradation, dehalogenation, debromination

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FINAL REPORT

Project: ER-201331

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

Page

LIST OF FIGURES

Page

LIST OF FIGURES

Page

LIST OF FIGURES

LIST OF FIGURES

Page

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

$\delta^{13}C$	Delta 13-Carbon (measure of carbon isotope composition)
ε	isotope enrichment factor
‰	Per mille
µg	microgram
µg/L	micrograms per liter
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
APTIM	Aptim Federal Services, LLC
AR	Administrative Record
ARCH	Air Rotary Casing Hammer
AvGas	Aviation Gasoline
bgs	below ground surface
BFF	Bulk Fuels Facility
BTEX	benzene, toluene, ethylbenzene, and xylene
BTX	benzene, toluene and p-xylene
°C	degrees Celsius
C	carbon
CB&I	Chicago Bridge & Iron Federal Services, LLC
COC	Contaminant of Concern or Chain of Custody
CSIA	Compound Specific Isotope Analysis
cVOC	Chlorinated Volatile Organic Compound
DAP	diammonium phosphate
1,2-DCA	1,2-dichloroethane
DCM	*Dehalobacter* DCM
DHBt	*Dehalobacter* spp.
DHC	*Dehalococcoides* spp.
DHG	*Dehalogenimonas* spp.
DO	Dissolved Oxygen
DoD	U.S. Department of Defense
DPT	Direct push technology
DRO	Diesel range organics
DSB	*Desulfitobacterium* spp.
EDB	1,2-Dibromoethane
ESTCP	Environmental Security Technology Certification Program
EVO	emulsified vegetable oil
EX	Extraction Well
FCV	Flow control valve
Fe	Iron

FeS	Iron sulfide
ft	foot or feet
g	gram
G&A	general and administrative
GC	Gas Chromatography
GC-IRMS	Gas Chromatography-Isotope Ratio Mass Spectrometry
gpm	gallons per minute
GRO	Gasoline range organics
GW	groundwater
H	hydrogen
^2H_2O	deuterium oxide
HS^-	bisulfide
IDW	Investigation-Derived Waste
IN	Injection Well
ISB	In-Situ Bioremediation
KAFB	Kirtland Air Force Base
kg	kilogram
KI	potassium iodide
L	liter
LNAPL	Light Non-Aqueous Phase Liquid
MC-ICP-MS	multi-collector inductively couple plasma mass spectrometer
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MGN	methanogens
Mn	Manganese
MNA	Monitored Natural Attenuation
MS	Mass spectrometer
mV	millivolt
MW	Monitoring Well
NAPL	Non-Aqueous Phase Liquid
ng	nanogram
NMED	New Mexico Environment Department
ODC	other direct costs
ORP	Oxidation-Reduction Potential
OUST	Office of Underground Storage Tanks
P&ID	piping and instrumentation diagram

PI	Principal Investigator
PVC	Polyvinylchloride
RCRA	Resource Conservation and Recovery Act
SCADA	supervisory control and data acquisition
SERDP	Strategic Environmental Research and Development Program
SOP	Standard Operating Procedure
SRB	sulfate-reducing bacteria
SVOC	Semi-volatile Organic Compound
TCE	Trichloroethene
TPH	Total petroleum hydrocarbons
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USEPA/EPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
VFA	Volatile Fatty Acid
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

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ABSTRACT

INTRODUCTION AND OBJECTIVE

1,2-Dibromoethane (EDB) is a suspected human carcinogen and a contaminant of concern (COC) for the Department of Defense (DoD). Because analytical methods for volatile organic compounds (VOCs) often used at fuel-related sites (e.g., EPA 8260B) have detection limits greater than the Federal maximum contaminant level (MCL) for EDB of 0.05 µg/L, the extent of EDB contamination at military and civilian sites is unclear and may be underappreciated. Objectives of this DoD ESTCP Project were to: (1) evaluate EDB attenuation, particularly using novel compound specific isotope analysis (CSIA) tools; and (2) determine whether biostimulation or bioaugmentation could effectively enhance in situ treatment of EDB.

TECHNOLOGY DESCRIPTION

Carbon (C) isotope fractionation of EDB can be used to help in the understanding of EDB attenuation. During this project, improved CSIA methods for measuring isotope composition with low concentrations were developed and applied. Differences in the isotopic composition of EDB among field samples provided valuable insights regarding EDB degradation processes.

After successful treatability testing, a lactate-based anaerobic in situ bioremediation (ISB) approach like that used for many chlorinated VOCs compounds (e.g., TCE) was also applied in a highly impacted source area. The goal of this ISB effort was to demonstrate that higher EDB concentration source areas can be treated for cases when attenuation processes themselves are insufficient to protect receptors.

PERFORMANCE AND COST ASSESSMENT

Two conditions made CSIA measurements challenging: interest in very low concentrations of EDB, and high concentrations of collocated non-target VOCs (e.g., BTEX). During this project, we demonstrated that informative CSIA measurements were possible when each condition was examined exclusive of the other (i.e., in dilute plume or hydrocarbon rich source areas), but that when the two conditions were combined (e.g., very dilute EDB in hydrocarbon rich source area), CSIA measurements were challenging or impossible at this time. CSIA data from the field clearly demonstrated that EDB degraded at the site prior to intensive remediation efforts.

Large decreases in EDB concentrations resulted from the ISB treatment approach demonstrated, with observed reductions exceeding 99%. In almost all cases, final EDB concentrations were less than the MCL for EDB after treatment. EDB degradation was evident through comparison to other COCs, increases in degradation products, and changes in isotopic composition.

Application of the improved methods for examining EDB attenuation and source zone treatment demonstrated during this project may result in significant cost savings when EDB is a significant driver of remediation costs.

IMPLEMENTATION ISSUES

No issues encountered during this project affected the conclusions drawn; although two issues encountered should be considered when applying the technologies: (1) difficult CSIA measurements in hydrocarbon rich source zones when EDB concentrations are low; and (2) fouling of groundwater treatment systems during long-term operations.

PUBLICATIONS

Koster van Groos PG, Hatzinger PB, Streger SH, Vainberg S, Philp RP, Kuder T, 2018. Carbon Isotope Fractionation of 1,2-Dibromoethane by Biological and Abiotic Processes, Environmental Science and Technology. 52 (6), 3440-3448. DOI: 10.1021/acs.est.7b05224.

EXECUTIVE SUMMARY

INTRODUCTION

1,2-Dibromoethane (EDB) is a suspected human carcinogen and a contaminant of concern (COC) for the Department of Defense (DoD). EDB was historically used as a soil fumigant from the 1950s until the early 1980s, when such use was banned, but its largest use has been as a lead scavenger in fuels. Lead and EDB were largely removed from fuels in the US by the end of the 1980s, but their use continues in aviation gasoline (AvGas) used for piston-powered aircraft. Because EDB is present in AvGas, sites with hydrocarbon contamination resulting from past AvGas handling practices may have EDB in groundwater. The extent of EDB contamination at military and civilian sites is currently uncertain, however, as analytical methods for volatile organic compounds (VOCs) often used at fuel-related sites (e.g., EPA 8260B) have detection limits for EDB greater than the Federal maximum contaminant level (MCL) of 0.05 µg/L. High concentrations of EDB in leaded fuels (~300 mg/L in automobile fuel and ~600 mg/L in aviation gasoline), combined with its relatively high aqueous solubility, low octanol-water partitioning coefficient, and Henry's law constant favoring the aqueous phase, can result in sizeable EDB plumes exceeding its MCL, despite known biological and abiotic degradation mechanisms. Better understanding of EDB attenuation and approaches for EDB remediation are desired.

OBJECTIVES

Objectives of this DoD ESTCP Project were to: (1) evaluate EDB attenuation, particularly using novel compound specific isotope analysis (CSIA) tools; and (2) determine whether biostimulation or bioaugmentation could effectively enhance in situ treatment of EDB. Demonstrating improved methods for examining EDB attenuation may result in remedial cost savings for the DoD and demonstrating the use of in situ bioremediation (ISB) may reduce the remedial timeframe required for EDB treatment at sites.

During this project, CSIA was used to help evaluate EDB attenuation in groundwater at Kirtland Air Force Base (AFB), New Mexico under a range of geochemical conditions – from highly reducing to more oxic. AvGas containing EDB as a lead scavenger was used at Kirtland KAFB from approximately the 1940s to 1975, and an EDB plume several thousand feet long that exceeded its MCL was historically observed in site groundwater (Figure ES-), which is encountered at depths of up to approximately 500 ft bgs. CSIA measurements, geochemical parameters, and concentration data were combined to evaluate EDB fate in the context of groundwater transport at the site.

This project also tested the efficacy of ISB to enhance EDB degradation for situations when ongoing processes may be too slow. The demonstration of ISB was originally scoped to be performed at limited scale with a push-pull test, but after site representatives expressed interest, a larger and more comprehensive pilot test demonstration was performed in cooperation with United States Army Corps of Engineers (USACE) and United States Air Force (USAF) stakeholders. Evaluation of ISB for EDB used a variety of methods including CSIA.

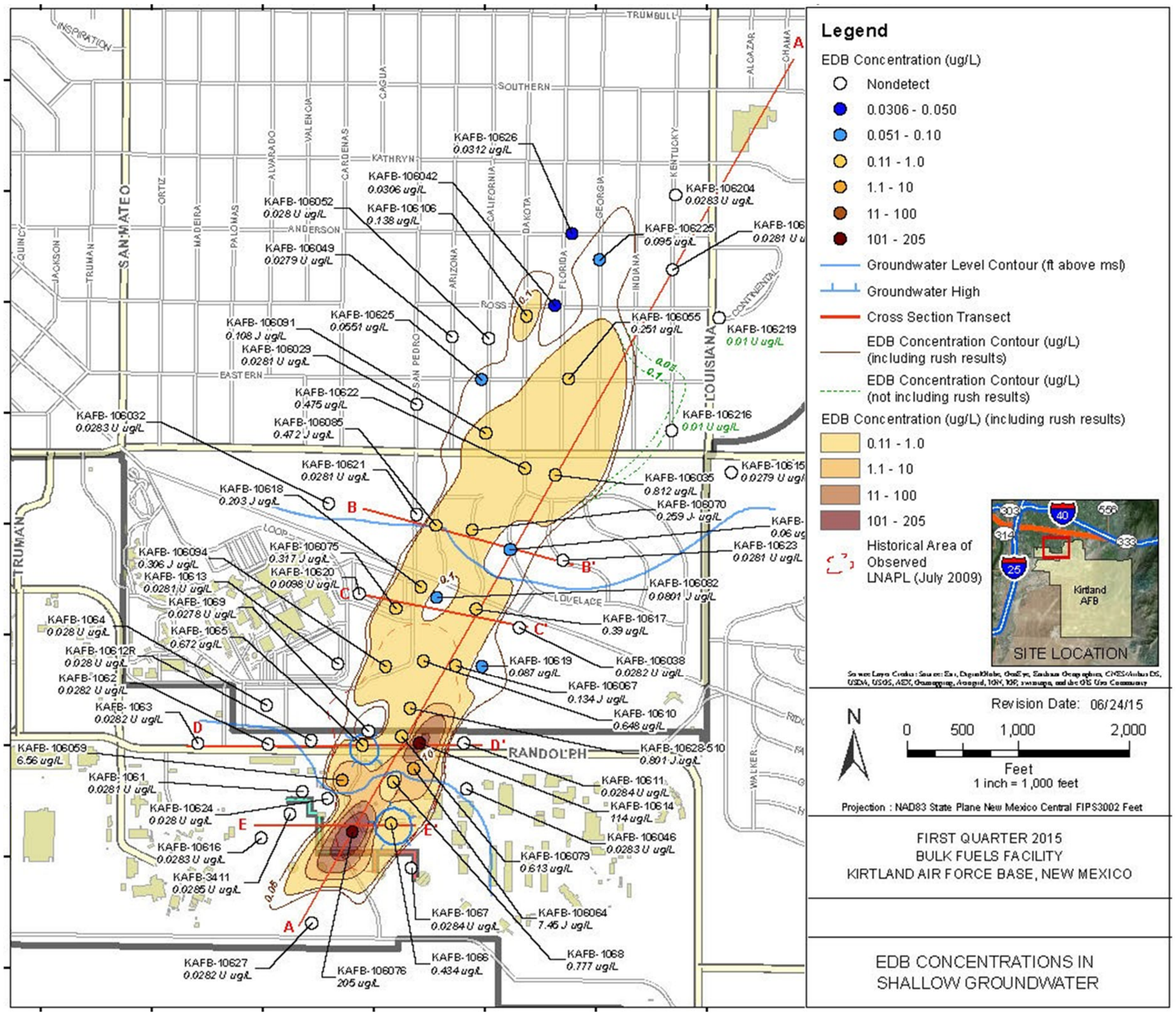


Figure ES-1. EDB Concentrations in Groundwater at Kirtland AFB (NM).

The EDB distribution reflects general north-northeast groundwater flow since 1980. (1st Quarter 2015)

TECHNOLOGY DESCRIPTION

CSIA Approaches to Quantify EDB Natural Attenuation

During this project, we investigated how carbon (C) isotope fractionation of EDB can help improve our understanding of EDB attenuation. In addition to collection and measurement of field samples, knowledge of C isotope fractionating processes and improved CSIA methods for measuring isotope composition with low concentrations were necessary for this application.

C isotope composition of EDB is reported using delta (δ) notation, where $\delta^{13}C = R_{\text{sample}}/R_{\text{standard}}-1$ and R represents the $^{13}C/^{12}C$ ratio for a sample (EDB) or the standard (Vienna Pee Dee Belemnite, VPDB), as indicated by subscripts. In many cases, the process of isotope fractionation can be described using a form of the Rayleigh equation (Eq. 1), with a bulk enrichment factor ($\varepsilon_{\text{bulk}}$) reflecting the strength of the given isotope effect.

$$\ln\left(\frac{R_i}{R_0}\right) = \ln\left[\frac{(\delta^{13}C_i+1)}{(\delta^{13}C_0+1)}\right] = \varepsilon_{\text{bulk}} \times \ln(F_i) \quad (1)$$

In Eq. 1, subscripts indicate values with the transformation of interest (i) or without transformation (0), R refers to the carbon isotope ratio discussed above, and F_i refers to the residual fraction of EDB mass remaining. Eq. 1 can be used under controlled conditions to determine ε_{bulk} for well constrained processes, and several ε_{bulk} values were experimentally determined during this project. Two of the determined ε_{bulk} values were particularly relevant: anaerobic biodegradation (ε_{bulk}=-8.2‰) and hydrolysis (ε_{bulk}=-19.9‰). When appropriate ε_{bulk} values are known for relevant processes, Eq. 1 can also be used to estimate residual fractions of EDB remaining and the extent of degradation. This application of Eq. 1 was utilized during field efforts.

Anaerobic Bioremediation with EDB Degrading Microorganisms

Anaerobic bioremediation approaches typically rely on the stimulation of in situ biodegradation activity through the addition of electron donor (e.g., lactate, vegetable oil), nutrients, and bioaugmentation culture, as necessary. Several organisms are known to reductively debrominate EDB, including *Dehalococcoides* spp.; and many of the bioremediation approaches used to stimulate dehalogenating organisms for anaerobic biodegradation of chlorinated compounds (e.g., TCE) should be applicable for EDB. During this project, we demonstrated ISB through the pulsed addition of a lactate-based electron donor and nutrients using a groundwater recirculation system. We were particularly interested in demonstrating that such an approach could result in water meeting the MCL for EDB.

PERFORMANCE ASSESSMENT

Application of improved CSIA measurements

EDB concentrations required for high-precision CSIA analysis by Gas Chromatography-Isotope Ratio Mass Spectrometry (GC-IRMS) with standard purge and trap sample introduction are typically ~ 6 µg/L, although useful results can be obtained with slightly lower concentrations, albeit with a tradeoff in precision. With an MCL of 0.05 µg/L, it was important to further improve the sensitivity of CSIA methods for this project. Two conditions made CSIA measurements difficult when examining EDB resulting from leaded fuels: interest in very low concentrations of EDB, and high concentrations of collocated non-target VOCs, usually from fuels (e.g., BTEX).

During the evaluation of natural attenuation, water with EDB concentrations similar to the low EDB MCL (0.05 µg/L) were encountered that were also relatively free of non-target VOCs. Increased EDB masses required for CSIA measurements in this case were obtained from larger volumes of groundwater using a closed-loop purge and trap system. With this method, CSIA measurements with less than 1 µg/L were successful, albeit with increased uncertainties as concentrations approached the MCL. Resulting CSIA data from the field clearly demonstrated that EDB degraded at the site prior to intensive remediation efforts (see Figure ES-). The CSIA data were consistent with EDB degradation resulting from slower processes (e.g., hydrolysis) in downgradient stretches, and with more rapid biodegradation occurring in higher concentration anaerobic zones. Based on CSIA measurements, at least 36% of EDB degraded at each well prior to any active treatment, and at least 96% of EDB had degraded in the farthest downgradient well examined (KAFB-106091). Due to use of conservative parameters (i.e., more positive $\delta^{13}C$ source and degradation process with more negative ε_{bulk}), both these percentages likely underestimate the true extent of degradation.

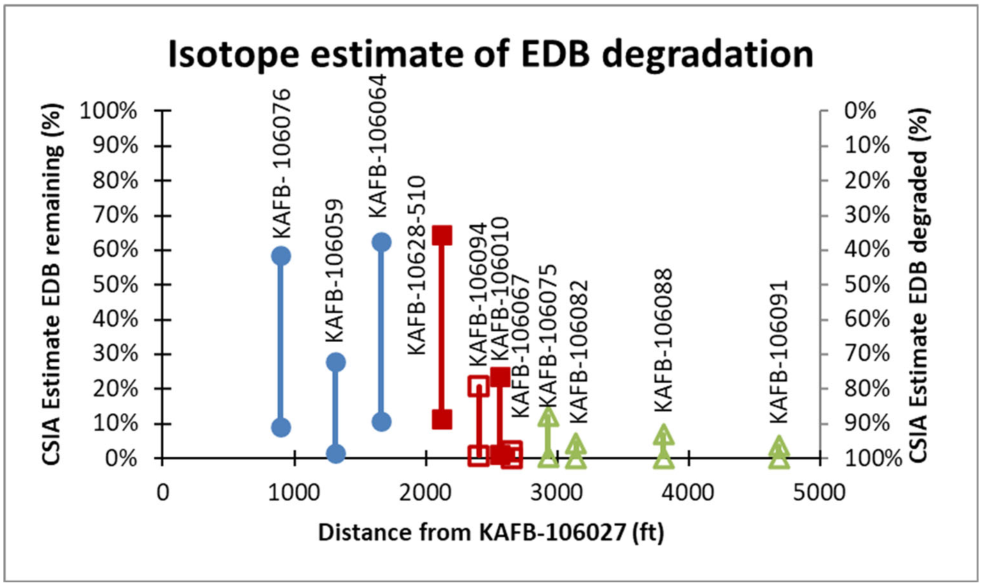


Figure ES-2. Estimates of EDB Degraded Based on CSIA Measurements, εbulk Values, and Initial δ13C Values Ranging from -30‰ or -21‰.

Blue circles indicate more impacted source zone wells, green triangles indicate downgradient aerobic wells, and red squares indicate a more dynamic zone in between these two zones. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was never observed.

<u>Simple attenuation model for EDB</u>

Simple attenuation models can be useful when evaluating COC fate at a given site. Such models can provide valuable insights regarding the relative importance of attenuation and degradation mechanisms. A simple model focused on degradation mechanisms for EDB was developed using RemChlor and simplified parameters representing past conditions at Kirtland AFB to evaluate degradation and isotope fractionation. This model described the overall trends in EDB concentration and isotope composition at Kirtland AFB (see dashed lines in Figure ES-), and helped illustrate the relative importance of biological and abiotic attenuation processes.

While a simple model of this type is unlikely to replace more advanced and complex modeling efforts, such as those available at Kirtland AFB, it is useful for illustrating that EDB attenuation differs substantially based on geochemical conditions. For EDB sites resulting from leaded fuel leaks, at least three zones should be accounted for, as described and included in this model: (1) an anaerobic zone heavily impacted by fuel hydrocarbons with very strong potential for anaerobic EDB biodegradation, (2) an anaerobic/aerobic transition zone where contributions from separate/residual fuel phases are weaker and large decreases in aqueous EDB concentrations may be evident due to anaerobic and/or aerobic degradation processes, and (3) a downgradient zone where abiotic hydrolysis or other slow attenuation processes may decrease EDB concentrations further. In addition to EDB concentrations and isotope composition, measurements of degradation products (i.e., ethene/ethane and bromide) and geochemical conditions also supported this interpretation.

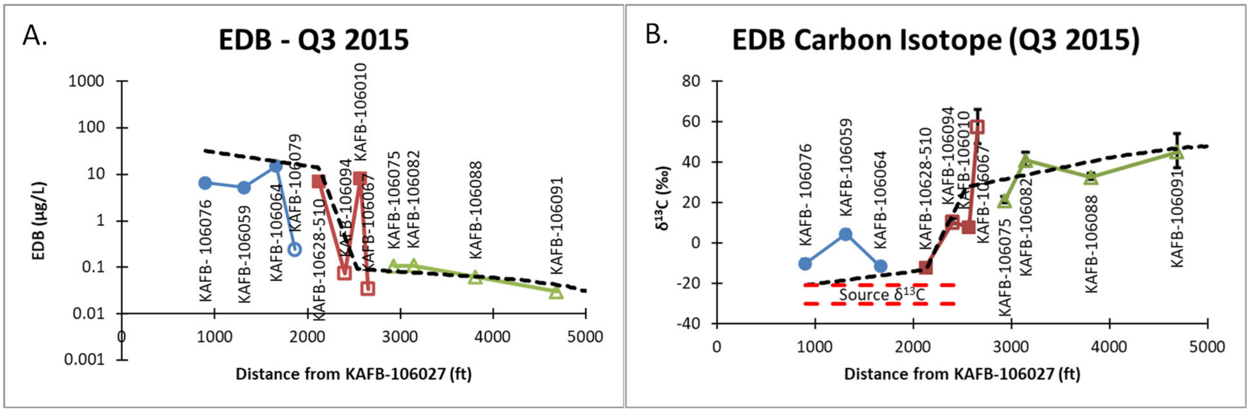


Figure ES-3. A.) Concentration and B.) Carbon Isotope Measurements of EDB at the Thirteen Wells Evaluated Across Geochemical Zones at Kirtland AFB.

Blue circles indicate more impacted source zone wells, green triangles indicate downgradient aerobic wells, and red squares indicate a more dynamic zone in between these two zones. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was never observed. The dashed black line illustrates a simple RemChlor model that utilized a simple representative set of parameters, including ε_{bulk} values representing anaerobic biodegradation (ε_{bulk}=-8.2‰) in the blue and red zones and hydrolysis (ε_{bulk}=-19.9‰) in the green zone.

Degradation of EDB during pilot demonstration to below MCL (0.05 µg/L)

Effective source zone treatment is often essential for reducing long-term remediation costs. A primary goal of this project was to demonstrate that EDB concentrations could be significantly reduced through an anaerobic ISB treatment approach.

During the pilot demonstration, groundwater was extracted, mixed with amendments, and injected at a centrally located well (see Figure ES-). Six monitoring wells, including existing monitoring wells KAFB-106064 and KAFB-106063, were used to help monitor treatment performance. The pilot demonstration was implemented in four phases, each briefly described below:

- Phase 1 – Evaluation of baseline conditions and distribution of recirculated water using tracer amendments.
- Phase 2 – Evaluation of biostimulation in the subsurface after distribution of treatment amendments in recirculated groundwater.
- Phase 3 – Additional evaluation of biostimulation in the subsurface after distribution of treatment amendments in recirculated groundwater.
- Phase 4 – Extended monitoring with no addition of amendments or recirculation of groundwater.

Figure ES- shows EDB and benzene concentrations observed at the three shallow monitoring wells (KAFB-106064, KAFB-106MW1-S, and KAFB-106MW2-S) throughout the pilot demonstration. EDB concentrations at all three wells, and all other wells except KAFB-106EX2 (data not shown), were at or below 0.05 µg/L within two years of the last addition of amendments, although there was perhaps a hint of EDB rebound at KAFB-106MW2-S towards the end of the demonstration.

Decreases in EDB concentration were most rapid at KAFB-106064 and KAFB0106MW2-S, and these two wells were nearest the injection well and experienced greater impact from amendments. KAFB-106MW1-S was located farther from the injection well, but may also have been more impacted by fuels, as NAPL was observed in this well prior to the demonstration. Because decreases in EDB concentrations were not matched by changes in benzene, another site COC (see Figure ES-), despite similar physical-chemical characteristics, these decreases likely reflect EDB degradation rather than other processes such as volatilization. After the ISB demonstration, large decreases in EDB concentrations (greater than 99%) were evident at all site wells, and in most cases, not matched by benzene decreases (Figure ES). EDB degradation was also evident through increases in daughter products of degradation (ethene/ethane and bromide).

The demonstration of ISB for EDB treatment occurred in an area significantly impacted by non-target VOCs. These non-target VOC concentrations effectively precluded use of the closed-loop purge and trap method for more sensitive CSIA measurements. As such, it was not possible to evaluate C isotope composition of EDB when concentrations were less than 1 µg/L. Where CSIA measurements were possible, however, $\delta^{13}C$ values were generally higher during passive periods than during preceding periods of groundwater recirculation, providing complementary evidence of EDB biodegradation during the pilot demonstration.

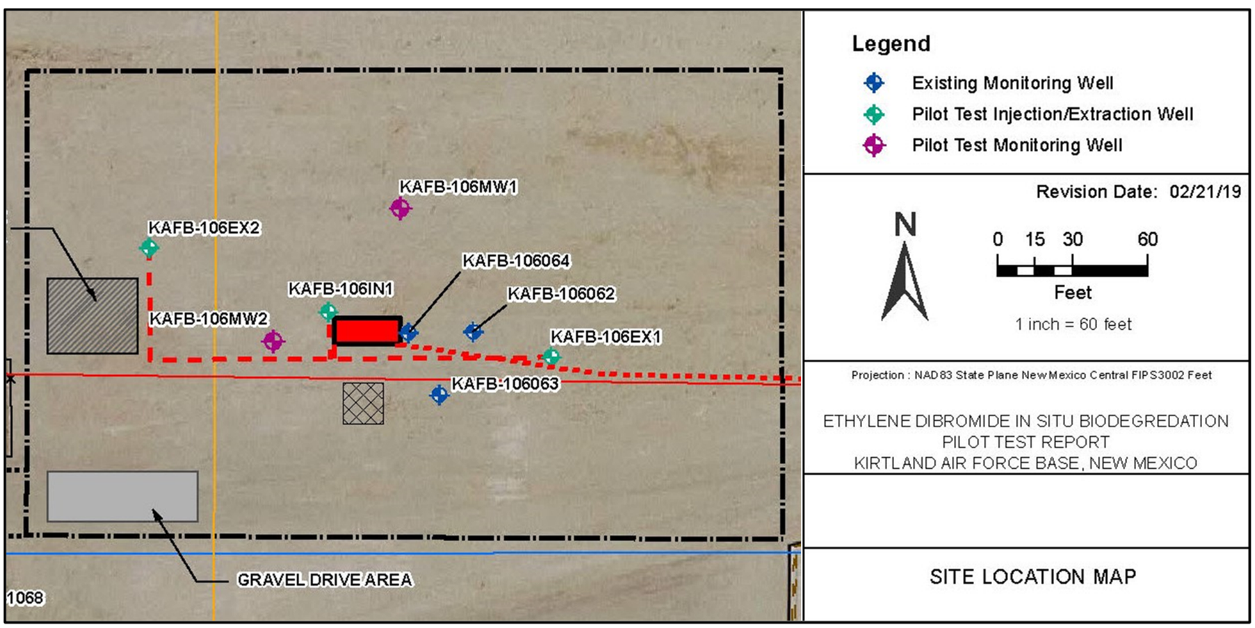


Figure ES-4. Well Layout of the ISB Pilot Demonstration. KAFB-106EX1 and KAFB-106EX2 Were Extraction Wells, KAFB-106IN1 Was the Injection Well, and the Remaining Wells Were Monitoring Wells.

Both KAFB-106MW1 and KAFB-MW2 contained a shallow and intermediate depth well in a common borehole. KAFB-106062 is screen at greater depth and was not monitored during this effort.

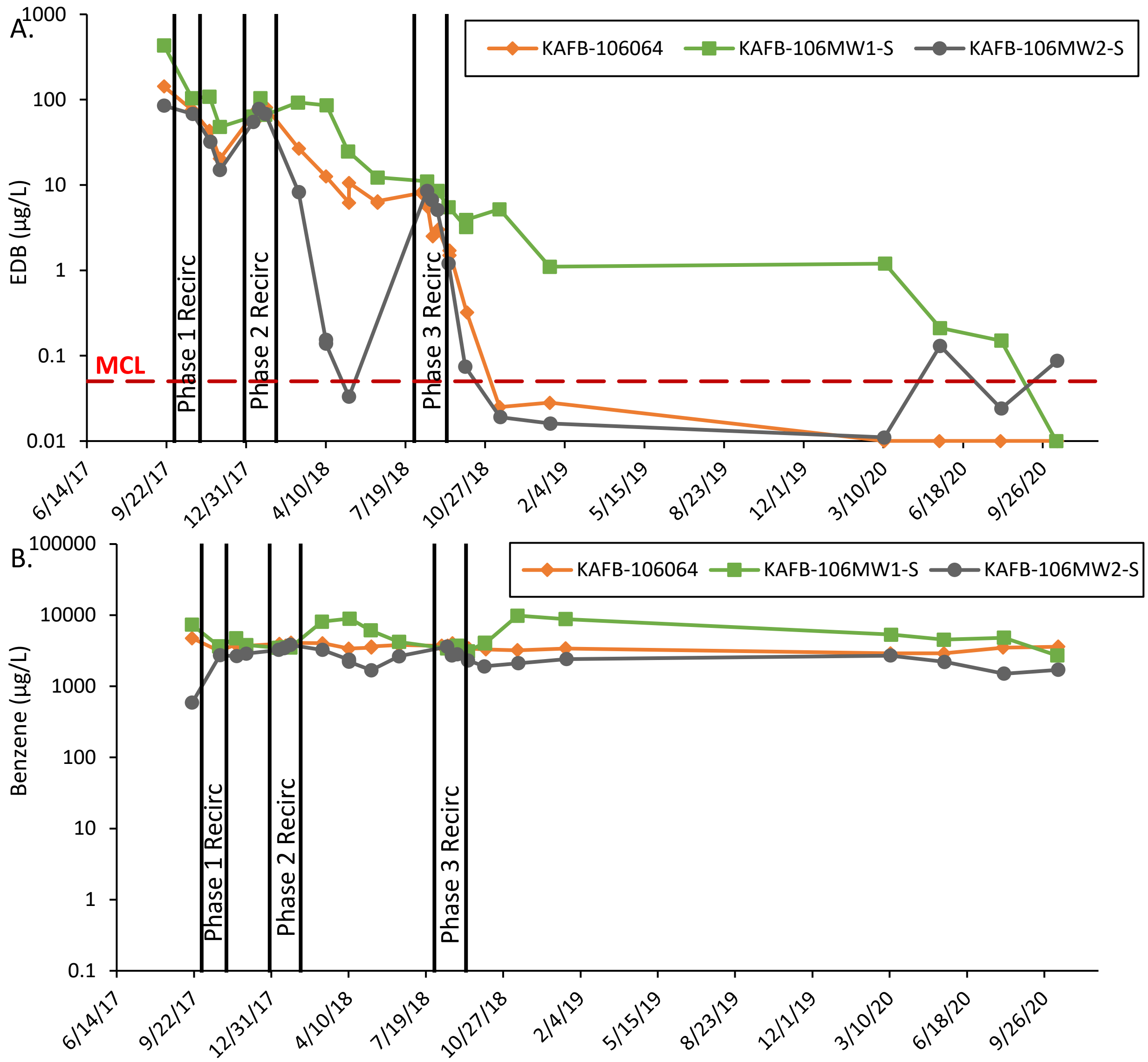


Figure ES-5. A) EDB and B) Benzene Concentrations Observed at Shallow Monitoring Wells Associated with the ISB Demonstration.

The three recirculation phases are indicated. The first phase only included recirculation of site groundwater, while the second and third recirculation phases included biostimulation amendments.

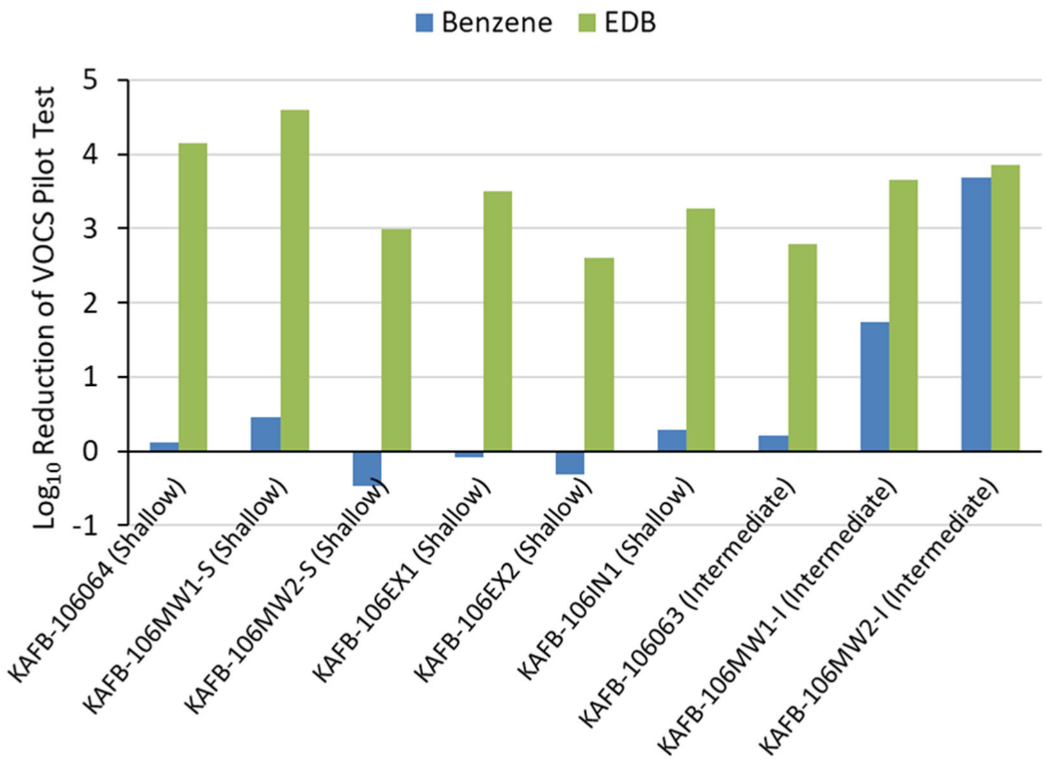


Figure ES-6. Log10 Reduction of Benzene and EDB Observed at All Wells Associated with the ISB Demonstration.

With the exception of two deeper wells (i.e., "Intermediate"), EDB decreases were three orders of magnitude or greater than for benzene.

COST ASSESSMENT

While sometimes necessary to protect receptors, it can be expensive to operate downgradient treatment systems to capture and treat groundwater with dilute concentrations of COCs. Such a system has been in operation at Kirtland AFB to address EDB since 2015. Treatment of source zones, coupled with clear evidence of downgradient attenuation, could help reduce long term costs associated with such treatment. The ISB demonstration during this project indicated that EDB could be targeted and biodegraded in the source zone, although impacts to other site COCs (e.g., benzene) were limited.

The depth to groundwater is one of the largest cost drivers for remediation at Kirtland AFB, making all active remediation strategies costly in comparison to monitored natural attenuation (MNA), if appropriate. As noted in the Performance Assessment above, there is clear evidence of EDB degradation at the site, and this should be carefully considered when remediation approaches for EDB are evaluated – particularly as several attenuation processes can be documented using CSIA methods.

Due to widespread application of anaerobic bioremediation approaches targeting chlorinated compounds (e.g., PCE and TCE), associated costs are generally reasonably well understood. At shallower sites than Kirtland AFB, additional methods for distributing biostimulation amendments, such as direct-push technology drilling approaches, can also be considered such that anaerobic treatment approaches may be more cost-efficient. When targeting EDB treatment, such approaches should be considered, although it is important to recognize that possible co-contaminants, such as benzene or other fuel hydrocarbons, are likely unaffected by such treatment. In all cases, application of CSIA tools can help document the extent to which degradation processes affect EDB attenuation and assess whether these processes protect the public.

IMPLEMENTATION ISSUES

Issues encountered during this project did not impact any conclusions drawn. Two of the greatest implementation issues encountered were the following:

- ***CSIA measurements affected by high concentrations of non-target VOCs.*** The improved CSIA method targeting low concentrations of EDB was effective when non-target VOC concentrations were low, such as in downgradient zones. Use of this more sensitive CSIA method was very effective for documenting past EDB degradation in more dilute zones where EDB approached its MCL of 0.05 µg/L. In more impacted source zones, however, high concentrations of non-target VOCs (e.g., benzene > 1 mg/L) precluded use of the low-concentration CSIA approach and isotopic evidence of EDB degradation was more limited as a result.

- ***Fouling of the groundwater recirculation system***. Fouling can impact in situ treatment systems, and fouling of inline filters and extraction/injection wells became a challenge towards the end of this demonstration. To mitigate such issues during future bioremediation applications, automated or periodic biocide treatments to limit microbial biomass accumulation within filters and injection wells can be considered. Careful consideration of biocide type, dosage concentration, and volume is necessary to avoid adversely affecting the ISB remedy. The injection and extraction well heads should be constructed in such a manner that piping can be easily removed for periodic well rehabilitation efforts, if/when needed. At shallower sites, alternative approaches for distributing amendments less sensitive to fouling, such as direct-push technology, can also be considered.

1.0 INTRODUCTION

1.1 BACKGROUND

1,2-Dibromoethane (EDB) is a suspected human carcinogen and a contaminant of concern (COC) for the Department of Defense (DoD). Historically, the largest use of EDB has been as a lead scavenging compound in leaded fuels, where EDB prevents the build-up of lead deposits in engines, including piston-powered aircraft engines. Lead and EDB were largely removed from fuels in the US by the end of the 1980s, but use of lead and EDB in aviation gasoline (AvGas) continues. Lead- and EDB-free AvGas alternatives with the required performance characteristics have been difficult to develop and certify, and EDB use in AvGas seems likely to continue for some time. EDB was also historically used as a soil fumigant from the 1950s until the early 1980s, when such use was banned.

Laboratory studies have shown that EDB is biodegradable under anaerobic conditions (Belay and Daniels, 1987; Bouwer and McCarty, 1985; Koster van Groos et al., 2018; Kuntze et al., 2016; Peethambaram, 2010; Yu et al., 2013) and is susceptible to abiotic transformation by sulfide minerals and hydrolysis (Koster van Groos et al., 2018; Kuntze et al., 2016; Schwarzenbach et al., 1985; Wilson et al., 2008). The compound is also susceptible to aerobic cometabolism (Danko et al., 2012; Hartzell et al., 2001; Hatzinger et al., 2015; Koster van Groos et al., 2018; McKeever et al., 2012) and can be used as a growth substrate by at least one organism under aerobic conditions (Poelarends et al., 1999).

While EDB is known to degrade by many mechanisms, it also appears persistent, and has been observed decades after being removed from most gasoline products and banned from use as a fumigant. EDB is likely present in groundwater at thousands of sites in the US at concentrations exceeding its maximum contaminant level (MCL) (Falta, 2004; Wilson et al., 2008). A study by Falta et al. (2005) found EDB at concentrations exceeding the Federal MCL of 0.05 µg/L (50 ppt) at 537 underground storage tank (UST) sites in South Carolina alone. The median maximum concentration of EDB at sites where it was detected was ~5 µg/L, 100-fold higher than the MCL, and more than 10% of the sites had EDB concentrations exceeding 200 µg/L (Falta et al., 2005).

Mobility and persistence of EDB in groundwater aquifers is related in part to its physicochemical properties. EDB has a relatively high water solubility (~4,000 mg/L), low octanol-water partitioning coefficient ($K_{ow} \approx 60$), and Henry's law constant favoring the aqueous phase (~0.02 mol m^{-3} Pa^{-1}) (Falta, 2004; Falta et al., 2005; Sander, 2014). Combined with high concentrations in leaded fuels (~300 mg/L in automobile fuel and ~600 mg/L in aviation gasoline; Falta et al., 2005), these properties have led to the prolonged transfer of EDB from fuel non-aqueous phase liquids (NAPL) to the aqueous phase, and transport of dissolved EDB in groundwater at concentrations exceeding its MCL with little retardation. This has resulted in significant EDB plumes of concern, despite biological and abiotic degradation.

The technologies described in this report focus on: (1) EDB attenuation, particularly using novel compound specific isotope analysis (CSIA) tools, and (2) in situ EDB degradation thru the stimulation of EDB degrading microorganisms. Demonstrating improved methods for examining EDB attenuation may result in significant remedial cost savings for the DoD and demonstrating the use of in situ bioremediation (ISB) may reduce the remedial timeframe required for EDB treatment at sites.

1.2 OBJECTIVE OF THE DEMONSTRATION

The objectives of this DoD ESTCP Project were: (1) to evaluate EDB attenuation, and (2) to determine whether biostimulation or bioaugmentation could effectively enhance EDB degradation rates in case natural attenuation was insufficient to protect receptors.

During this project, CSIA was used to evaluate EDB degradation in groundwater at Kirtland Air Force Base (AFB), New Mexico under differing geochemical conditions, ranging from highly reducing to more oxic. These data provided insights regarding the natural attenuation of EDB via biological and abiotic pathways. Isotope values, geochemical parameters, and concentration data were combined to evaluate EDB fate in the context of groundwater transport at the site.

This project also tested the efficacy of ISB to enhance EDB removal and evaluated this technology using a variety of methods including CSIA. The demonstration of ISB was originally envisioned to be performed at limited scale with a push-pull test, but after site representatives expressed interest, a larger, more comprehensive pilot test demonstration was performed in cooperation with the United States Army Corps of Engineers (USACE) and United States Air Force (USAF) stakeholders. The pilot testing efforts are summarized herein and discussed in greater detail in a Pilot Test Report submitted in March 2021, under a different contract, which has been included herein as Appendix B (USACE, 2021). In addition to contributing to that larger effort demonstrating the technology, this ESTCP project also evaluated ISB performance using CSIA. Development of attenuation parameters and bioremediation options for EDB will help inform future remedial decisions and likely result in future cost savings for the DoD, which manages numerous sites with historic fuel leaks, some of which likely contain EDB concentrations exceeding the Federal MCL of 0.05 µg/L.

1.3 REGULATORY DRIVERS

The current Federal MCL of 0.05 µg/L for EDB was promulgated in 1992 (Wilson et al., 2008). The extent of EDB contamination at military and civilian sites is currently unclear, as analytical methods for volatile organic compounds (VOCs) often used at UST sites (e.g., EPA 8260B) have detection limits for EDB greater than the MCL (Wilson et al., 2008). In recognition of the potential extent of EDB contamination from leaded fuels, the United States Environmental Protection Agency (USEPA) director of the Office of Underground Storage Tanks (OUST) issued a memorandum in May, 2010 recommending that the USEPA, states, and tribes begin appropriate monitoring for EDB at leaking UST sites (Hoskinson, 2010). Because EDB is present in AvGas, sites with hydrocarbon contamination resulting from AvGas handling practices may have EDB in groundwater. The Massachusetts Military Reservation (MMR) and former Williams AFB, for example, each have plumes with EDB, and efforts continue at Kirtland AFB to define and remediate an EDB plume, which is a continuing environmental challenge for the USAF. Kirtland AFB was the demonstration site for this project.

2.0 TECHNOLOGY

2.1 TECHNOLOGY DESCRIPTION

Many EDB degradation processes have been investigated at laboratory scales, but improved tools for evaluation at field scales are needed. Laboratory studies have shown that EDB degrades under anaerobic conditions through reductive debromination by *Dehalococcoides* spp. (DHC) (Peethambaram, 2010; Yu et al., 2013), *Dehalogenimonas* spp. (DHG) (Trueba-Santiso, 2018), and perhaps also methanogenic bacteria (Belay and Daniels, 1987; Bouwer and McCarty, 1985). Further, EDB is susceptible to abiotic transformation by hydrogen sulfide (H_2S) (Schwarzenbach et al., 1985) and iron sulfide (FeS) (Wilson et al., 2008), which often occur under sulfate reducing conditions. EDB degradation has also been reported under aerobic conditions by cometabolism supported by methane, ethane, propane, pentane and phenol (Danko et al., 2012; Hartzell et al., 2001; Hatzinger et al., 2015; Koster van Groos et al., 2018; McKeever et al., 2012) and to serve as a growth substrate under aerobic conditions for *Mycobacterium* sp. strain GP1 (Poelarends et al., 1999). Additionally, EDB is known to degrade by hydrolysis (Koster van Groos et al., 2018; Vogel and Reinhard, 1986; Weintraub, 1989). Other processes affecting EDB concentrations in the field include advection, dilution, dispersion, and volatilization. With a wide variety of relevant processes at field scales, improved methods to quantify EDB fate including CSIA are helpful. In addition to the need for improved understanding of EDB fate, remediation approaches addressing EDB contamination also require further validation at field scales. This project focused on these two aspects of EDB in the environment: 1) developing CSIA based approaches to help quantify natural attenuation of EDB; and 2) in situ anaerobic bioremediation of EDB.

2.1.1 CSIA Approaches to Quantify EDB Natural Attenuation

During this project, we investigated how carbon (C) isotope fractionation of EDB can help improve understanding of EDB attenuation. CSIA approaches offer promise for improved understanding of EDB degradation at field sites, similar to their application for other COCs (e.g., TCE).

C isotope composition of EDB is reported using delta (δ) notation, where $\delta^{13}C = R_{\text{sample}}/R_{\text{standard}}-1$ and R represents the $^{13}C/^{12}C$ ratio for the sample (EDB) or the standard (Vienna Pee Dee Belemnite, VPDB), as indicated by subscripts. In many cases, isotope fractionation can be described using a form of the Rayleigh equation (Eq. 1), with a bulk enrichment factor ($\varepsilon_{\text{bulk}}$) reflecting the strength of the isotope effect of given degradation processes.

$$\ln\left(\frac{R_i}{R_0}\right) = \ln\left[\frac{(\delta^{13}C_i+1)}{(\delta^{13}C_0+1)}\right] = \varepsilon_{\text{bulk}} \times \ln(F_i) \quad (1)$$

In Eq. 1, subscripts indicate values with the transformation of interest (i) or without transformation (0), R refers to the carbon isotope ratio discussed above, and F_i refers to the residual fraction of EDB mass remaining. Eq. 1 can be used under controlled conditions to determine $\varepsilon_{\text{bulk}}$ for well constrained processes. Alternatively, using appropriate $\varepsilon_{\text{bulk}}$ values for relevant field processes, Eq. 1 can be used to estimate residual fractions of EDB remaining and the extent of degradation.

Bromine (Br) isotope fractionation during EDB degradation has been observed and quantified during lab studies using a unique method coupling gas chromatography (GC) with a multi-collector inductively couple plasma mass spectrometer (MC-ICP-MS) (Kuntze et al., 2016). The smaller relative mass differences of Br isotopes compared to C isotopes leads to more limited Br isotope fractionation, but the use of both C and Br isotope systems simultaneously could be very beneficial in identifying transformation pathways. Unfortunately, the described method for analyzing Br isotopes is unique and was not available for use during this project. EDB also contains hydrogen atoms, but we are unaware of studies evaluating hydrogen (H) isotope fractionation during EDB degradation. Isotope effects for H are possible, but the quantity of EDB required for current state-of-the-art isotopic analysis (5-10 nanomoles compared to <1 nanomole for C) make this analysis impractical at many sites with low concentrations of EDB. Due to availability of suitable methods and promising results described in the literature, this project focused on C isotopes of EDB.

2.1.2 Anaerobic Bioremediation with EDB Degrading Microorganisms

Anaerobic bioremediation typically involves the stimulation of in situ biodegradation activity through the addition of electron donor (e.g., lactate, vegetable oil), nutrients, and bioaugmentation culture, as necessary. As described earlier, several organisms are known to reductively debrominate EDB, including DHC, and many of the bioremediation approaches used to stimulate dehalogenating organisms for biodegradation of chlorinated VOCs (cVOCs, e.g., TCE) should be applicable for EDB. During this project, we examined the pulsed addition of electron donor and nutrients through use of a groundwater recirculation system. We sought to address several issues, including: 1) whether bioaugmentation with a debrominating culture was necessary given the potential of native debrominating populations and 2) whether an anaerobic bioremediation approach effectively reduced source inputs such that downgradient compliance points would meet MCLs (0.05 µg/L).

2.2 TECHNOLOGY DEVELOPMENT

2.2.1 EDB Carbon Isotope Fractionation during Degradation

During this project we experimentally determined several bulk isotope enrichment factors, ε_{bulk}, for environmentally relevant EDB degradation processes. To quantify the extent of EDB degradation using isotope data, ε_{bulk} of important degradation mechanisms must be known, and these are often determined under controlled settings. These efforts are described in the Treatability Study Report included here as Appendix C as well as in Koster van Groos et al., (2018). In short, significant C isotope fractionation was observed during EDB degradation through a variety of anaerobic and aerobic processes (see Table 2.1). Figure 2.1 shows the C isotope changes during the degradation processes described in Table 2.1. Two of the ε_{bulk} are particularly relevant for the field studies performed during this project and will be discussed throughout this document, that occurring anaerobic biodegradation (ε_{bulk}=-8.2‰) and during hydrolysis (ε_{bulk}=-19.9‰)

Table 2.1. Laboratory Determined Bulk Carbon Isotope Enrichment Factors (ε_{bulk}) for EDB Degradation.

The anaerobic cultures listed are representative dehalogenating cultures available at APTIM. The ENV 490 field enriched was enriched from Kirtland AFB. Adapted from Koster van Groos et al. (2018).

Degradation Experiment	ε_{bulk} (‰)		2SE	R^2
Biological Degradation				
Anaerobic				
SDC-9	-8.8	±	0.4	0.99
Hawaii-05	-7.6	±	0.5	0.99
Field enrichment (ENV 490)	-8.8	±	1.1	0.96
SDC-9, Hawaii-05, & ENV 490, pooled	-8.2	±	0.4	0.98
PJKS	-20.4	±	2.9	0.95
Aerobic (co-substrate)				
Methylocella palustris (methane)	-2.7	±	0.2	0.99
Mycobacterium sphagni ENV482 (ethane)	-5.8	±	1.0	0.91
Abiotic Degradation				
Minerals				
FeS	-19.3	±	2.4	0.98
FeS_2	-28.8	±	1.3	0.99
Hydrolysis				
50 °C	-19.4	±	0.7	0.99
60 °C	-18.7	±	2.6	0.99
75 °C	-21.1	±	3.3	0.98
90 °C	-19.3	±	2.7	0.98
-Hydrolysis, pooled	-19.9	±	1.2	0.98

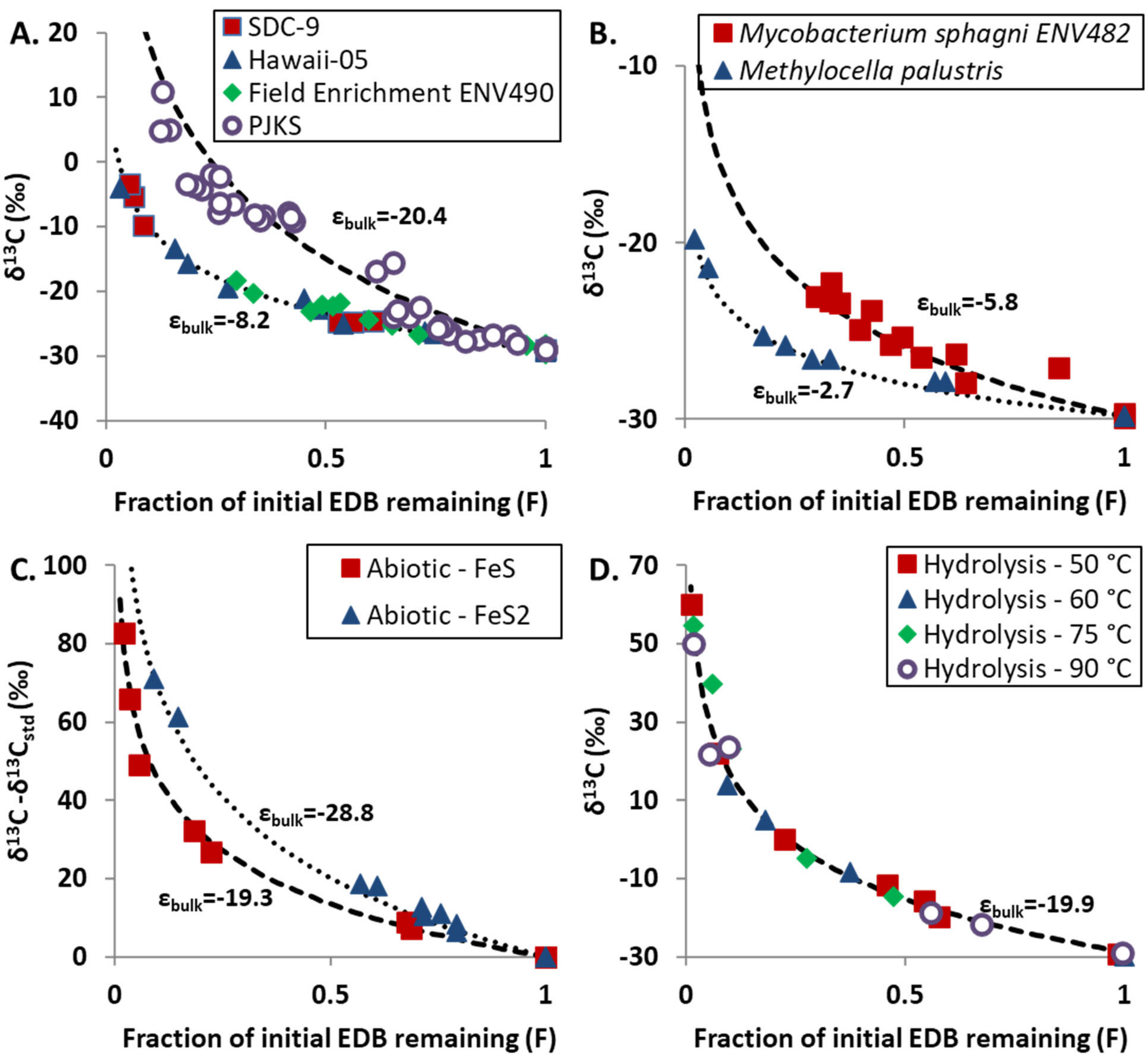


Figure 2.1. Isotope Fractionation Associated with EDB Degradation Resulting from Various Biological and Abiotic Mechanisms: A.) Anaerobic Biodegradaton, B.) Aerobic Cometabolic Degradation C.) Abiotic Degradation with Iron Sulfide Minerals, and D.) Abiotic Degradation by Neutral Hydrolysis.

Epsilon (ε_{bulk}) values reflect isotope effects consistent with the Rayleigh equation (Eq. 1).

The process of neutral hydrolysis is of interest because it provides a baseline degradation rate for EDB in the aqueous phase and resulting isotope fractionation. Figure 2.2 shows a plot of ln k vs T^{-1}, where k is the estimated first order rate constant for reactions at 50 °C, 60 °C, 75 °C, and 90 °C, and T is the absolute temperature (in Kelvin). Rate constants observed during this work were consistent with literature values (Barbash and Reinhard, 1989; Haag and Mill, 1988; Kuntze et al., 2016; Vogel and Reinhard, 1986). The kinetic data are consistent with the Arrhenius equation (Eq. 2), which was used to estimate an activation energy, E_a, associated with hydrolysis.

$$k = A \times e^{-E_a/(R \times T)} \quad (2)$$

In Eq. 2, A is the pre-exponential factor, E_a is the activation energy, R is the universal gas constant, and T is the absolute temperature (in Kelvin). E_a was estimated using individual concentration measurements and was 112 ± 11 kJ mol^{-1}, matching literature values ranging from 103 kJ mol^{-1} to 112 kJ mol^{-1} (Barbash and Reinhard, 1989; Vogel and Reinhard, 1986). The estimated natural logarithm of the pre-exponential term, ln(A), was 34.4 ± 3.9 when first order rate constants are given with units of h^{-1}. Extrapolating these data to 19 °C, the approximate average groundwater temperature observed at Kirtland AFB, suggests that baseline, or longest, half-life for EDB is approximately 10 years. This baseline degradation due to hydrolysis would be slower in colder climates, with extrapolated half-lives of approximately 20 years at 15 °C and 40 years at 10 °C.

Hydrolysis rates and associated C fractionation are described by Eq. 1 and Eq. 2 above, and these can be combined resulting in an estimate of C isotope fractionation per time due to hydrolysis:

$$\left(\delta^{13}C_t - \delta^{13}C_0\right)/_t = -\varepsilon_{bulk} \times A \times e^{-E_a/(R \times T)} \quad (3)$$

where $(\delta^{13}C_t - \delta^{13}C_0)$ describes the shift in isotope composition due to hydrolysis in the aqueous phase. Figure 2.3 shows this relationship for ε_{bulk}, A, and E_a values presented in this work, along with data from the hydrolysis experiments. For preliminary validation of this concept, the average fractionation (2.8 ± 0.3‰ yr^{-1}) observed in control bottles stored for 889 days is shown as a triangle in Figure 2.3 and matches expectations (~2.3‰ yr^{-1}) well. Extrapolated to Kirtland AFB groundwater temperature of 19 °C, these data suggest that hydrolysis results in baseline C isotope fractionation on the order of 1.4‰ yr^{-1} at the demonstration site.

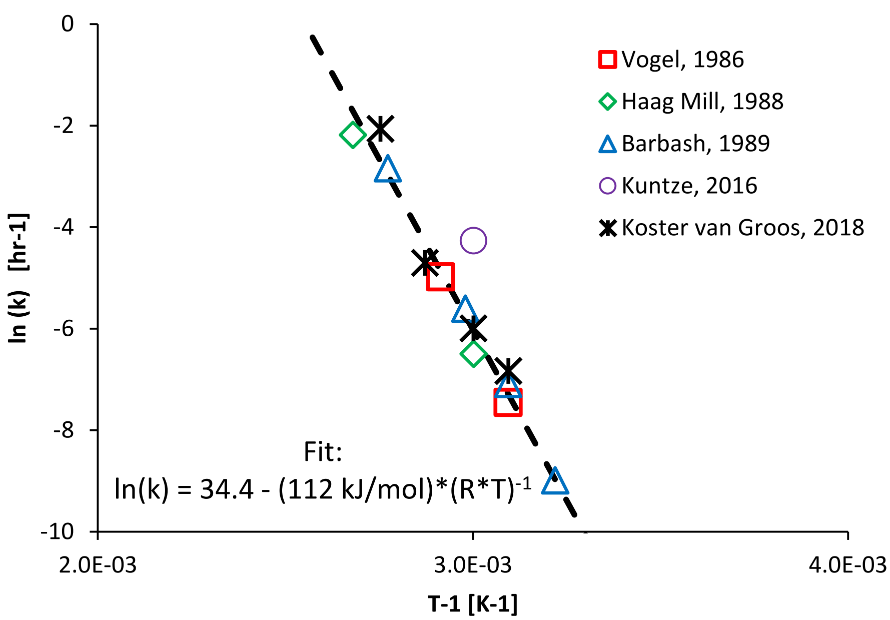


Figure 2.2. Arrhenius Plot of Neutral Hydrolysis Rates.

The dashed line indicates the Arrhenius fit to this project's experiments. Adapted from Koster van Groos el al. (2018).

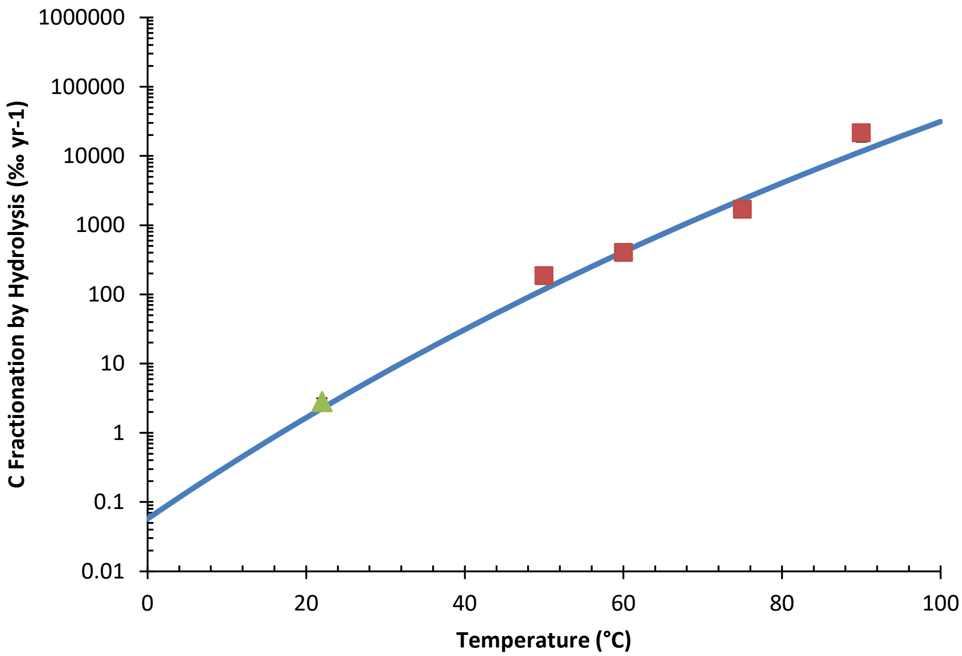


Figure 2.3. Estimated EDB C Isotope Fractionation per Year Due to Hydrolysis According to Eq. 3 and Parameters for Hydrolysis Provided in the Text.

Red squares indicate laboratory estimates during hydrolysis experiments, and the green triangle indicates fractionation of a control solution maintained at ambient laboratory temperatures. Adapted from Koster van Groos al. (2018).

The determined carbon ε_{bulk} values that were determined indicate differences in isotope fractionation between faster biodegradation mechanisms (generally with smaller ε_{bulk} values) and slower abiotic degradation mechanisms (generally with greater ε_{bulk} values). Because biogeochemical environments where these mechanisms predominate typically differ, examining these processes in the field to constrain and estimate in situ EDB attenuation showed promise. At relatively warm groundwater temperatures, such as found at Kirtland AFB, hydrolysis can result in EDB degradation at timescales of interest, and also result in measurable isotope fractionation.

2.2.2 CSIA Method Development

Applying CSIA of EDB to field samples sourced from leaded fuels (e.g., AvGas) presented several challenges due to high concentrations of non-target VOCs from the fuel and low relative concentrations of EDB. These are challenges because: 1) precision and/or accuracy of mass spectrometer (MS) detector output may be negatively impacted by relatively low EDB concentrations; 2) high loads of non-target VOCs may interfere with EDB extraction from the water matrix; and 3) non-target VOCs present in the samples may mask EDB as a chromatographic interference. During this project, the last issue was resolved using two-dimensional chromatography; the two other issues are further discussed below and relate to one of the performance objectives of this project.

2.2.2.1 Performance benchmark for thermal desorption-CSIA

Concentrations of EDB outside the source area at the demonstration site were too low for analysis using standard purge and trap extraction, such as that applied previously (Kuder et al., 2012). Accordingly, EDB extraction utilized a closed-loop approach with preconcentration on thermal desorption tubes, permitting preconcentration of EDB from larger sample volumes. Sorbent tubes were utilized to concentrate and introduce EDB to the CSIA system. To evaluate performance during thermal desorption, repeated control samples were prepared by spiking adsorbent tubes with concentrated solution of EDB (170 ng of EDB per tube except two tubes spiked with 85 ng of EDB), flushed with 1 L of inert gas, and analyzed. These control samples were analyzed repeatedly over the duration of the project to monitor the performance of the thermal desorber, the GC, and the mass spectrometer. This analysis did not address isotope effects occurring during EDB extraction from water, but isolated the performance of the analytical instrumentation.

Figure 2.4 shows the results of these repeated thermal desorption analyses. The average of EDB samples was -29.5‰, a value consistent with the EDB spiking solution itself. All data were within ± 0.8‰ of the average, representing an "ideal" performance benchmark for EDB. All carbon CSIA data for EDB was compared to this benchmark to assess the uncertainty added by the extraction processes and by the presence of non-target VOCs.

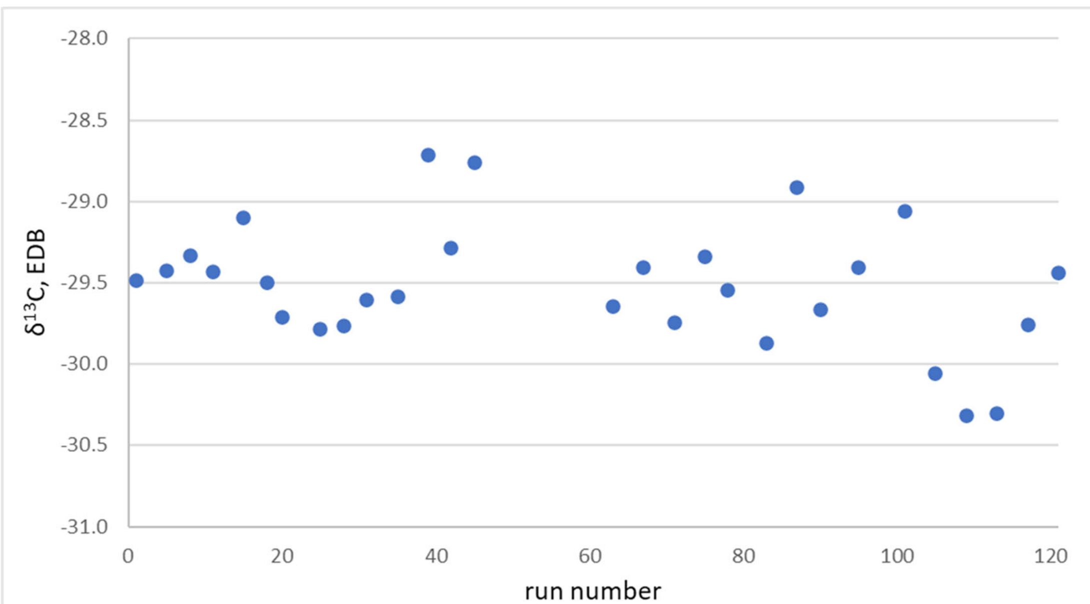


Figure 2.4. Repeated CSIA Measurements of EDB Standard after Thermal Desorption.

2.2.2.2 Performance benchmark for the extraction of EDB from water matrix

To evaluate performance of EDB extraction from aqueous matrix, control samples were prepared by spiking 850 mL of VOC-free water with different masses of EDB. The mass of the EDB used was between 9 and 220 ng, corresponding to aqueous concentrations between 0.01 µg/L and 0.26 µg/L. These aqueous control samples were extracted using a closed-loop purge and trap system and the extracted EDB (trapped using adsorbent tubes) was analyzed using thermal desorption-CSIA. Figure 2.5 shows a schematic of the closed-loop purge and trap system. This extraction and sample analysis procedure was used for lower concentration groundwater samples during the project.

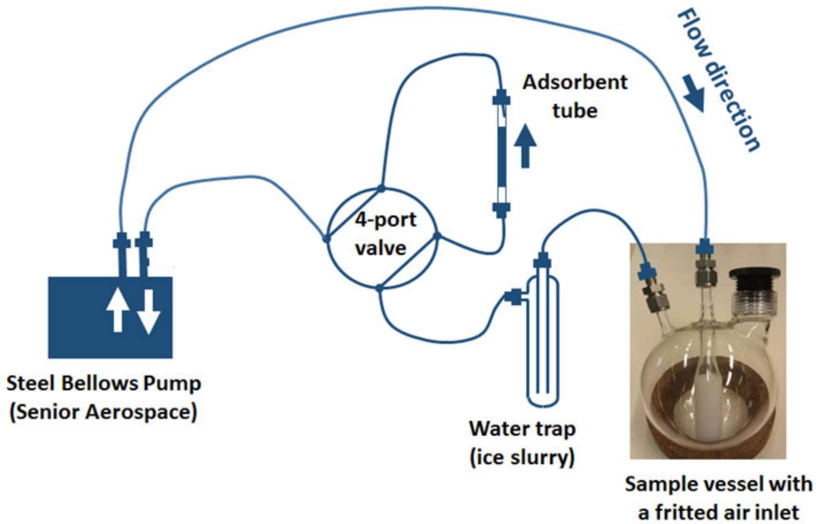


Figure 2.5. Closed-loop Purge and Trap System to Concentrate Dilute EDB Samples.

Figure 2.6 shows $\delta^{13}C$ values of EDB observed in these control samples with respect to peak amplitude. $\delta^{13}C$ values of EDB from peaks with amplitudes greater than 100 mV (i.e., EDB at 0.04 µg/L and above) are very similar to the benchmark range for thermal desorption-CSIA controls, with only two out of 12 results exhibiting slight ^{13}C enrichment vs. the benchmark range (by + 0.2‰). Analytical noise increased for control samples at lower concentrations. The data in Figure 2.6 with these lower peak amplitudes represent average values of multiple peak integrations, with error bars representing the uncertainty of individual integrations (only shown for the samples with excessive integration noise). The overall uncertainty of the three controls yielding ~50 mV signal (i.e., approximately 0.02 µg/L EDB) was acceptable, at ± 2-3‰ (3‰ was used in field sample data assessment). The overall uncertainty margin of the lowest concentration samples (i.e., approximately 0.01 µg/L EDB) was largest, at ± 5-8‰ (8‰ was used in field sample data assessment).

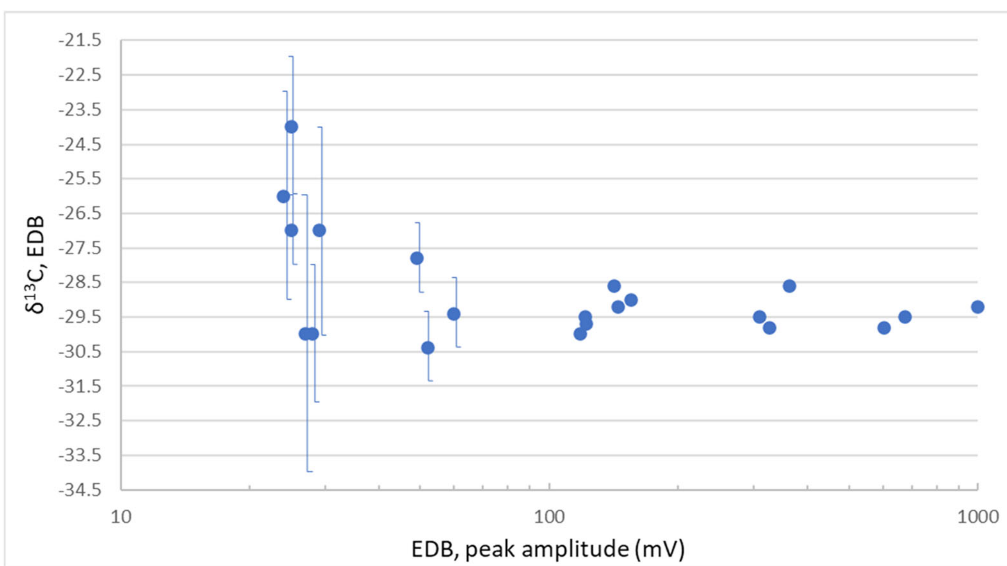


Figure 2.6. CSIA Measurements of Dilute EDB Standard After Extraction and Concentration Using the Closed-loop Purge and Trap system.

2.2.2.3 The effects of non-target VOCs on the analytical uncertainty

To evaluate possible impacts of non-target VOCs on EDB recoveries and associated isotope effects during extraction from aqueous matrix, control samples were prepared by spiking 850 mL of water with combinations of EDB and non-target VOCs. Several of these control samples were prepared using a mixture of benzene, toluene and p-xylene (the BTX mass was 20 µg or 200 µg). Additional control samples were prepared using 1.5 mg of a 50:50 mixture of unleaded gasoline and JP-8 fuel, which was intended to represent some of the most contaminated samples collected and analyzed for this project. In practice, many field samples contained higher fuel concentrations, but the analyses performed here likely captured the overall behavior appropriately.

The extraction and analysis process during this testing were the same as described in Section 2.2.2.2. Figure 2.7 shows EDB spike recovery using the sorbent tubes for controls with non-target VOCs. Decreased EDB recovery likely resulted from competitive sorption in the presence of high concentrations of non-target VOCs. Note that due to EDB partitioning behavior among phases, the average recovery under ideal conditions (i.e., no competing non-target VOCs) was only 73%. Figure 2.8 shows the $\delta^{13}C$ values of EDB from controls as a function of EDB recovery. While many data points remain within the uncertainty margin of ± 1‰ with respect to the average of the results obtained without non-target VOCs (-29.5‰, see Figure 2.6), a systematic enrichment of approximately +1‰ in ^{13}C was evident that was not correlated with the decreased EDB spike recovery in the presence of elevated concentrations of interfering VOCs.

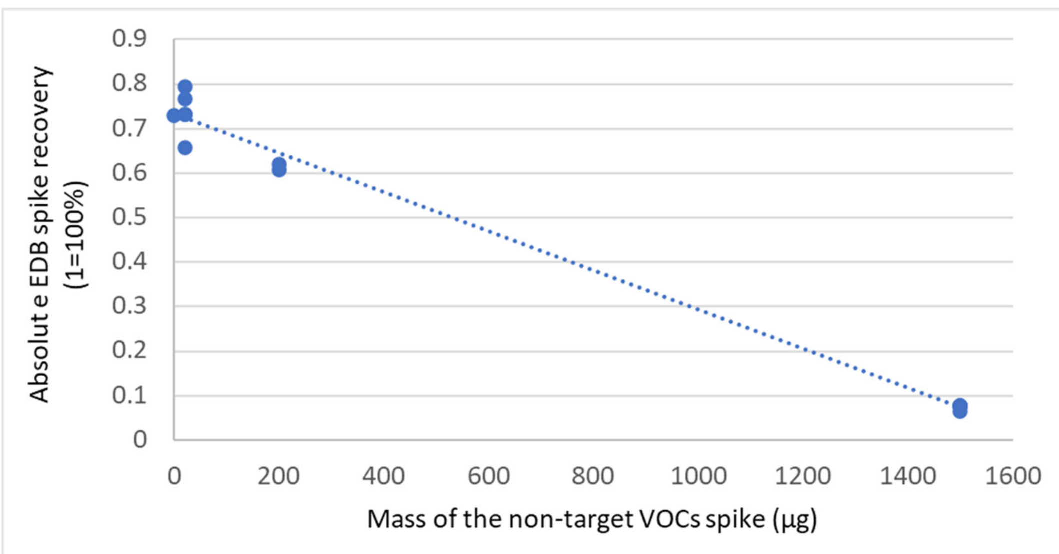


Figure 2.7. EDB Spike Recovery for Controls Mixed with Non-target VOCs Using the Closed-loop Purge and Trap System.

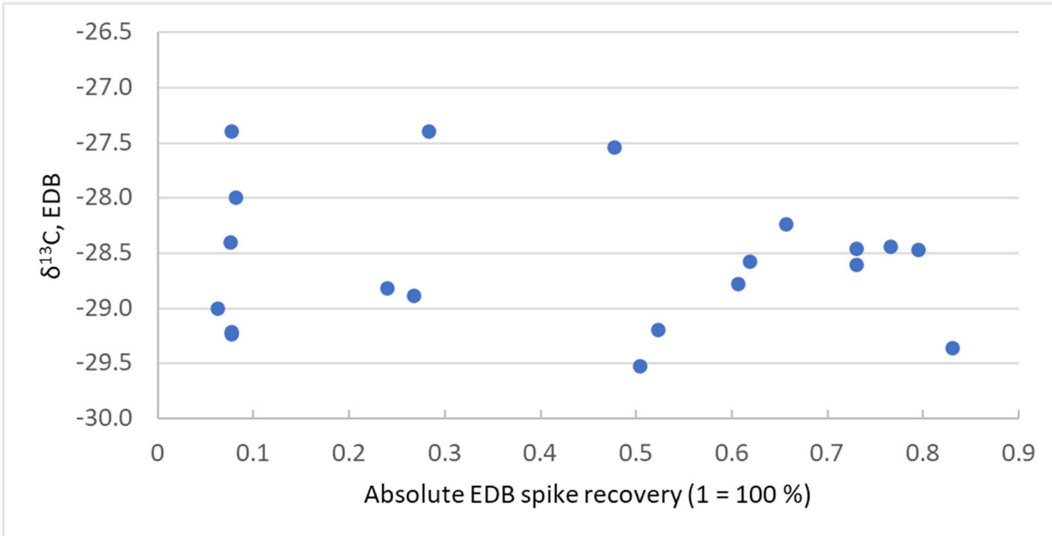


Figure 2.8. CSIA Measurements of Spiked Standard EDB Mixed with Non-target VOCs after Used of Closed-loop Purge and Trap System.

2.2.2.4 Implications for Field Demonstration

The overall analytical uncertainty of C CSIA is significantly greater if the mass of EDB recovered from the sample is lower than ~15 ng, due to resulting low CSIA detector signal (~50 mV EDB peak amplitude, Figure 2.6). Another type of error was observed in controls containing non-target VOCs, where some of the observed results were enriched on ^{13}C by up to 1‰ (Figure 2.8). The cumulative uncertainties assigned to field samples described in Sections 5.7.1.4.3 and 5.7.2.6.3 incorporated the effect of peak amplitude and the ^{13}C enrichment caused by the presence of non-target VOCs as described in Sections 2.2.2.2 and 2.2.2.3.

2.2.3 Anaerobic Bioremediation with EDB Degrading Microorganisms

Based on literature (Henderson et al., 2008; Wilson et al., 2008; Yu et al., 2013), and the experiments described in Section 2.2.1, anaerobic biostimulation approaches consistent with approaches used for cVOCs were expected to be successful for EDB. Treatability testing described in Section 5.3 indicated that degradation of EDB to concentrations below its MCL was achievable after amendment with EDB degrading organisms. It was unclear, however, whether native organisms present in field soils could be stimulated to degrade EDB. The potential for successful enhancement of anaerobic bioremediation of EDB was further supported by the findings of Henderson et al. (2008) who observed enhanced rates of EDB removal in lactate-amended microcosms. We are unaware of specific applications of anaerobic ISB in the field for EDB remediation.

2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

Tools that help evaluate and sustain the implementation of monitored natural attenuation (MNA) approaches can be extremely valuable. CSIA, especially of contaminants themselves, provides a powerful tool for evaluating attenuation processes by helping to determine the extent of contaminant transformation (Hunkeler et al., 2008). Isotope fractionation of EDB documented to occur in the field can provide clear evidence of EDB transformations occurring in situ. CSIA based estimates of degradation extent can also provide limited kinetic information of in situ transformation when coupled with additional temporal information, which may be provided by transport models of varying complexities. CSIA methods for carbon in EDB have been developed, and the preconcentration method for low-concentration samples (see Section 2.2.2) have improved such that informative investigations of carbon isotope fractionation of EDB in the field are now feasible. Low EDB concentrations and interferences may, however, increase uncertainties associated with isotope measurements.

The recirculation pilot test described herein demonstrated the application of anaerobic biostimulation to enhance in situ EDB biodegradation at the demonstration site. ISB with and without bioaugmentation is a common remedial approach to treat chlorinated solvents such as trichloroethene (TCE), yet application to EDB is still novel. Limitations of anaerobic bioremediation and bioaugmentation include the risk of well biofouling and decreased hydraulic conductivity of the aquifer. Fuel hydrocarbons from AvGas (and other fuels) typically result in reducing geochemical conditions that facilitate anaerobic degradation processes, and anaerobic treatment approaches reduce risks of forming mineral oxide phases that may otherwise affect hydraulic performance of the aquifer.

3.0 PERFORMANCE OBJECTIVES

The performance objectives for this project are listed in Table 3.1. Treatability testing, CSIA method development, plume-wide field sampling, and an in-situ field demonstration of anaerobic biostimulation were all performed in an effort to attain the objectives. The following subsections provide more detailed descriptions of each objective.

Table 3.1. Performance Objectives.

Performance Objective	Data Requirements	Success Criteria	Criteria Met
Quantitative Performance Objectives			
EDB CSIA measurements of samples containing <1 µg/L EDB	Low concentration EDB analysis performed using an improved low concentration CSIA method.	<2‰ variability in carbon CSIA data with triplicate samples containing 0.5 µg/L EDB. CSIA data from 5 site monitoring wells with low concentration EDB (<1 µg/L)	Yes
CSIA to quantify in situ EDB degradation and attenuation	CSIA data from monitoring wells along the EDB plume. Laboratory studies to identify carbon isotope enrichment factors associated with biodegradation and abiotic degradation.	CSIA evidence of EDB degradation along contaminant plume, and use of CSIA data together with a groundwater transport model to help quantify EDB attenuation.	Yes
Biodegrade EDB to MCL (0.05 µg/L) in microcosms	Microcosm biodegradation results for several treatment approaches.	EDB degraded to MCL by using either biostimulation (aerobic or anaerobic) or co-metabolic treatment	Yes
Degrade EDB in pilot demonstration to MCL (0.05 µg/L)	Low level EDB detection method and analysis of groundwater samples during in situ pilot demonstration test	Groundwater EDB concentration of <0.05 µg/L achieved during pilot demonstration test	Yes
EDB degradation resulting in <0.05 µg/L at compliance point.	EDB attenuation model; EDB degradation rates calculated from laboratory studies and pilot demonstration; CSIA data from groundwater along EDB plume	EDB attenuation model predicting that treatment approaches will result in EDB concentration below MCL at compliance points.	Yes
Low-cost treatment	Field demonstration cost assessment and cost estimates of alternative treatment approaches	Bioremediation is less costly than alternative technologies.	Incomplete
Performance Objective	**Data Requirements**	**Success Criteria**	**Criteria Met**
Qualitative Performance Objectives			
Simple and informative attenuation/treatment model	Feedback from stakeholders involved with Kirtland AFB remediation efforts	Attenuation/treatment model is used to help guide remedy selection and performance evaluation of larger scale treatment options at Kirtland AFB	Incomplete

3.1 CSIA MEASUREMENTS OF EDB AT <1 µG/L

The EDB concentration in groundwater required for high-precision CSIA analysis by Gas Chromatography-Isotope Ratio Mass Spectrometry (GC-IRMS) with standard purge and trap sample introduction is typically ~ 6 µg/L, although useful results can be obtained with slightly lower concentrations, albeit with a tradeoff in precision. With an MCL of 0.05 µg/L, it was important to further improve the sensitivity of the CSIA technique for this project.

Laboratory data demonstrating recovery of EDB during concentration processes without isotope fractionation were needed to verify our ability to reliably quantify $\delta^{13}C$ values of EDB at low concentrations. Method validation included an assessment of the precision and accuracy of the method. Successful demonstration of the method included demonstrating <2‰ uncertainty in $\delta^{13}C$ for samples containing 0.5 µg/L or less of EDB, and ultimately measuring $\delta^{13}C$ of field samples with low EDB concentrations (<1 µg/L). This was achieved during this project. Further discussion of this method and performance objective can be found in Sections 2.2.2 and 6.1.

3.2 CSIA TO QUANTIFY IN SITU EDB DEGRADATION AND ATTENTUATION

The extent of degradation along an EDB plume can be evaluated by measuring $\delta^{13}C$ of EDB and applying understanding of how stable carbon isotopes of EDB are fractionated by biotic or abiotic processes. During this project, this was of interest for examining EDB attenuation under different biogeochemical conditions at the demonstration site, as well as during the demonstration of ISB.

To estimate the extent of EDB degradation along the contaminant plume using isotopic information, ε_{bulk} values for relevant degradation processes (see Section 2.2.1) and $\delta^{13}C$ values of collected EDB were required. Complemented by knowledge of biogeochemical conditions and groundwater transport, the isotope information provided valuable insights regarding EDB attenuation at the site. Overall, the large increases in $\delta^{13}C$ observed at the site provided clear evidence of EDB degradation. Further discussion of this performance objective can be found in Section 6.2.

3.3 BIODEGRADE EDB TO MCL (0.05 µG/L) IN MICROCOSMS

Microcosm tests were performed to identify suitable biotreatment approaches for lowering EDB concentrations to below 0.05 µg/L. Tested treatments included aerobic biostimulation, aerobic co-metabolic treatment with propane, methane, and ethane, anaerobic biostimulation, and anaerobic bioaugmentation.

Microcosms were repeatedly sampled and analyzed by EPA method 8011 to evaluate performance and decreases in EDB concentrations to less than 0.05 µg/L were observed in several microcosms, including in anaerobic systems bioaugmented with the dehalogenating SDC-9 culture. Further discussion of this treatability testing and the performance objective can be found in Sections 5.3 and 6.3.

3.4 DEGRADE EDB IN PILOT DEMONSTRATION TO MCL (0.05 µG/L)

A primary goal of this demonstration project was to perform an in situ field pilot demonstration of the anaerobic bioremediation approach selected based on successful microcosm studies, and in consultation with the demonstration site. The performance objective was to meet the Federal MCL of EDB (i.e., 0.05 µg/L) in site groundwater as a result of enhanced biodegradation processes.

Low-level EDB measurements in site groundwater, as well as evidence that decreases in concentrations were not due to dilution or volatilization processes, were required to achieve this objective. EDB degradation after ISB was observed to result in concentrations less than 0.05 µg/L with little evidence of significant dilution; and the goal of this performance objective was achieved. Further discussion of this treatability testing and the performance objective can be found in Section 6.4.

3.5 EDB DEGRADATION RESULTING IN <0.05 µG/L AT COMPLIANCE POINT

In lieu of degrading EDB to concentrations less than the MCL in the immediate source zone, there would be interest in demonstrating that source zone treatment with subsequent attenuation processes could meet the MCL of 0.05 µg/L at a compliance point. Understanding of EDB attenuation, and application of a simple attenuation model, could be used to demonstrate the feasibility of this process. The pilot demonstration implemented during this project resulted in EDB concentrations below the MCL; and while additional time might be necessary for impacts to propagate downgradient, it is likely that EDB concentrations below the MCL would be met at a compliance point. Further discussion of this performance objective can be found in Section 6.5.

3.6 LOW-COST TREATMENT

Source zone treatment is often essential for reducing long-term remediation costs. Coupled with sufficient downgradient attenuation, source zone treatment can also help reduce the time downgradient treatment systems must be operated to protect receptors. To evaluate enhanced anaerobic ISB for source zone EDB treatment, costs of alternative treatment approaches should be known. The depth of groundwater at Kirtland AFB (approaching 500 ft in the source zone) makes it challenging to effectively estimate these high costs. Additionally, co-located contaminants (e.g., BTEX hydrocarbons) could impact selection of treatment approaches. The feasibility of anaerobic ISB for degrading EDB in anaerobic source zones was demonstrated, but due to site complexities cost comparisons were ultimately not made during this project. It is clear, however, that all active treatment approaches would be significantly more costly than natural attenuation processes. Further discussion of this performance objective can be found in Section 6.6.

3.7 SIMPLE AND INFORMATIVE ATTENUATION AND TREATMENT MODEL

Simple attenuation models can be useful when evaluating COC fate at a given site. Such models can provide valuable insights regarding the relative importance of attenuation and degradation mechanisms. These types of models (e.g., RemChlor, Falta et al., 2007) often utilize simplified parameters and illustrate COC fate and possible treatment outcomes, particularly in the absence of more complex modeling. It is too soon to know whether such modeling will be useful for evaluating remedy alternatives at Kirtland AFB, but it may be unlikely as significantly more sophisticated and site-specific groundwater flow models have already been constructed for this site. Further discussion of this performance objective can be found in Section 6.7.

4.0 SITE DESCRIPTION

4.1 SITE LOCATION AND HISTORY

Kirtland AFB was selected as the demonstration site for this project. Kirtland AFB is southeast of the City of Albuquerque in Bernalillo County, New Mexico. Overall site cleanup is being performed as a RCRA Corrective Action. At the time of this demonstration, a plume of EDB at the site included an anaerobic area with extensive hydrocarbon contamination and downgradient zones with fewer hydrocarbon impacts, but with EDB concentrations exceeding its MCL.

The Kirtland AFB Bulk Fuels Facility (BFF) (see Figure 4.1) is a known source of EDB at the site. The Kirtland AFB BFF site was the location of an accidental leak of aviation gasoline (AvGas) and jet propellant fuel grades 4 (JP-4) and 8 (JP-8). The area has been used for fuel transfer and storage since 1953 (Travis and Wilkins, 2021). From 1953 to late 1975, the primary fuel stored and used at the BFF was AvGas. The use of AvGas and JP-4 at Kirtland AFB was phased out in 1975 and 1993, respectively (USACE, 2021). JP-8 was handled through the Former Fuel Offloading Rack (FFOR) until the leak was discovered in 1999. AvGas containing EDB as a lead scavenger was used from approximately the 1940s to 1975. Fuels and fuel constituents migrated through the vadose zone and are observed in groundwater, located 350 to 500 ft bgs depending on time and place.

The evaluation of EDB attenuation at Kirtland AFB described herein utilized 13 groundwater sampling wells covering several zones of the EDB plume from an anaerobic source zone to aerobic zones significantly farther downgradient, and also included an upgradient location that exhibited little evidence of the leak. The location selected to demonstrate anaerobic ISB targeting EDB was approximately 300 feet to the east of Building 1024 (Figure 4.2) and near a previously installed monitoring well cluster that included Kirtland AFB (KAFB)-106062, KAFB-106063, and KAFB-106064. The effort associated with ISB described herein was performed in cooperation with USACE and USAF and is also described in detail in the Pilot Test Report included in Appendix B.

4.2 SITE GEOLOGY AND HYDROGEOLOGY

The demonstration site is within the Albuquerque Basin, and the sedimentary deposits include fluvial deposits of the ancestral Rio Grande and its tributaries. The water table at the site occurs approximately 460 to 490 feet bgs, and groundwater monitoring wells at the site are primarily screened within the sand and gravel deposits of the Santa Fe Group. Santa Fe Group deposits extend to depths exceeding 1300 feet below ground surface (bgs) and comprise the regional Rio Grande aquifer. Santa Fe Group deposits containing contaminated groundwater are predominantly composed of interbedded sand and gravel. Fine-grained silt and clay lenses are observed less frequently. Figure 4.3 provides a representative cross-section along the primary axis of historic groundwater flow at the site.

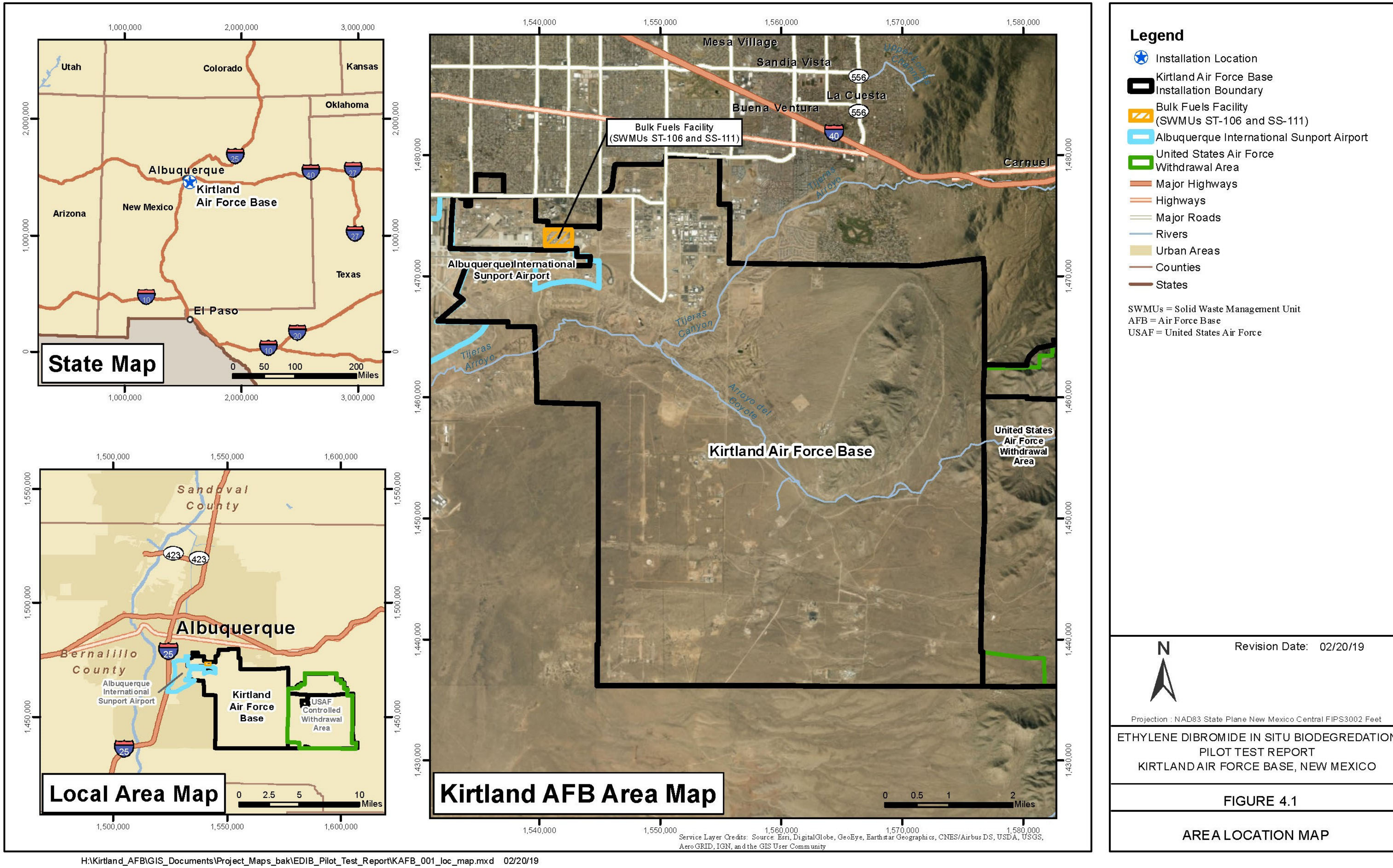


Figure 4.1. Area Location Map.

Figure 4.2. **ISB Demonstration Site Location Map.**

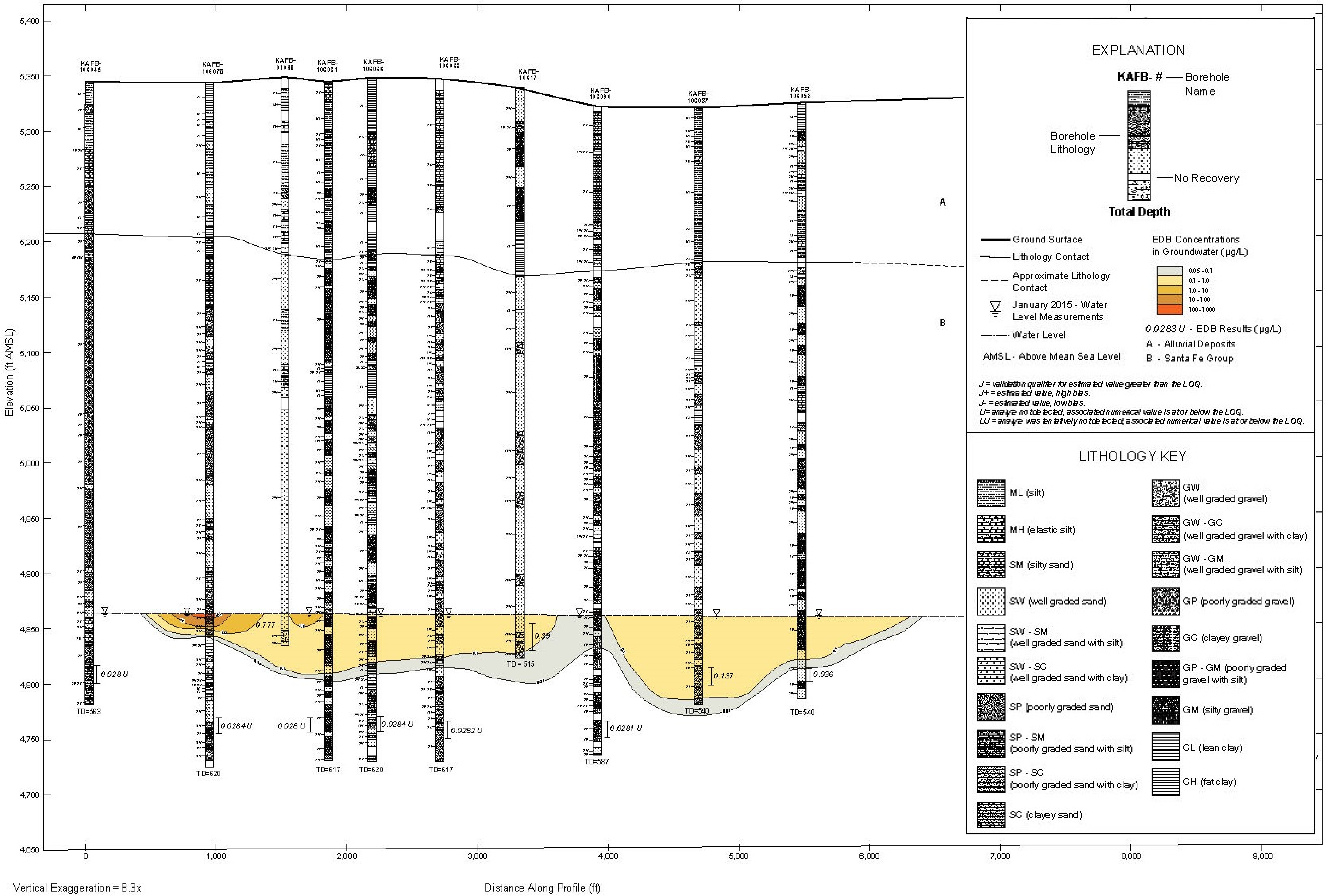


Figure 4.3. Kirtland AFB Geologic Cross Section.

The water table in the vicinity of Kirtland AFB was estimated to be approximately 350 feet bgs before extensive groundwater pumping from the regional aquifer occurred. Throughout the history of the BFF site, the water table has fluctuated due to groundwater pumping to supply water to the residents of Albuquerque and vicinity. The deepest depth to water, representing the lowest historical groundwater elevation in the BFF source area, occurred in 2009 and ranged from 500 to 502 feet bgs. In more recent years, the water table has risen due to water-conservation efforts by the greater Albuquerque community, and groundwater elevations in the source area were approximately 455 to 480 ft bgs at the time of the study.

Groundwater flow at the site since operations at the BFF began has varied over time. Prior to larger groundwater withdrawals to the northeast of the site, flows were generally to the southwest. However, after increased withdrawals, the direction of groundwater flow shifted to the north and east sometime about 1980 (Travis and Myers, 2019), resulting in much of the documented contaminant distribution. Gradients have fluctuated with withdrawal history, but were estimated to be approximately 0.0012 ft/ft in 2009 when groundwater elevations were at their nadir (Kirtland AFB, 2010) but have become shallower as groundwater levels have increased more recently (Kirtland AFB, 2018). Hydraulic conductivity at an extraction well located north of Kirtland AFB installed to intercept water containing EDB and protect downgradient receptors was estimated at 150 ft/day (Kirtland AFB, 2018) and other estimates of hydraulic conductivity have ranged from 6 to 131 ft/day, with higher values in the ancestral Rio Grande deposits that averaged 72 ft/day (Ellinger, 2013). Average total porosity and effective porosity at the site were estimated as 34.1% and 27.4% respectively (Kirtland AFB, 2018).

The water table at the ISB pilot test location occurred at approximately 475 feet bgs, and newly installed pilot test groundwater wells were screened in the shallow part of the aquifer within the Santa Fe Group. Well screens were placed to target the highest EDB concentrations (i.e., approximately the top 20 feet of the aquifer), and groundwater extraction and injection facilitated flow primarily in sediments with greatest hydraulic conductivity. Due to the nature of the active groundwater recirculation processes involving pumping and reinjection, system operations appeared relatively insensitive to thin layers with lower hydraulic conductivity.

4.3 CONTAMINANT DISTRIBUTION

Fuels, including AvGas, from the former BFF have impacted soil, soil-gas, and groundwater at the site. Fuel constituents including EDB and hydrocarbons have dissolved into groundwater over time, and their degradation has led to anaerobic conditions in the source area where NAPL was historically observed. More aerobic conditions have been observed downgradient in the mid- to distal- end of the EDB plume.

A brief summary of the prominent constituents of concern at the time of the study is provided below:

- EDB above its MCL (0.05 µg/L) historically formed a plume in the shallow zone approximately 7,000 feet long and 300 to 1,300 feet wide (see Figure 4.4). EDB was found in both anaerobic and aerobic areas of the plume.

- NAPL was historically present at undisturbed thicknesses of approximately 1.5 ft on top of groundwater at monitoring wells. Of the 13 wells examined during the sitewide natural attenuation evaluation, NAPL was observed at 5, with the most recent observations of NAPL occurring between October 2010 (at KAFB-106010) and October 2013 at (KAFB-106076). Since 2014, observations of NAPL have been more sporadic. NAPL was observed in one of the pilot test monitoring wells (KAFB-106MW1-S) after installation and prior to initiation of the pilot test, together with elevated concentrations of hydrocarbons. During later stages of the pilot test, when well infrastructure was removed for assessment, NAPL was also observed in extraction wells KAFB-106EX1 and KAFB-106EX2.

- To help protect the community, a pump and treat system has been operating within the dilute downgradient EDB plume since 2015.

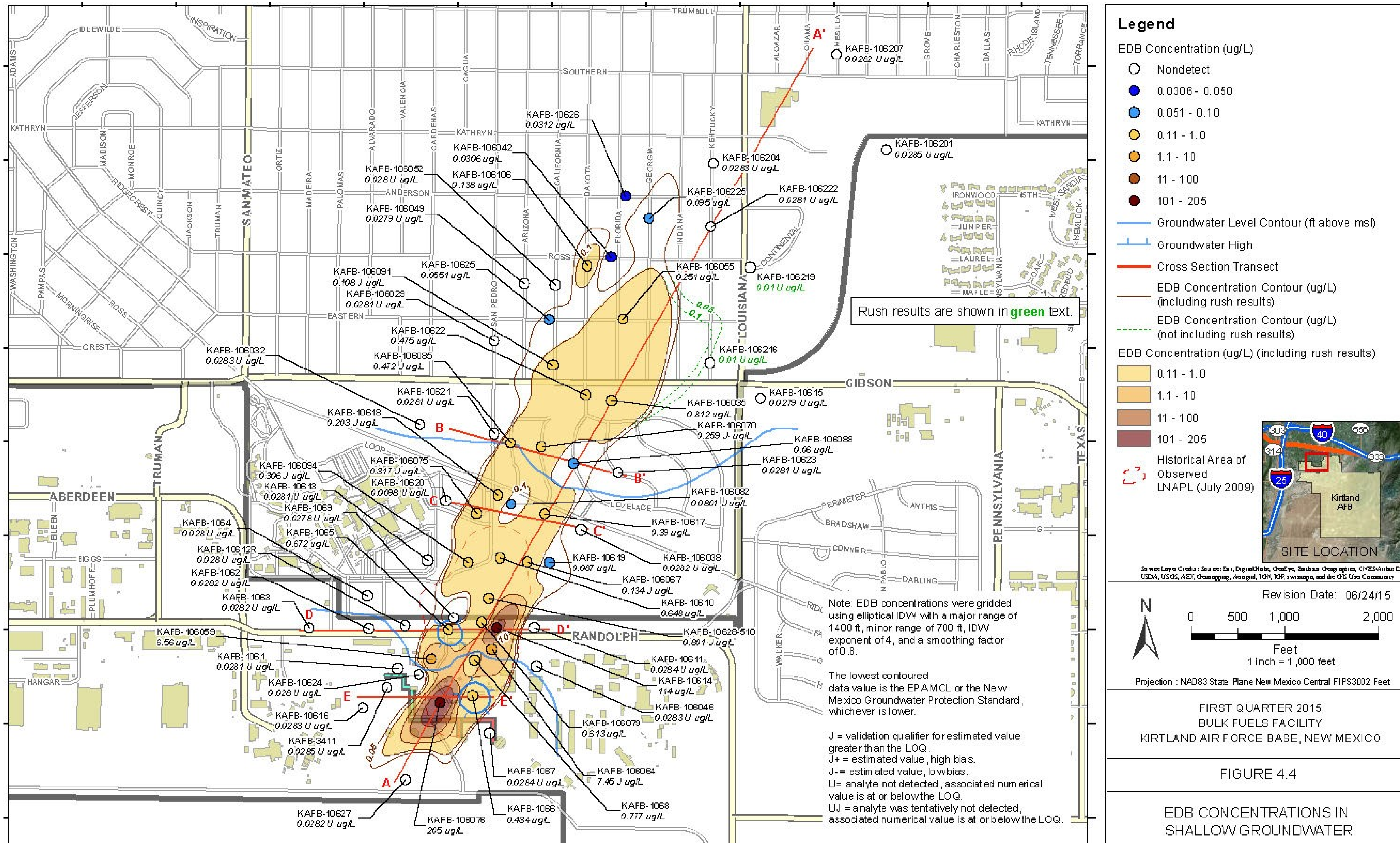


Figure 4.4. EDB Concentrations in Shallow Groundwater

(1st Qtr 2015).

5.0 TEST DESIGN

The following subsections provide a description of the system design and testing conducted to address the performance objectives described in Section 3.0.

5.1 CONCEPTUAL EXPERIMENTAL DESIGN

The demonstration included: (1) plume sampling, specialty analyses (e.g., CSIA), and data evaluation to examine EDB attenuation at the site; and (2) in situ pilot testing to evaluate the potential for enhanced EDB degradation after biostimulation. The plume sampling portion of the field demonstration was conducted using standard procedures for collection of groundwater samples from existing monitoring wells. The in-situ pilot testing was conducted using a groundwater recirculation system as further described below.

CSIA of EDB was performed using field samples and evaluated using enrichment factors, ε_{bulk}, determined in the lab as described in Section 2.2.1. This CSIA effort was complemented by analysis of additional biogeochemical indictors and analysis of the microbial community at a variety of wells covering different geochemical regimes of the plume. This information was evaluated to help inform whether MNA may be a reasonable approach for addressing the environmental presence of EDB resulting from AvGas.

A pilot demonstration system was installed to facilitate groundwater recirculation and in situ testing of EDB biodegradation after biostimulation. This effort was performed together with USACE and USAF. The system was successfully used to extract, amend, and reinject anaerobic groundwater. The system was sized to ensure distribution of amendments across an approximately 150-foot-long demonstration zone, such that subsequent impacts could be observed at monitoring wells at a depth of approximately 500 feet. The system was also designed to allow the introduction of a bioaugmentation culture, but due to the success of biostimulation alone, bioaugmentation was not performed.

5.2 BASELINE CHARACTERIZATION

Characterization activities at Kirtland AFB as part of the Resource Conservation and Recovery Act (RCRA) Corrective Action process have been extensive. Prior to site selection, Aptim reviewed site documents including results from quarterly sampling and well logs. To facilitate analyses of EDB attenuation, 13 shallow groundwater monitoring wells throughout the plume were selected and analyzed for evidence of EDB attenuation as further described in Section 5.4.1. Aptim consulted with USACE, USAF, New Mexico Environment Department (NMED), and New Mexico stakeholders through technical working groups to identify an appropriate site for the anaerobic bioremediation pilot test. Baseline conditions associated with the ISB pilot testing are discussed along with tracer testing in Section 5.7.2.1.

5.3 TREATABILITY STUDY RESULTS

Aptim conducted laboratory treatability studies to evaluate alternative anaerobic and aerobic EDB bioremediation approaches being considered for demonstration at Kirtland AFB. A Treatability Study Report describing these treatability studies is included in Appendix C. The primary conclusions and implications of the treatability studies are described here.

Because EDB is present together with the fuel hydrocarbon constituents such as benzene, toluene, ethylbenzene, and xylenes (BTEX) in the source area wells, the impacts of the bioremediation approaches on BTEX compounds were also investigated during treatability testing. The treatability studies were supported by this ESTCP project and other USAF supported remediation efforts at Kirtland AFB.

Soils for treatability testing were collected during installation of two new wells (KAFB-10612R and KAFB-106210), one of which was in an area where fuel associated NAPL was previously observed, and the other in an area much less impacted by EDB and fuel hydrocarbons. Groundwater used for the treatability testing was later extracted from these same two wells. Installation of KAFB-106210 was funded through this ESTCP project and its primary purpose was the collection of subsurface materials, but it was also screened from 5 to 15 ft below the water table in case it could be used for demonstration or other site remediation efforts. However, as planning for the demonstration evolved, including the cooperation with USACE and USAF, KAFB-106210 was not further utilized.

Treatability tests were performed to assess the degradation of EDB and BTEX compounds under aerobic and anaerobic conditions using batch microcosms filled with aquifer materials (solids and water) collected at the two locations described above. Different amendments were used to determine their effects on EDB and BTEX in the aquifer samples. Oxygen and inorganic nutrients were added to samples from each location to investigate potential aerobic degradation of EDB and BTEX. Additionally, two aerobic bacterial cultures previously isolated by Aptim and known to degrade EDB (*M. sphagni* ENV482 and *Rhodococcus ruber* ENV425) were tested using the site-specific materials. Anaerobic treatments included sulfate alone, sulfate in combination with ferrous iron, and sulfate in combination with ferrous iron, lactate and inorganic nutrients. These amendments were included to enhance the growth of sulfate-reducing bacteria (SRB) and produce sulfide minerals capable of facilitating abiotic EDB degradation. The presence of sulfate may also facilitate BTEX degradation. An anaerobic dehalogenating culture that was previously observed to degrade EDB (SDC-9) was also investigated using the site-specific materials to determine whether anaerobic bioaugmentation could be used to promote EDB biodegradation at Kirtland AFB.

General treatability testing conclusions related to EDB are provided below. The full results are presented in Appendix C.

1. Anaerobic degradation of EDB was rapid using bioaugmentation with a dehalogenating culture along with lactate and nutrient addition. EDB concentrations <0.04 µg/L were achieved in both the Source Area and Sidegradient microcosms from initial concentrations of ~ 200 µg/L and 5 µg/L, respectively (Figure 5.1).
2. Aerobic degradation of EDB was observed, and EDB concentrations of 0.06 µg/L were achieved in the Sidegradient microcosms Figure 5.2. EDB degradation in the Source Area microcosms was more limited, with residual concentrations above 120 µg/L after 5 months of incubation (from ~ 200 µg/L at initiation). The nature of this biodegradative process was unclear, but aerobic co-metabolism may have been supported by fuel hydrocarbons that also biodegraded aerobically with time. Once those hydrocarbons were degraded, EDB degradation may have slowed.

3. Stimulation of aerobic biodegradation of EDB was most rapid and extensive using bioaugmentation with the ethane-degrading culture *M. sphagni* ENV482. EDB concentrations declined from spiked levels of approximately 4 mg/L to non-detectable levels (i.e., <8.5 µg/L) in these aerobic Sidegradient microcosms. The propane-degrading culture *R. ruber* ENV425 was also capable of degrading EDB.

4. Sulfate reduction (and subsequent production of HS^- and FeS, each of which react abiotically with EDB) was limited to microcosms with lactate amendments. Lactate amended microcosms with SDC-9 (both Source Area and Sidegradient) exhibited sulfate reduction, while Sidegradient microcosms exhibited more limited sulfate reduction without SDC-9 addition.

5. Elevated pH was observed in microcosms over time, and the pH was adjusted back to neutrality on occasion only to increase again. The pH increase was unexpected and may have been an artifact of the treatability study design (e.g., due to sealed bottles or addition of glass beads to fill void space after sampling). Degradation of EDB and BTEX occurred in many instances irrespective of the pH increase in the bottles, but it is possible that this increase had an inhibitory effect on some processes (e.g., sulfate reduction).

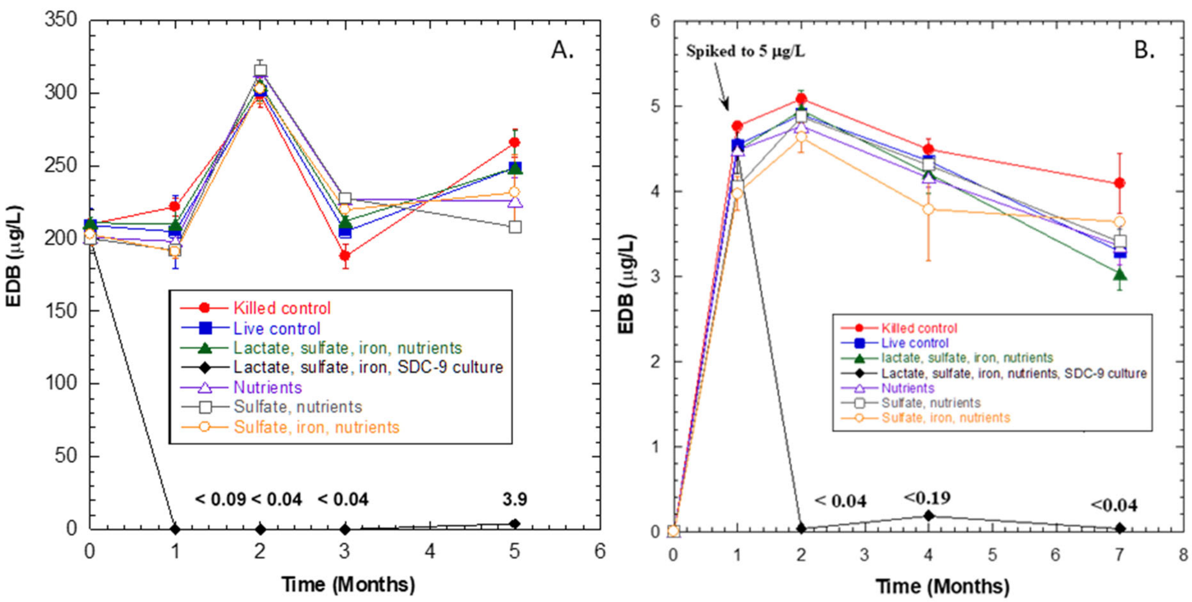


Figure 5.1. EDB Concentrations in Anaerobic Microcosms with A.) Source Area and B.) Sidegradient Materials.

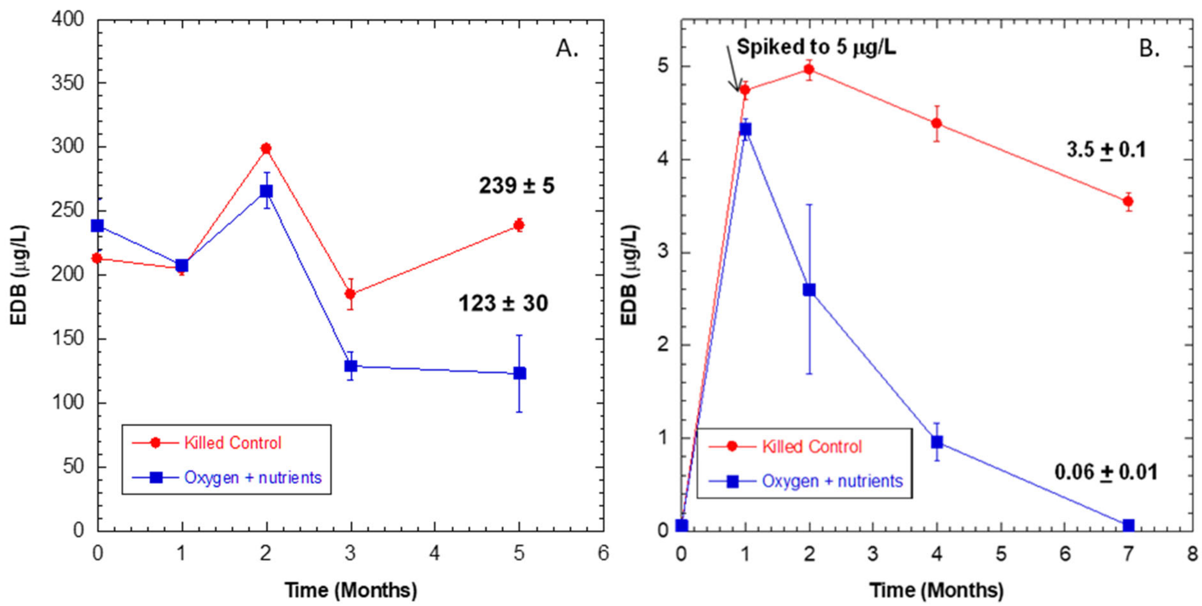


Figure 5.2. EDB Concentrations in Aerobic Microcosms with A.) Source Area and B.) Sidegradient Materials.

The treatability study results indicated that bioremediation could be used to treat EDB to concentrations below its MCL of 0.05 µg/L. The anaerobic dehalogenating culture SDC-9 was shown to facilitate this degradation rapidly with source area materials and at source area concentrations (Figure 5.1). Because technologies capable of degrading EDB in source areas are of interest, anaerobic bioremediation was demonstrated using the pilot test described herein, which included a biostimulation stage. The success in achieving concentrations below the MCL during microcosm treatability testing provided evidence that enhanced in situ EDB biodegradation during the pilot test was likely to achieve success. The treatability studies, along with the technology development efforts described in Section 2.2 provided a strong foundation for the ESTCP demonstration.

5.4 DESIGN AND LAYOUT OF TECHNOLOGY COMPONENTS

5.4.1 EDB Attenuation Evaluation

To evaluate evidence of EDB attenuation, monitoring wells along the length of the EDB plume were selected for sampling. The selected monitoring wells were in the source area where NAPL was previously observed; a transition zone with anaerobic conditions (DO < 1 mg/L) immediately downgradient of the source area; and a zone farther downgradient with more oxic conditions (1-4 mg/L). One upgradient monitoring well was included to provide background data. The groundwater monitoring wells that were sampled are:

- Background monitoring well KAFB-106027;
- Source area monitoring wells KAFB-106076, KAFB-106059, KAFB-106064, KAFB-106079, KAFB-10628-510, KAFB-106010, KAFB-106067, and KAFB-106094;

- Transition monitoring wells KAFB-106075 KAFB-106082; and
- Downgradient monitoring wells KAFB-106088 and KAFB-106091.

These monitoring well locations are shown on Figure 5.3 and their screen intervals are provided in Table 5.1. These wells were all screened at "shallow" depths near or at the groundwater interface where EDB concentrations were highest. Figure 5.4 shows groundwater (GW) elevations for the monitoring wells during the third quarter of 2011, soon after all the wells were installed and sampled but prior to the activities further described in this report. The gradient at that time among the 13 wells examined was approximately 0.0007 ft/ft.

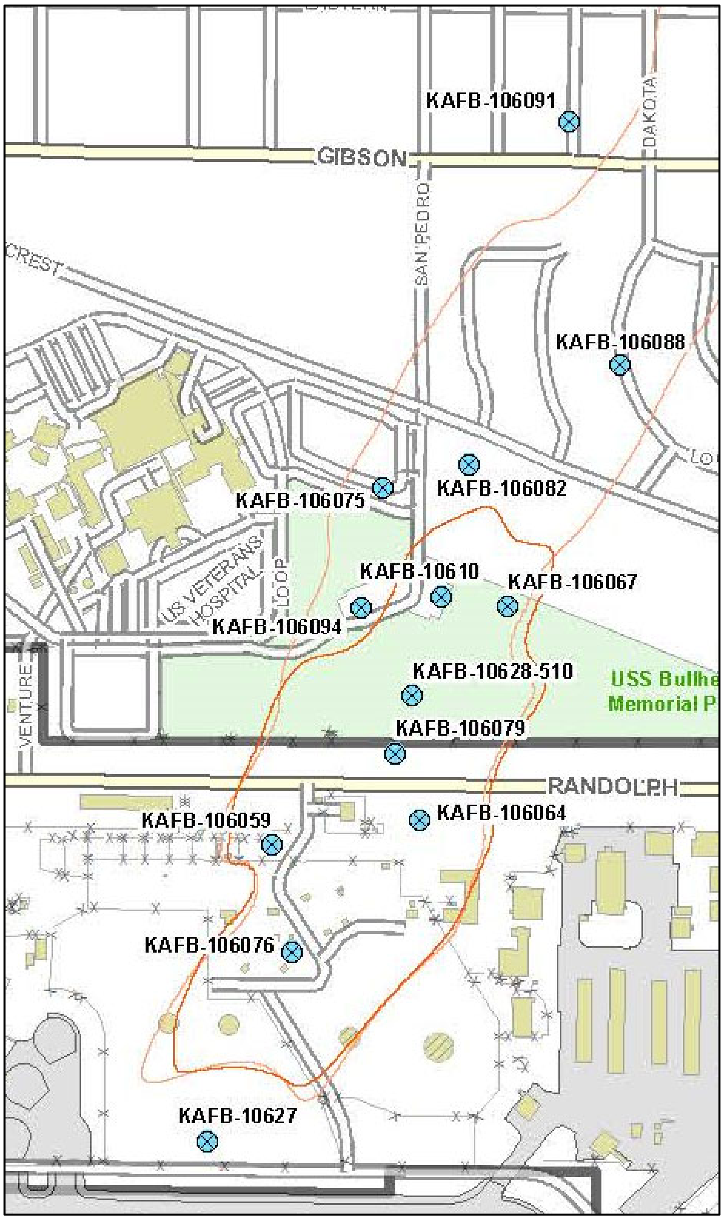


Figure 5.3. Monitoring Well Locations for Attenuation Analysis

Table 5.1. Attenuation Analysis Well Screen Intervals.

Well Location ID	Depth to Top of Screen Interval (ft-bgs)	Depth to Bottom of Screen Interval (ft-bgs)	Screen Interval Length (ft)	Screen Interval Elevation (ft-msl)
Background Monitoring Wells				
KAFB-10627	481	501	20	4864 - 4844
Source Area Monitoring Wells				
KAFB-106076	480	500	20	4865 - 4845
KAFB-106059	483	503	20	4861 - 4841
KAFB-106064	485	505	20	4863 - 4843
KAFB-106079	484	504	20	4863 – 4843
KAFB-10628-510	486	511	25	4863 – 4838
KAFB-10610	483	508	25	4860 – 4835
KAFB-106067	485	505	20	4862 – 4842
KAFB-106094	484	504	20	4861 – 4841
Transition Monitoring Wells				
KAFB-106075	480	500	20	4860 – 4840
KAFB-106082	472	492	20	4863 – 4843
Downgradient Monitoring Wells				
KAFB-106088	460	480	20	4864 – 4844
KAFB-106091	454	474	20	4860 – 4840

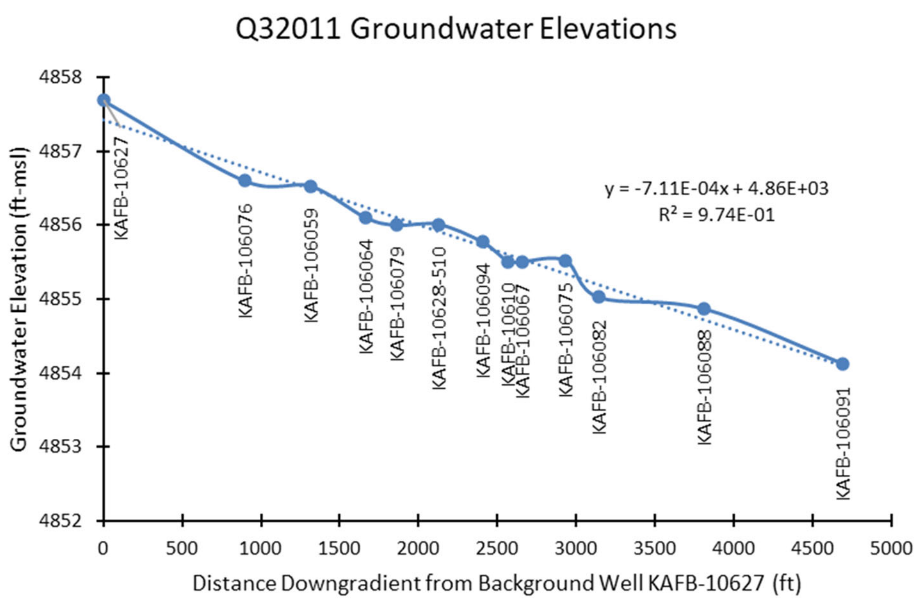


Figure 5.4. Q3,2011 GW Elevations at the 13 Wells Use for Natural Attenuation Evaluation.

The overall gradient was approximately 0.0007 ft/ft.

5.4.2 Anaerobic In Situ Bioremediation of EDB

The demonstration of anaerobic ISB at Kirtland AFB occurred in cooperation with the USACE and USAF at Kirtland AFB and is documented in the previously mentioned Pilot Test Report (USACE, 2021) included in Appendix B. The Pilot Test Report includes a description of pilot system design and construction, but descriptions of the most pertinent design and layout components are provided below.

Site preparation activities, mobilization, and installation of the demonstration test system were performed from September 2016 through May 2017. Construction of the system consisted of well installation and development; installation of underground piping, conduit, and direct buried electrical lines; and installation of the system control building with required electrical service and components.

5.4.2.1 Basis and Rationale for Demonstration Layout

Characteristics that impacted the design of the demonstration test included: 1) the distribution of EDB, 2) existing infrastructure (i.e., wells and utilities), and 3) general knowledge of site hydrogeology. This information was used to inform injection/extraction rates and anticipated amendment distribution among the wells. Key aspects that were considered are discussed below:

- **Pilot Testing Centered Within Elevated EDB Concentration Zone (concentrations greater than 5 µg/L)**—Historic groundwater sampling showed elevated EDB concentrations within the footprint of the pilot test plot (adjacent to existing monitoring well KAFB-106064, see Figure 4.4), and within the target depth interval of approximately the top 20 feet of the water column. Elevated EDB concentrations were needed to facilitate the demonstration of ISB of EDB.
- **Anaerobic Groundwater**—Anaerobic conditions necessary for reductive processes (e.g., debromination of EDB) were present at the test location prior to the demonstration, likely due to oxygen consumption associated with degradation of co-located hydrocarbons. Anaerobic conditions were anticipated to minimize the risk of iron and manganese oxide mineral formation that might affect hydraulic performance and were also anticipated to lower the demand for fermentable substrate during the biostimulation phases of the pilot test.
- **Microbial Community**—QuantArray-Chlor analyses of the microbial community during the attenuation studies indicated that microorganisms capable of dehalogenating EDB, or its chlorinated analog 1,2-dichloroethane (1,2-DCA), were present in the subsurface in the pilot test area.
- **Site Infrastructure**—No buildings or other infrastructure were located in the pilot test area that could preclude implementation of the pilot test.
- **Groundwater Flow Direction Between Injection and Extraction Wells**—Ambient groundwater flow prior to the pilot test was expected to be slow and in a general east- southeast direction within the pilot test area. While injection/extraction wells were oriented to be in line with expected flow conditions, the pilot system was generally expected to recirculate water independently of ambient groundwater flow. Monitoring wells located near the injection well were expected to effectively sample the pilot test zone independently of ambient groundwater flow.
- **Well Capacity**—Based on site experience, groundwater wells located in the pilot test area were expected to be capable of producing sufficient groundwater for recirculation activities.
- **Amendment Distribution**—Groundwater modeling was used to verify that well designs and pumping rates were expected to sufficiently distribute amendments during the pilot test. Based

on this groundwater modeling, pumping extraction wells KAFB-106EX1 and KAFB-106EX2 at approximately 10 gpm each (20 gpm total) and reinjecting into injection well KAFB-106IN1 were expected to sufficiently distribute amendments over a period of approximately one month.

5.4.2.2 Injection, Extraction, and Monitoring Wells

Pilot test wells were sited to accommodate existing well infrastructure, site utilities, and facilitate the use of existing wells for monitoring. The pilot test utilized one injection, two extraction, and six monitoring wells, including existing monitoring wells KAFB-106064 and KAFB-106063 (nine wells total). Injection well KAFB-106IN1 was centrally located in a field approximately 30 ft from existing well KAFB-106064, with the two extraction wells (KAFB-106EX1 and KAFB-106EX2) located on opposite sides of the injection well and within 200 ft of each other (see Figure 4.2).

General construction information for each well, including the distance from each well to the injection well (KAFB-106IN1) is summarized in Table 5.2. Details regarding well design, installation, and development are provided in the Pilot Test Report (Appendix B). Briefly, new wells were installed using an Air Rotary Casing Hammer (ARCH) drill rig from January through March 2017. All boreholes were drilled with a 13-3/8" diameter to a depth of between 200 and 260 ft and then with an 11-3/4" diameter at greater depths. Injection and extraction wells were constructed with 6" casing and stainless-steel screens, while new shallow and intermediate depth monitoring wells with 4" and 3" Polyvinylchloride (PVC) casings, respectively, were nested in common boreholes. New monitoring wells were constructed with PVC screens. Soil boring logs and well construction diagrams for monitoring, extraction, and injection wells installed during the pilot test are included in Appendix D of the Pilot Test Report (Appendix B). All newly installed well locations are depicted on Figure 4.2. A cross-sectional view illustrating the depths of the wells associated with the demonstration of ISB is shown on Figure 5.5.

Development of the wells was performed through a combination of surging, bailing, and pumping. Development of the injection well KAFB-106IN1 also included jetting. Short term performance of the injection and extraction wells was evaluated with limited constant rate pump tests at a rate of 20 gpm.

Table 5.2. Demonstration Well Construction Details.

Well ID	Well Type	Ground Elevation (ft-msl)	Top of PVC Elevation (ft-msl)	Screened Interval (ft bgs)	Screened Interval (ft-msl)	Well Depth (ft bgs)	Distance from Injection Well (ft)
Newly Installed Wells							
KAFB-106EX1	Extraction	5349.35	5345.82	487 - 502	4862.35 - 4847.35	507	91.2
KAFB-106EX2	Extraction	5346.84	5343.50	487 - 502	4859.84 - 4844.84	507	76.4
KAFB-106IN1	Injection	5348.37	5345.07	477 - 497	4871.37 - 4851.37	502	--
KAFB-106MW1-S	MW	5347.45	5347.03	463 - 498	4884.45 - 4849.45	500.5	47.0
KAFB-106MW1-I	MW		5347.07	513 - 523	4834.45 - 4824.45	528	46.6
KAFB-106MW2-S	MW	5347.97	5347.55	463 - 498	4884.97 - 4849.97	500.5	28.2
KAFB-106MW2-I	MW		5347.57	513 - 523	4834.97 - 4824.97	528	27.9
Existing Wells							
KAFB-106064	MW	5347.90	5350.50	488 - 508	4859.90 - 4839.90	513	31.4
KAFB-106063	MW	5348.50	5351.20	508 - 523	4840.50 - 4825.50	528	54.9

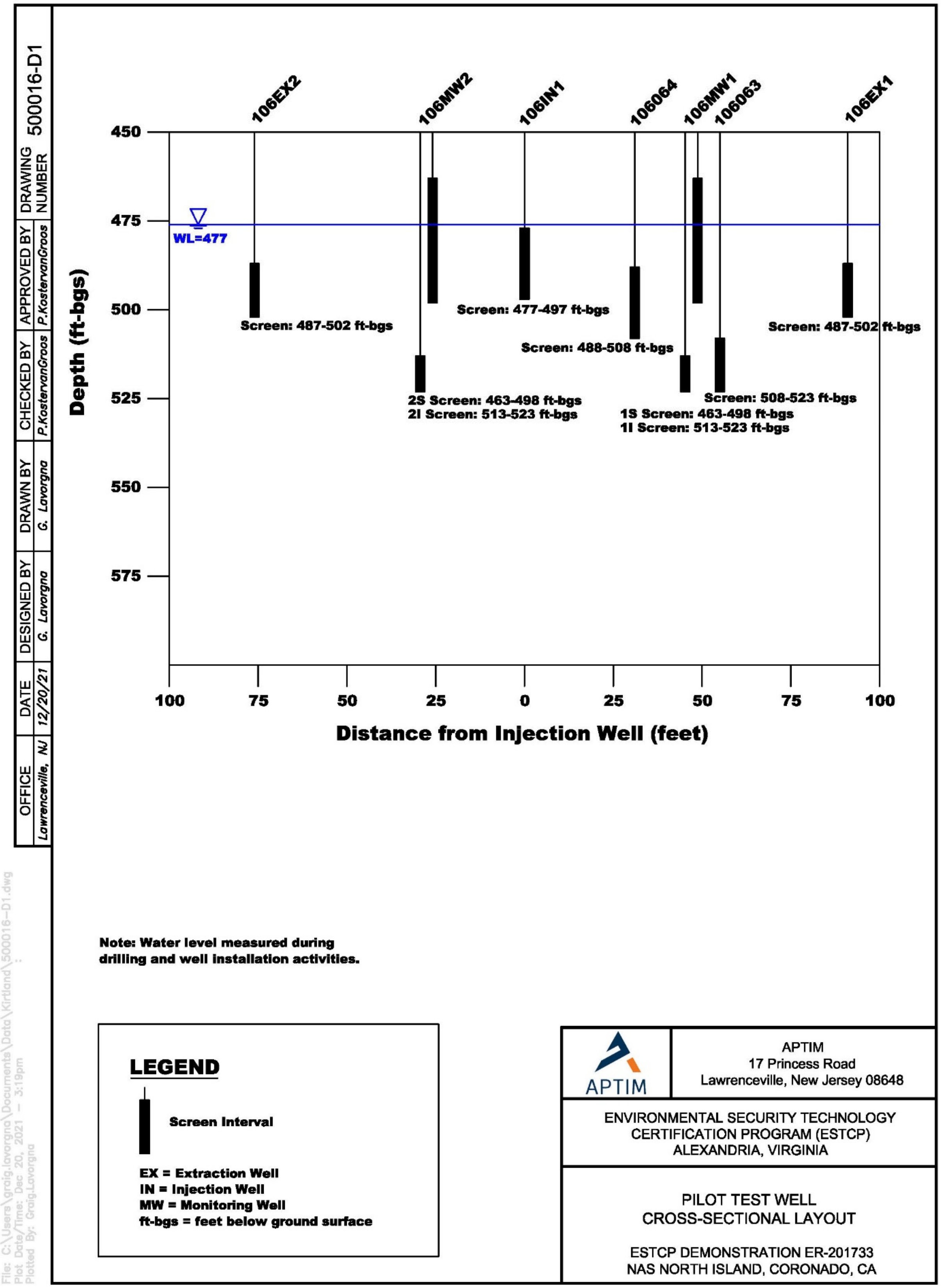


Figure 5.5. Pilot Test Well Cross-Sectional Layout

Well KAFB-106IN1 was installed with a 20 ft screen with the top of the screen located at the groundwater table at the time of installation. KAFB-106IN1 was used to inject recirculated groundwater, tracers, and biostimulation amendments, but also included a submersible pump to facilitate sampling when not receiving recirculating water. The injection pipe extended down into the water column and was fitted with a 4-inch diameter, custom designed and fabricated down-hole flow control valve (FCV, manufactured by Baski, Inc.) to limit risks of cavitation within the pipe, reduce aeration of the anaerobic recirculation water, and minimize loss of volatile components. A check valve was installed at the base of the FCV, with an electric submersible pump (Grundfos 5SQE-10-410, 2.3 horsepower) with variable speed frequency drive installed underneath to sample groundwater in the vicinity of the injection well. The injection well sampling pump intake was set at 492 feet bgs, approximately 10 feet above the total depth of the well.

Wells KAFB-106EX1 and KAFB-106EX2 were installed and used to extract groundwater for the recirculation system, but also included ports to facilitate sampling. The two extraction wells were located approximately 76 ft (KAFB-106EX2) and 92 ft (KAFB-106EX1) from the single injection well, as shown in Figure 4.2 and Figure 5.5. The extraction wells have 15 ft screens with the tops of the screens located 10 ft below the groundwater table at the time of installation. Multi-stage centrifugal stainless-steel submersible pumps (Grundfos 25S50-26, 5.5 horsepower) were installed in each extraction well. The extraction well pump intakes were set at 497 feet bgs, approximately 20 feet below the water table (as measured during well installation) and 10 feet above the total depth of the well to allow sufficient room for drawdown during pumping. As described later (Section 5.5.2), the extraction wells were used to periodically recirculate groundwater during individual phases of the demonstration. The periods of active groundwater recirculation were designed to facilitate the distribution of amendments, after which pumping was halted to observe ISB treatment performance.

Existing wells KAFB-106064 and KAFB-106063, and new nested wells KAFB-106MW1-S, KAFB-106MW1-I, KAFB-106MW2-S, and KAFB-106MW2-I were used as the primary groundwater monitoring wells and are shown on Figure 4-2. The four new monitoring wells were installed within two boreholes utilizing a nested configuration with two wells in each borehole. Each borehole contained a shallow well with approximately 15 feet of screen in the vadose zone and 20 feet of screen in the aquifer, along with a deeper well (intermediate) with the top of a 10-foot screen set approximately 35 feet below the water table. Well screen intervals were isolated within the borehole using bentonite seals. Existing monitoring wells KAFB-106063 (screened from 505 to 520 feet bgs, with top of screen approximately 25 feet below the water table) and KAFB-106064 (screened from 485 to 505 feet bgs, with top of screen approximately 5 feet below the water table) were also used for groundwater monitoring during the pilot test, along with the other newly installed wells. Dedicated bladder sampling pumps (QED MicroPurge® Model P1101HM) were used for sampling each of the six groundwater monitoring wells and were installed at approximately the middle point of their saturated screen intervals.

Monitoring wells were located as near to the injection well as possible to facilitate observation of groundwater amendments and their impacts. Closer spacing than approximately 30 ft for wells of approximately 500 ft depth was considered risky due to concerns regarding well plumbness, construction, and development. One borehole that was originally intended for well KAFB-106MW2 was advanced at the site, but after it was noted to be over 25 ft from plumb, it was subsequently abandoned and not utilized for the demonstration. By specification, all newly drilled wells that were used were within 5 ft of plumb at depth.

5.4.2.3 Recirculation Pilot System Equipment and Materials

The demonstration of ISB for EDB involved multiple test phases requiring recirculation of anaerobic groundwater and addition of tracers and amendments to this water. Details regarding the equipment used to accomplish this are provided in the Pilot Test Report (Appendix B). Briefly, the system was designed to minimize gas exchange between the recirculated groundwater and the atmosphere in order to maintain anaerobic groundwater conditions and prevent loss of volatile components. The system extracted groundwater from the two extraction wells and reinjected that groundwater in the injection well after tracer or amendment additions. A flow rate of 24 gpm was achieved by the system at the time of installation, but operational flowrates were lower and adjusted throughout the pilot test based on tracer results and other site conditions, as discussed further in Section 5.5.2.

The equipment necessary to perform the pilot test was installed in the appropriate wells and a 20-ft long portable shipping (Conex-type) container, which was also used for security and environmental control. The system for amending and recirculating water was fabricated by Calcon Systems Inc. (Calcon). The box contained a partition wall, separating the enclosure into two spaces. The smaller of the two spaces was the system control room that housed the supervisory control and data acquisition (SCADA) system with integrated computer, electrical control panel, Baski FCV controls and associated nitrogen cylinder, and a combination air conditioner/heater. The larger space, which included the recirculation water piping/fittings, flowmeters, pressure transmitters, tracer/amendment tanks, chemical feed pump, and other system process components, was rated as a Class 1, Division 2 atmosphere, due to the possible presence of fuel hydrocarbons in the recirculation water flowing through piping in this portion of the enclosure. All electrical components and connections in this portion of the enclosure were intrinsically safe to meet the hazardous atmosphere classification. Electrical power for system operation was supplied by on-base grid power through an electrical line that runs from a power source on the east side of the site to the recirculation system (see Figure 5.3). A 480-volt, 3-phase electrical service was installed in a 3-foot deep trench from April 17 to April 21, 2017.

Water conveyance pipelines that connected the Conex box to the extraction and injection wells were installed in trenches approximately 4 feet deep (below the frost line) in April 2017. The underground conveyance piping consisted of a double-walled containment system that housed the 2-inch piping. The conveyance piping, injection valve pneumatic tubing, pump electrical leads, well vault leak detection wire, Baski nitrogen lines, and water level transducer wire that lead from the Conex box to the wells were all located within the trenches. Where extraction and injection well piping breached the ground surface and entered the Conex box (above grade), the piping transitioned to 1.5-inch single-walled Schedule 80 PVC and was insulated to prevent freezing.

Groundwater extraction occurred using electric submersible well pumps (Grundfos 25S50-26) with variable speed frequency drives. Groundwater extracted from each of the two extraction wells was directed through a pair of particle filters prior to combining flows and amendment introduction. As needed, mixtures of water, tracers, and biostimulation amendments were batched/mixed within a 550-gallon amendment tank prior to addition to the process stream via a chemical feed pump (LMI E711-368SI). Amended groundwater then flowed through a 19-inch PVC static-mixer prior to injection using the down-hole FCV. Flow meters, pressure transducers and gauges, and control valves installed throughout the system were used for feedback control with the SCADA system. A piping and instrumentation diagram (P&ID) for the pilot test system is presented as Figure 5.6.

5.5 FIELD TESTING

5.5.1 EDB Attenuation Evaluation

Sampling associated with EDB attenuation studies occurred during regularly scheduled quarterly sampling events during the final quarter of 2014 and the first 3 quarters of 2015 in accordance with the site specific Groundwater Investigation Work Plan (USACE, 2011). Specialized analyses performed to aid evaluation of attenuation included Microbial Insight's QuantArray-Chlor, which quantified populations/genes known to facilitate degradation of chlorinated compounds as well as methanogens, sulfate reducers, and various aerobic cometabolic organisms/genes (http://www.microbe.com/quantarray-chlor/); and analysis of hydrogen and reduced gases (e.g., methane, ethane, and ethene; EPA RSK175). During the third quarter of 2015, samples were also collected with no headspace in acid-preserved 1-L bottles with Teflon septa for CSIA analysis of EDB.

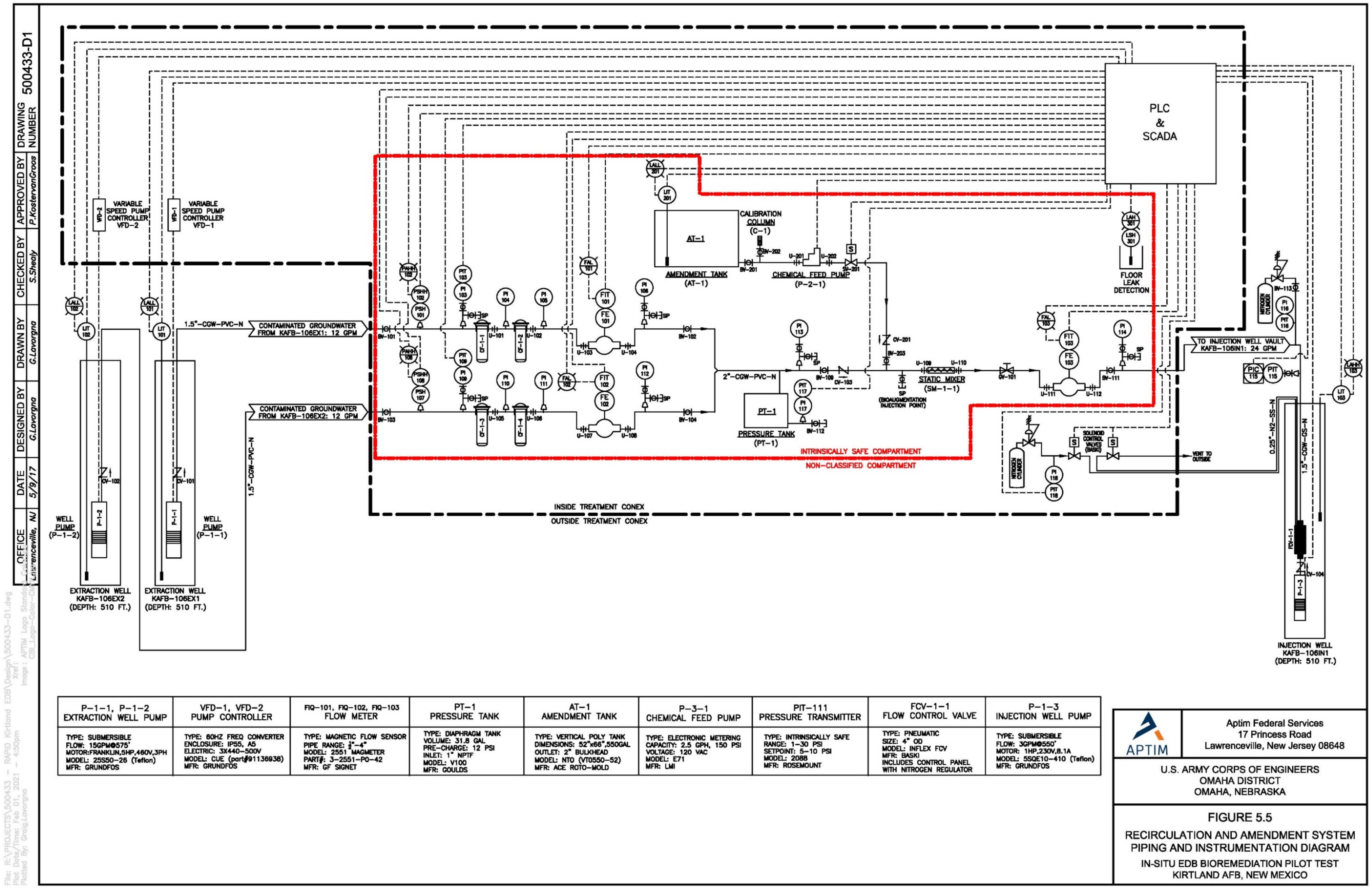


Figure 5.6. Piping and Instrumentation Diagram.

5.5.2 Anaerobic In Situ Bioremediation of EDB

The anaerobic pilot demonstration was performed in four phases. Data were collected and evaluated during each phase and the results were used to adjust operations, as needed. The duration and timeline of each phase are summarized in Table 5.3 and the Gantt chart presented as Figure 5.7. Details regarding the operations during the phases can be found in the Pilot Test Report (Appendix B) but are also summarized here. The first phase (Phase 1) started after installation, development, and testing of the wells and equipment associated with the Pilot Test System. Phase 1 included an evaluation of baseline conditions, and operation of the recirculation system while performing tracer tests to evaluate distribution of injected water in the subsurface. The second phase (Phase 2) included an evaluation of biostimulation on EDB degradation through operation of the recirculation system and the addition of a conservative tracer, nutrients, and a fermentable substrate to the subsurface. The third phase (Phase 3) of the pilot testing was originally proposed to include bioaugmentation with an exogenous debrominating culture (SDC-9), with subsequent evaluation of enhanced EDB degradation. Bioaugmentation, however, was unnecessary based on results during Phase 2, and a further evaluation of biostimulation was performed as Phase 3. The fourth and final phase of the pilot test focused on longer-term performance of ISB (post-treatment monitoring) was initiated in January of 2019 and continued through October 2020. Results of this phase are discussed herein, despite occurring after the POP of the ESTCP funded work expired. The scope and timing of the demonstration phases was determined by requirements of the overall pilot test performed in cooperation with the USACE and USAF, and the period of performance (POP) for this ESTCP demonstration ended towards the tail end of Phase 3. Given the focus of this demonstration on anaerobic ISB for EDB, this ESTCP report includes discussion of data collected during all phases, including those collected after ESTCP efforts generally ceased.

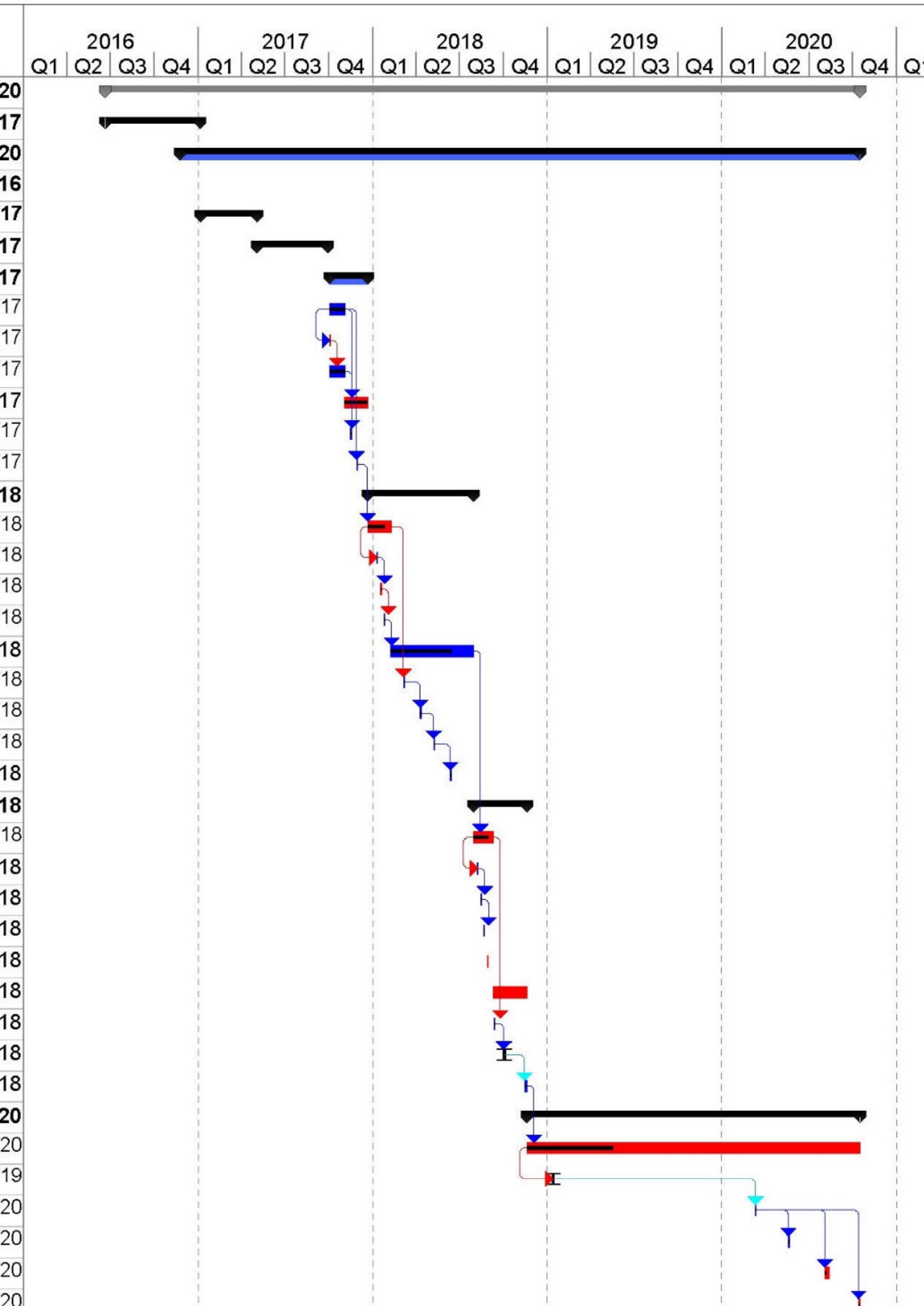
5.5.2.1 Pilot System Start-up Testing

Shakedown testing of the Pilot Test System, which included testing the extraction well pumps; pressure and flow transmitters; leak detection and level sensors; chemical feed pump; Baski FCV and control system; injection well sample pump; remote telemetry; and alarm interlocks was performed on May 16 and 17, 2017 prior to full system start-up. There were no notable operational issues with the system during shakedown testing, with all interlocks and associated alarms working properly. The Pilot Test System was started on June 29, 2017 during the first baseline sampling event at the extraction and injection wells. The Pilot Test System was restarted and retested on September 26, 2017, after a project delay caused by faulty monitoring well sampling pumps that were replaced prior to initiation of tracer testing (Phase 1).

Table 5.3. Timeline of Pilot Test Activities.

Month	Year	Phase	Event
January - March			Drilling and construction of two nested groundwater monitoring wells, two extraction wells, and one injection well.
March - May			Surface completion on wells and well development.
March - May			Installation of system pipeline and utilities.
April			Recirculation system delivered to site.
May			Extraction and Injection well down-hole assembly installation; Geotech bladder pump installation.
May		N/A	Recirculation system shakedown testing with Calcon.
May - August			Troubleshoot Geotech bladder pump issues.
June - August			Baseline samples collected from all wells except KAFB-106MW1-S due to pump failure.
			Installation of QED bladder pumps. LNAPL detected in KAFB-106MW1-S.
September	2017		Recollect baseline samples with new pumps.
			Start system in preparation for Phase 1 on September 26, 2017.
October - November		1	Phase 1 Recirculation (Tracer Test). Fluorescein and deuterated water were injected over a 24-hour period on October 2 through October 3.
November - December			Phase 1 Passive period.
			Start system in preparation for Phase 2 on December 11, 2017.
December			Begin injecting amendments on December 22, 2017. Notice that chemical feed pump is leaking; crystallization is observed within checkball housing; turn off system on 12/23/17 to troubleshoot.
			Remix amendment tank to include lower ratios of DAP and lactate. Resume injecting on 12/29/17.
February		2	Finishing injecting amendments and groundwater for Phase 2 on 2/7/18. Total additions for Phase 2: 150 kg DAP, 290 gallons WilClear Plus®, and 71 kg KI.
February - July			Phase 2 Passive period.
July - August			Data from Phase 2 indicates biostimulation has effectively reduced concentrations of EDB within the pilot test area. Suggested that bioaugmentation be deferred for Phase 3 and additional biostimulation be performed. NMED concurs and approves the Phase 3 Notification Letter in a letter dated August 7, 2018.
July - September	2018		Start system for Phase 3 on July 30, 2018. Total additions for Phase 3: 143 kg DAP and 340 gallons WilClear plus. No tracer was used.
September			Phase 3 Passive period began on September 9, 2018.
September		3	During the first Phase 3 Passive sampling event (9/12/18), the Grundfos pump installed in the injection well failed to lift water after 40 minutes. Excessive drawdown was observed at injection well with transducer, and the pump was shutoff. Tripping out the transducer indicates fine sand, silt, and grey biological growth on the transducer. KAFB-106IN1 is not sampled.
October - November			Samples from the injection well are collected by bailing the sound tube using a stainless steel bailer.
November		4	Phase 4, long-term rebound monitoring began on November 19, 2018.
January - February	2019		Collect first Phase 4 sample on January 16, 17, and 21, 2019. System continues to remain off.

ID	Task Name	Duration	Start	Finish
0	**RAPID / ESTCP 500433 EDB Recirculation Pilot Study**	**1135 days**	**Mon 6/20/16**	**Thu 10/15/20**
1	**Planning Tasks**	**150 days**	**Mon 6/20/16**	**Wed 1/4/17**
58	**Field Activities**	**1012 days**	**Wed 11/23/16**	**Thu 10/15/20**
59	**Field Site Prep Activities**	**20 days**	**Wed 11/23/16**	**Thu 12/22/16**
64	**Construction and Drill Activities**	**87 days**	**Thu 1/5/17**	**Wed 5/3/17**
78	**Post Construction System Startup Activities**	**104 days**	**Wed 5/3/17**	**Thu 9/28/17**
82	**Phase 1 Tracer Test**	**59 days**	**Mon 10/2/17**	**Thu 12/21/17**
83	Recirculation for Phase 1	25 days	Mon 10/2/17	Fri 11/3/17
84	24-hour pulsed injection of 2H2O and flourescein	2 days	Mon 10/2/17	Tue 10/3/17
85	8 Sampling events during recirculation (approx 2 days each)	25 days	Mon 10/2/17	Fri 11/3/17
86	Phase 1 passive period/data evaluation	34 days	Fri 11/3/17	Thu 12/21/17
87	Phase 1 passive sample event 1	2 days	Wed 11/15/17	Thu 11/16/17
88	Phase 1 recovery sample event 2	2 days	Tue 11/28/17	Wed 11/29/17
89	**Phase 2 Evaluation of Biostimulation**	**158 days**	**Thu 12/21/17**	**Mon 7/30/18**
90	Recirculation for Phase 2 (nutrients, iodide, and substrate added through pulsed injection)	35 days	Thu 12/21/17	Wed 2/7/18
91	Phase 2 recirc sample event 1	2 days	Tue 1/9/18	Wed 1/10/18
92	Phase 2 recirc sample event 2	3 days	Tue 1/16/18	Thu 1/18/18
93	Phase 2 recirc sample event 3	2 days	Wed 1/24/18	Thu 1/25/18
94	Phase 2 passive period/data evaluation	124 days	Wed 2/7/18	Mon 7/30/18
95	Phase 2 recovery sample event 1	2 days	Tue 3/6/18	Wed 3/7/18
96	Phase 2 recovery sample event 2	2 days	Tue 4/10/18	Wed 4/11/18
97	Phase 2 recovery sample event 3	2 days	Tue 5/8/18	Wed 5/9/18
98	Phase 2 recovery sample event 4	3 days	Tue 6/12/18	Thu 6/14/18
99	**Phase 3 Evaluation of Bioaugmentation**	**81 days**	**Mon 7/30/18**	**Mon 11/19/18**
100	Recirculation for Phase 3 (nutrients and substrate, flourescein as needed, and SDC-9)	30 days	Mon 7/30/18	Sun 9/9/18
101	Phase 3 recirc sample event 1	2 days	Tue 8/7/18	Wed 8/8/18
102	Phase 3 recirc sample event 2	2 days	Wed 8/15/18	Thu 8/16/18
103	Phase 3 recirc sample event 3	2 days	Tue 8/21/18	Wed 8/22/18
104	Phase 3 recirc sample event 4	2 days	Tue 8/28/18	Wed 8/29/18
105	Phase 3 passive period/data evaluation	51 days	Mon 9/10/18	Mon 11/19/18
106	Phase 3 recovery sample event 1	2 days	Tue 9/11/18	Wed 9/12/18
107	Phase 3 recovery sample event 2	2 days	Tue 10/2/18	Wed 10/3/18
108	Phase 3 recovery sample event 3	4 days	Wed 11/14/18	Mon 11/19/18
109	**Phase 4 Rebound Monitoring**	**499 days**	**Mon 11/19/18**	**Thu 10/15/20**
110	Rebound/Recovery monitoring phase	499 days	Mon 11/19/18	Thu 10/15/20
111	Phase 4 recovery sample event 1	2 days	Sat 1/12/19	Mon 1/14/19
112	Phase 4 recovery sample event 2	2 days	Wed 3/11/20	Thu 3/12/20
113	Phase 4 recovery sample event 3	2 days	Tue 5/19/20	Wed 5/20/20
114	Phase 4 recovery sample event 4	7 days	Tue 8/4/20	Wed 8/12/20
115	Phase 4 recovery sample event 5	3 days	Tue 10/13/20	Thu 10/15/20



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Date: Mon 12/20/21

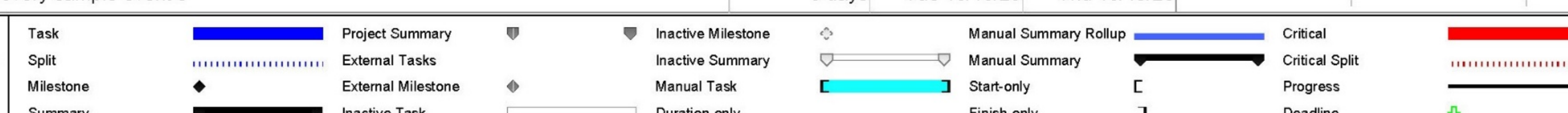

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Figure 5.7. Pilot Test Gantt Chart.

5.5.2.2 Phase 1 – Baseline Sampling and Tracer Testing

Initial baseline sampling occurred from June 29 through August 16, 2017 using dedicated bladder pumps at the monitoring wells and submersible pumps at the extraction and injection wells. While initially installed bladder pumps produced water, numerous failures were noted during this shakedown period, and these pumps were replaced with new bladder pump models that performed as expected throughout the remainder of the pilot test. New baseline samples were recollected for all analyses except for Microbial Insights QuantArray-Chlor from September 18 through September 26, 2017. All pilot test wells were sampled prior to Phase 1 recirculation activities to establish pre-test baseline conditions.

The purpose of Phase 1 was to evaluate the distribution of recirculated water using tracer amendments and to continue evaluating baseline conditions prior to addition of biostimulation amendments during Phase 2. Phase 1 included a period of active groundwater recirculation and a passive period during which recirculation was suspended. During the active recirculation period, groundwater was extracted from the two extraction wells at flow rates of 10 gpm each, combined, and reinjected back into the subsurface at the injection well. During the entire Phase 1 recirculation period, which was conducted for four weeks from October 2 to November 3, 2017, approximately 890,000 gallons of water were extracted and reinjected. The passive portion of Phase 1 began on November 3, 2017, upon shutdown of the recirculation system, and concluded on December 21, 2017.

To evaluate subsurface transport characteristics, two conservative (i.e., non-reactive) tracers of water flow were added as a pulse over a period of approximately 24 hours, from October 2 through 3, 2017. The two tracers used were fluorescein and water labeled with additional deuterium, with approximately 54 grams of fluorescein and 15 kilograms of deuterium oxide (^2H_2O) injected during the 24-hour pulse.

Water level readings in the extraction and injection wells were continuously monitored by the SCADA system with appropriate alarms set to avoid excessive drawdown or mounding. During recirculation system operation, it became apparent that water level readings from pressure transducers located in the extraction well drop pipes were too noisy to be reliable. Readings were likely affected by unanticipated electrical interference from the extraction well pumps' power leads. To address this issue, manual water level readings were performed periodically using a Solinst water level meter.

Eight groundwater sampling events designed to quantify transport properties during active recirculation were conducted during Phase 1, with two additional sampling events conducted approximately 2 and 4 weeks after recirculation activities ceased. Groundwater fluorescein concentrations and $\delta^2 H$ values of the water were determined for these samples. In addition, groundwater samples were collected during one of the recirculation sampling events (Day 23, collected on October 24 and 25, 2017) and during both sampling events of the passive period to determine baseline conditions for other analytes.

5.5.2.3 Phase 2 – Biostimulation Testing

The purpose of Phase 2 was to evaluate biostimulation in the subsurface after distribution of treatment amendments in recirculated groundwater. Phase 2 consisted of two operational periods, a recirculation/mixing (active) period, and a subsequent passive monitoring period (no recirculation).

During the recirculation period, groundwater was extracted, amended with a fermentable lactate-based substrate (WilClear Plus®, manufactured by JRW Bioremediation), nutrients (diammonium phosphate, DAP), and conservative tracer (potassium iodide, KI), and reinjected to distribute the amendments in the pilot testing zone.

Prior to introducing amendments to initiate Phase 2 of the ISB demonstration, the groundwater recirculation system was restarted on December 11, 2017 and allowed to run at extraction rates of 10 gpm (each well). After this verification that the recirculation system operated as expected, introduction of amendments was initiated on December 21, 2017. Two hours after amendment injection began, a small leak originating from the chemical feed pump was observed. It was determined that amendments were precipitating within the chemical feed pump, and subsequent use of lower amendment concentrations introduced at higher volumetric flow rates into the process stream resolved the issue for the remainder of the demonstration. Introduction of amendments using the new concentrations began on December 29, 2017 and, to deliver the planned mass of amendments, the active portion of Phase 2 continued until February 7, 2018. Throughout the remainder of the demonstration, amendments were pulsed into the process stream to minimize biofouling of the injection well. Over the approximately 7-week active injection period in Phase 2, approximately 290 gallons of WilClear Plus, 150 kilograms of DAP, and 71 kilograms of KI were injected into the treatment zone. During the entire Phase 2 recirculation period, approximately 1,470,000 gallons of water were extracted and reinjected, but due to testing of the system and challenges associated with amendment introduction described above, only approximately 930,000 gallons were recirculated during the period that carbon substrate, DAP and KI were introduced.

During the active period of Phase 2, approximately 11 feet of water level drawdown was observed at KAFB-106EX2. To prevent additional drawdown of water below the top of the screened interval, the flowrate at KAFB-106EX2 was incrementally reduced to 7 gpm beginning on January 8 through January 22, 2018. Extraction well KAFB-106EX1 did not display a similar drawdown trend, and thus, remained at 10 gpm throughout Phase 2.

The passive portion of Phase 2 began on February 7, 2018, when the recirculation system was shut down, and concluded in July 2018. After the chemical feed pump was turned off and injection of the amendments ceased, the recirculation system was operated for several additional hours to flush the injection well screen and filter pack. During the passive period of Phase 2, groundwater in the treatment zone was monitored for approximately 4 months to evaluate whether EDB degradation was enhanced (as further described in Section 5.7.2).

Groundwater samples were collected on a weekly basis during active recirculation and on a monthly basis during the passive portion of Phase 2 at extraction, injection, and monitoring wells, to evaluate the effectiveness of biostimulation. At the end of Phase 2, an additional passive sampling event was performed to verify biostimulation performance, extending the passive period resulting in seven total sampling events for Phase 2. Sampling methods and analytes are discussed in Section 5.6.

5.5.2.4 Phase 3 – Biostimulation Testing

Phase 3 was initially planned to include an exogenous bioaugmentation culture together with additional biostimulation amendments. After evaluating analytical data from Phase 2, however, it was evident that the rate of anaerobic EDB biodegradation had increased as a result of biostimulation amendments, and bioaugmentation was unlikely to provide unambiguous data regarding its impacts. As a result, bioaugmentation was not performed as a part of Phase 3. This decision is further discussed in the Pilot Test Report (Appendix B).

The purpose of Phase 3, then, was to continue evaluating biostimulation in the subsurface after distribution of additional treatment amendments in recirculated groundwater. As during previous phases, Phase 3 also consisted of two operational periods, a recirculation/mixing (active) period, and a subsequent passive monitoring period (no recirculation). During the recirculation period, groundwater was extracted and WilClear Plus and DAP were added to the process water stream before reinjecting it to the pilot testing zone. Potassium iodide was not included as a tracer during Phase 3, but monitoring of previously introduced iodide continued.

The active portion of Phase 3 began on July 30, 2018, with groundwater extraction rates of 10 gpm at KAFB-106EX1 and 7 gpm at KAFB-106EX2. Pulsed injection of treatment amendments continued until September 9, 2018, and approximately 340 gallons of WilClear Plus and 143 kilograms of DAP were injected to the treatment zone during Phase 3. During the entire Phase 3 recirculation period, approximately 930,000 gallons of water were extracted, amended, and then reinjected.

Additional drawdown was apparent at KAFB-106EX2 during Phase 3 and to prevent drawdown of water below the top of the screened interval, the extraction flow rate at KAFB-106EX2 was further reduced from 7 to 4 gpm (beginning on August 6 through August 30, 2018). Extraction well KAFB-106EX1 remained at 10 gpm during Phase 3. Increased mounding at the injection well KAFB-106IN1 was also observed throughout the active period of Phase 3, increasing to approximately 35 feet above the static level by the end of Phase 3 active recirculation.

The recirculation system was shut down on September 9, 2018, initiating the passive period of Phase 3 that concluded on November 19, 2018. After the chemical feed pump was turned off and injection of the amendments ceased, the recirculation system was operated for several additional hours to flush the injection well screen and filter pack. During the passive period of Phase 3, groundwater in the treatment zone was monitored for approximately 3 months to evaluate whether EDB degradation was enhanced (as further described in 5.7.2). As noted earlier, the POP for this ESTCP project ended in September 2018, during the passive period of Phase 3. Additional sampling, however, continued as part of the overall Pilot Test conducted by USACE and the USAF. The results of that continued effort are provided in the Pilot Test Report (Appendix B), and the results of all phases of the pilot test effort are also discussed in this document.

Groundwater samples were collected weekly during active recirculation and monthly during the passive portion of Phase 3 at extraction, injection, and monitoring wells to evaluate the effectiveness of biostimulation. During the first Phase 3 passive sampling event (September 2018), the injection well sampling pump mounted below the FCV failed to pump water to the surface likely due to well fouling or obstruction of the check valve located between the FCV and the pump. As sample collection using the injection well pump was no longer possible, and samples from KAFB-106IN1 were collected using a 0.85-inch by 36-inch stainless steel bailer lowered to the groundwater through the transducer drop tube. Samples were also collected with the bailer for the remainder of Phase 3 passive sampling events conducted on October 4 and November 19, 2018. The last samples for CSIA of EDB were collected during the first Phase 3 passive sampling event.

5.5.2.5 Phase 4 – Long-Term Monitoring

Phase 4 of the pilot test consisted of continued groundwater monitoring to evaluate longer term performance. It began upon completion of the final Phase 3 sampling event on November 19, 2018. The recirculation system was not operated during Phase 4, except briefly in January 2019 to facilitate extraction well sampling. During January 2020, all downhole equipment in the extraction (KAFB-106EX1 and KAFB-106EX2) and injection well (KAFB-106IN1) was removed and evaluated. Bladder pumps for low-flow sampling were installed in KAFB-106EX1 and KAFB-106IN1, but not KAFB-106EX2 due to the observation of approximately 10 ft of LNAPL in that well. The LNAPL in KAFB-106EX2 was subsequently removed, and a bladder pump was also installed in KAFB-106EX2.

Five sampling events were conducted as a part of Phase 4: one in January 2019 and during each quarter of 2020. Sampling of the groundwater in the vicinity of the pilot demonstration is anticipated to continue as part of site-wide monitoring.

5.5.2.6 Waste Management

APTIM teamed with other ongoing work at Kirtland AFB, including quarterly sampling and the larger scale pilot test, and these contemporaneous efforts were responsible for investigation-derived waste (IDW) produced during these activities. The ESTCP project described in this document was responsible for a limited quantity of non-hazardous IDW (drill cuttings) that was generated during installation of well KAFB-106210. These were disposed of at the Kirtland AFB construction and demolition landfill. During this project, KAFB-106210 was ultimately only used for collection of field materials for treatability testing.

5.6 SAMPLING METHODS

5.6.1 EDB Attenuation Evaluation

Coincident with regularly scheduled quarterly sampling at Kirtland AFB, additional groundwater samples were collected by APTIM personnel at 13 monitoring wells to facilitate the evaluation of EDB attenuation. This sampling was performed in accordance with the broader site-specific Groundwater Investigation Work Plan (USACE, 2011). The analytes (including those part of regular sampling) and wells sampled each quarter are provided in Table 5.4. The analytical methods used are provided in Table 5.5. Except for CSIA of EDB performed for this project at the University of Oklahoma, all analyses for the evaluation of EDB attenuation were performed at contracted laboratories. Wells were analyzed for a wide range of compounds, including EDB (Method SW 8011), VOCs (EPA 8260), semivolatile organic compounds (SVOCs) (EPA 8270D), gasoline and diesel range organics (EPA 8015C), and anions (EPA E300.0). Specialized analyses performed on the samples included Microbial Insight's QuantArray-Chlor, which quantified populations/genes known to facilitate degradation of chlorinated compounds as well as methanogens, sulfate reducers, and various aerobic cometabolic organisms/genes (http://www.microbe.com/quantarray-chlor/), analysis of dissolved hydrogen gas (AM20GAX), and reduced gases (e.g., methane, ethane, and ethene; EPA RSK175). During the third quarter of 2015, groundwater samples were also collected for CSIA analysis by GC-isotope-ratio mass spectrometry (Varian 3000 GC with Thermo-Finnegan MAT 252 IRMS) according to Kuder et al. (2012). CSIA samples were collected with no headspace in acid-preserved 1-L bottles with Teflon septa. As necessary, EDB was concentrated for CSIA measurements using a closed-loop purge-and-trap extraction as described in Section 2.2.2.

Table 5.4. Groundwater Samples and Analytes Collected for Attenuation Studies.

Phase	Analyte	Wells Sampled
Q4, 2014	EDB TPH VOCs SVOCs Metals (As, Ca, Pb, Mg, K, Na) Diss. Metals (Fe, Mn) Anions (bromide, chloride, nitrate, nitrite, sulfate, sulfide) Alkalinity Microbial Community	KAFB-106207 KAFB-106076 KAFB-106079 KAFB-10628-510 KAFB-106094 KAFB-106010 KAFB-106075 KAFB-106082 KAFB-106088 KAFB-106091
Q1, Q2 2015	EDB TPH VOCs SVOCs Gases (Methane, ethane, ethene, hydrogen) Metals (As, Ca, Pb, Mg, K, Na) Diss. Metals (Fe, Mn) Anions (bromide, chloride, nitrate, nitrite, sulfate, sulfide) Alkalinity Microbial Community	KAFB-106027 KAFB-106076 KAFB-106059 KAFB-106064 KAFB-106079 KAFB-10628-510 KAFB-106094 KAFB-106010 KAFB-106067 KAFB-106075 KAFB-106082 KAFB-106088 KAFB-106091
Q3, 2015	EDB EDB $\delta^{13}C$ via CSIA TPH VOCs SVOCs Gases (Methane, ethane, ethene, hydrogen) Metals (As, Ca, Pb, Mg, K, Na) Diss. Metals (Fe, Mn) Anions (bromide, chloride, nitrate, nitrite, sulfate, sulfide) Alkalinity Microbial Community	KAFB-106027 KAFB-106076 KAFB-106059 KAFB-106064 KAFB-106079 KAFB-10628-510 KAFB-106094 KAFB-106010 KAFB-106067 KAFB-106075 KAFB-106082 KAFB-106088 KAFB-106091

Table 5.5. Analytical Methods for EDB Attenuation Evaluation.

Analyte	Method/ Laboratory	Preservative	Bottle	Holding Time
EDB	EPA 8011 (Empirical)	6°C	40-mL VOA vial (x3)	14 days
EDB $\delta^{13}C$ via CSIA	Kuder et al, 2012 (University of Oklahoma)	6°C with HCl	1-liter amber glass screw-cap (x2)	--[a]
TPH-DRO/GRO	Hydrogen/H_2O Equilibration Isotope Ratio Mass Spectrometry (USGS Reston, VA)	6°C	40-mL VOA vial (x2)	--[a]
VOCs	EPA 8260B (Empirical)	6°C with HCl	40-mL VOA vial (x3)	14 days
SVOCs	EPA 8270D (Empirical)	6°C with HCl	40-mL VOA vial (x3)	14 days
Gases (Methane, ethane, ethene)	RSKSOP-175 EPA 3810 (Pace Analytical)	6°C with HCl	40-mL VOA vial (x2)	14 days
Hydrogen gas	AM20GAX	6°C with HCl	40-mL VOA vial (x2)	14 days
Metals (As, Ca, Pb, Mg, K, Na)	6010C	6°C	40+ mL water vials (x2)	--[a]
Dissolved Metals (Fe, Mn)	6010C-DISS	Capsule filter, 6°C with HNO_3	100-mL polyethylene screw-cap (x1)	6 months
Anions (bromide, chloride, nitrate, nitrite, sulfate, sulfide)	EPA 300.0 (Empirical, Test America)	6°C	100-mL polyethylene screw-cap (x1)	28 days
Alkalinity	SM 2320B (Empirical)	6°C	500-mL polyethylene screw-cap (x1)	14 days
Microbial Community	QuantArray-Chlor (Microbial Insights)	6°C	1-liter amber glass screw-cap (x2)	48 hours
- Dissolved Oxygen **- pH** **- Oxidation-Reduction Potential** **- Conductivity** **- Temperature** **- Turbidity**	Field Meter	-- [b]	-- [b]	--[b]

[a] - Laboratory method has not been approved by the EPA; therefore, a holding time has not been established.

[b] - Field parameters collected during purging and sampling of the well

5.6.2 Anaerobic In Situ Bioremediation of EDB

5.6.2.1 Groundwater Sampling

During the demonstration of ISB for EDB, groundwater samples were collected in accordance with the site-specific Groundwater Investigation Work Plan (USACE, 2011) and the Pilot Test Work Plan (Kirtland AFB, 2016a). This was achieved by low flow sampling at the monitoring wells (KAFB-106064, KAFB-106063, KAFB-106MW1-S, KAFB-106MW1-I, KAFB-106MW2-I, KAFB-106MW2-S, KAFB-106MW2-I) using QED MicroPurge® Model P1101HM bladder pumps and by use of sampling ports located along the recirculation system for each extraction well (KAFB-106EX1 and KAFB-106EX2). During periods when the recirculation system was not operating, groundwater at the injection well (KAFB-106IN1) was sampled using an associated submersible Grundfos pump prior to sampling/operating the extraction wells pumps.

Samples were submitted for the following analyses:

- VOCs (United States Environmental Protection Agency [EPA] Method 8260B)
- EDB (EPA Method 8011)
- Dissolved iron and manganese (EPA Method 6010C)
- Anions – bromide, nitrate, nitrite, chloride, and sulfate (EPA Method 9056A)
- Nitrate and nitrite as nitrogen (EPA Method 353.2)
- Iodide (EPA Method 300.0)
- Reduced Gases (RSK SOP-175; EPA 3810)
- Volatile Fatty Acids (EPA Method 300 Modified)
- Alkalinity (Standard Method 2320B)
- Microbial Community (QuantArray-Chlor)
- Dissolved ortho-phosphate (Standard Method 4500 PE and EPA Method 9056A)
- EDB CSIA (Kuder et al., 2012); Not collected at wells (KAFB-106063, KAFB-106MW1-I, KAFB-106MW2-I)
- $\delta^2 H$ (Hydrogen/H_2O Equilibration Isotope Ratio Mass Spectrometry)
- Fluorescein Dye Tracer (Spectrofluorophotometry)

5.6.2.2 NAPL Sampling

During sampling pump installation on September 5, 2017, measurable NAPL was detected in the shallow nested well KAFB-106MW1-S. Three separate measurements were collected using a Solinst interface probe and confirmed a thickness of approximately 0.27 to 0.31 feet. Well KAFB-106MW1-S was bailed on September 8, 2017 and approximately 60 milliliters of product were recovered. The product was containerized and submitted to Pace Analytical® (Pace) for the following analysis:

- C3-C12 PIANO Quantitative Molecular Characterization by gas chromatography-mass spectrometry (VOC Fingerprinting)
- C8-C40 Full Scan Qualitative Molecular Characterization by gas chromatography-mass spectrometry (semivolatile organic compound Fingerprinting)
- Density and Viscosity

Density and viscosity analyses were subcontracted to Clark Testing. Additional product recovery on September 13 and 14, 2017 produced approximately 60 milliliters that was sent to the APTIM Lawrenceville laboratory.

As the pilot test was initiated, NAPL was not detected at any other shallow monitoring wells within or around the treatment zone, or in the injection well. Extraction wells were not gauged for NAPL after installation, as the top of the well screens were designed to be installed below the static water level. In February 2020, NAPL was observed in both extraction wells after downhole equipment was removed to evaluate the condition of the pilot test infrastructure.

5.6.2.3 Sampling Documentation

Sample collection logs, purge logs, and chain-of-custody form were completed by field personnel during monitoring and sampling activities. Sample collection logs and purge logs are included in Appendix H of the Pilot Test Report, although not included in Appendix B here due to the large file size of the documents. The entire Pilot Test Report with all appendices included can be accessed through the USAF Kirtland AFB Administrative Record (AR) for site SS-111 (BFF) at https://ar.afcec-cloud.af.mil/Search.aspx. Chain-of-custody forms are included with the laboratory data packages in Appendix I-3 of the Pilot Test Report (not included in Appendix B here due to the file size; see Kirtland AFB AR for these documents).

5.6.2.4 Quality Control

Field quality control samples were collected as part of each sampling event and included field duplicate and trip blank samples. Duplicate samples were analyzed to evaluate the overall reproducibility of the sampling and analysis process and were collected immediately after the original/parent sample to reduce variability. Trip blank samples were used to evaluate potential contamination by VOCs during sampling, shipment, and laboratory processing. Additionally, internal laboratory quality control samples, including laboratory control samples, replicates, matrix spikes, matrix spike duplicates, and surrogate spike samples were analyzed concurrently with the groundwater samples.

The groundwater analytical data were validated for precision, bias, accuracy, representativeness, comparability, and completeness, and appropriate data qualifiers were appended to the analytical data. The data validation results are presented in the Data Quality Evaluation Reports, which are included as Appendix I-1 and I-2 of the Pilot Test Report (not included in Appendix B here due to the file size; see Kirtland AFB AR for these documents). Laboratory data packages are also provided in Appendix I-3 of the Pilot Test Report (not included in Appendix B here due to the file size; see Kirtland AFB AR for these documents).

Both hydrogen and carbon isotopes were reported using (δ) notation, where δ^2H or $\delta^{13}C = R_{sample}/R_{standard}-1$ and R is the $^2H/^1H$ or $^{13}C/^{12}C$ ratio of the sample and the standard (Vienna Standard Mean Ocean Water for δ^2H, and Vienna Pee Dee Belemnite for $\delta^{13}C$), respectively. $\delta^{13}C$ of EDB was analyzed by Dr. Tomasz Kuder at the University of Oklahoma using CSIA.

5.6.2.5 Groundwater Sampling Locations and Frequency

Analytical sampling associated with the ISB demonstration was performed at the locations and frequency described in Table 5.6.

Table 5.6. Groundwater Sampling Locations and Frequency for ISB of EDB.

Phase	Analyte	Locations [a]	Approximate Frequency
Phase 1 (Section 5.5.2.2)	Water Isotopes (δ^2H) (IRMS) and Dye Tracer (Fluorescein) (Fluorimetric)	6 MWs, 2 EWs, 1 IW 6 MWs, 2 EWs 6 MWs, 2 EWs, 1 IW	1 event (baseline) 8 events (recirculation, collected on Days 2, 4, 7, 10, 14, 18, 23, and 30) 2 events (passive, collected Weeks 2 and 4)
	Microbial Community (QuantArray-Chlor)	6 MWs, 2 EWs, 1 IW 6 MWs, 2 EWs, 1 IW	1 event (baseline) 1 event (passive, collected Week 4)
	CSIA (Kuder et al, 2012)	3 MWs[c], 2EWs, 1 IW	1 event (baseline) 1 event (passive, collected Week 4)
	All Other Analytes [b]	6 MWs, 2 EWs, 1 IW 6 MWs, 2 EWs 6 MWs, 2 EWs, 1 IW	1 event (baseline) 8 events (recirculation, collected on Days 2, 4, 7, 10, 14, 18, 23, and 30) 2 events (passive, collected Weeks 2 and 4)
Phase 2 (Section 5.5.2.3)	Microbial Community (QuantArray-Chlor)	6 MWs, 2 EWs 6 MWs, 2 EWs, 1 IW	1 event (recirculation, collected Week 4) 1 event (passive, collected at end of Month 3)
	CSIA (Kuder et al, 2012)	3 MWs[c], 2 EWs 3 MWs[c], 2 EWs, 1 IW	1 event (recirculation, collected Week 4) 1 event (passive, collected at end of Month 3)
	All Other Analytes [b]	6 MWs, 2 EWs 6 MWs, 2 EWs, 1 IW	3 events (recirculation, collected Weeks 2, 3, and 4) 4 events (passive, collected at end of Months 1, 2, 3, and 4)[d]
Phase 3 (Section 5.5.2.4)	Microbial Community (QuantArray-Chlor)	6 MWs, 2 EWs 6 MWs, 2 EWs, 1 IW	1 event (recirculation, collected Week 4) 1 event (passive, collected at end of Month 3)
	CSIA (Kuder et al, 2012)	3 MWs[c], 2 EWs 3 MWs[c], 2 EWs, 1 IW	1 event (recirculation, collected Week 4) 1 event (passive, collected at end of Month 3)
	All Other Analytes [b]	6 MWs, 2 EWs 6 MWs, 2 EWs, 1 IW	4 events (recirculation, collected Weeks 2, 3, 4, and 5)[e] 3 events (passive, collected at end of Months 1, 2, and 3)
Phase 4 (Section 5.5.2.5)	Microbial Community (QuantArray-Chlor)	6 MWs, 2 EWs, 1 IW	4 events (passive, quarterly)[f]
	All Other Analytes[g]	6 MWs, 2 EWs, 1 IW	4 events (passive, quarterly)[f]

[a] 6 MWs = KAFB-106064, KAFB-106063, KAFB-106MW1-S, KAFB-106MW1-I, KAFB-106MW2-S, KAFB-106MW2-I
2 EWs = KAFB-106EX1, KAFB-106EX2
1 IW = KAFB-106IN1

[b] EDB (EPA Method 8011), VOCs (EPA Method 8260B), reduced gases (RSK-175), anions (E353.2, SM4500PE, and SW9056A), VFAs (E300M), dissolved iron and manganese (EPA Method 6010C), and alkalinity (SM2320B).

[c] Includes shallow monitoring wells KAFB-106064, KAFB-106MW1-S, and KAFB-106MW2-S.

[d] An additional sampling event was conducted at the end of the passive phase (Month 4).

[e] An additional sampling event was conducted at the end of recirculation (Week 5).

[f] Quarterly Phase 4 sampling was initiated in March 2020 and continued through October 2020. Extraction well KAFB-106EX2 was not sampled during first and second quarter 2020 due to the presence of NAPL in the well.

[g] EDB (EPA Method 8011), VOCs (EPA Method 8260C), reduced gases (RSK-175; EPA 3810), anions (EPA Method 300.0, EPA Method 365.3, and SM4500PE), VFAs (EPA Method 300M), dissolved iron and manganese (EPA Method 6020A), total lead (EPA Method 6020A), and alkalinity (SM2320B).

5.6.2.6 Analytical and Sample Preservation for Groundwater Samples

The analytical methods, sample preservation, bottleware, and holding times used for the analyses are summarized in Table 5.7 below.

Table 5.7. Analytical Methods for ISB of EDB.

Analyte	Method/ Laboratory	Preservative	Bottle	Holding Time
EDB	EPA 8011 (Empirical)	6°C	40-mL VOA vial (x3)	14 days
EDB $\delta^{13}C$ via CSIA	Kuder et al, 2012 (University of Oklahoma)	6°C with HCl	1-liter amber glass screw-cap (x2)	--[a]
$\delta^{2}H$	Hydrogen/H_2O Equilibration Isotope Ratio Mass Spectrometry (USGS Reston, VA)	6°C	40-mL VOA vial (x2)	--[a]
VOCs	EPA 8260B (Empirical)	6°C with HCl	40-mL VOA vial (x3)	14 days
Reduced Gases	RSKSOP-175 EPA 3810 (APTIM)	6°C with HCl	40-mL VOA vial (x2)	14 days
Dye Tracer (Fluorescein)	Spectrofluorophotometry (Crawford Hydrology Lab, Ozark Undeground Lab)	6°C	40+ mL water vials (x2)	--[a]
Anions (with Bromide, Iodide)	EPA 300.0 (Empirical, Test America)	6°C	100-mL polyethylene screw-cap (x1)	28 days
Nitrate	EPA 353.2 (Empirical)	6°C with H_2SO_4	250-mL polyethylene screw-cap (x1)	28 days
Phosphate	SM4500 PE (Empirical)	6°C	100-mL polyethylene screw-cap (x1)	48 hours
Volatile Fatty Acids	EPA 300m (APTIM)	6°C	40-mL VOA vial (x2)	14 days
Dissolved Metals (Fe, Mn)	EPA 6010C (Empirical)	Capsule filter, 6°C with HNO_3	100-mL polyethylene screw-cap (x1)	6 months
Alkalinity	SM 2320B (Empirical)	6°C	500-mL polyethylene screw-cap (x1)	14 days
Microbial Community	QuantArray-Chlor (Microbial Insights)	6°C	1-liter amber glass screw-cap (x2)	48 hours
- **Dissolved Oxygen** - **pH** - **Oxidation-Reduction Potential** - **Conductivity** - **Temperature** - **Turbidity**	Field Meter	-- [b]	-- [b]	--[b]

[a] - Laboratory method has not been approved by the EPA; therefore, a holding time has not been established.
[b] - Field parameters collected during purging and sampling of the well.

5.7 SAMPLING RESULTS

5.7.1 EDB Attenuation Evaluation

5.7.1.1 Groundwater elevations

Groundwater flows at Kirtland AFB have varied significantly in the past century. As mentioned in Section 4.2, groundwater flow shifted to the north and east sometime near 1980 as a result of historic groundwater use (Travis and Myers, 2019), and sitewide groundwater gradients in that direction were estimated to be approximately 0.0012 ft/ft in 2009 when groundwater elevations were at their nadir (Kirtland AFB, 2010). Since that time, groundwater levels have increased, and the gradient has become shallower (Kirtland AFB, 2018).

Most of the 13 wells used to evaluate EDB attenuation during this ESTCP effort were installed during 2011. Groundwater elevations during the last two quarters of 2011 are presented in Figure 5.8, together with groundwater elevations observed during the four quarters that samples were collected for the EDB attenuation evaluation described here. Also indicated in Figure 5.8 are the top elevations of well screens. Most screens of wells used for this examination of EDB attenuation were submerged during at least one sampling event in 2014 or 2015 as groundwater elevations at the site increased. The gradient observed for the 13 wells in 2011 averaged 0.0008 ft/ft and was as low as 0.0002 ft/ft during the four quarters described in more detail here (Q4 2014, Q1 2015, Q2 2015, and Q3 2015). Given the estimate of average hydraulic conductivity for ancestral Rio Grande deposits of ~70 ft/day and average effective porosity of 27% respectively (see Section 4.2), estimated seepage velocities ranged from approximately 110 ft/year in 2009 to 70 ft/year in 2011 and down to 20 ft/year in 2015 as gradients at the site changed.

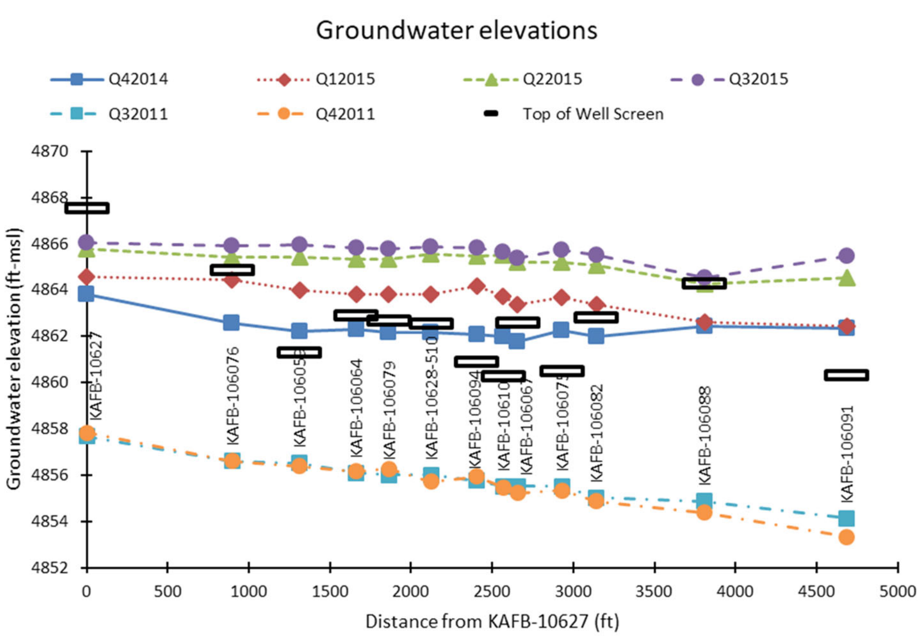

Figure 5.8. Observed GW Elevations at the 13 Wells Used During Period of Covered by Natural Attenuation Evaluation (Q4,2014 to Q3,2015). Also Provided Are GW Elevations During Q3,2011 and Q4,2011 when Groundwater Was Deeper. The Top of Well Screens Are Also Indicated.

5.7.1.2 Geochemical zones

Subsurface geochemical conditions greatly impact natural attenuation of halogenated substances in groundwater, particularly with respect to biodegradation under anaerobic and aerobic conditions. This is described in the USEPA's Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water (Protocol; Wiedemeier et al., 1998), and similar considerations are appropriate for EDB. There is great overlap among many halogenated species in terms of degradation processes, with significantly different mechanisms occurring under anaerobic and aerobic conditions. The screening framework for anaerobic biodegradation processes provided in the 1998 USEPA Protocol (Wiedemeier et al., 1998) will be used here to place different zones at Kirtland AFB in context. With the Protocol, geochemical conditions that facilitate reductive dehalogenation are scored; and while all parameters cannot be mapped to EDB, scores for the 13 wells examined are useful for discussing natural attenuation of EDB. For this screening, 12 of the parameters in the Protocol were evaluated: concentrations of oxygen, hydrogen, nitrate, ferrous iron, sulfate, methane, total organic carbon (as DRO or GRO), alkalinity, BTEX, and ethene/ethane, in addition to measures of ORP and pH. The anaerobic biodegradation screening scores for the 13 wells based on average measures over the 4 quarters of 2014 and 2015 are provided in Table 5.8 and Figure 5.9. In this figure and figures that follow, filled markers indicate whether NAPL was ever detected in the wells after installation and empty markers indicate that NAPL was not observed at the wells. A higher screening score provides more evidence that anaerobic degradation of EDB may have occurred. According to the Protocol, scores in excess of 20 provide "strong" evidence of anaerobic biodegradation, with lower scores providing progressively less evidence. For purposes of this report, excepting the background well KAFB-106027, we grouped the wells into three representative zones: (1) four wells with scores at or near that suggesting "strong" evidence of anaerobic biodegradation (Zone 1: KAFB-106076, KAFB-106059, KAFB-106064, and KAFB-106079), (2) four wells with intermediate scores (Zone 2: KAFB-10628-510, KAFB-106094, KAFB-10610, and KAFB-106067), and (3) four wells with weak evidence of anaerobic biodegradation that were likely more influenced by aerobic processes (Zone 3: KAFB-106075, KAFB-106082, KAFB-106088, and KAFB-106091). The discussion of natural attenuation will refer to these three zones.

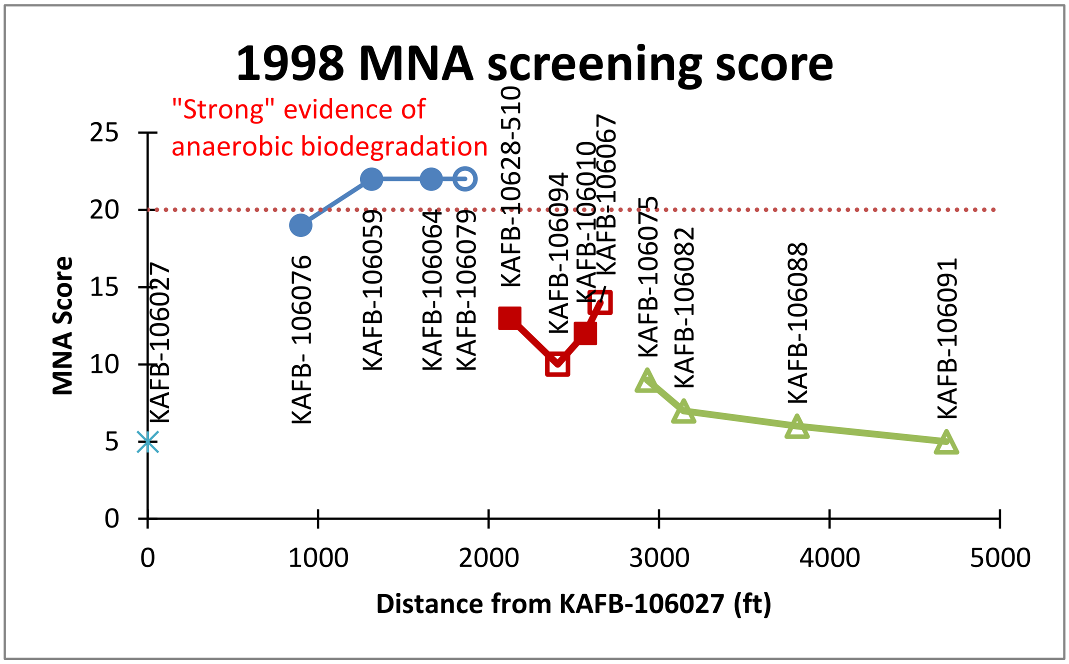

Figure 5.9. MNA Screening Scores for the 13 Natural Attenuation Wells Based on 1998 USEPA Protocol (Wiedemeier et al., 1998).

Higher scores indicate greater likelihood of anaerobic degradation. Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

Figure 5.10 to Figure 5.23 show the components that led to the screening scores described above, and the analytical data summary tables can be found in Appendix D. There is great consistency among these components for the three well groups. DO was depressed in Zones 1 and 2 and increased in Zone 3, consistent with conditions facilitating anaerobic processes in Zones 1 and 2 and aerobic processes increasing in their importance between Zone 2 and Zone 3. Zone 2 demonstrated the greatest variability in parameters, consistent with more dynamic underlying processes, and may also include regions where either anaerobic or aerobic processes (e.g., cometabolism) occur. Measured H_2 appears slightly elevated in hydrocarbon impacted areas. The elevated level of H_2 observed suggests that conditions may support the activity of dehalogenating organisms and anaerobic biodegradation of EDB. Ethene/ethane are anaerobic degradation products of EDB and were observed at elevated concentrations in Zones 1 and 2. EDB degradation products are discussed further in Section 5.7.1.4.2.

Table 5.8. MNA Screening Scores for the 13 Natural Attenuation Wells Based on 1998 USEPA Protocol (Wiedemeier et al., 1998). Higher Scores Indicate Greater Likelihood of Anaerobic Degradation.

		Well IDs												
Parameter	**Units**	**KAFB-106027**	**KAFB-106076**	**KAFB-106059**	**KAFB-106064**	**KAFB-106079**	**KAFB-10628-510**	**KAFB-106094**	**KAFB-106010**	**KAFB-106067**	**KAFB-106075**	**KAFB-106082**	**KAFB-106088**	**KAFB-106091**
Dissolved oxygen (3 pts if < 0.5 mg/L)	points (mg/L)	0 (4.3)	3 (0)	3 (0.028)	3 (0)	3 (0.15)	3 (0)	3 (0.2)	3 (0.02)	3 (0.05)	3 (0.17)	0 (1.31)	0 (0.92)	0 (4.1)
Hydrogen (3 pts if > 1 nM)	points (nM)	3 (3.04)	3 (3.98)	3 (8.22)	3 (3.88)	3 (2.73)	3 (3.09)	3 (2.56)	3 (3.74)	3 (2.69)	3 (2.38)	3 (3.90)	3 (3.32)	3 (2.71)
Nitrate (2 pts if < 1 mg/L)	points (mg/L)	2 (0.12)	2	2	2	2 (0.15)	2	2 (0.16)	2	2	2 (0.17)	2	2 (0.17)	2
Ferrous Iron (3 pts if > 1 mg/L)	points (mg/L)	0	0 (0.53)	3 (2.82)	3 (5.18)	3 (4.61)	0 (0.65)	0 (0.73)	0 (0.34)	0 (0.89)	0 (0.05)	0 (0.34)	0 (0.04)	0
Sulfate (2 pts of < 20 mg/L)	points (mg/L)	0 (28.5)	2 (17.4)	2 (4.2)	2 (0.48)	2 (10.8)	0 (39.4)	0 (53.4)	0 (38.5)	2 (16.2)	0 (54.8)	0 (68)	0 (35.2)	0 (40.7)
Methane (3 pts if >0.5 mg/L)	points (mg/L)	0	0 (0.009)	0 (0.075)	0 (0.043)	0 (0.022)	0 (0.005)	0 (0.004)	0 (0.245)	0 (0.002)	0 (0.0004)	0 (0.004)	0	0 (0.0005)
TOC (as GRO/DRO) (2 pts if > 20 mg/L)	points (mg/L)		2 (53.5)	2 (53.7)	2 (29.7)	2 (26.3)	0 (7.1)	0 (3.4)	0 (14.6)	0 (4.2)	0 (1.1)	0 (1.7)	0	0 (0.7)
Alkalinity (1 pt if >2x background)	points (mg/L)	0 (118)	1 (294)	1 (334)	1 (295)	1 (360)	1 (239)	0 (188)	0 (185)	1 (255)	0 (150)	0 (179)	0 (134)	0 (139)
BTEX (2 pts if > 0.1 mg/L)	points (mg/L)		2 (5.4)	2 (39.1)	2 (8.7)	2 (1.5)	2 (0.38)	0 (0.029)	2 (2.5)	2 (0.17)	0	0 (0.009)	0	0
Ethene/Ethane (2 pts if > 0.01 mg/L)	points (mg/L)	0	2 (0.024)	2 (0.048)	2 (0.039)	2 (0.018)	0 (0.0079)	0 (0.0096)	0 (0.0099)	0 (0.0019)	0 (0.0007)	0 (0.002)	0	0 (0.0003)
ORP (1 pt if < 50 mV and 2 pts if < -100 mV)	points (mV)	0 (116)	2 (-283)	2 (-244)	2 (-124)	2 (-153)	2 (-256)	2 (-142)	2 (-304)	1 (-12)	1 (-42)	2 (-136)	1 (10.7)	0 (114)
pH (-2 pts if 5>pH>9)	points (SU)	0 (7.9)	0 (7.2)	0 (7.0)	0 (7.0)	0 (6.8)	0 (7.3)	0 (7.6)	0 (7.6)	0 (7.1)	0 (7.6)	0 (7.5)	0 (7.9)	0 (7.7)
Total Score		**5**	**19**	**22**	**22**	**22**	**13**	**10**	**12**	**14**	**9**	**7**	**6**	**5**

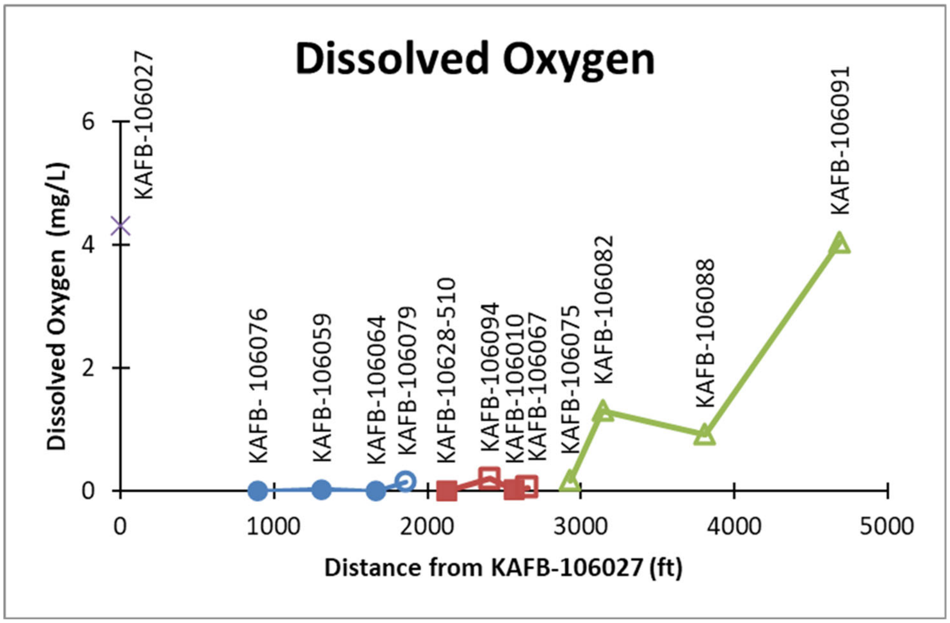

Figure 5.10. Geometric Mean of Dissolved Oxygen Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

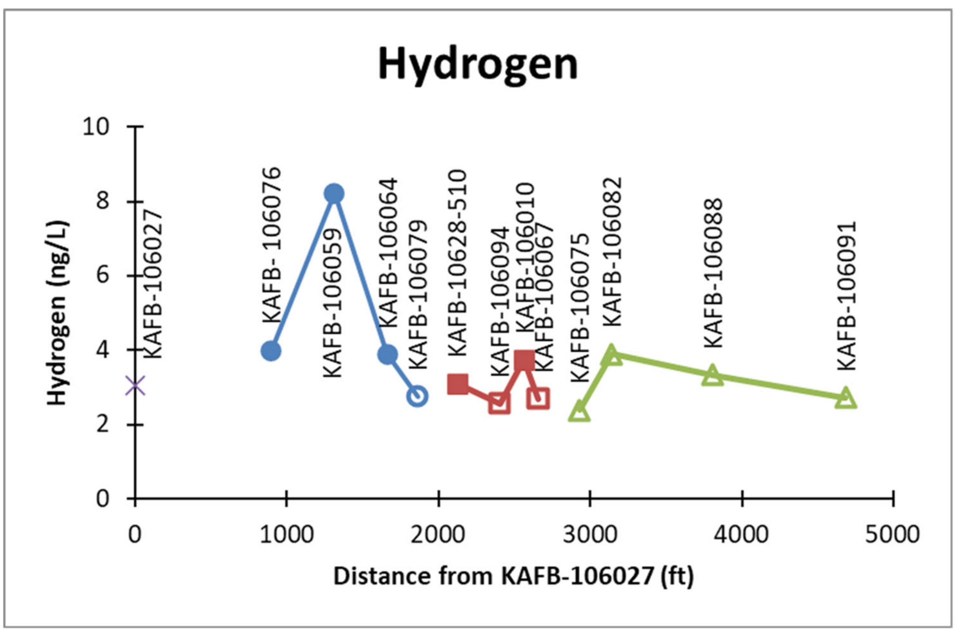

Figure 5.11. Geometric Mean of Hydrogen Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

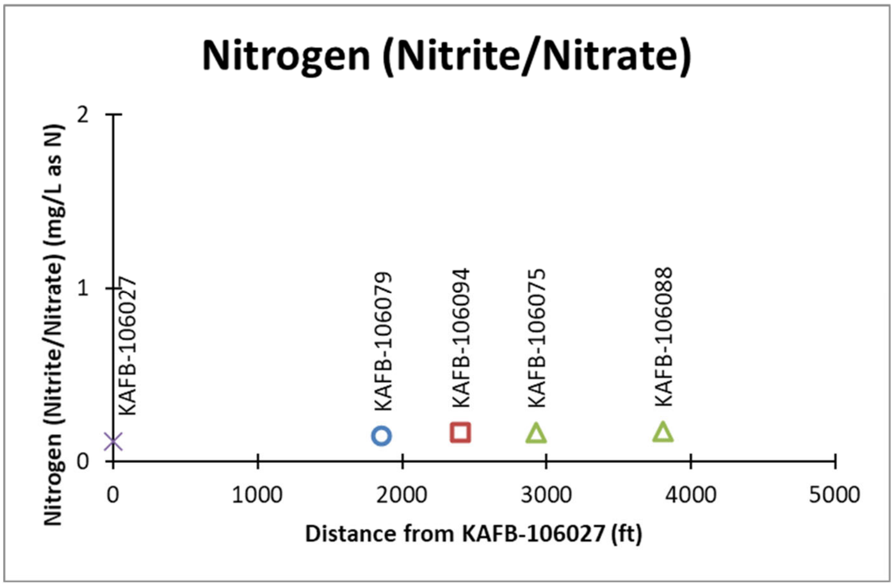

Figure 5.12. Geometric Mean of Combined Nitrite and Nitrate Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

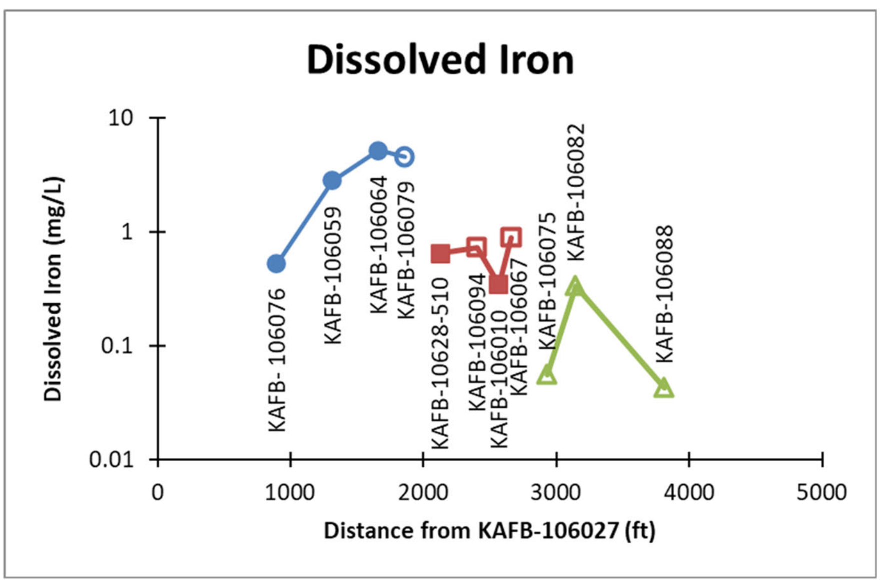

Figure 5.13. Geometric Mean of Dissolved Iron Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

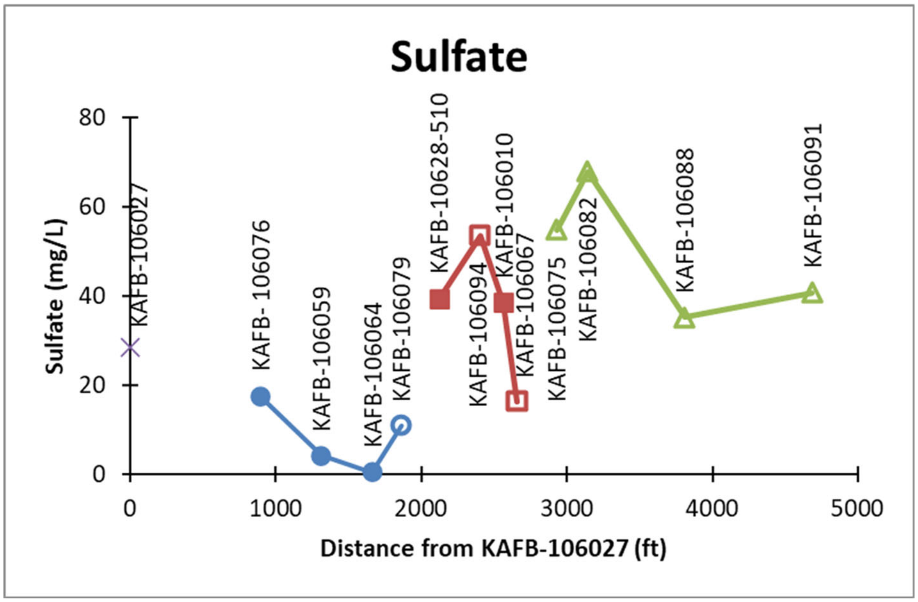

Figure 5.14. Geometric Mean of Sulfate Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

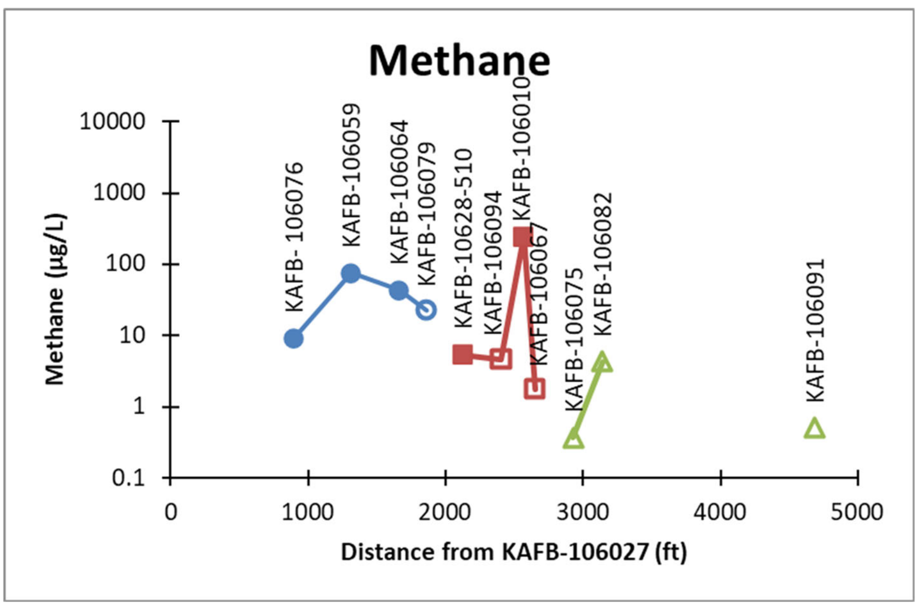

Figure 5.15. Geometric Mean of Methane Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

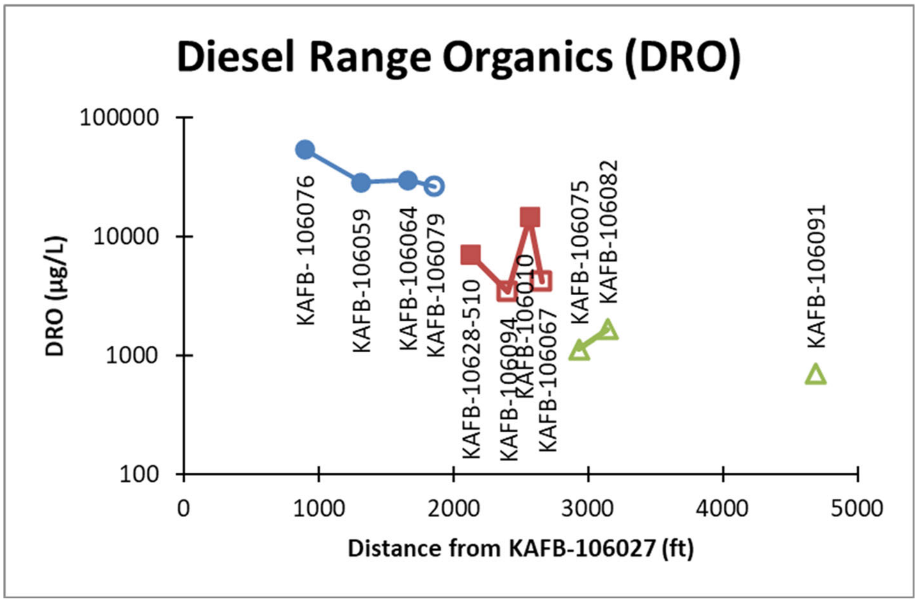

Figure 5.16. Geometric Mean of Diesel Range Organic (TPH-DRO) Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

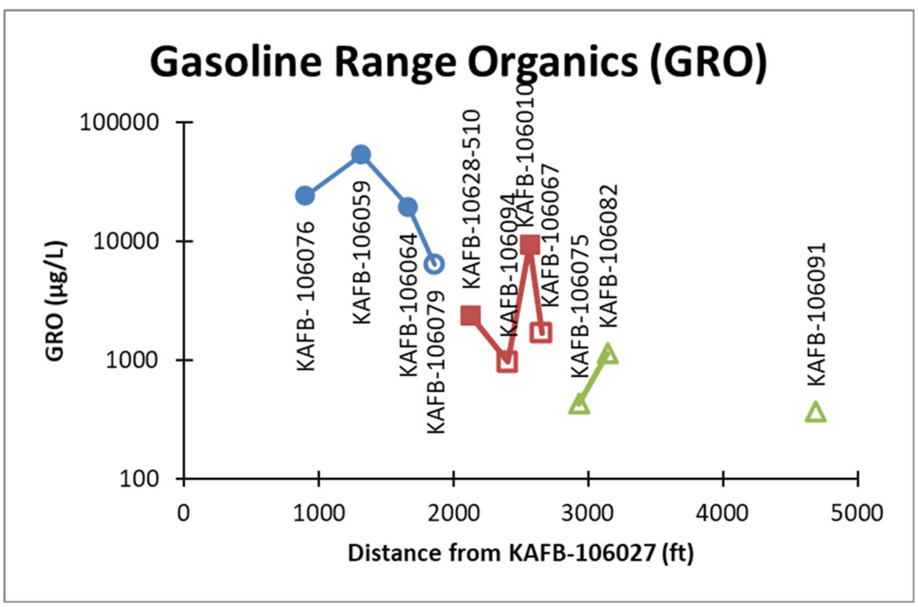

Figure 5.17. Geometric Mean of Gasoline Range Organics (TPH-GRO) Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

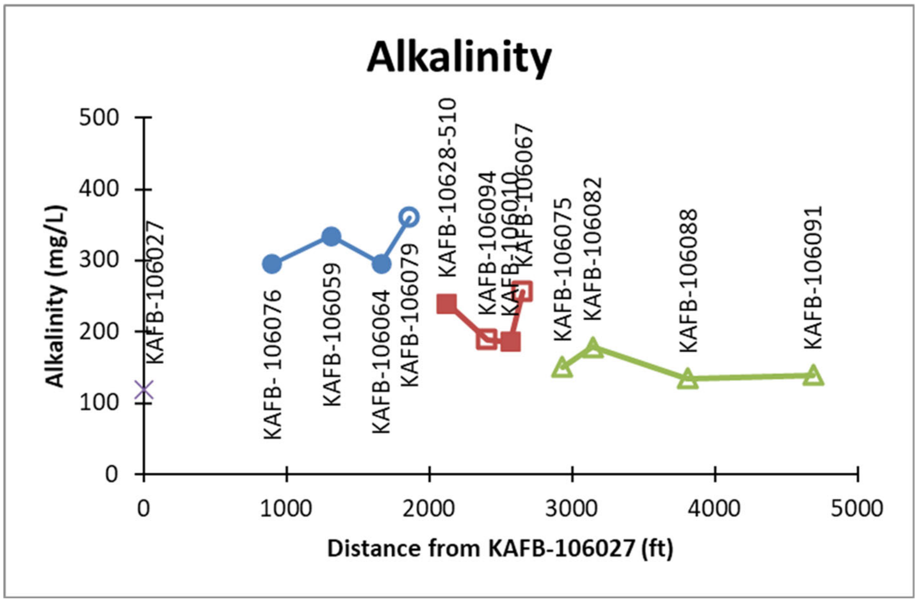

Figure 5.18. Geometric Mean of Alkalinity at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

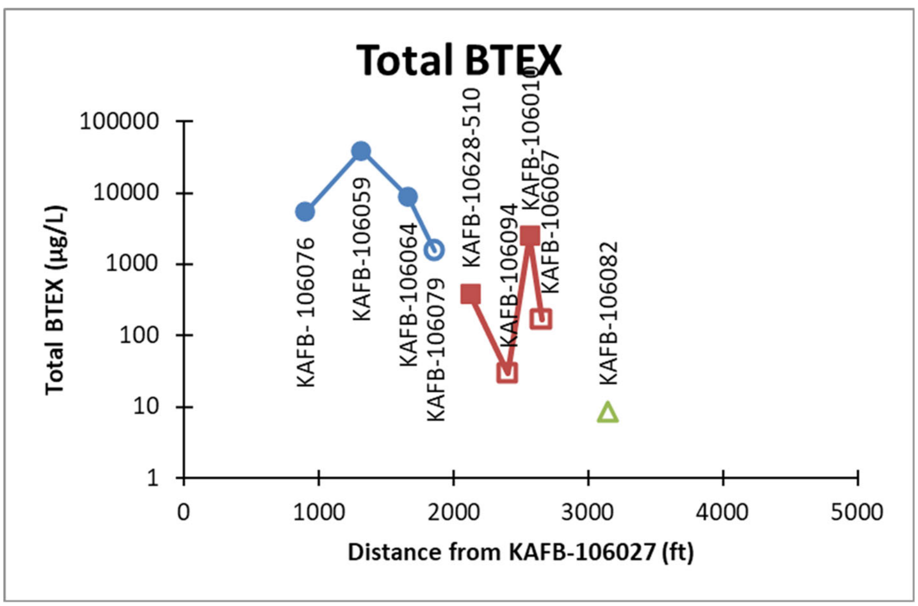

Figure 5.19. Geometric Mean of Sum of BTEX Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

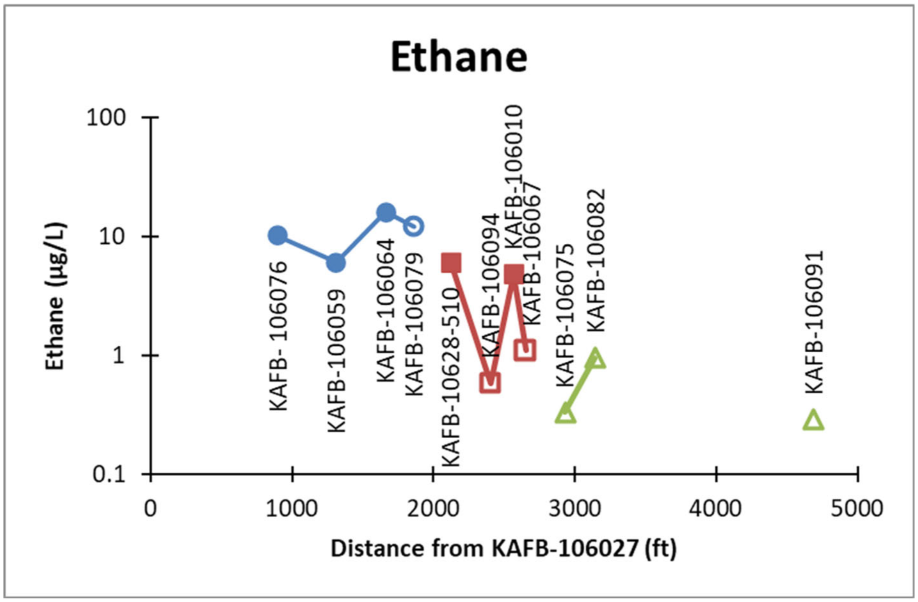

Figure 5.20. Geometric Mean of Ethane Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

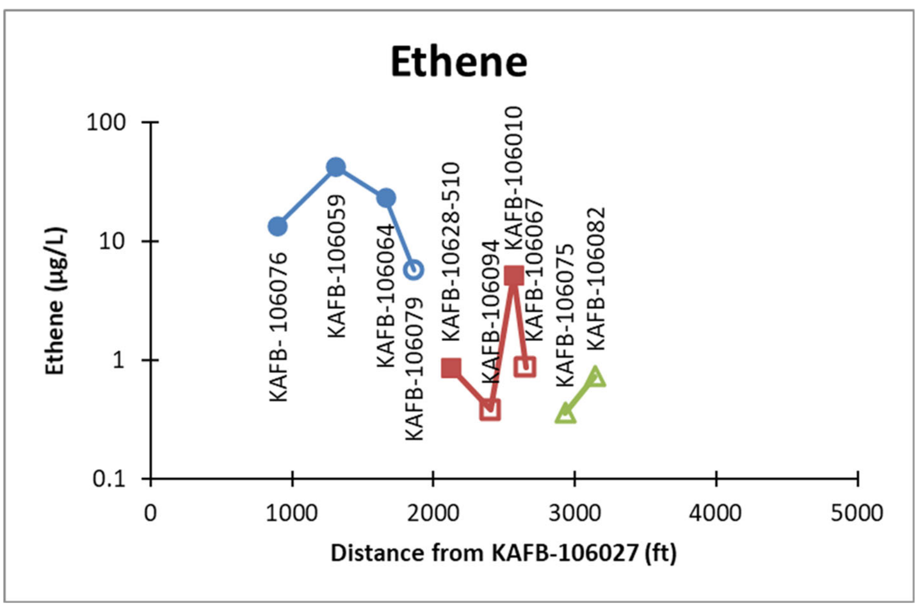

Figure 5.21. Geometric Mean of Ethene Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

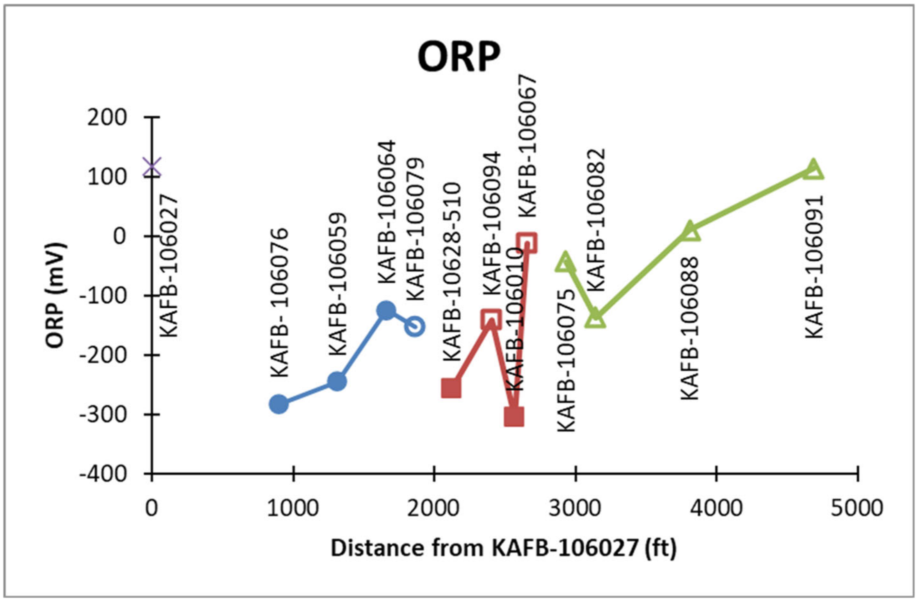

Figure 5.22. Average ORP Values at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

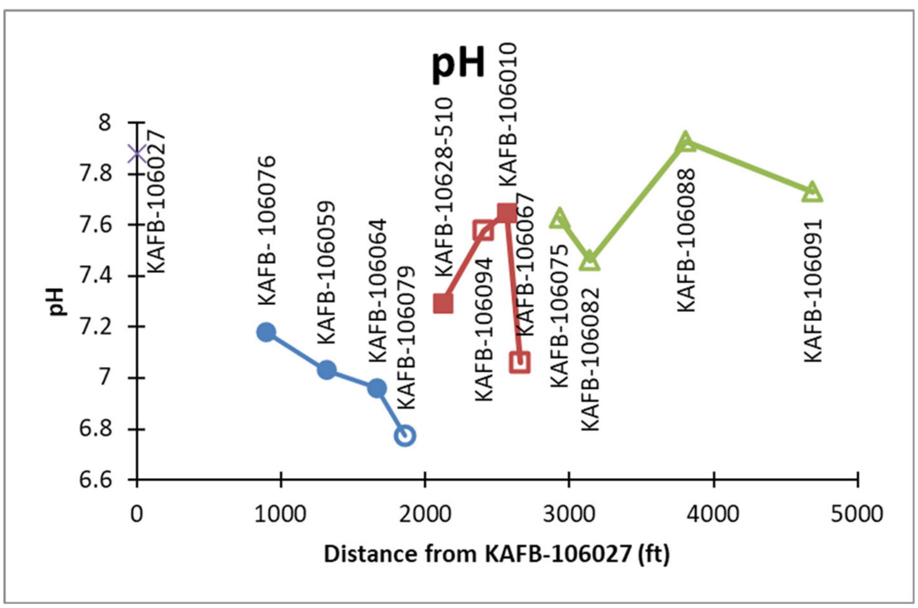

Figure 5.23. Average pH Values at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

5.7.1.3 Microbial analyses

Microbial Insights' QuantArray-Chlor assay was used to assess the microbial community among the thirteen wells with respect to their capacity to facilitate anaerobic biodegradation of halogenated substances. This qPCR-based tool quantified a set of organisms and genes associated with dehalogenation (i.e., dechlorination and debromination), as well as aerobic degradation of halogenated solvents via cometabolism. Sulfate-reducing organisms, methanogens, and total eubacteria are also quantified. Appendix D contains the analytical data summary tables from the 13 wells for the three or four quarters (based on well) discussed herein.

Overall, the microbial community observed by QuantArray analyses is consistent with the geochemical zones described before. This includes increased total bacterial counts (i.e., Total Eubacteria) in areas with greatest impact of hydrocarbons (Zone 1; Figure 5.24) as well as larger counts of sulfate reducing and (APS) methanogenic (MGN) bacteria indicative of anaerobic environments in Zone 1 (Figure 5.25 and Figure 5.26). Impacts in Zone 3 wells appear smaller, and there are fewer indicators of anaerobic conditions. In terms of overall microbial community, the wells in Zone 2 where NAPL was previously observed (KAFB-10628-510 and KAFB-106010) generally appear similar to Zone 1 wells, while anaerobic indicators are weaker at the other two wells (KAFB-106094 and KAFB-106067).

Populations of four dehalogenating organisms, *Dehalococcoides* spp. (DHC; Peethambaram, 2010; Yu et al., 2013), *Dehalobacter* spp. (DHBt; Grostern and Edwards, 2009, 2006), *Dehalogenimonas* spp. (DHG; Maness et al., 2012), and *Desulfitobacterium* spp. (DSB; De Wildeman et al., 2003; Marzorati et al., 2007), as identified at the time of the analyses, are plotted on a logarithmic scale in Figure 5.27 through Figure 5.30. These are known to either degrade EDB or its chlorinated analog 1,2-dichloroethane (1,2-DCA) under anaerobic conditions. With the exception of DHC, many of these populations exceeded 10^3 cells/ml in highly impacted locations (i.e., Zones 1 and 2), and populations were smaller in the aerobic Zone 3. The representative populations located in Zones 1 and 2, particularly in wells where NAPL was previously observed, indicate a strong likelihood of anaerobic dehalogenation, consistent with the screening scores and geochemical information provided in Section 5.7.1.2. It should be noted that since the time of the QuantArray analyses, the analytical laboratory modified its primers for DHG and its identification cannot be considered unequivocal, but instead likely identified/amplified species that were related to both DHC and DHG, and may also have facilitated dehalogenation (personal communication, Microbial Insights).

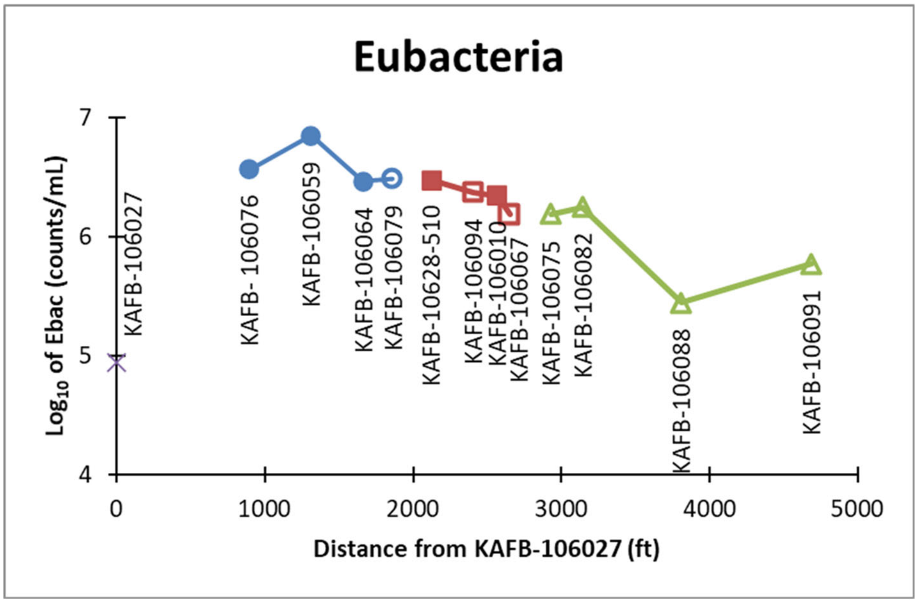

Figure 5.24. Geometric Mean of Eubacteria Levels at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

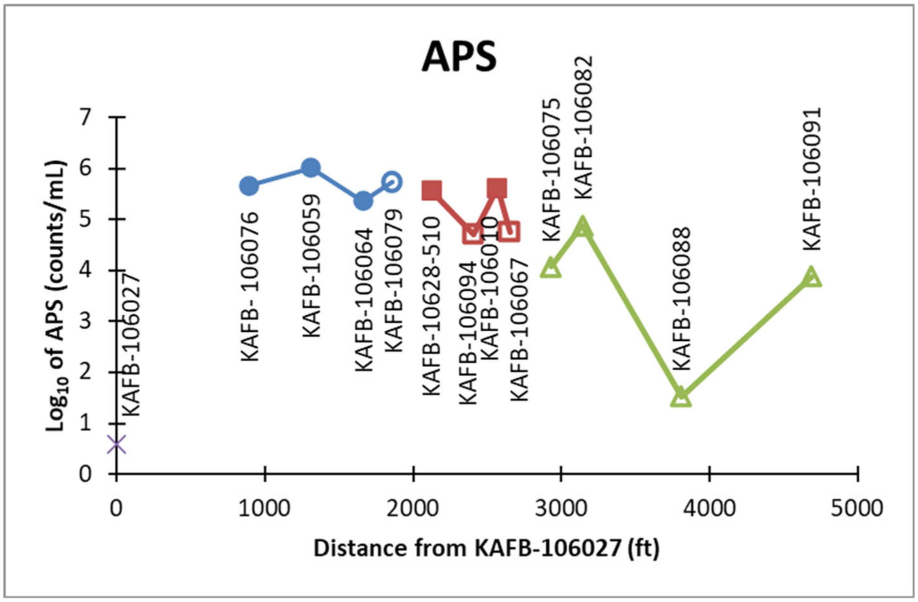

Figure 5.25. Geometric Mean of Sulfate Reducing Bacteria Levels at the 13 Natural Attenuation Wells as Quantified by APS Gene.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

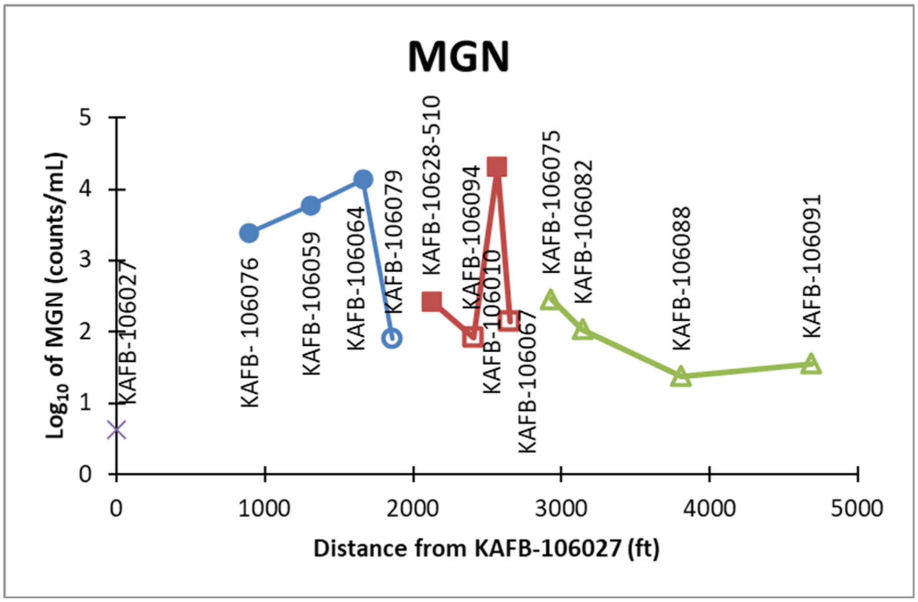

Figure 5.26. Geometric Mean of Methanogen (MGN) Levels at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

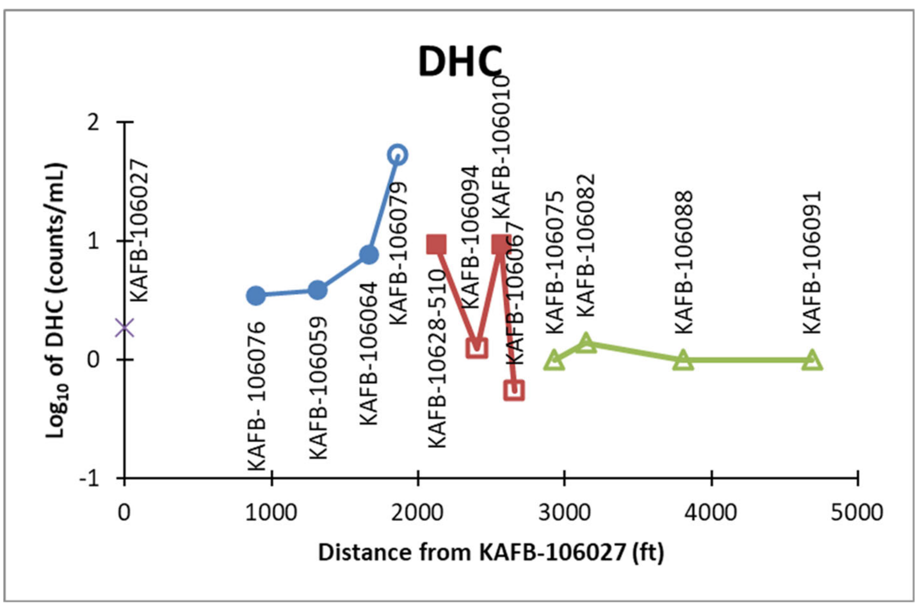

Figure 5.27. Geometric Mean of *Dehalococcoides* spp. (DHC) Levels at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

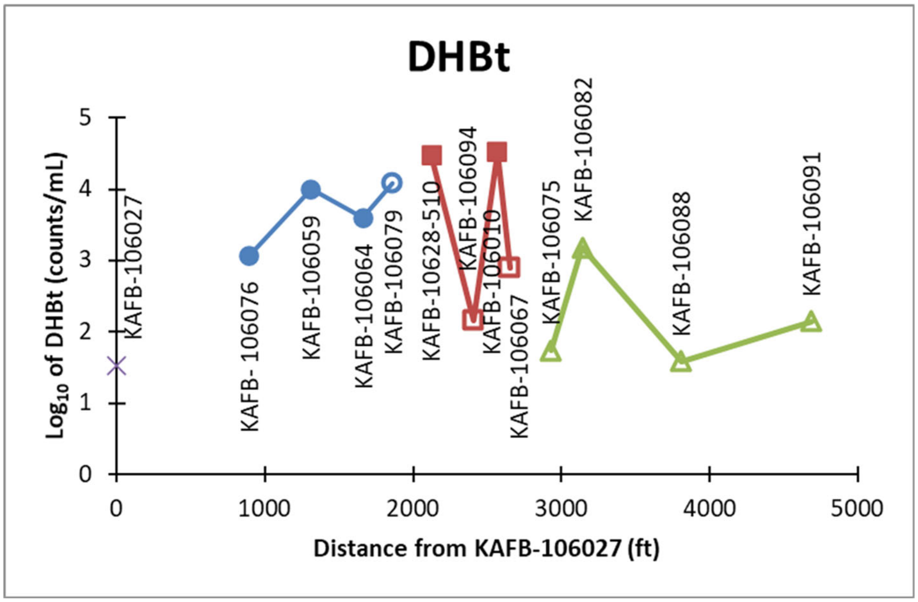

Figure 5.28. Geometric Mean of *Dehalobacter* spp. (DHBt) Levels at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

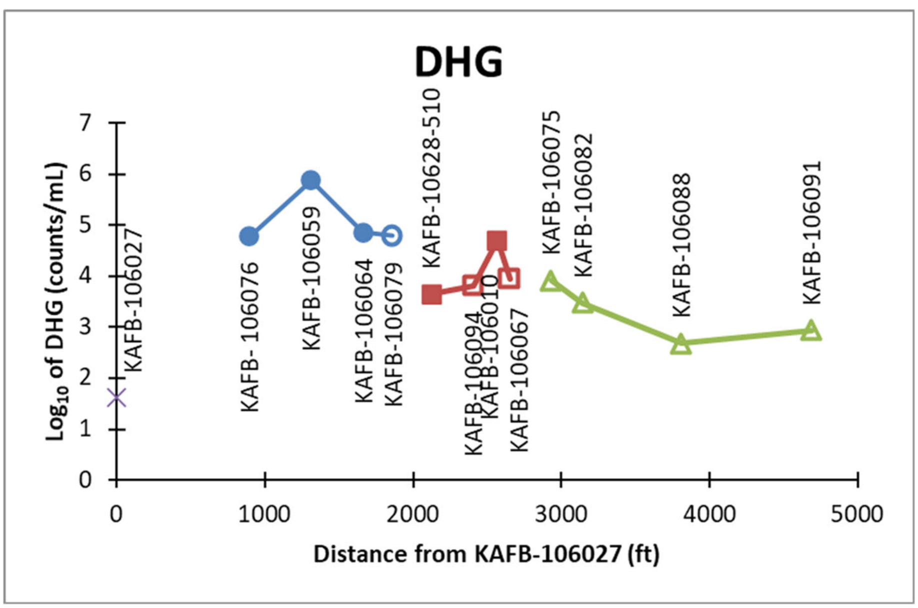

Figure 5.29. Geometric Mean of *Dehalogenimonas* spp. (DHG) Levels at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

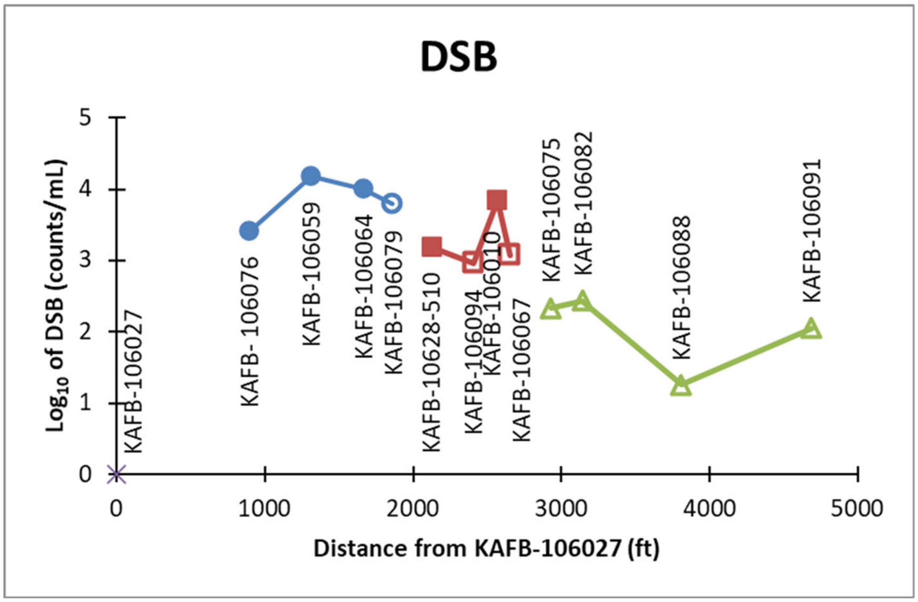

Figure 5.30. Geometric Mean of *Desulfitobacterium* spp. (DSB) Levels at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed. ***EDB degradation / attenuation***

5.7.1.4.1 <u>EDB concentrations</u>

Figure 5.31 shows average detected EDB concentrations at 12 of the 13 wells over the 4 quarters examined, grouped according to the geochemical zones described above. EDB was not detected at the thirteenth well, KAFB-106027, which was the background well. As before, if NAPL was ever detected in the wells after their installation, this is indicated in the figure by filled rather than empty markers. The wells with the greatest EDB concentrations all contained observable NAPL at one point in their histories (Zone 1: KAFB-106076, KAFB-106059, KAFB-106064; and Zone 2: KAFB-106028-510, KAFB-106010); and lower EDB concentrations were observed where NAPL was not observed (Zone 1: KAFB-106079; Zone 2: KAFB-106094, KAFB-106067; and Zone 3: KAFB-106075, KAFB-106082, KAFB-106088, KAFB-106091). EDB was 1-3 orders of magnitude higher in wells where NAPL was previously observed than in wells where it was not. The shift in EDB concentrations may indicate contribution/dissolution of EDB from residual NAPL sources to the aqueous phase and biodegradation when these contributions from residual NAPL were absent or more limited. This trend contrasts with isopropylbenzene (Figure 5.32), a component of fuels at the site that is more recalcitrant under anaerobic conditions, for which differences among locations with and without previous NAPL observations were smaller.

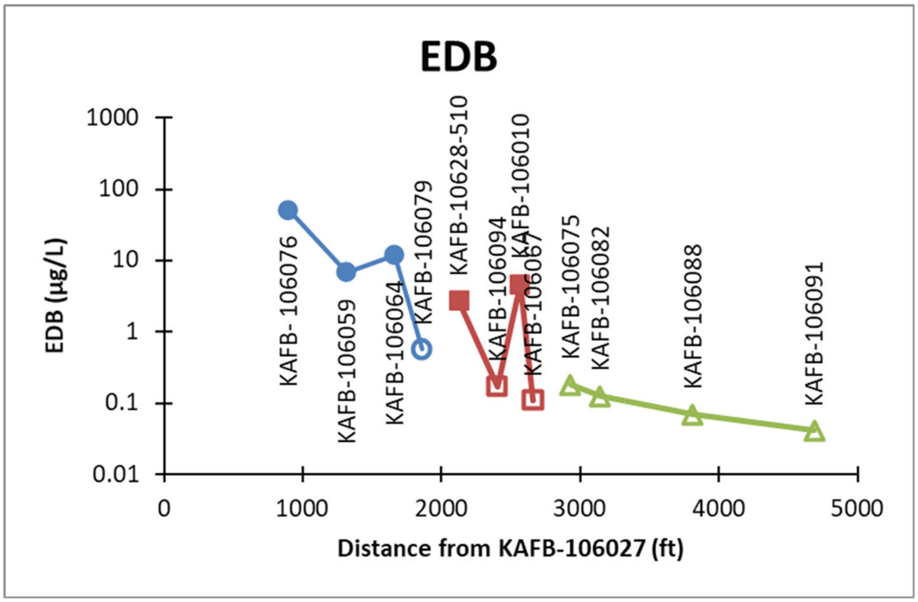

Figure 5.31. Geometric Mean of EDB Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

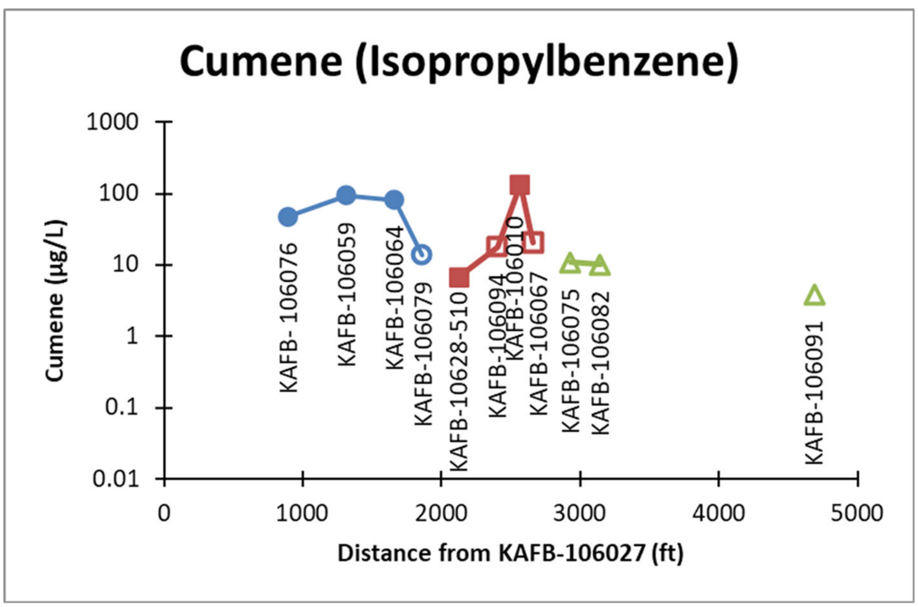

Figure 5.32. Geometric Mean of Cumene (isopropylbenzene) Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

5.7.1.4.2 EDB degradation products

EDB degradation products under anaerobic conditions due to abiotic and biological processes have been observed to include ethene and bromide ions (Koster van Groos et al., 2018). The presence of ethane at Kirtland AFB may be the result of further reduction of ethene to ethane or due to sequential hydrogenolysis of EDB, both of which may occur in anaerobic environments (De Bruin et al., 1992; Koene-Cottaar and Schraa, 1998). Ethene and ethane concentrations were observed to be elevated in Zones 1 and 2, particularly at locations where EDB concentrations were greater (Figure 5.20 and Figure 5.21). Concentrations of these two species appear consistent with their presence as a result of EDB degradation.

Bromide and chloride concentrations at the 13 wells varied between 0.07 and 0.83 mg/L and 7 and 71 mg/L, respectively, with little direct relationship to the geochemical zones (Figure 5.33 and Figure 5.34). Background water in the vicinity of the plume Kirtland AFB was previously noted to have an approximate bromide to chloride ratio of 0.0079 (Kirtland AFB, 2016b), and examining this ratio for the 13 wells (Figure 5.35 and Figure 5.36) indicates that EDB impacted groundwater was likely enriched in bromide relative to this background ratio at several wells. The greatest enrichment of bromide appeared to be in Zones 1 and 2 where EDB concentrations were generally greatest and where anaerobic biodegradation was likely to have occurred. Interestingly, KAFB-106067 in Zone 2 was strongly enriched in bromide, but less in terms of ethene and ethane. Whether this is indicator of aerobic degradation processes (e.g., cometabolism), or possible transport from upgradient sources, is unclear.

Other degradation products of EDB could include vinyl bromide, bromoethanol, and ethylene glycol. These were not observed in the field and are not customarily quantified through common analytical methods.

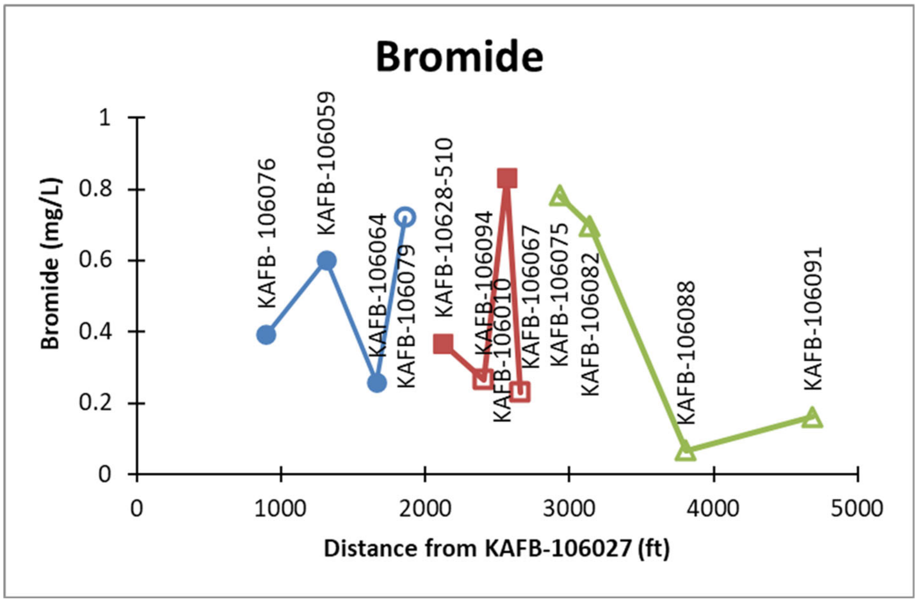

Figure 5.33. Geometric Mean of Bromide Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

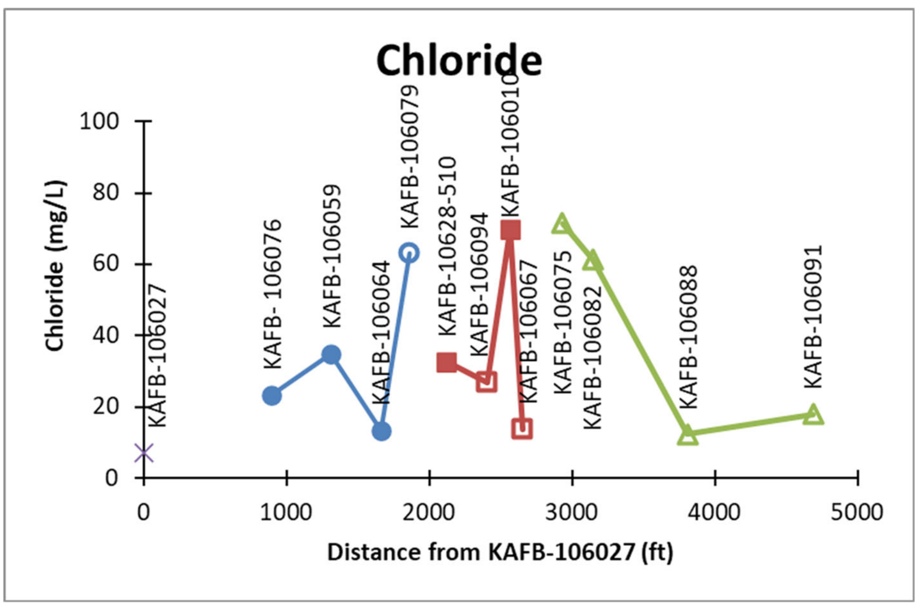

Figure 5.34. Geometric Mean of Chloride Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

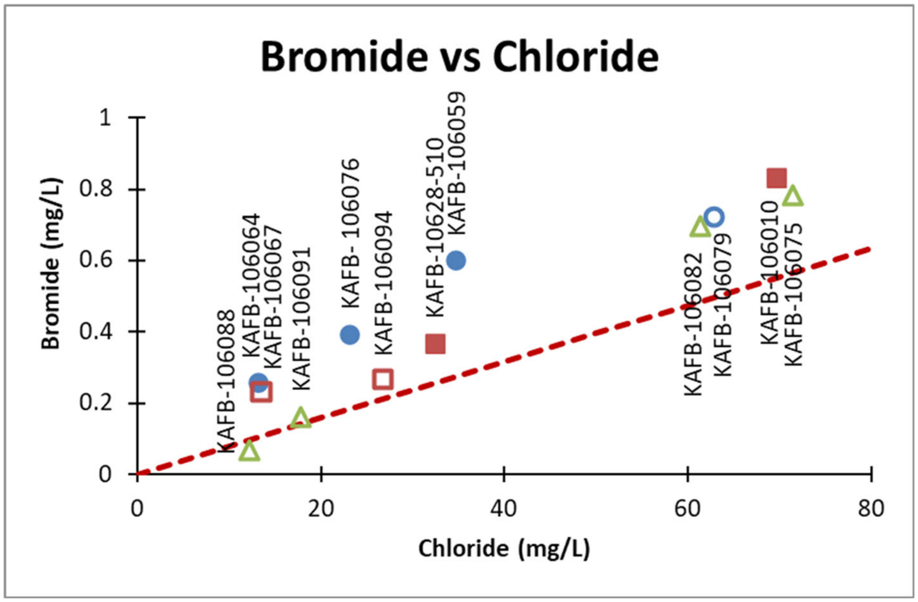

Figure 5.35. Geometric Mean of Bromide vs. Chloride Concentrations at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed. The red dashed line indicates the approximate background ratio of 0.0079 (Kirtland AFB, 2016b).

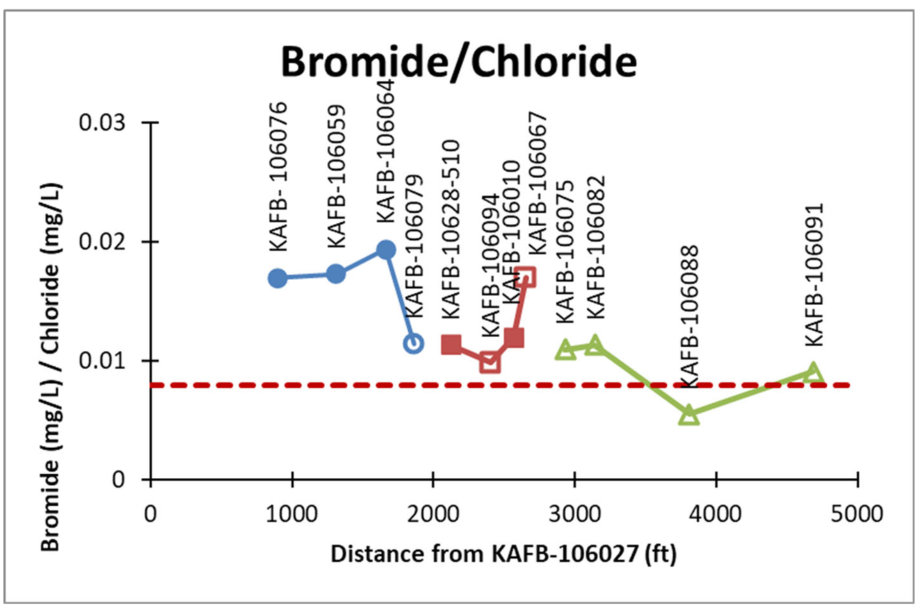

Figure 5.36. Geometric Mean of Bromide to Chloride Concentration Ratios at the 13 Natural Attenuation Wells.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed. The red dashed line indicates the approximate background ratio of 0.0079 (Kirtland AFB, 2016b).

5.7.1.4.3 EDB CSIA

The carbon isotope compositions of EDB (as $\delta^{13}C$ values) collected during the third quarter 2015 sampling event for the three geochemical zones are shown in Figure 5.37 and provided in Table 5.9, including representative uncertainties based on studies described in Section 2.2.2. While these uncertainties are sizeable (up to 9‰) at the low quantities of EDB collected, they are much less than the variations and trends observed in the carbon isotope composition of the EDB.

The isotope composition of EDB varies by geochemical zone, with $\delta^{13}C$ values ranging from -12‰ to +57‰. Utilizing a Rayleigh model (Eq. 1), and ε_{bulk} determined as described in Section 2.2.1 (ε_{bulk} = -19.9‰ for hydrolysis, and ε_{bulk} = -8.2‰ for anaerobic biodegradation), this large shift in $\delta^{13}C$ suggests that between 96.9% and 99.98% more EDB was degraded in the sample with the most positive $\delta^{13}C$ value (KAFB-106067) than in the sample with the most negative $\delta^{13}C$ value (KAFB-10628-510). Isotope fractionation of EDB can also be assessed relative to two other estimates of source composition: (1) $\delta^{13}C$ of -30‰ as a representative value common to EDB and other halogenated solvents (Wilson et al., 2008); and (2) $\delta^{13}C$ of -21‰ as a representative value of EDB found in LNAPL collected during preparations for the field demonstration (see Section 5.6.2.2). With respect to these possible source $\delta^{13}C$ values and the ε_{bulk} for hydrolysis and anaerobic biodegradation processes, between 98% and 99.99% of EDB had degraded as a result of natural attenuation processes where the most positive $\delta^{13}C$ value was observed (KAFB-106067).

Further discussion of CSIA data with respect each of the three geochemical zones is provided below.

Table 5.9. EDB Concentrations and $\delta^{13}C$ Values Measured at the 13 Natural Attenuation Wells During Q3, 2015.

Well ID	Distance from well KAFB-106027 (ft)	EDB Concentration (µg/L)	$\delta^{13}C$ of EDB (‰)	$\delta^{13}C$ uncertainty (‰)
KAFB-106027	-			
KAFB-106076	897	6.58	-10.3	±2
KAFB-106059	1313	5.22	-4.45	±2
KAFB-106064	1663	15.1	-11.6	±2
KAFB-106079	1863	0.241	-[a]	-[a]
KAFB-10628-510	2124	6.96	-12.15	±2
KAFB-106094	2405	0.072	+10.3	±2
KAFB-106010	2566	8.16	+7.9	±2
KAFB-106067	2656	0.0342	+57	±9
KAFB-106075	2930	0.106	+21	±2
KAFB-106082	3142	0.109	+41	±4
KAFB-106088	3808	0.062	+32.5	±2
KAFB-106091	4685	0.0296	+45	±9

[a] – Imprecise CSIA measurement due to low EDB concentration and high non-target VOCs

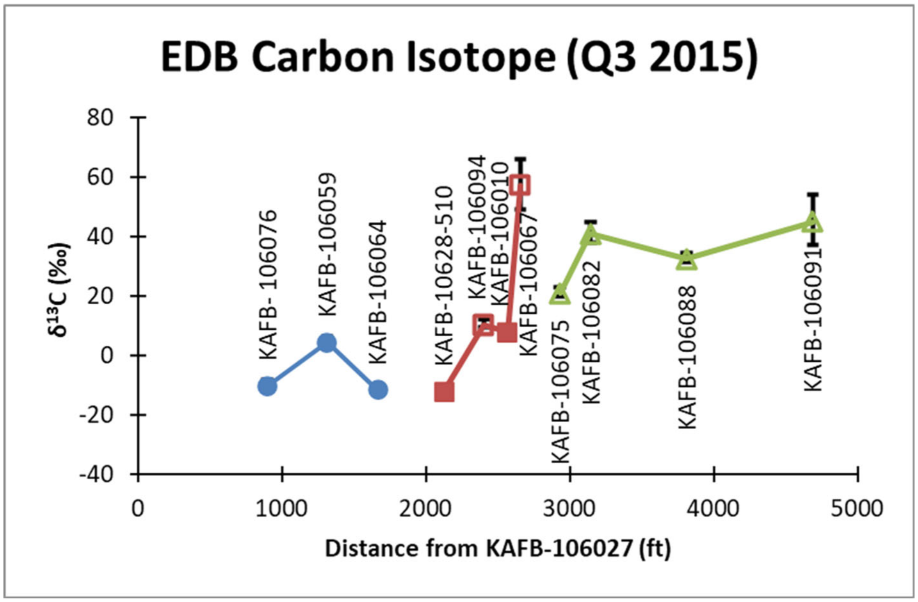

Figure 5.37. Measured $\delta^{13}C$ Values for EDB Collected at the 13 Natural Attenuation Wells During the Q3 2015 Sampling Event.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

<u>*Zone 1 (Anaerobic)*</u>

In this zone, geochemical conditions and biological populations were supportive of reductive debromination of EDB, and degradation products (ethene, ethane, bromide) indicate this occurred. Variations in EDB concentrations and isotope composition were significant in this zone, but are more muted than found further downgradient in geochemical Zone 2.

Concentrations of EDB in the Zone 1 wells collected during the third quarter 2015 (at the same time as samples for isotope analyses) ranged from 5.2 to 15.1 µg/L in wells where NAPL was previously observed and was 0.241 µg/L in KAFB-106079 (Figure 5.38). Isotope measurements were successfully performed with samples from the three wells with higher concentrations (ranging from $\delta^{13}C$ = -11.6‰ at KAFB-106064 to $\delta^{13}C$ = + 4.5‰ at KAFB-106059), but the low EDB concentrations at KAFB-106079 relative to other VOCs resulted in unreliable isotope measurements such that $\delta^{13}C$ was not reported for this well.

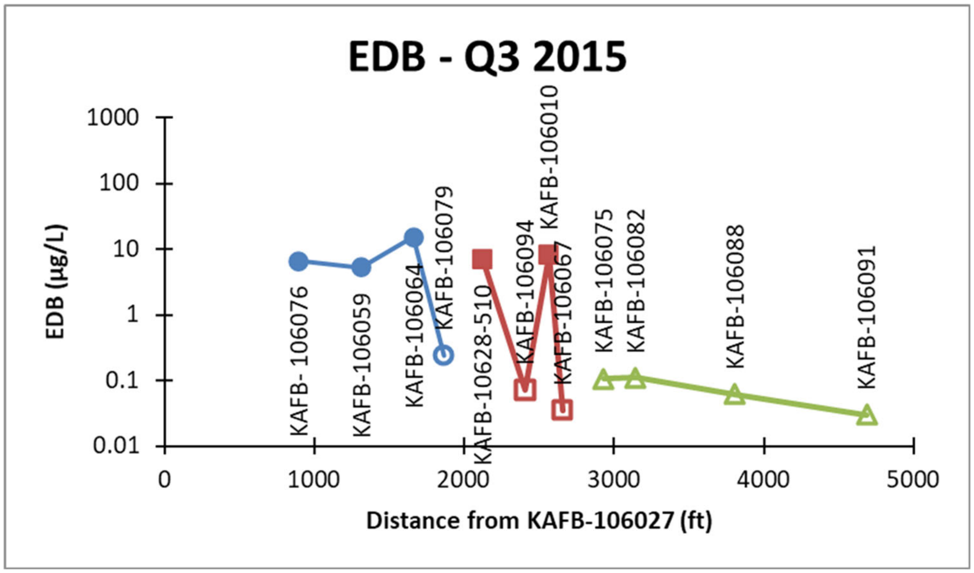

Figure 5.38. EDB Concentrations at the 13 Natural Attenuation Wells During the Q3 2015 Sampling Event.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

Using the Rayleigh Equation (Eq. 1), measured $\delta^{13}C$ values from field samples, estimates of source $\delta^{13}C$ values, and the ε_{bulk} values described earlier for reductive debromination and hydrolysis, the extent of EDB degradation throughout the site was estimated (Figure 5.39). For the Zone 1 wells where $\delta^{13}C$ values were determined, between 38% (hydrolysis ε_{bulk}, KAFB-106064) and 99% (reductive debromination ε_{bulk}, KAFB-106059) of EDB degraded. Because the biogeochemical conditions and microbial community analyses suggested that anaerobic biodegradation was likely the dominant attenuating mechanism in this zone, the extent of EDB degradation in Zone 1 is likely best described by reductive debromination. If only reductive debromination and both estimates of source $\delta^{13}C$ are considered ($\delta^{13}C$ of -30‰ or -21‰), between 69 and 99% of EDB was estimated to have degraded in this zone as a result of natural attenuation.

It is possible that the observed extent of EDB degradation and isotope fractionation were limited in this zone due to the continued presence of residual NAPL. EDB located in NAPL was likely unavailable for direct biodegradation, and repartitioning of this EDB from NAPL to the aqueous phase may have suppressed signals of ongoing degradation including isotope fractionation. Degradation of EDB in the Zone 1 and associated isotope fractionation will be further discussed below in Section 5.7.2.6.3 in the context of the field demonstration of ISB for EDB.

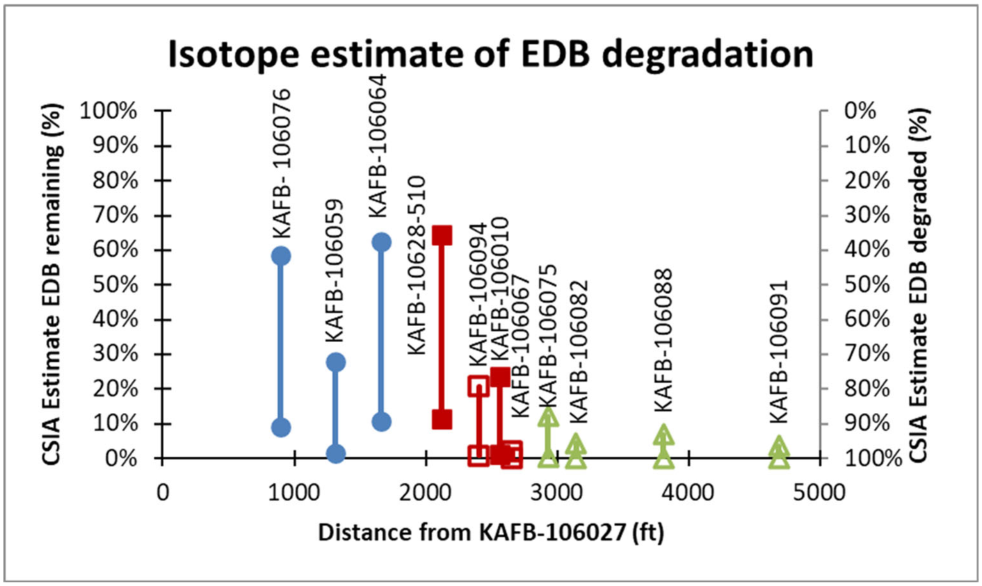

Figure 5.39. Estimates of EDB Degraded Based on CSIA Measurements, εbulk Values, and Initial δ13C Vales Ranging from -30‰ or -21‰.

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

Zone 2 (Generally anaerobic)

Like Zone 1, Zone 2 generally exhibited geochemical conditions and biological populations supportive of reductive debromination of EDB, and related degradation products (ethene, ethane, bromide) were observed. Near wells where NAPL was not previously observed (KAFB-106094 and KAFB-106067) indicators of anaerobic processes were somewhat weaker, and areas where aerobic processes (e.g., cometabolism) occur may be present. There were large variations in Zone 2 among EDB concentrations and isotope composition, as well as shifts in geochemical conditions. During the third quarter 2015 sampling event, there was a 240x difference in EDB concentrations from a high of 8.2 µg/L (KAFB-106010) to a low of 0.034 µg/L (KAFB-106067), and a shift in isotope composition from a low $\delta^{13}C$ value of -12.15‰ (KAFB-106028-510) to a high $\delta^{13}C$ value of +57‰ (KAFB-106067). As noted in Section 5.7.1.4.1, the greatest shift in EDB concentrations existed between wells where NAPL was previously observed (KAFB-106028-510 and KAFB-106010) and where it was not (KAFB-106094 and KAFB-106067), and the most positive $\delta^{13}C$ value in Zone 2 occurred where NAPL was not observed

While the conditions in Zone 2 strongly suggest a dominant influence of reductive debromination, both hydrolysis and reductive debromination ε_{bulk} were considered. With respect to the possible source $\delta^{13}C$ values ($\delta^{13}C$ of -30‰ or -21‰), between 36% (KAFB-10628-510) and 99.99% (KAFB-106067) of EDB is estimated to have degraded as a result of natural attenuation (Figure 5.39). As ε_{bulk} values for the cometabolic tested during laboratory studies were typically nearer to zero than anaerobic processes (see Table 2.1), utilization of the reductive debromination ε_{bulk} may slightly underestimate the extent of degradation.

Zone 3 (Aerobic)

In this zone, general geochemical conditions were not conducive to reductive debromination of EDB. Concentrations of EDB were signification lower in this zone and varied by less than 4x between an average of 0.20 µg/L (KAFB-106075) and 0.05 µg/L (KAFB-106091) during the 4 quarters examined, and from a high of 0.11 µg/L (KAFB-106075 and KAFB-106082) to a low of 0.03 µg/L (KAFB-106091) during the third quarter of 2015. While aerobic cometabolic biodegradation of EDB may have occurred in this zone, this process is difficult to assess and may be relatively slow due to low concentrations of supporting hydrocarbon substrates. As both anaerobic debromination and hydrolysis processes may have led to EDB degradation prior to arrival at these downgradient wells, both these ε_{bulk} were considered to constrain estimates of degradation. With respect to the possible source $\delta^{13}C$ values ($\delta^{13}C$ of -30‰ or -21‰), between 88% (KAFB-106075) and 99.99% (KAFB-106091) of EDB is estimated to have degraded as a result of natural attenuation (Figure 5.39). The total extent of EDB degradation likely lies in between these two estimates.

Hydrolysis kinetics and isotope fractionation are reasonably well constrained (Section 2.2.1) and related expectations for EDB at the field site can be assessed for this process. Figure 5.40 and Figure 5.41 show expected trends in EDB concentrations and $\delta^{13}C$ values resulting from hydrolysis with a dashed line fit through KAFB-106091 given representative field conditions at the site, as described in Section 4.2 (temperature of 19 °C, gradient of 0.0012 ft/ft, hydraulic conductivity of 72 ft/day, and effective porosity of 27.4%). These estimates of EDB concentrations and $\delta^{13}C$ values assume a constant source term at some upgradient location and plug-flow type transport without dilution or sorption, which may be appropriate in dilute zones of the plume where less organic matter is present and concentration gradients are less. With these assumptions, much of the variation in observed EDB concentrations and isotope composition observed in the dilute downgradient Zone 3 appears consistent with the slow processes of hydrolysis. The $\delta^{13}C$ value of EDB at KAFB-106082 was greater than the trend, which may be attributed to additional degradation of EDB prior to collection at this location occurring due to other processes, such as biodegradation in Zone 1 or Zone 2. Of the wells in Zone 3, this well (KAFB-106082) had the highest anaerobic biodegradation screening score, lowest ORP, and greatest population of DHBt, suggesting it may have been more affected by anaerobic processes than the others.

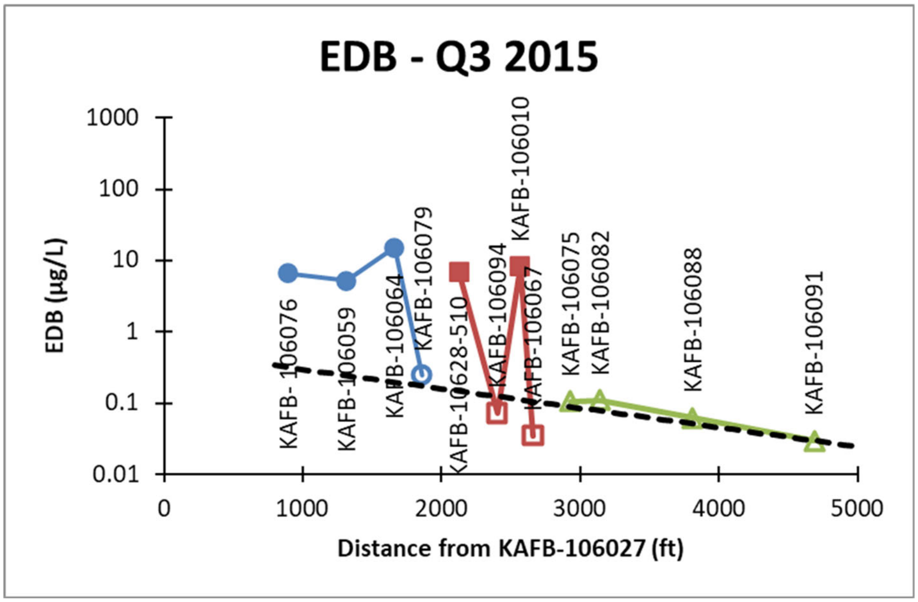

Figure 5.40. EDB Concentrations at the 13 Natural Attenuation Wells During the Q3 2015 Sampling Event, Together with Expected Trend Due to Neutral Hydrolysis Alone (Dashed Line).

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

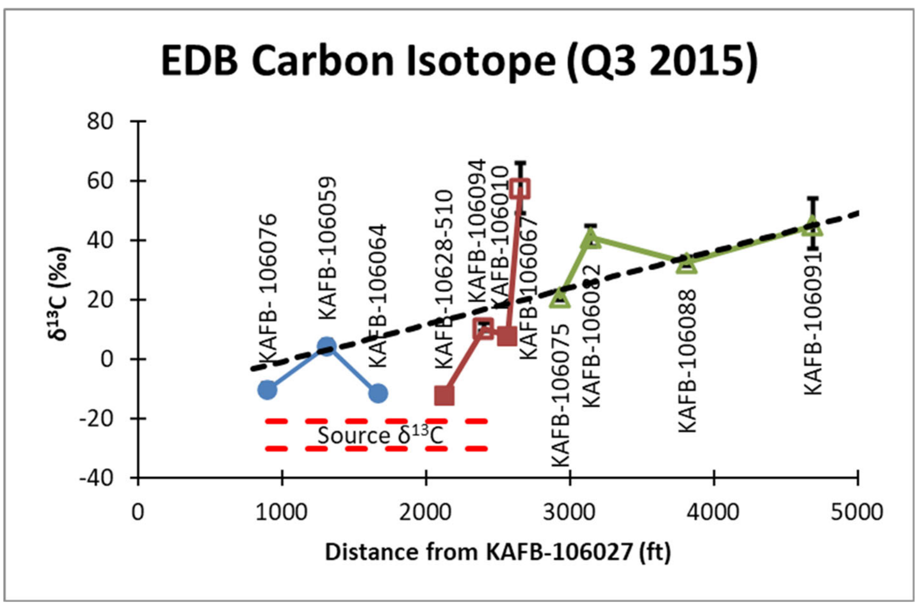

Figure 5.41. Measured *$\delta^{13}C$* Values for EDB Collected at the 13 Natural Attenuation Wells During the Q3 2015 Sampling Event, Together with Expected Trend Due to Neutral Hydrolysis Alone (Dashed Line).

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

Sitewide Attenuation

EDB concentrations and $\delta^{13}C$ values at many wells in Zones 1 and 2 appear inconsistent with the trend for hydrolysis in Zone 3 indicated in Figure 5.40 and Figure 5.41. At several of these wells, EDB concentrations are greater (at wells where NAPL was previously observed) and $\delta^{13}C$ values more negative. Shifts in isotope composition from possible source $\delta^{13}C$ values (indicated on Figure 5.41 covering the wells where NAPL was previously observed) to more positive $\delta^{13}C$ values required to meet the hydrolysis trendline indicate that other degradation process were likely of greater local significance than hydrolysis. Anaerobic biodegradation, together with possible EDB release from residual NAPL phases, may explain much of this behavior. This is consistent with the geochemical conditions and the observation of degradation products that would not otherwise be present due to hydrolysis (e.g., ethene).

Figure 5.42 shows the relationship between $\delta^{13}C$ values and EDB concentrations at the site. As noted above, EDB concentrations and isotope composition appear to shift from wells where NAPL was previously observed to those where it was not, with both sets observed in Zone 2. A Rayleigh-type (see Eq. 1) regression through this data has a slope of -8.2 ± 1.5‰, a value consistent with the experimental ε_{bulk} for reductive debromination (Table 2.1). The similarity between the field and laboratory regression slopes suggests that reductive degradation alone could have led to the significant shift in EDB concentration and isotope composition in that part of the plume. Coupled with other lines of evidence, this supports the preliminary assessment that anaerobic biodegradation was a large component of historic EDB attenuation at the site.

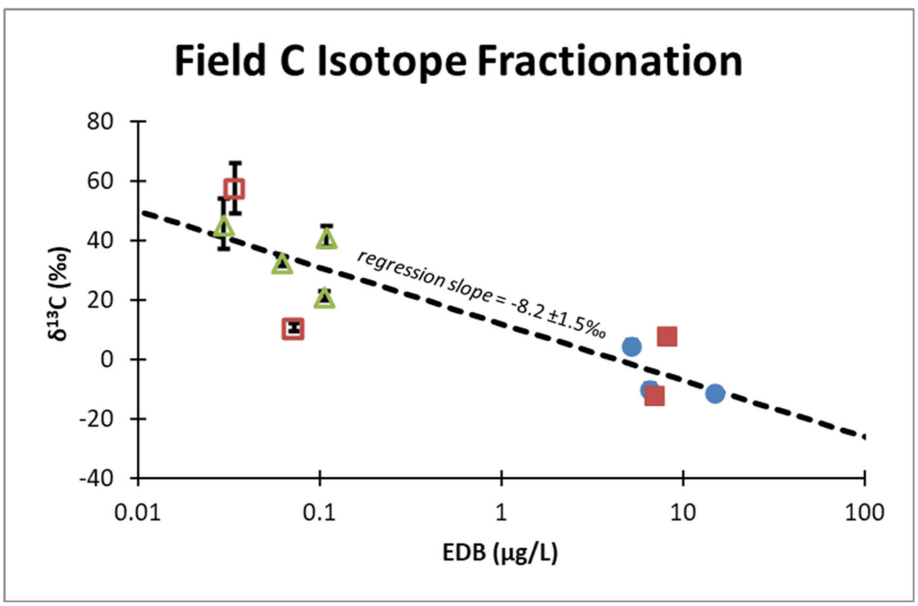

Figure 5.42. Linearized Plot of δ13C Measurements vs. EDB Concentrations Collected During the Q3 2015 Sampling Event.

The linear regression through the data has a slope of -8.2 ± 1.5‰, a value consistent with the experimental ε_{bulk} for reductive debromination (Table 2.1) Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

5.7.1.5 Conceptual attenuation model

A conceptual attenuation model for the demonstration site was developed using RemChlor (Falta et al., 2007). The goal of this modeling exercise was to demonstrate that representative parameters could capture the overall behavior observed at the site. There are many uncertainties associated with the demonstration site and the modeling presented here represents just a single hypothetical scenario with kinetic and isotope fractionation parameters for each of the three geochemical zones. Particularly with respect to the modeled source, Zone 1, and Zone 2, these uncertainties are very large. The parameters used for this modeling scenario are listed in Table 5.10 below, together with an explanation for their selected values, and the RemChlor input screen for ^{12}C conditions are shown in Figure 5.43. Modeled isotope values were estimated by running the model twice, one for each carbon isotope, with rate parameters adjusted according to each applicable ε_{bulk}.

Figure 5.44 and Figure 5.45 represent the modeled EDB concentrations and $\delta^{13}C$ values across the demonstration site, together with measured values for each of the three geochemical zones. The overall magnitude of attenuation trends in EDB concentration and isotope composition were captured by the relatively simple set of parameters used. Again, this represents just one hypothetical scenario indicating how observed EDB concentration and isotope data might be explained and does not capture the true complexity of the field, where great uncertainties exist. Possible aerobic cometabolism processes occurring in Zone 2, for example, were not represented in this model.

Table 5.10. RemChlor Modeling Parameters.

Modeling parameter	Value	Justification
Source Mass (kg)	900	Arbitrary estimate for 1980
Source conc (g/L)	0.0006	Estimate of 600 µg/L in aqueous phase at time gradient changed to the North-Northeast (1980)
Source $\delta^{13}C$ EDB (‰)	-27.1	Estimate for 1980 based on source $\delta^{13}C$ = -30‰ in 1963 (10 years after first use) and $\delta^{13}C$ = -21‰ in 2013
k_{source} (1/yr)	0.022 /yr	Rate based on 9‰ shift in $\delta^{13}C$ over 50 years with estimated ε_{source} = -8.2‰
ε_{source} (‰)	-8.2	Anaerobic Biodegradation
k_{Zone1} (1/yr)	0.11	Based on assumption of ~5x less NAPL in this zone than in source
ε_{Zone1} (‰)	-8.2	Anaerobic Biodegradation
k_{Zone2} (1/yr)	1.5	Based on natural attenuation rate due to anaerobic biodegradation (Henderson et al., 2009)
ε_{Zone2} (‰)	-8.2	Anaerobic Biodegradation
k_{Zone3} (1/yr)	0.0693	Based on Hydrolysis at ~19 °C
ε_{Zone3} (‰)	-19.9	Hydrolysis

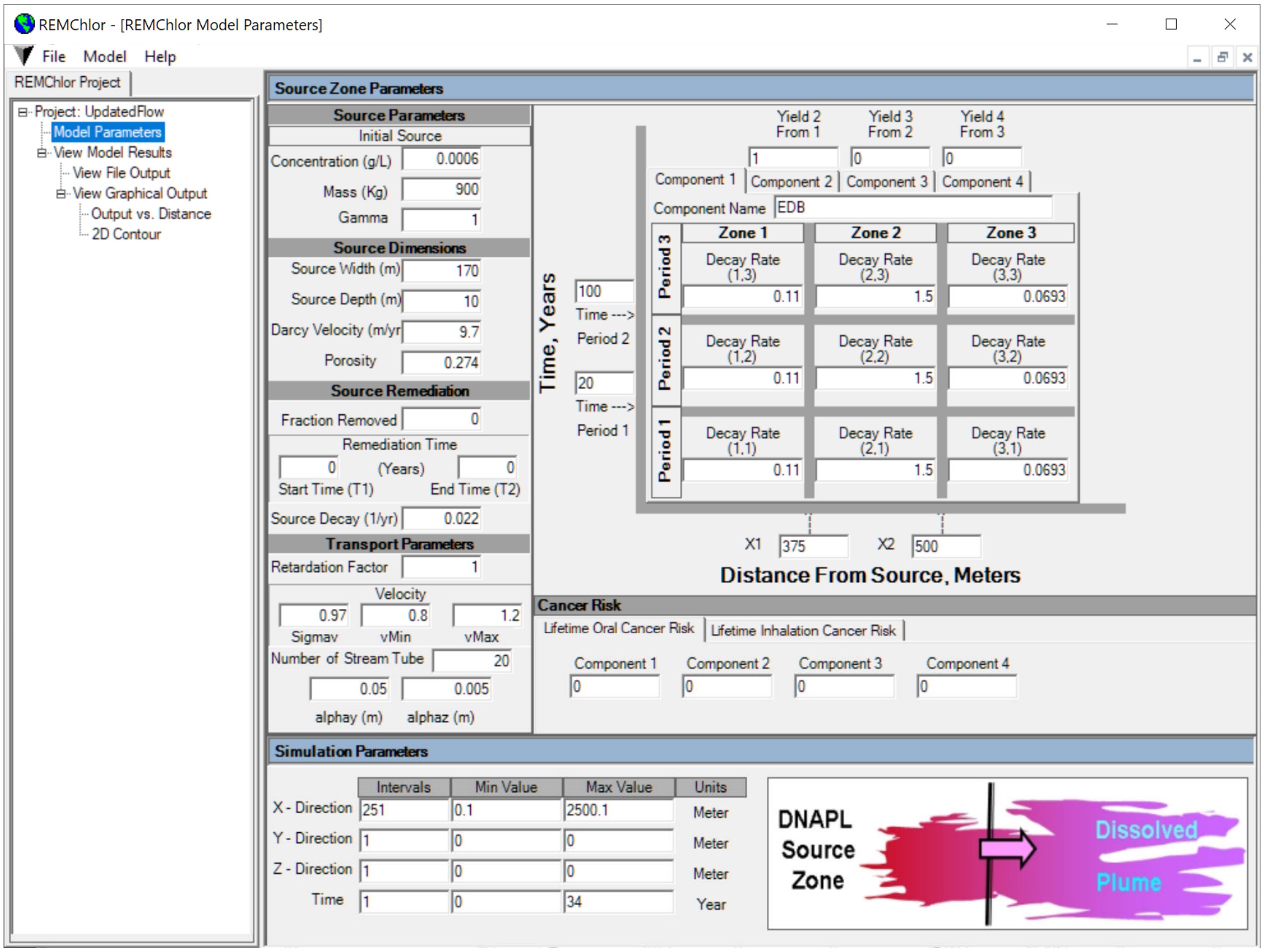

Figure 5.43. Model Parameter Input Screen for RemChlor Utilized.

The starting time for the model is approximately 1980, and rates provided are for EDB containing ^{12}C. Parameters are also provided in Table 5.10.

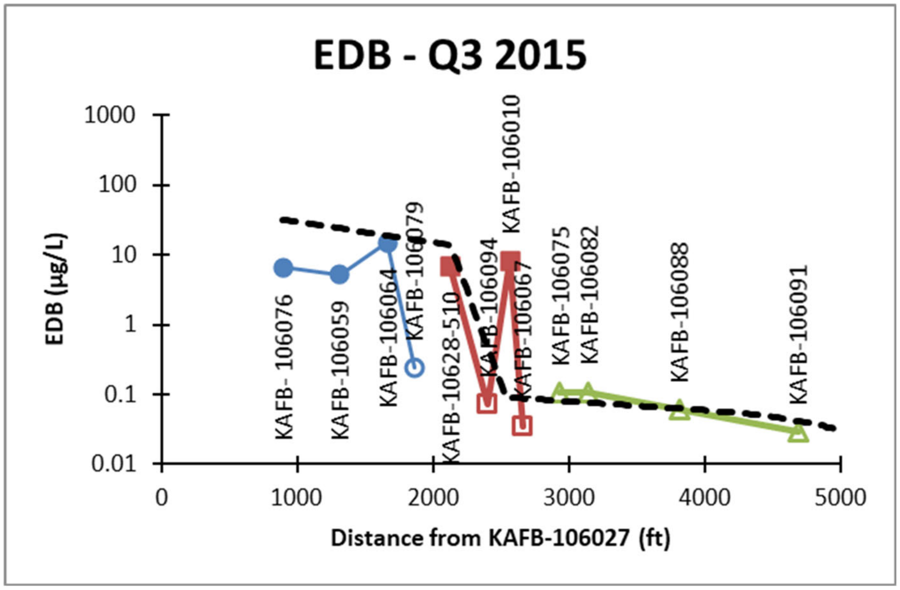

Figure 5.44. EDB Concentrations at the 13 Natural Attenuation Wells During the Q3 2015 Sampling Event, Together with Expected Trend Determined Using the RemChlor Model (Black Dashed Line).

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

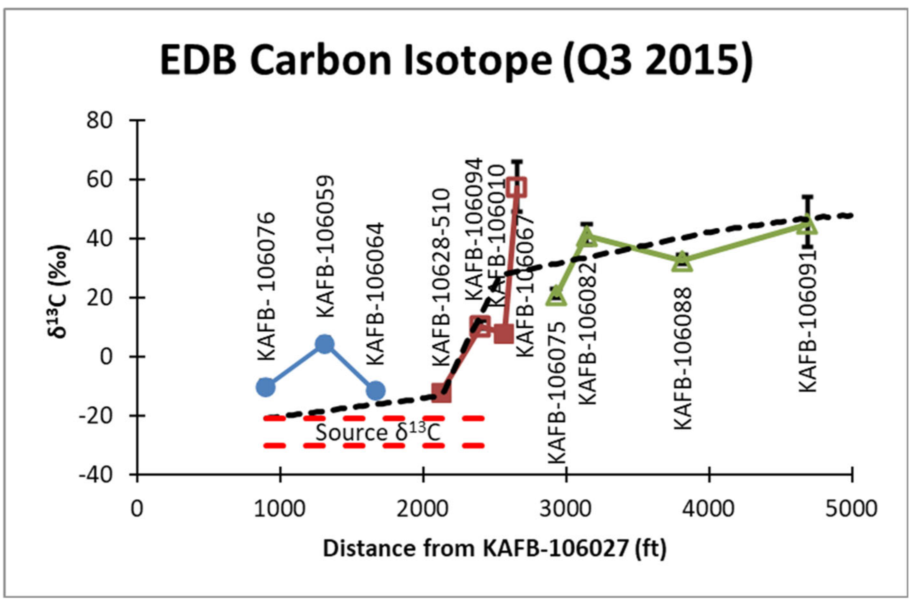

Figure 5.45. Measured $\delta^{13}C$ Values for EDB Collected at the 13 Natural Attenuation Wells During the Q3 2015 Sampling Event, Together with Expected Trend Determined Using the RemChlor Model (Black Dashed Line).

Blue circles indicate Zone 1 wells, red squares indicate Zone 2, and green triangles indicate Zone 3. Closed symbols indicate wells where NAPL was previously observed while open symbols indicate that NAPL was not observed.

5.7.2 Anaerobic In Situ Bioremediation of EDB

5.7.2.1 Baseline Conditions

The anaerobic ISB demonstration test was sited near existing well KAFB-106064, which contained EDB at concentrations of 17 µg/L (Second Quarter 2016) and 9.3 µg/L (Fourth Quarter 2016) and benzene at concentrations of 1,100 µg/L (Second Quarter 2016) and 1,000 µg/L (Fourth Quarter 2016) prior to installation of the new pilot test wells (USACE, 2021). ISB wells associated with the demonstration were sampled prior to the start of recirculation activities to establish pre-test baseline conditions. As noted in Section 5.6.2.2, NAPL was observed at KAFB-106MW1-S after well installation and prior to the ISB demonstration, and a sample of this NAPL was also collected for analysis.

After installation and development of the new pilot test wells, EDB and benzene concentrations of baseline groundwater samples at KAFB-106064 were measured at 143 µg/L and 4,730 µg/L, respectively. The observed increases in EDB and benzene concentrations may have been the result of different types of sample pumps (bladder pumps) placed at different depths, heterogenous distribution of EDB and benzene in the subsurface, or increased mass transfer from residual NAPL during well installation and development.

EDB concentrations evaluated by two independent methods (USEPA 8011 and USEPA 8260) from the baseline sampling event and from the October 2020 post-test sampling event are presented in Figure 5.46. Baseline EDB concentrations in shallower wells ranged from an estimated 20.1 µg/L (J+ flag) at the injection well (KAFB-106IN1) to 432 µg/L (J+ flag) at the monitoring well where NAPL was observed (KAFB-106MW1-S). Baseline EDB concentrations at the deeper wells ranged from ND (KAFB-106063 and KAFB-106MW1-I) to 0.072 µg/L (KAFB-106MW2-I). Significant decreases in EDB concentration, with only two detections, were observed after the ISB demonstration and these are discussed later in this report. Tables 7 through 15 of the Pilot Test Report (Appendix B) summarize the analytical data collected during the pilot test by well.

Analysis of the NAPL collected at KAFB-106MW1-S indicated the presence of many hydrocarbons, but notably benzene (31.8 mg/kg) and EDB (20.5 mg/kg) concentrations were low compared to toluene (7,396 mg/kg) and ethylbenzene (6,098 mg/kg). APTIM received an aliquot of the NAPL, which was then equilibrated with water at 1:1 and 1:10 ratios. Equilibrated aqueous concentrations for EDB, benzene, and toluene were approximately 150 µg/L, 160 µg/L, and 8,200 µg/L, respectively, for both dilutions, indicating that most of mass remained in the NAPL at these dilutions. The $\delta^{13}C$ value of the EDB in the NAPL, a possible estimate of source EDB, was -21±2‰.

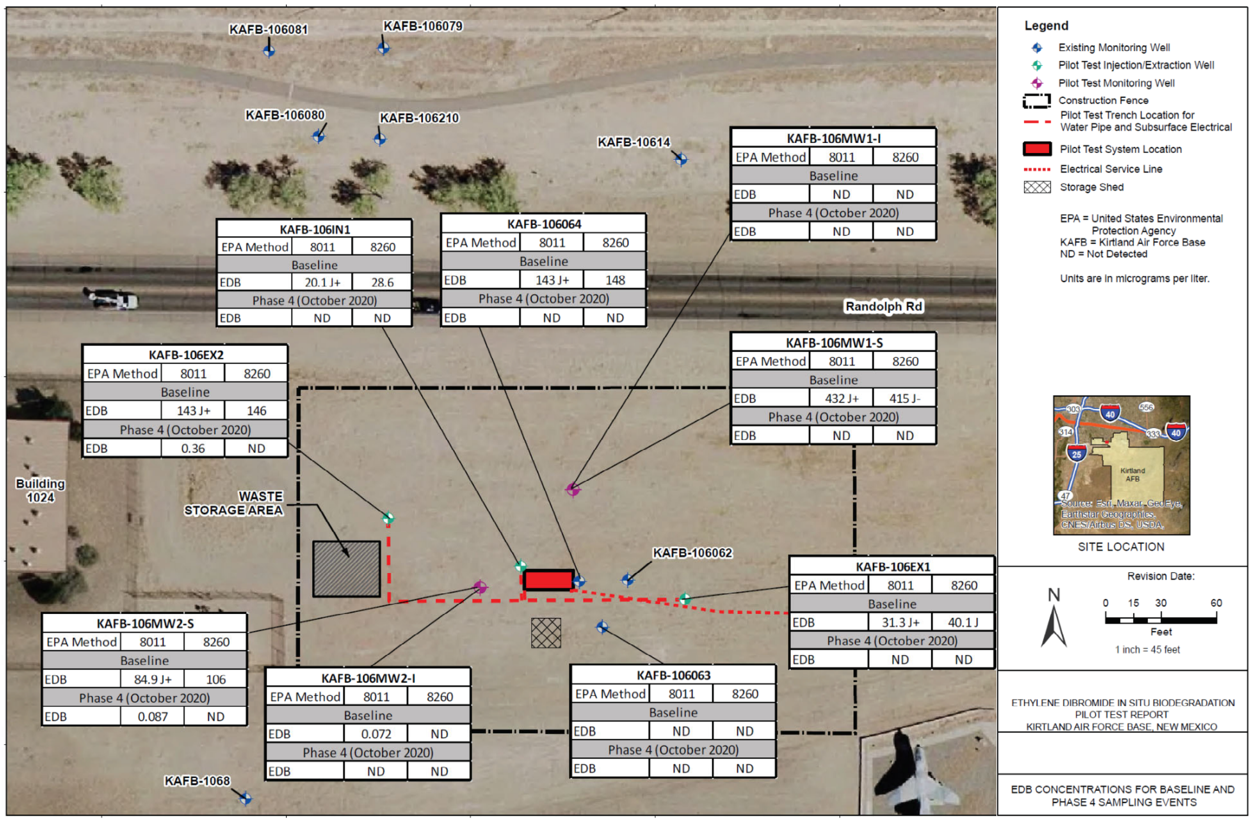

Figure 5.46. EDB Concentrations Associated with the ISB Demonstration, Quantified by EPA 8260 and EPA 8011.

Concentrations from the baseline sampling event and most recent sampling event (Phase 4, October 2020) are provided showing significant reductions in EDB concentrations.

5.7.2.2 Amendment Distribution

Conservative tracers were amended to the recirculated groundwater to evaluate and verify the distribution between wells during the pilot test. These tracers included fluorescein dye (Phase 1), deuterium labeled water (^2H_2O, Phase 1), and iodide (Phase 2). In addition to these tracers, biostimulation amendments added to the groundwater included a fermentable sodium lactate-based substrate with nutrients (WilClear Plus®) and DAP.

5.7.2.2.1 Tracer Distribution During Phase 1

Fluorescein was added together with deuterated water over a period of 24 hours while the recirculation system operated at 20 gpm (10 gpm at KAFB-106EX1, and 10 gpm at KAFB-106EX2). Two tracers were used to provide independent measures of water distribution and to increase the likelihood of successful observations. After addition of the tracers, the recirculation system continued to be operated for approximately a month as described in Section 5.5.2.2.

Three measurements of injected water collected directly at the KAFB-106IN1 sample port averaged 570 µg/L of fluorescein and had δ^2H values that averaged +590‰ during the 24 hours of tracer injection. Fluorescein was not detected in baseline samples and δ^2H values at the test area ranged from -97‰ to -92‰ prior to tracer injection. Figure 5.47 Figure 5.48 show measured fluorescein concentrations and δ^2H values in samples collected from shallow and intermediate wells, respectively. Transport times to the anaerobic shallow wells, estimated by arrival times of greatest tracer signal, were of interest and are provided in Table 5.11. Arrival times increased with increasing distance, and no strong indications of preferential flow were apparent. Decreases in maximum concentrations with increasing distances and time since injection were indicative of dispersion within the subsurface as more water was recirculated.

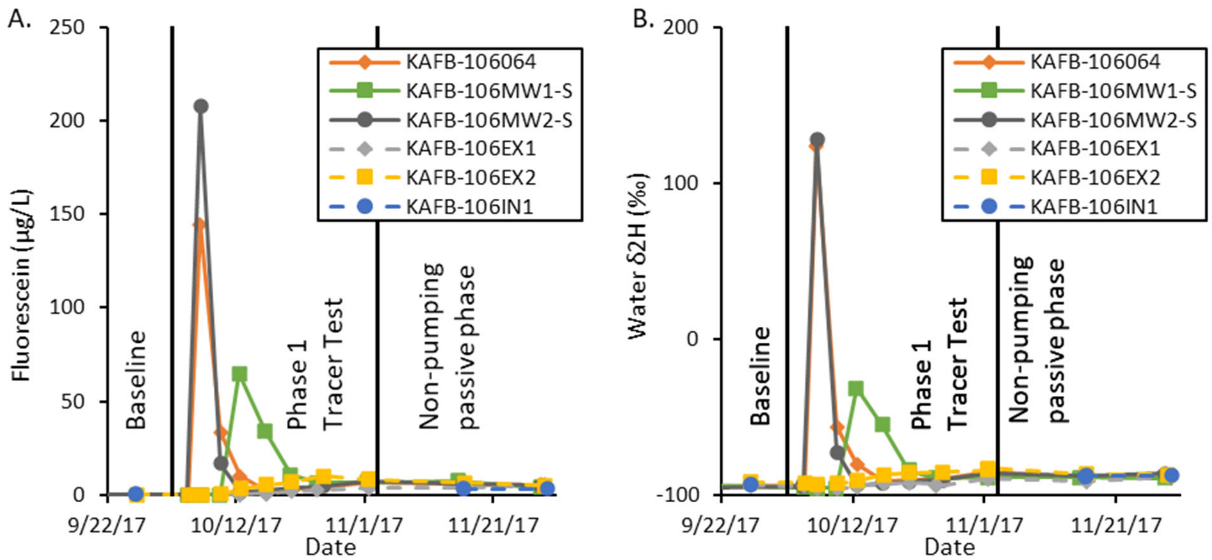

Figure 5.47. Tracer Levels Observed in Shallow Monitoring and Recirculation Wells During Phase 1 of the ISB Demonstration; A.) Fluorescein Concentrations and B.) Water δ^2H Values.

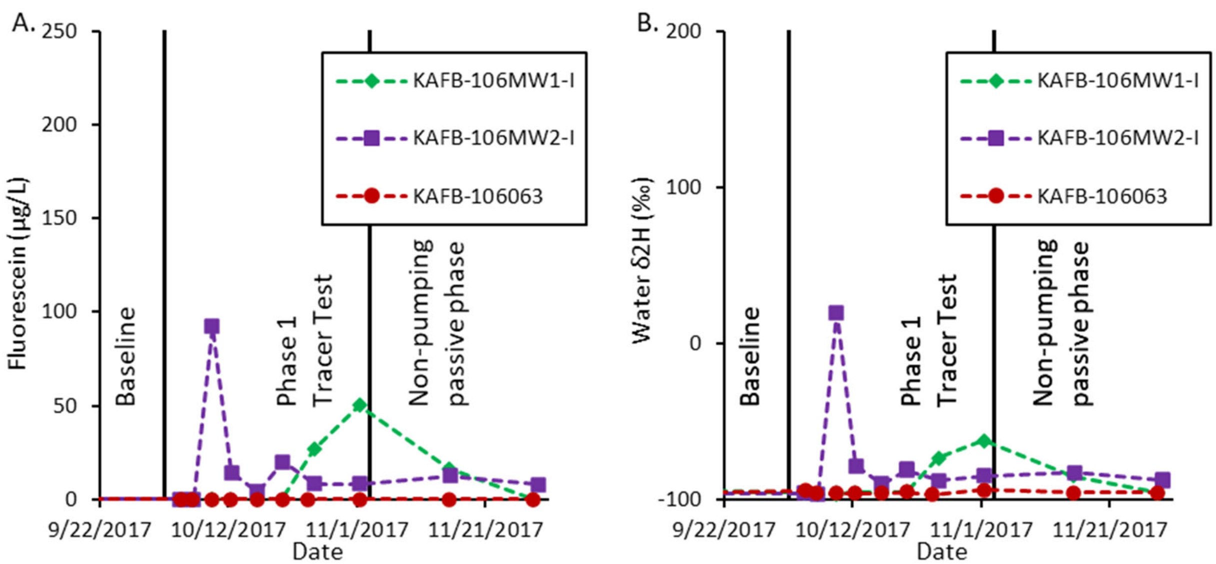

Figure 5.48. Tracer Levels Observed in Intermediate Level Monitoring Wells During Phase 1 of the ISB Demonstration; A.) Fluorescein Concentrations and B.) Water δ^2H Values.

Table 5.11. Tracer Arrival Times and Concentrations at Shallow Wells During Phase 1.

Well ID	Distance from Injection Well at Surface (Feet)	Greatest Fluorescein Concentration (µg/L)	Greatest $\delta^2 H$ Value (‰)	Date of Greatest Tracer Contribution (fluorescein and $\delta^2 H$)	Transport Time (as indicated by date of greatest tracer contribution [days])
KAFB-106IN1	--	570[a]	+590[a]	10/2/2017	--
KAFB-106MW2-S	28	207.7	+128	10/6/2017	3.5
KAFB-106064	31	144.5	+124	10/6/2017	3.5
KAFB-106MW1-S	47	64.9	-31	10/12/2017	9.5
KAFB-106EX2	76	10.1	-83	10/26/2017 (fluorescein) 11/1/2017 ($\delta^2 H$)[b]	22.5-29.5[b]
KAFB-106EX1	92	3.7	-90	11/1/2017[b]	29.5[b]

Notes:

[a] Average injected concentration over 24-hour period.

[b] Greatest quantities occurred at the last sampling of recirculation period and it is unknown if greater quantities might have been observed later had recirculation continued

‰ - Per mille.

$\delta^2 H$ - delta hydrogen (measure of hydrogen isotope composition).

ID - Identification.

KAFB - Kirtland Air Force Base.

µg/L - Micrograms per liter.

The results from the Phase 1 tracer test indicated that the targeted treatment zone encompassing the shallow groundwater monitoring wells were hydraulically connected with the injection well. Additionally, it was evident that amendments were distributed in the treatment zone under the planned operating conditions. In particular, distribution of amendments to groundwater sampled by monitoring wells nearest to the injection well (KAFB-106MW2-S and KAFB-106064) occurred within 5 days of operation, suggesting a high likelihood of successfully distributing biostimulation amendments that favor reductive debromination of EDB to regions sampled by the nearest monitoring wells, at a minimum. Based on these Phase 1 observations, the recirculation system was operated similarly to distribute biostimulation amendments during Phases 2 and 3.

5.7.2.2.2 Tracer Distribution During Phase 2 and 3

Iodide, introduced as KI, was used as conservative tracer to verify distribution of water containing biostimulation amendments, and to allow for distinction between recirculated waters and background water. During the Phase 2 recirculation period, four samples of the injected groundwater were collected directly from the KAFB-106IN1 sample port while the chemical feed pump was operating. Iodide results from the injectate ranged from 18 to 26 mg/L. Only iodide already present in the extracted groundwater was re-introduced to the subsurface during Phase 3.

Figure 5.49 and Figure 5.50 show iodide concentrations of samples collected from shallow and intermediate wells, respectively, during the pilot test. The iodide data are consistent with observations made during Phase 1, showing rapid transport to the shallow monitoring wells nearest to the injection well (KAFB-106MW2-S and KAFB-106064), with amendments arriving at the more distant extraction wells last. Concentrations observed at the nearest monitoring wells (KAFB-106MW2-S and KAFB-106064) were similar to injected iodide concentrations, which indicated that most of the groundwater observed at these wells was previously amended and reinjected. During Phase 2 recirculation, iodide concentrations at the more distant shallow groundwater monitoring well (KAFB-106MW1-S) was slightly lower than injected concentrations, indicating that the water sampled was a mixture of amended water and other water. During Phase 3, iodide concentrations at KAFB-106MW1-S were similar to those at other shallow monitoring wells. Later arrival and lower concentrations of iodide at the extraction wells indicated longer transport times and dispersion consistent with Phase 1 results, and mixing of water from both inside and outside the treatment zone. Among intermediate wells, elevated iodide concentrations were observed first at the nearest intermediate monitoring well (KAFB-106MW2-I), while transport to the other intermediate monitoring wells was slower. Overall, iodide concentrations observed during the recirculation periods indicated good distribution of injected waters, particularly within the treatment zone encompassing the shallow monitoring wells nearest to the injection well.

After recirculation of amendments, passive periods without recirculation, but with continued monitoring occurred. Iodide concentrations among the shallow groundwater monitoring wells nearest the injection well were fairly constant during these periods and indicated that the sampled groundwater remained heavily influenced by treatment activities. Interestingly, iodide concentrations at KAFB-106EX1 increased during passive periods and iodide concentrations at KAFB-106EX2 decreased during passive periods. A decrease in iodide concentrations can result from iodide oxidation to iodate, but reducing conditions present at the well locations suggest this process was likely limited. Rather the shifts in iodide concentrations at the outer boundaries of the treatment zone likely provide limited evidence that groundwater from outside the treatment zone entered the treatment zone near KAFB-106EX2, and that groundwater with higher iodide concentrations from within the treatment zone flowed toward KAFB-106EX1. A decrease in iodide concentrations was also observed at the intermediate monitoring well KAFB-106MW2-I, indicating that this well may also have been located near the upgradient area of the treatment zone and influenced by groundwater from outside the treatment zone during passive periods.

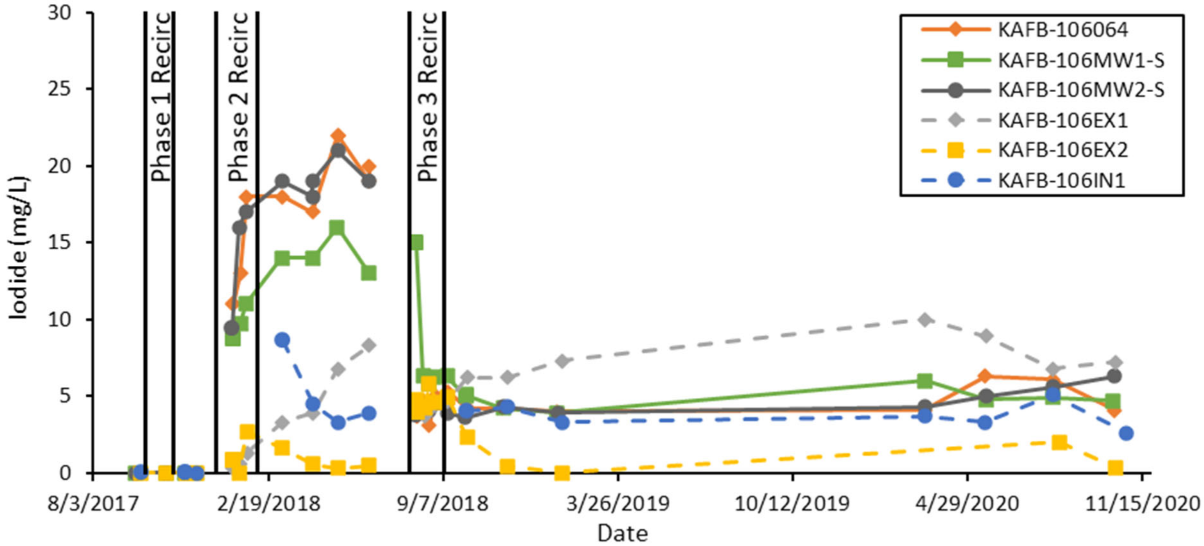

Figure 5.49. Iodide Tracer Concentrations at Shallow Monitoring and Recirculation Wells During the ISB Demonstration.

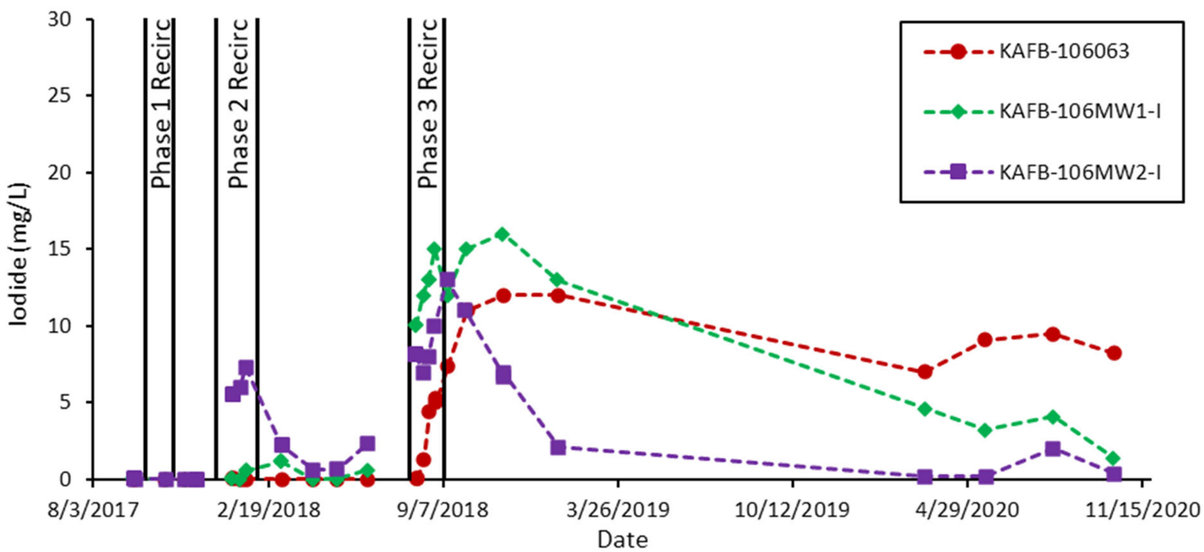

Figure 5.50. Iodide Tracer Concentrations at Intermediate Level Monitoring Wells During the ISB Demonstration.

5.7.2.2.3 <u>Distribution of Fermentable Substrate</u>

Recirculated groundwater during Phase 2 and Phase 3 was amended with WilClear Plus, which served as a fermentable substrate to stimulate debrominating organisms in the subsurface during the pilot test. This stimulation frequently occurs through fermentation of substrate by organisms to produce H_2, which subsequently serves as an electron donor for active dehalogenating species.

As noted in the discussion of tracers above, reinjected groundwater was distributed throughout the treatment zone of the pilot test. However, due to possible sorption and retardation of organic compounds, the distribution of this fermentable substrate may have been slower than that of the tracers, and observations of substrate and its immediate transformation products (e.g., acetate and propionate) provide insight regarding distribution of these substrates. During the Phase 2 recirculation period, three samples of the injected groundwater were collected directly from the KAFB-106IN1 sample port while the chemical feed pump was operating. Lactate concentrations of the injectate ranged from 140 to 154 mg/L. While direct measurements of reinjected substrate concentrations at KAFB-106IN1 were not made during Phase 3 recirculation activities, the system was operated under similar conditions as during Phase 2 and lactate concentrations were likely similar.

Figure 5.51 shows measured lactate concentrations of samples collected at the shallow monitoring wells during the pilot test. While lactate was introduced to the subsurface in excess of 100 mg/L, concentrations at monitoring wells never exceeded 4 mg/L. Biological transformation of lactate is often very rapid, and can result in significant quantities of both acetate and propionate, in addition to desired H_2. Figure 5.52 and Figure 5.53 show measured acetate and propionate concentrations, respectively, from samples collected at the shallow monitoring wells during the pilot test. Throughout the demonstration, wells showed clear increases in acetate and propionate concentrations, indicating that organic substrates contained in WilClear Plus were transformed and products were distributed among most wells during the pilot test. As expected, concentrations of acetate and propionate decreased at many of the wells during passive periods, likely due to the activity of indigenous organisms.

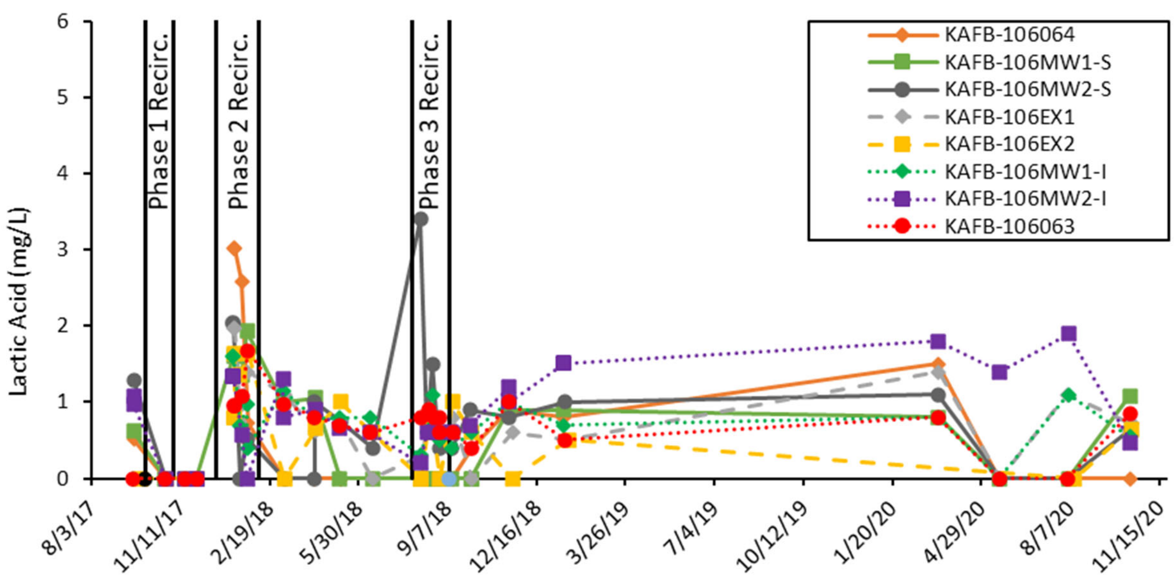

Figure 5.51. Lactic Acid Concentrations at All Monitoring and Recirculation Wells During the ISB Demonstration.

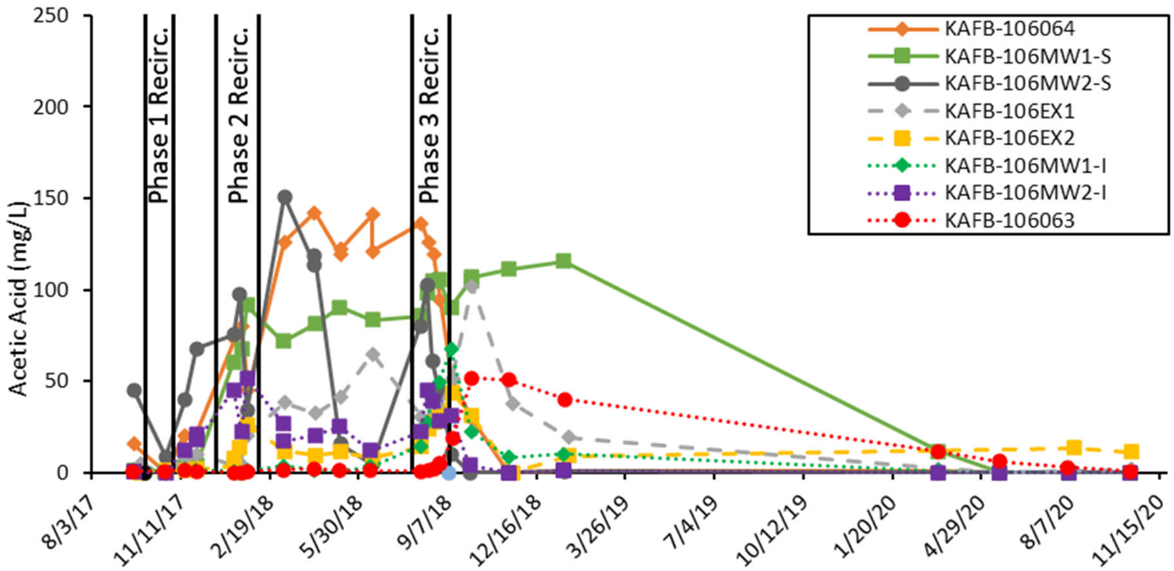

Figure 5.52. Acetic Acid Concentrations at All Monitoring and Recirculation Wells During the ISB Demonstration.

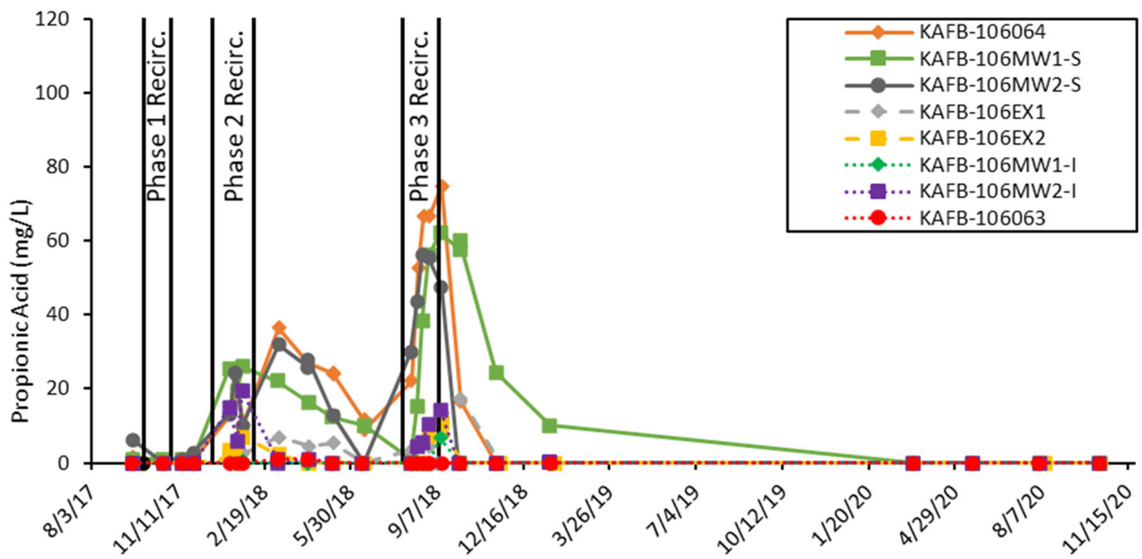

Figure 5.53. Propionic Acid Concentrations at All Monitoring and Recirculation Wells During the ISB Demonstration.

5.7.2.3 Microbial Analysis

Amendments were supplied in the treatment area during Phase 2 and 3 to stimulate biological activity capable of reductive debromination of EDB. Figure 5.54 to Figure 5.58 show populations of *Desulfitobacterium* spp. (DSB), *Dehalobacter* spp. (DHBt), *Dehalobacter* DCM (DCM), *Dehalogenimonas* spp. (DHG), and methanogens (MGN) as determined by Microbial Insights' QuantArray-Chlor assay analysis. Generally, the results indicate that large populations of representative organisms likely capable of EDB debromination (i.e., DHBt and DSB) were present during baseline sampling and persisted or grew during the ISB test.

DHBt and DSB were the most abundant organisms quantified that are likely capable of reductive debromination, with populations ranging between approximately 10^4 cells/mL and 10^6 cells/mL. The high abundance and distribution of these species suggests that the capacity for EDB debromination was prevalent throughout the demonstration test. These populations are also of similar magnitude as earlier determinations associated with the natural attenuation assessment where populations of DHBt and DSB on the order of 10^4 cells/mL were observed in the vicinity of the demonstration.

Three microbial populations increased by more than 2 orders of magnitude during pilot test: DHG, DCM, and MGN. DHG and DCM increased only after the addition of biostimulation amendments, but it is unclear whether these directly impacted EDB degradation, due to relatively small numbers compared to DHBt and DSB. DHG are known to reductively dehalogenate 1,2-dichloroethane (Maness et al., 2012), the chlorinated analog of EDB, and DHG likely also dehalogenate EDB. DCM are particularly known for their ability to grow using dichloromethane (Justicia-Leon et al., 2012), but are also a species of DHBt that may include the ability to reductively dehalogenate other compounds. The growth of DHG and DCM suggest that capacity for EDB debromination facilitated through microbial activity may have been stimulated during the ISB test. The stimulation of MGN at the site after the introduction of biostimulation amendments was of some interest, as MGN may consume some reducing equivalents to form methane that may otherwise be used for debromination, but the impact of this on debromination was not clearly observed. The increase of MGN activity was also evident through increases in methane within the treatment zone, as discussed below in Section 5.7.2.4

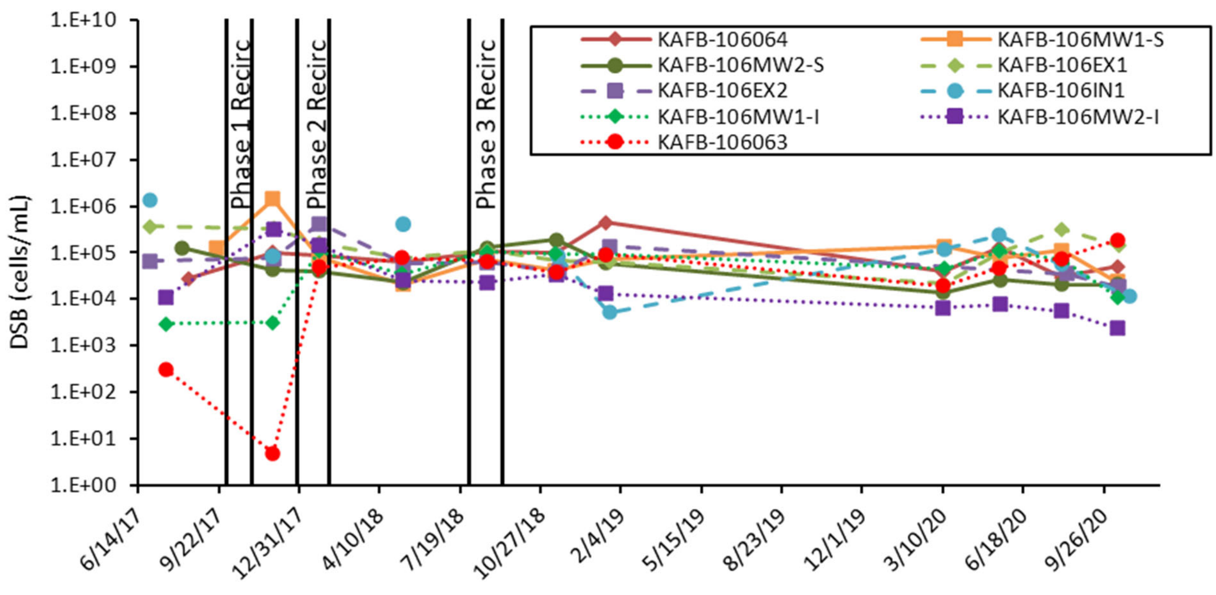

Figure 5.54. ***Desulfitobacterium* spp. (DSB) Levels at All Monitoring and Recirculation Wells During the ISB Demonstration.**

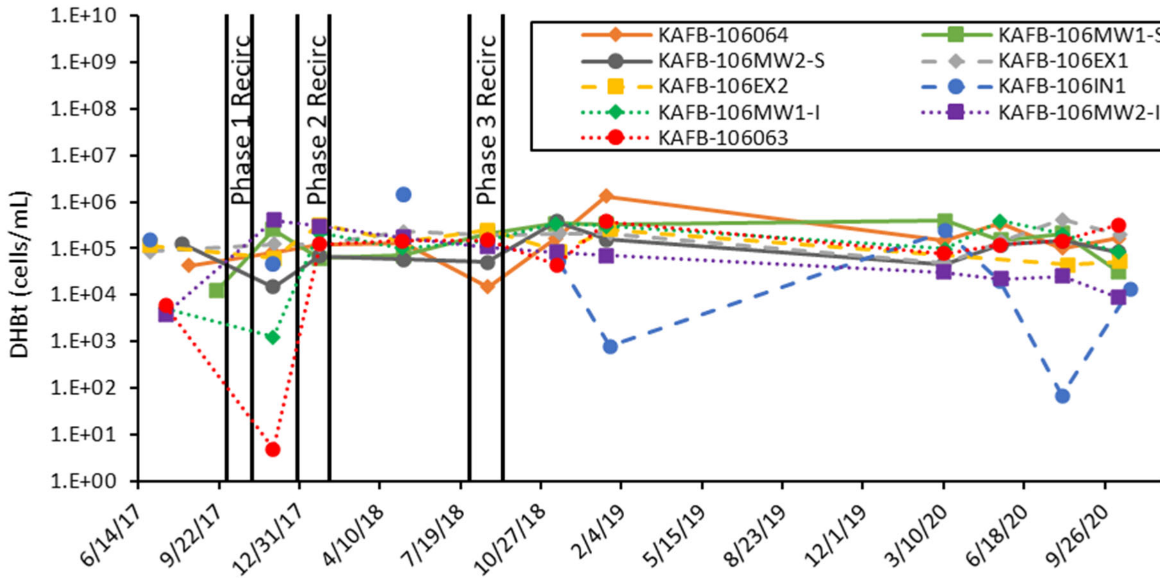

Figure 5.55. ***Dehalobacter*** **spp. (DHBt) Levels at All Monitoring and Recirculation Wells During the ISB Demonstration.**

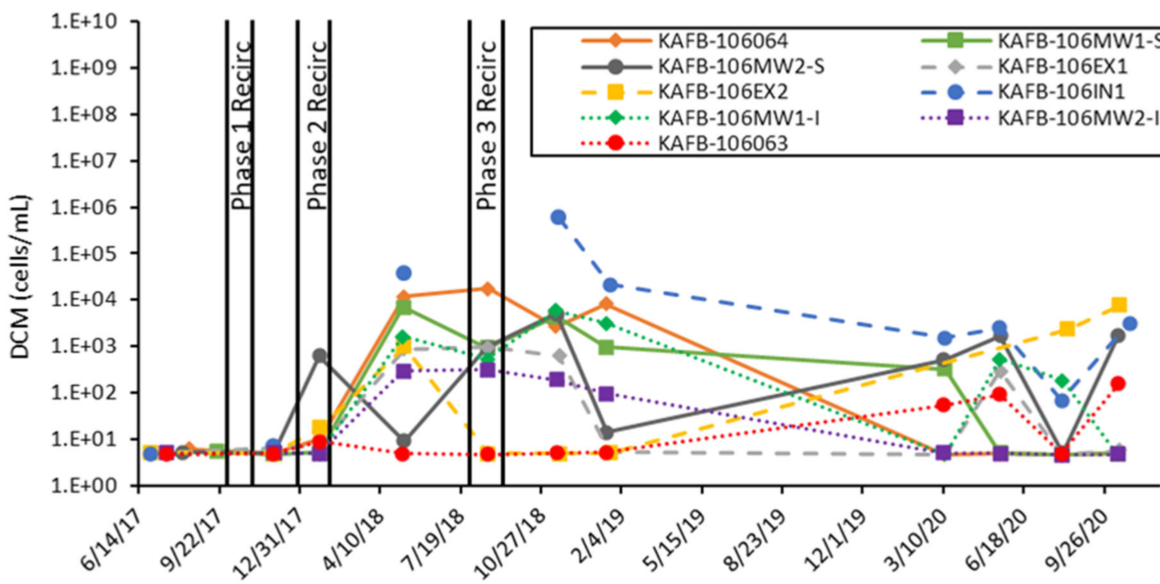

Figure 5.56. ***Dehalobacter*** **DCM (DCM) Levels at All Monitoring and Recirculation Wells During the ISB Demonstration.**

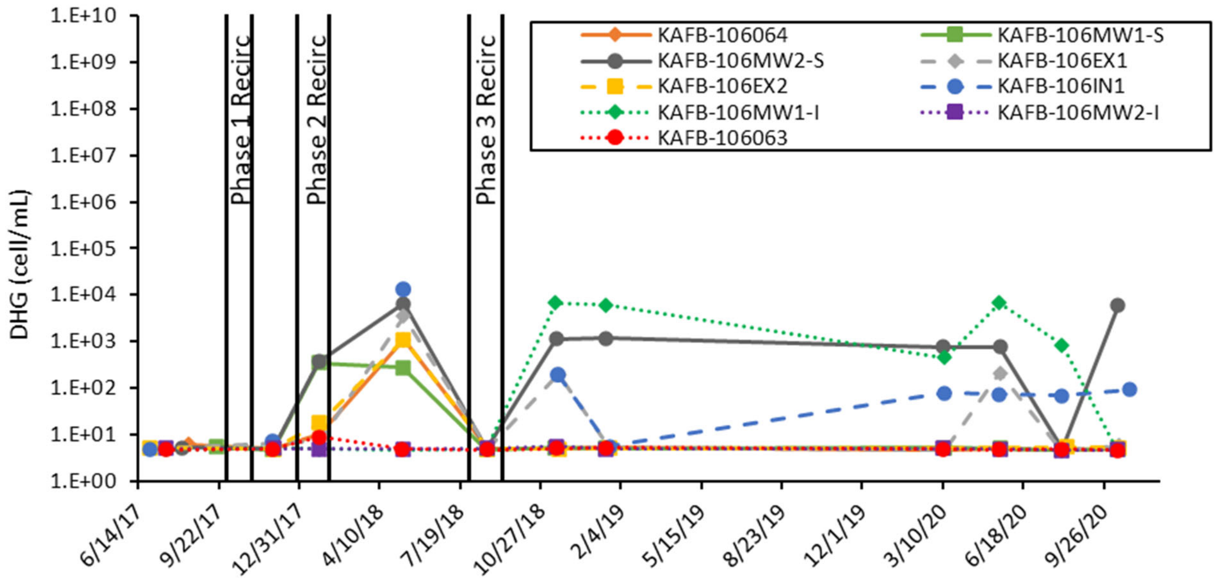

Figure 5.57. ***Dehalogenimonas*** **spp. (DHG) Levels at All Monitoring and Recirculation Wells During the ISB Demonstration.**

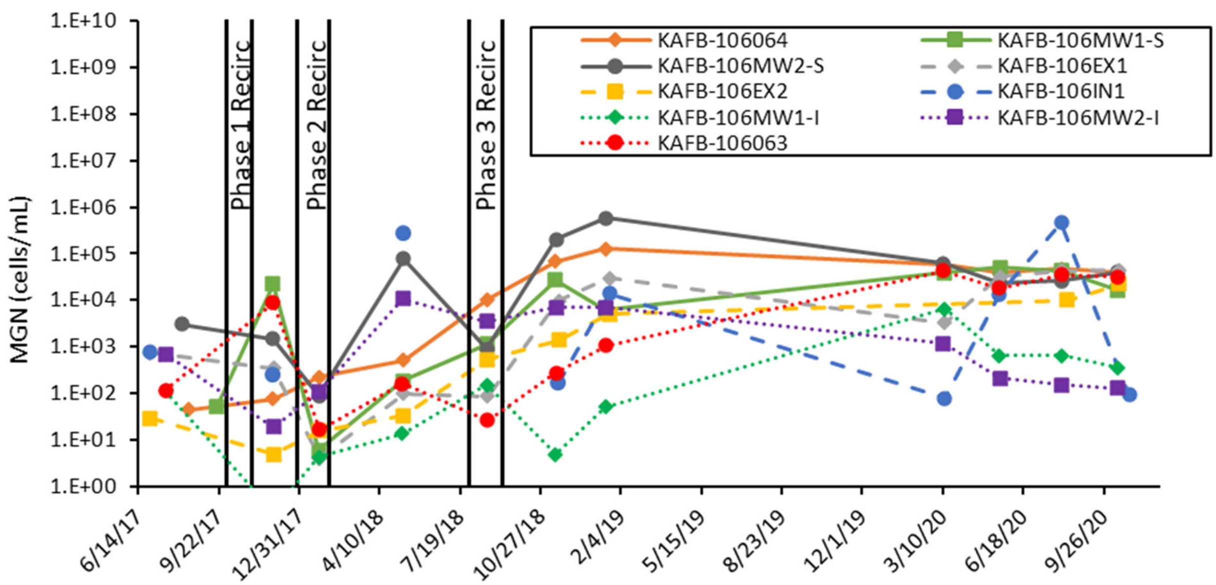

Figure 5.58. Methanogen (MGN) Levels at All Monitoring and Recirculation Wells During the ISB Demonstration.

5.7.2.4 Geochemistry

DO, sulfate, iron, and methane were monitored during the pilot test as indicators of geochemical conditions (Figure 5.59 to Figure 5.62). All four parameters indicated that anaerobic conditions favoring reductive debromination of EDB to ethene occurred during the pilot test.

The pilot test was sited within a zone significantly impacted by hydrocarbons (i.e., Zone 1 of the natural attenuation evaluation). Consistent with the natural attenuation evaluation, DO concentrations at the shallow wells were low (less than 1 mg/L) under baseline conditions, presumably due to past degradation of some of these hydrocarbons. Intermediate wells were not as impacted by hydrocarbons and generally had greater DO concentrations. During Phase 1 recirculation without biostimulation amendments, DO decreased to less than 0.5 mg/L at most wells with the exception of KAFB-106EX1 (2.1 mg/L), KAFB-106MW1-I (8.4 mg/L), and KAFB-106063 (1.9 mg/L). During and after Phase 2 and Phase 3 recirculation periods in which organic substrate amendments were introduced to groundwater, DO concentrations were generally below 1 mg/L at all wells, with most concentrations below 0.5 mg/L. Sporadic observations of DO concentrations above 1 mg/L occurred at the extraction wells KAFB-106EX1 and KAFB-106EX2 during passive periods, particularly during the October 2020 sampling event, when concentrations of 3.2 mg/L and 7.3 mg/L, respectively, were observed. The low DO concentrations within the treatment zone reflect favorable conditions for reductive debromination of EDB.

With the exception of KAFB-106EX2 (25 mg/L), sulfate concentrations in shallow wells were low (<5 mg/L) at the time of baseline sampling, presumably due to past sulfate reduction to sulfide. Sulfate reduction is indicative of bulk reducing conditions in the aquifer that favor EDB debromination. During and after Phase 2 and Phase 3 recirculation periods when organic substrate was added, sulfate concentrations were below 5 mg/L in the wells (except for KAFB-106EX1 and KAFB-106EX2) and were often not detected. During the recirculation events themselves, both extraction wells had sulfate concentrations that exceeded 5 mg/L, and it is likely that much of this observed sulfate was drawn to the extraction wells from outside the treatment zone. Prior to 2020, sulfate concentrations at KAFB-106EX2 were consistently higher than others, and exceeded 10 mg/L with a maximum concentration of 39.7 mg/L (Phase 2 passive), perhaps indicating the inclusion of groundwater richer in sulfate from outside the treatment zone. In 2020, increased sulfate concentrations were observed at intermediate wells (KAFB-106MW1-I and KAFB-106MW2-I), perhaps due to influence of deeper, less impacted water, or change of redox state at these locations. Overall, low sulfate concentrations within the treatment zone reflect favorable conditions for reductive debromination of EDB.

Baseline measurements at the site indicated dissolved iron concentrations ranging from 1 mg/L (KAFB-106MW1-S) to 12 mg/L (KAFB-106MW2-S) in shallow wells, but concentrations at deeper, less impacted wells were all less than 1 mg/L. During and after Phase 2 and Phase 3 recirculation periods, dissolved iron concentrations increased due to iron reduction and maximum concentrations at individual wells ranged from 4.2 mg/L in KAFB-106EX2 to 22.1 mg/L in KAFB-106MW2-I. Elevated dissolved iron concentrations are consistent with anaerobic conditions in the aquifer favorable for reductive debromination of EDB. Reduced iron species may also help facilitate abiotic reduction of EDB.

High methane concentrations are generally indicative of methanogenesis under anaerobic conditions. Methane was observed during baseline measurements among shallow wells with concentrations ranging from 2 µg/L at KAFB-106MW1-S to 179 µg/L at KAFB-106064. While there were decreases in methane concentrations during Phase 1 and Phase 2 recirculation activities, perhaps due to mixing from less methanogenic regions, increased abiotic losses (e.g., due to degassing under flow conditions), or methane oxidation, large overall increases in methane were observed during other periods of the ISB demonstration. Ultimately, methane increased by many orders of magnitude at most wells during the demonstration and dissolved concentrations exceeded 1,000 µg/L at all but one well (KAFB-106MW1-I) at some point during the demonstration.

Methane concentrations exceeding 10,000 µg/L were observed at three wells (KAFB-106064, KAFB-106MW2-S, and KAFB-106IN1) during the pilot test; and it should also be noted that this approaches the aqueous solubility of methane, which is in the range of 20,000 µg/L. Elevated methane concentrations are consistent with the increased populations of methanogens discussed in Section 5.7.2.3 and are indicative of reducing conditions favorable for EDB debromination.

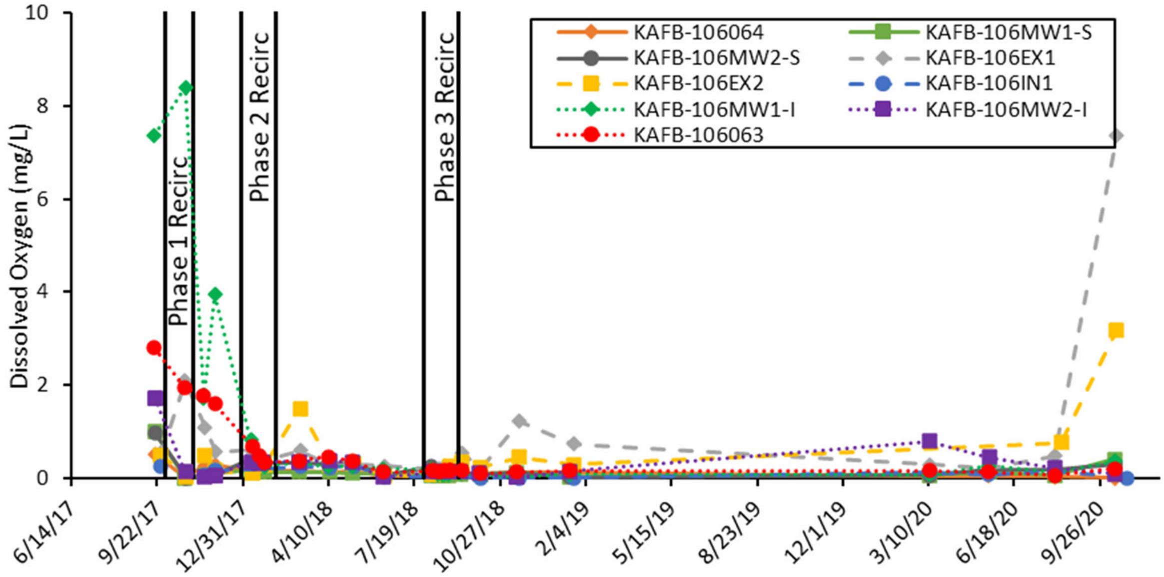

Figure 5.59. Dissolved Oxygen Concentrations at All Monitoring and Recirculation Wells During the ISB Demonstration.

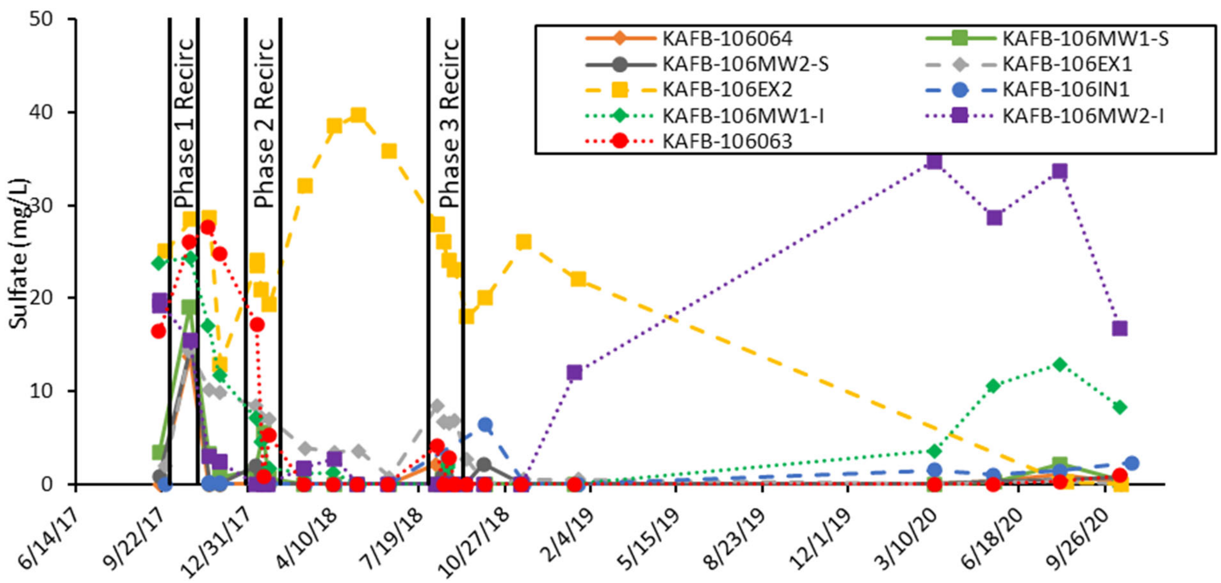

Figure 5.60. Sulfate Concentrations at All Monitoring and Recirculation Wells During the ISB Demonstration.

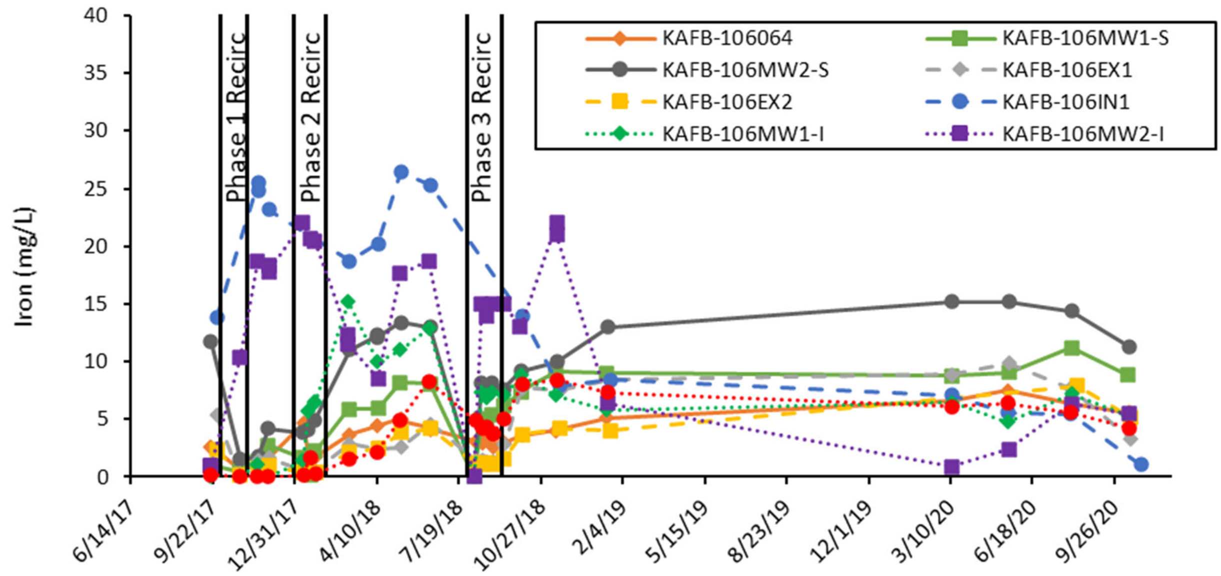

Figure 5.61. Dissolved Iron Concentrations at All Monitoring and Recirculation Wells During the ISB Demonstration.

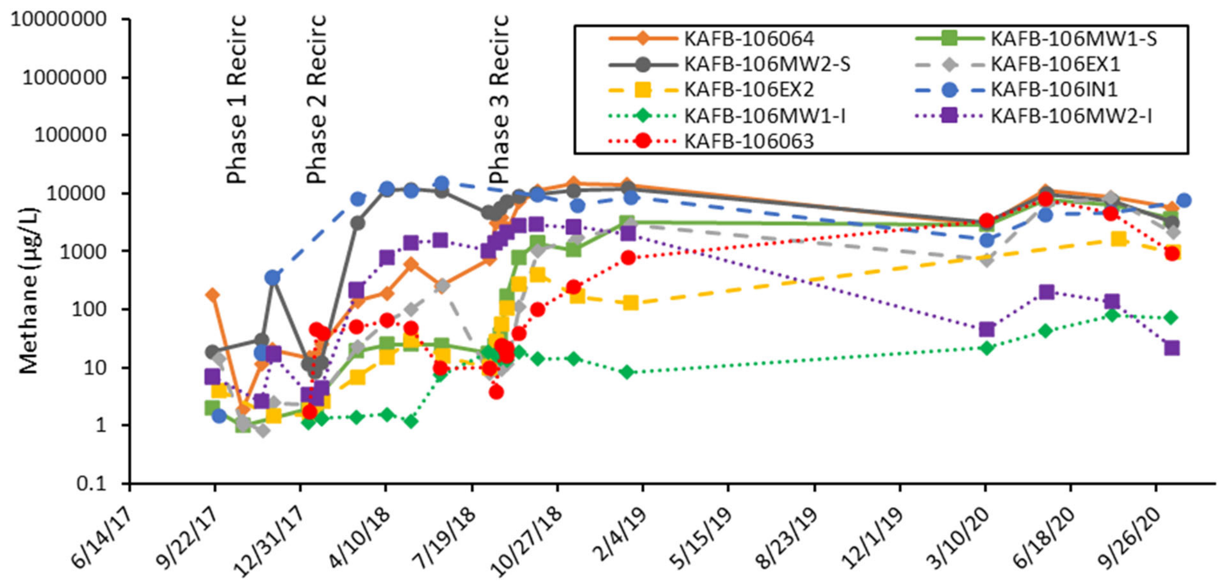

Figure 5.62. Methane Concentrations at All Monitoring and Recirculation Wells During the ISB Demonstration.

5.7.2.5 Benzene

Benzene was not targeted during this demonstration, but its presence was used to help assess several possible abiotic loss mechanisms for EDB; benzene is slightly less water soluble and more volatile than EDB. Benzene is also less susceptible than EDB to degradation under anaerobic conditions. As such, it is helpful to discuss the behavior of benzene relative to EDB. Figure 5.63 to Figure 5.65 show the concentration of benzene for all wells of the pilot test.

Benzene concentrations in shallow monitoring wells during the baseline evaluation ranged from 586 µg/L at KAFB-106MW2-S to 8,240 µg/L at KAFB-106MW1-S; benzene was not detected in the intermediate wells during baseline measurements. The measured benzene baseline concentrations were somewhat higher than those measured prior to pilot test well installation and development activities. This increase may have been the result of different types of sample pumps (bladder pumps) placed at different depths, heterogenous distribution of benzene in the subsurface, or increased mass transfer from residual NAPL during well installation and development. The highest benzene concentration during baseline sampling was observed at KAFB-106MW1-S where NAPL had been observed. During the Phase 1 recirculation period, benzene concentrations at shallow monitoring wells were more evenly distributed throughout the site and ranged from 2,730 µg/L (KAFB-106MW2-S) to 3,630 µg/L (KAFB-106MW1-S). With the exception of the injection well (KAFB-106IN1) and monitoring well KAFB-106MW1-S, benzene concentrations in shallow monitoring wells for the remainder of the pilot test ranged in concentration from 1,500 µg/L at KAFB-106MW2-S to 6,700 µg/L at KAFB-106EX2, indicating limited losses due to biodegradation or abiotic mechanisms (e.g., volatilization, dilution). Low benzene concentrations (down to 590 µg/L) were observed at the KAFB-106IN1 during Phase 4 sampling. Benzene increased during passive periods at shallow well KAFB-106MW1-S to concentrations as high as 9,800 µg/L, which is similar to baseline conditions prior to recirculation and may be the result of increased mass transfer from residual NAPL phases. NAPL had previously been observed at that location.

Relative to the shallower monitoring wells, benzene concentrations at the intermediate wells during the pilot test varied more (Figure 5.65). As noted earlier, benzene was not detected at the intermediate wells during baseline measurements, but benzene concentrations increased after recirculation activities mixed groundwater over a greater depth. During Phase 2 and Phase 3 recirculation periods, benzene concentrations ranged from 1,200 µg/L to 3,600 µg/L at the intermediate wells. However, these benzene concentrations decreased to approximately 50 µg/L during the Phase 2 passive period at KAFB-106MW1-I and KAFB-106MW2-I, and to 65 µg/L at KAFB-106MW1-I and less than 1 µg/L at KAFB-106MW2-I during Phase 4 passive monitoring. No significant decrease in benzene concentrations was noted at KAFB-106063. The observed decreases in benzene concentrations may be due to sorption in the soils or degradation, but could also have resulted from the influx of groundwater not impacted by benzene as corresponding decreases in the iodide tracer were also observed at intermediate wells.

Overall, the trends among benzene concentrations suggest that losses during and after recirculation were limited at the shallower wells, but interpretation of trends at the intermediate wells is more challenging. The reasonably stable benzene concentrations observed in the shallow zone throughout the pilot test provide a good point of comparison to help evaluate EDB degradation. Decreases in EDB concentrations much greater than observed for benzene provide evidence of EDB degradation, as many other abiotic mechanisms (e.g., volatilization) leading to lower concentrations would likely be reflected in benzene data.

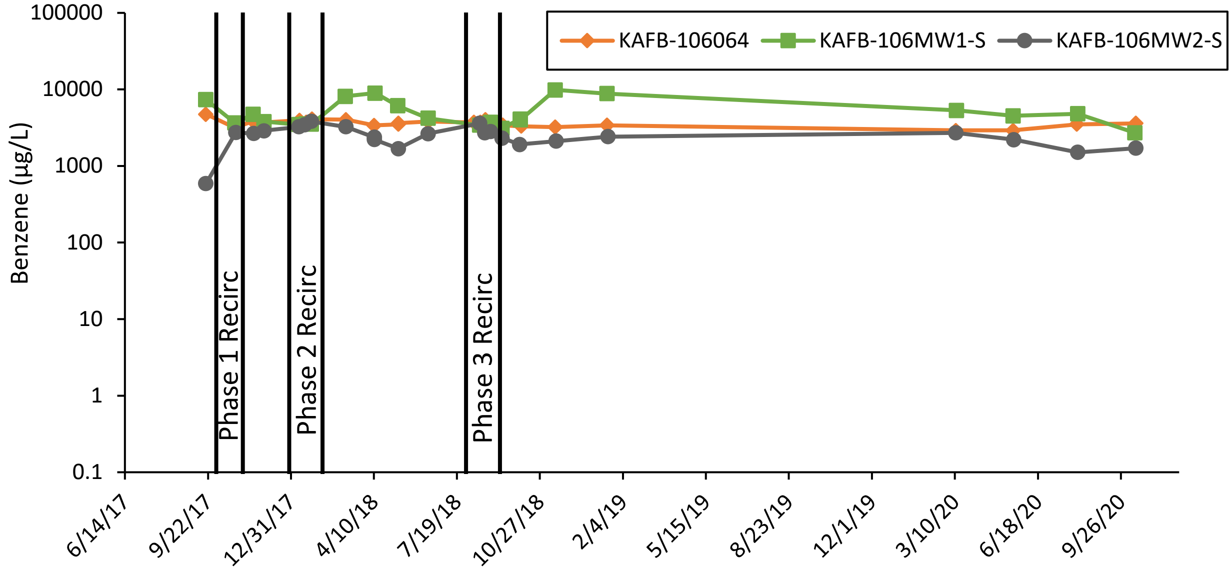

Figure 5.63. Benzene Concentrations at Shallow Monitoring Wells During the ISB Demonstration.

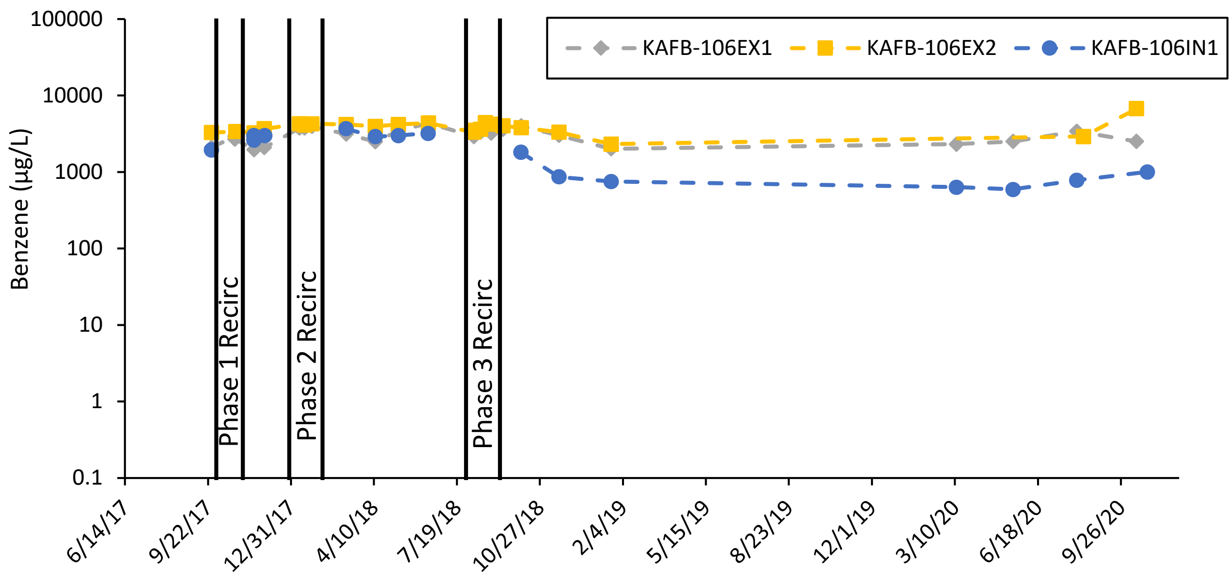

Figure 5.64. Benzene Concentrations at Recirculation Wells During the ISB Demonstration.

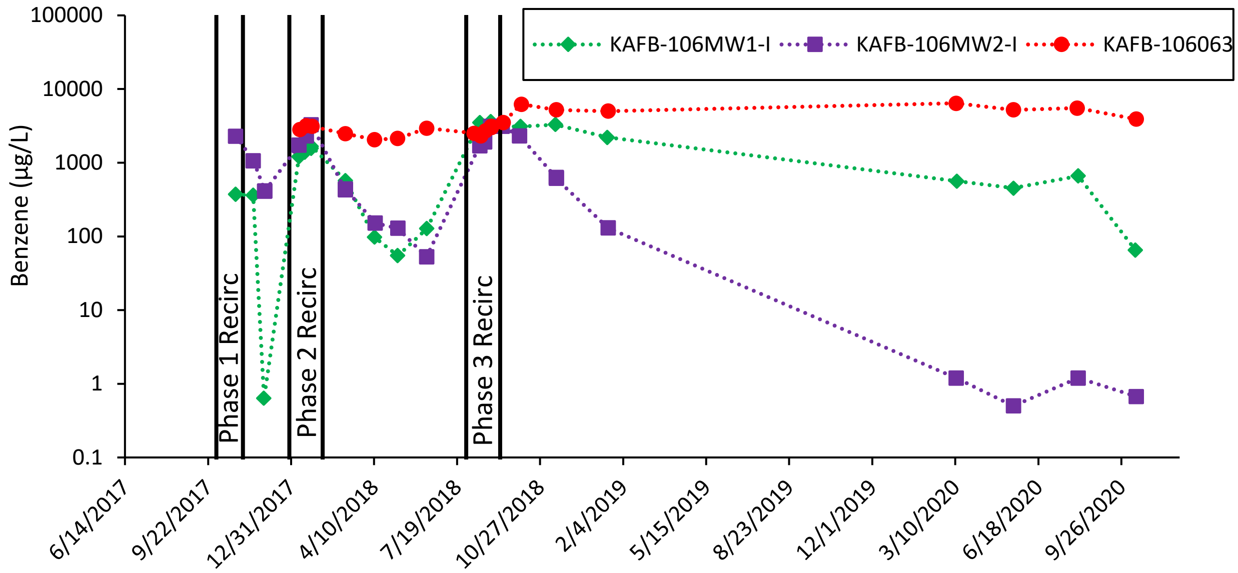

Figure 5.65. Benzene Concentrations at Intermediate Level Monitoring Wells During the ISB Demonstration.

5.7.2.6 EDB

5.7.2.6.1 <u>EDB Concentrations</u>

EDB was targeted during this demonstration of anaerobic ISB. Figure 5.66 and Figure 5.68 show concentrations of EDB for all wells of the pilot test. EDB concentrations in shallow monitoring wells during the baseline evaluation ranged from 20.1 µg/L at KAFB-106IN1 to 432 µg/L at KAFB-106MW1-S, and among the intermediate wells EDB was only detected at KAFB-106MW2-I with a concentration of approximately 0.1 µg/L. These baseline EDB concentrations were generally higher than that measured prior to pilot test well installation, when EDB concentrations at KAFB-106064 were 9.3 µg/L (Fourth Quarter 2016) and 17 µg/L (Second Quarter 2016) (USACE, 2021). As noted in Section 5.7.2.5, an increase was also observed for benzene, and the increase may have been the result of different types of sample pumps (bladder pumps) placed at different depths, heterogenous distribution of EDB in the subsurface, or increased mass transfer from residual NAPL during well installation. As with benzene, the highest EDB concentration during the baseline evaluation was observed at KAFB-106MW1-S where NAPL was previously observed.

EDB concentrations at shallow monitoring wells were more evenly distributed during the Phase 1 recirculation period than during the baseline and ranged from 50.4 µg/L (KAFB-106EX1) to 137 µg/L (KAFB-106EX2), with EDB concentrations at wells closer to the injection well ranging from 68 µg/L (KAFB-106MW2-S) to 104 µg/L (KAFB-106MW1-S). Compared to the EDB concentrations observed during Phase 1 recirculation, concentrations at the shallow monitoring wells decreased during the following Phase 1 passive period, with EDB reductions of approximately 75% observed at wells KAFB-106064 (20.3 µg/L), KAFB-106EX1 (12.9 µg/L), and KAFB-106MW2-S (15 µg/L) after the one-month passive period. This is slightly less than a one-log reduction (i.e., 90%). Decreases of similar magnitude were not observed for benzene, where losses were less than 25% and, in most cases, less than 10% with some increases in concentration.

These observations are consistent with some ongoing EDB degradation that may have been further stimulated by groundwater recirculation and nutrient mixing from other locations within the aquifer. Whether this EDB degradation would have been sustained for longer periods was not assessed during this demonstration, as Phase 2 recirculation and biostimulation activities commenced as planned after the approximately one-month passive period. Decreases in EDB concentrations were observed at intermediate monitoring wells too, with losses up to 95%. However, these EDB reductions were mirrored in benzene data, and may be due to degradation or other processes, such as sorption in the soils or influx of unimpacted groundwater.

During the last sampling of the Phase 2 recirculation period, the range of EDB concentrations observed at shallow monitoring wells was less variable, ranging from 66.4 µg/L at KAFB-106MW1-S to 90.9 µg/L at KAFB-106EX2. This indicated some redistribution of EDB within the treatment zone and provides a point of comparison for changes during the subsequent passive period. Except for KAFB-106EX2, where EDB concentrations appeared relatively stable, EDB concentrations decreased during the Phase 2 passive period by approximately 90% or more. This corresponds to one-log (90%) to three-log reduction (99.9%) relative to maximum concentrations measured during Phase 2 recirculation. Notably, EDB was not detected at the injection well (KAFB-106IN1) or KAFB-106MW2-S at the end of the passive period, with detection limits of approximately 0.02 µg/L. As mentioned earlier, no significant decrease of benzene was observed, providing evidence that abiotic losses (e.g., volatilization) were limited, and that anaerobic EDB degradation was stimulated during this passive period. As during the Phase 1 passive period, decreases in EDB concentrations were observed at the intermediate monitoring wells, but decreases in benzene were also observed, such that changes were not exclusive to EDB. In addition to EDB and benzene degradation, other possible explanations leading to these decreases at intermediate wells include sorption in the soils or influx of unimpacted groundwater.

After the significant decrease in EDB concentrations during Phase 2 passive period that likely resulted from in situ biodegradation activity of indigenous debrominating organisms, a decision was made among stakeholders to table the planned bioaugmentation with exogenous debrominating organisms (USACE, 2021). Instead, Phase 3 was performed with additional recirculation with more organic substrate and nutrients with the goal of expanding the biological treatment zone. In contrast to Phase 1 and Phase 2 recirculation activities and in contrast to other solutes (e.g., iodide, benzene, toluene), EDB concentrations observed during Phase 3 recirculation exhibited a new pattern. Measured EDB concentrations at the extraction wells were reasonably constant during this recirculation period, with concentrations at KAFB-106EX1 ranging from 11 to 20 µg/L, and concentrations at KAFB-106EX2 ranging from 47 to 97 µg/L. Based on flows through the treatment system from the extraction wells, EDB in the reinjected groundwater ranged from approximately 35 µg/L to 45 µg/L, yet concentrations at the monitoring wells were less, ranging from approximately 3 µg/L at KAFB-106064 to 11 µg/L at KAFB-106MW1-S. Notably, EDB concentrations also decreased at the shallow wells during this recirculation period with time. Observed concentrations lower than injected concentrations and decreasing EDB concentrations during the recirculation period suggested that EDB degradation was stimulated and occurred between the injection well and the shallow monitoring wells during the Phase 3 recirculation period. Similar decreases in concentrations were not observed for benzene. Except for KAFB-106EX2 and KAFB-106MW1-S, where changes in EDB concentrations were less, EDB concentrations during the subsequent passive period decreased by 95% or more relative to maximums observed during the preceding recirculation period.

These decreases correspond to one-log (90%) to three-log reduction (99.9%) relative to maximum concentrations measured during Phase 3 recirculation, and EDB was detected at concentrations less than the EPA MCL of 0.05 µg/L at the injection well (KAFB-106IN1) and wells KAFB-106MW2-S and KAFB-106064. As mentioned earlier, no significant losses of benzene were observed, providing evidence that abiotic losses (e.g., volatilization) were limited, and that anaerobic EDB degradation was stimulated during this passive period. Overall, the footprint of decreased EDB concentrations appeared larger after Phase 3 activities than during Phase 2. As during the Phase 1 and 2 passive periods, decreases in EDB concentrations were observed among the intermediate monitoring wells during Phase 3, but because similar decreases in benzene were also observed, such changes were not exclusive to EDB and could not be solely attributed to reductive debromination.

Phase 4 monitoring of pilot test performance commenced after Phase 3, and five sampling rounds were performed, the first of which occurred approximately four months after Phase 3 recirculation activities were halted. No significant rebound in EDB concentrations was observed during Phase 4. During Phase 4, EDB decreased to non-detectable concentrations at all wells except KAFB-106EX2 and KAFB-106MW2-S. Concentrations of EDB decreased at KAFB-106EX2 from 55 µg/L (last Phase 3 passive sampling event) to 0.36 µg/L at the end of Phase 4. It should be noted that approximately 10 ft of NAPL were removed from KAFB-106EX2 during 2020, and this NAPL may have impacted earlier EDB measurements at this well. Concentrations of EDB increased slightly at KAFB-106MW2-S from 0.019 µg/L (last Phase 3 passive sampling event) to 0.087 µg/L at the end of Phase 4. Whether this is a preliminary indication of more significant EDB rebound in the future is unclear.

Figure 5.69 show the overall extent of reduction in EDB and benzene from baseline measurements (or the highest observed concentrations for intermediate wells) to the most recent Phase 4 sampling event (October 2020). EDB reductions were greater than two-log units (99%) in all six shallow wells, with five of the wells exhibiting three-log reductions (99.9%) or greater. Further, four of the shallow wells were below the EPA MCL of 0.05 µg/L for EDB during their most recent sampling event (Figure 5.66 and Figure 5.67). The large and rapid reductions in EDB concentrations in an environment conducive to reductive debromination strongly suggests that in situ anaerobic biodegradation of EDB occurred.

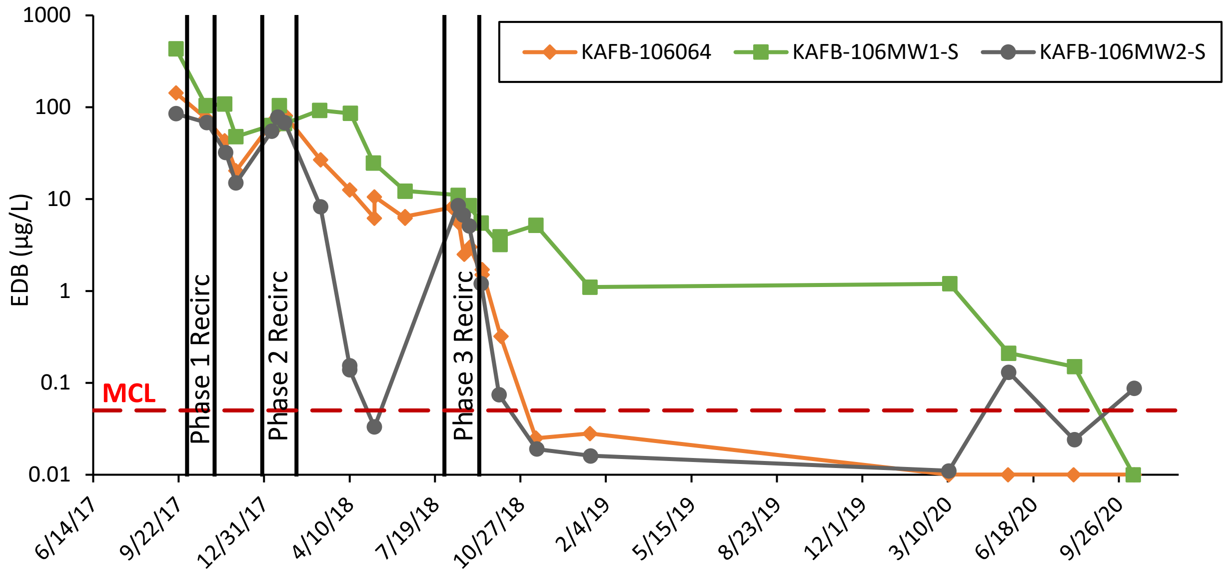

Figure 5.66. EDB Concentrations at Shallow Monitoring Wells During the ISB Demonstration.

The MCL of 0.05 µg/L for EDB is indicated by the dashed red line.

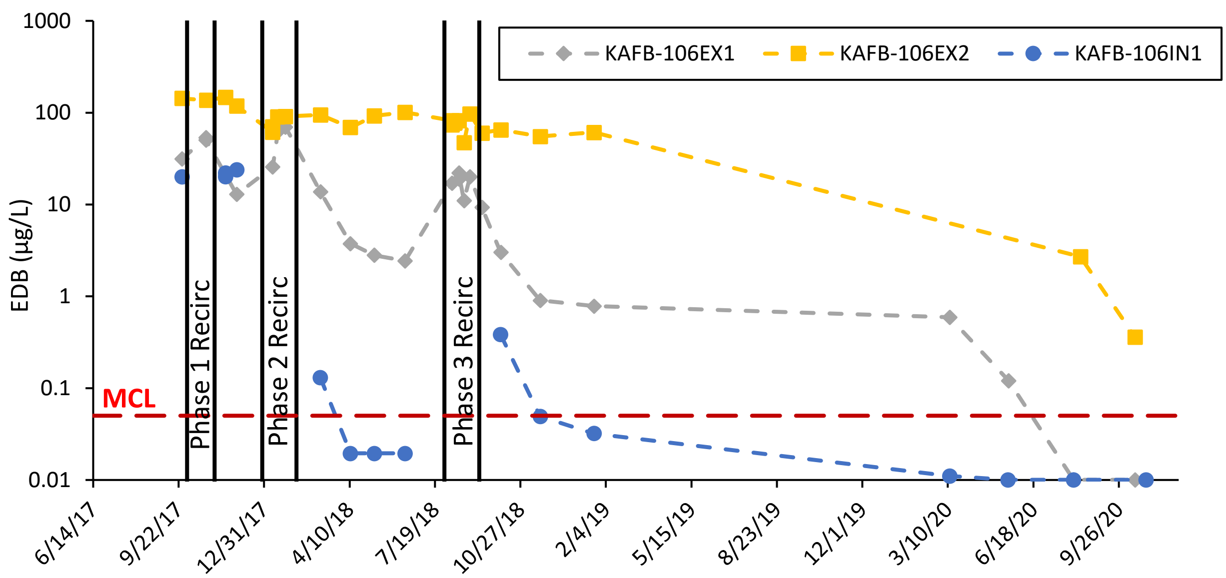

Figure 5.67. EDB Concentrations at Recirculation Wells During the ISB Demonstration.

The MCL of 0.05 µg/L for EDB is indicated by the dashed red line.

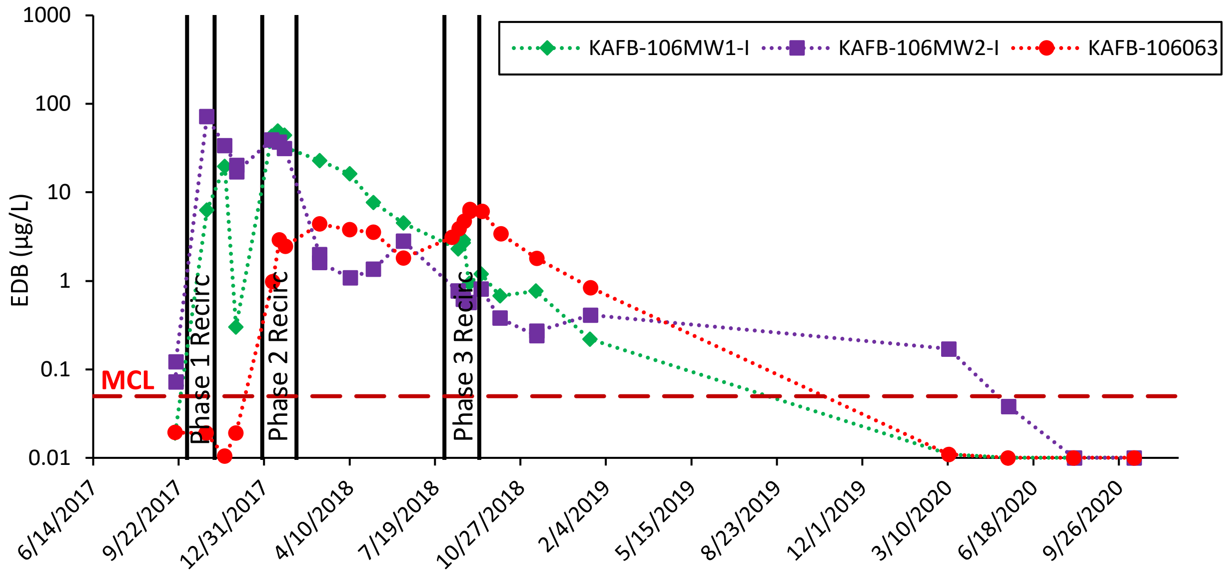

Figure 5.68. EDB Concentrations at Intermediate Level Monitoring Wells During the ISB Demonstration.

The MCL of 0.05 µg/L for EDB is indicated by the dashed red line.

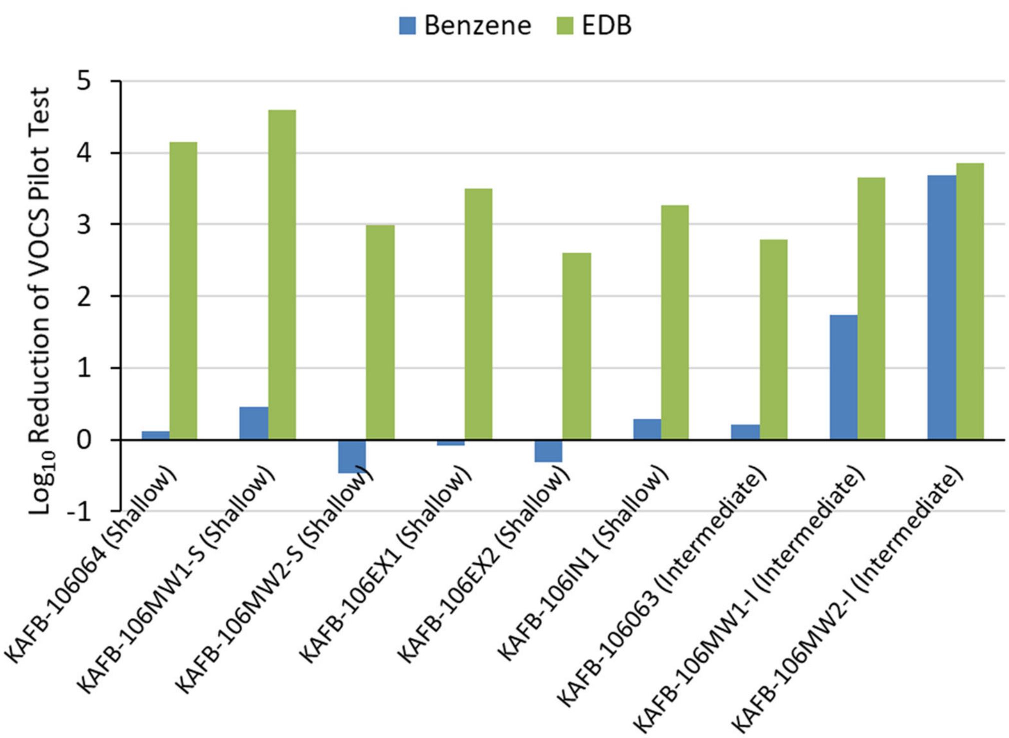

Figure 5.69. Log_{10} Reduction in Benzene or EDB from Baseline measurements (or the Highest Observed Concentrations for Intermediate Wells) to the Most Recent Phase 4 Sampling Event (October 2020).

Reductions for EDB greatly exceeded reductions in benzene.

5.7.2.6.2 EDB Degradation Products

As noted in Section 5.7.1.4.2, reductive debromination of EDB can result in stoichiometric production of one mole of ethene and two moles of bromide for each mole of EDB reduced (Koster van Groos et al., 2018); and ethene may be further transformed to ethane. Both gases, as well as bromide, are reasonably stable under anaerobic conditions. Elevated concentrations of these degradation products can provide evidence of reductive debromination of EDB during natural attenuation or during pilot test efforts.

Assuming stoichiometric conversion of EDB to ethene and ethane during reductive debromination, and that contributions of ethene and ethane from sources other than EDB were negligible, quantities of EDB degraded were estimated using measured concentrations of ethene and ethane:

$$\boldsymbol{C_{EDB-degraded} = MW_{EDB} * \left(\frac{C_{ethene}}{MW_{ethene}} + \frac{C_{ethane}}{MW_{ethane}}\right)} \quad (4)$$

where *C* indicates concentrations in units of mass per volume, and *MW* indicates the molecular weights of the respective compounds. Figure 5.70 thru Figure 5.72 show estimated quantities of EDB degraded through reductive debromination based on the formation of ethene and ethane products observed at the shallow, recirculation, and intermediate wells, respectively. In shallow wells, estimates of EDB converted to ethene and ethane during the baseline evaluation ranged from approximately 20 µg/L at KAFB-106EX1 to over 130 µg/L at both KAFB-106064 and KAFB-106MW2-S, indicating that there was likely EDB debromination occurring prior to any pilot test activities. This is consistent with the natural attenuation evaluation. During the Phase 1 recirculation period, these estimates of EDB degraded decreased and ranged from 5 µg/L (KAFB-106MW2-S and KAFB-106EX2) to 24 µg/L (KAFB-106064). Many geochemical measures (e.g., sulfate, iron, methane) indicated more oxidizing conditions during this recirculation period, which may be attributed to redistribution of the low concentrations of DO and less impacted water observed at KAFB-106EX1 throughout the treatment zone. The small quantities of DO introduced during this process may have helped facilitate some ethene and ethane consumption. During the Phase 1 passive period, increases in estimates of EDB degraded based on ethene and ethane were noted, which is consistent with the decreases in EDB concentrations during this period described earlier, providing further evidence of EDB degradation prior to biostimulation efforts.

During and after the Phase 2 recirculation period, estimates of EDB degraded based on ethene and ethane increased to magnitudes similar to initial EDB concentrations. The highest estimates of EDB degraded occurred at KAFB-106MW1-S and KAFB-106EX2 after Phase 3 biostimulation efforts with estimated values of approximately 270 µg/L and 310 µg/L. These are also locations with high initial baseline EDB concentrations and where NAPL was observed either prior to the study (KAFB-106MW1-S) or at its end (KAFB-106EX2). Decreases in ethene and ethane occurred with time at several wells during passive periods, despite EDB reductions at these locations. These decreases in ethene and ethane could indicate slowed production of these daughter compounds due to the lower parent EDB concentrations, together with some ethene or ethane degradation or partitioning into gas-phase pockets that may be present due to methanogenesis. As described in Section 5.7.2.4, very high methane concentrations were observed at these wells that could reflect the presence of gas-phase methane.

The presence of bromide in background water and low concentrations of bromide expected to result from EDB debrominations were two challenges faced during evaluation of bromide. For example, degradation of 100 µg/L of EDB would result in production of just 0.085 mg/L of bromide, which may be challenging to measure. As described in Section 5.7.1.4.2, one method for distinguishing bromide originating from EDB from background water is to examine the ratio of bromide to chloride, which is typically relatively constant as the two anions are often correlated due to common sources and concentration and dilution effects. Deviation from a constant ratio in favor of greater bromide might indicate a unique source of bromide, such as EDB debromination.

Figure 5.73 shows concentrations of bromide vs. chloride for all the wells of the pilot test, and Figure 5.74 thru Figure 5.76 show the bromide to chloride ratio with time for the shallow, recirculation, and intermediate wells, respectively. The dashed red line in each of these figures approximates the background ratio of 0.0079 based on previous studies (Kirtland AFB, 2016b). Very few samples were enriched in chloride relative to bromide compared to the background, but many samples were enriched in bromide. Many of the increases in bromide are on the order of 1 mg/L, which corresponds to degradation of approximately 1,200 µg/L of EDB – much more than was observed in aqueous phase measurements during the pilot test. One explanation for such excess of bromide could be continued degradation of EDB beyond that available in the aqueous phase (e.g., from NAPL), which would be of interest. The largest increases in bromide to chloride ratio occurred during and after the Phase 3 recirculation period, which would be consistent with enhanced biodegradation occurring at the site; unfortunately, this also coincided with use of a different analytical laboratory after the original analytical laboratory measuring bromide ceased operations. Both analytical laboratories were certified.

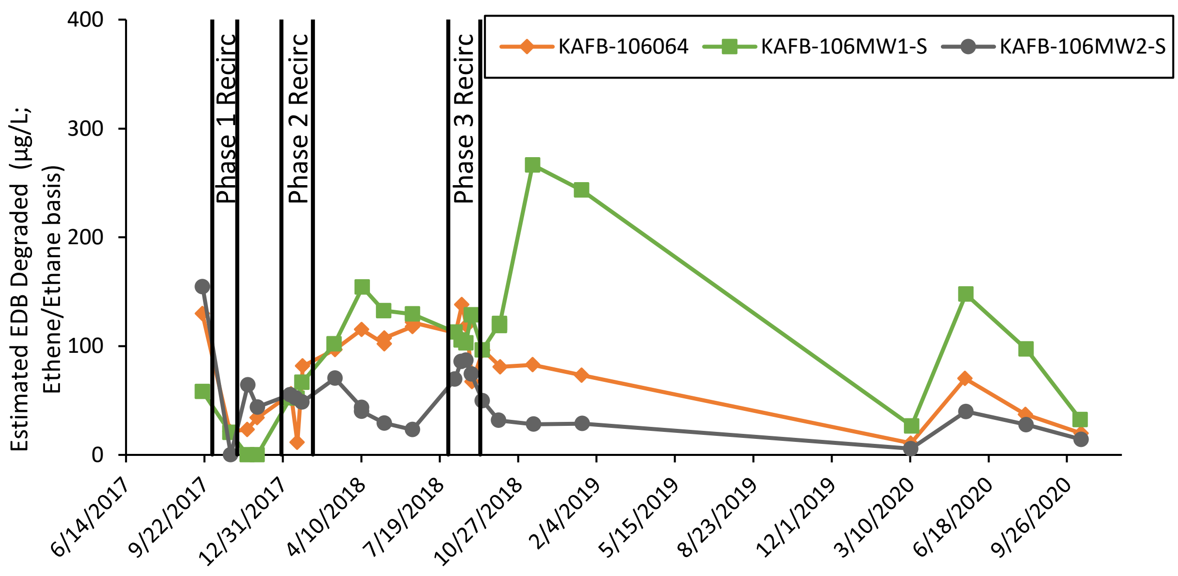

Figure 5.70. Estimates of EDB Degraded at Shallow Monitoring Wells During the ISB Demonstration Assuming Quantitative Conversion to Ethene and Ethane.

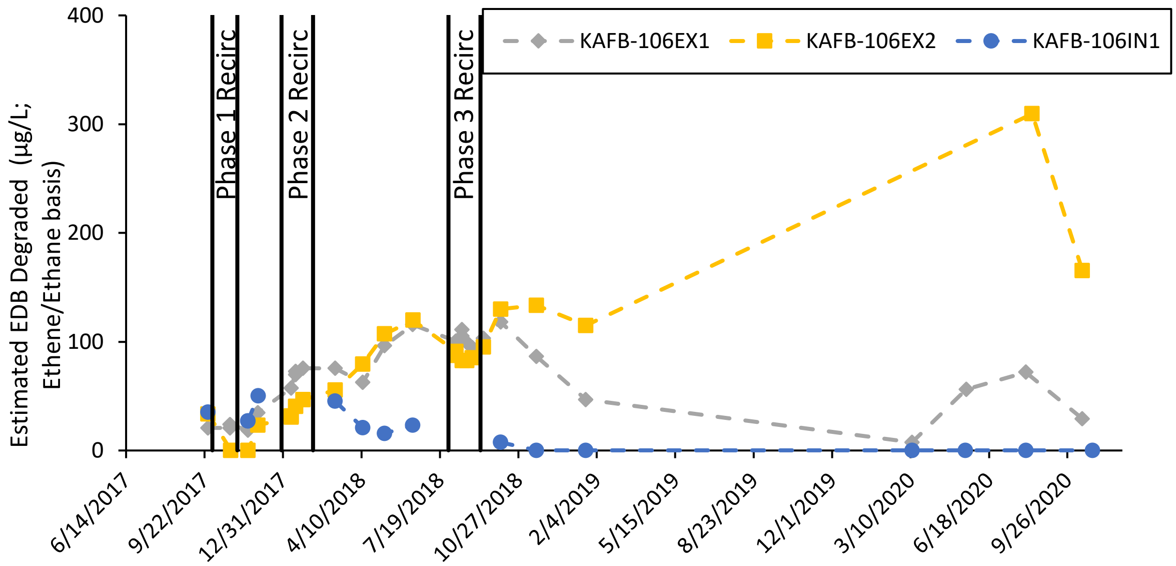

Figure 5.71. Estimates of EDB Degraded at Recirculation Wells During the ISB Demonstration Assuming Quantitative Conversion to Ethene and Ethane.

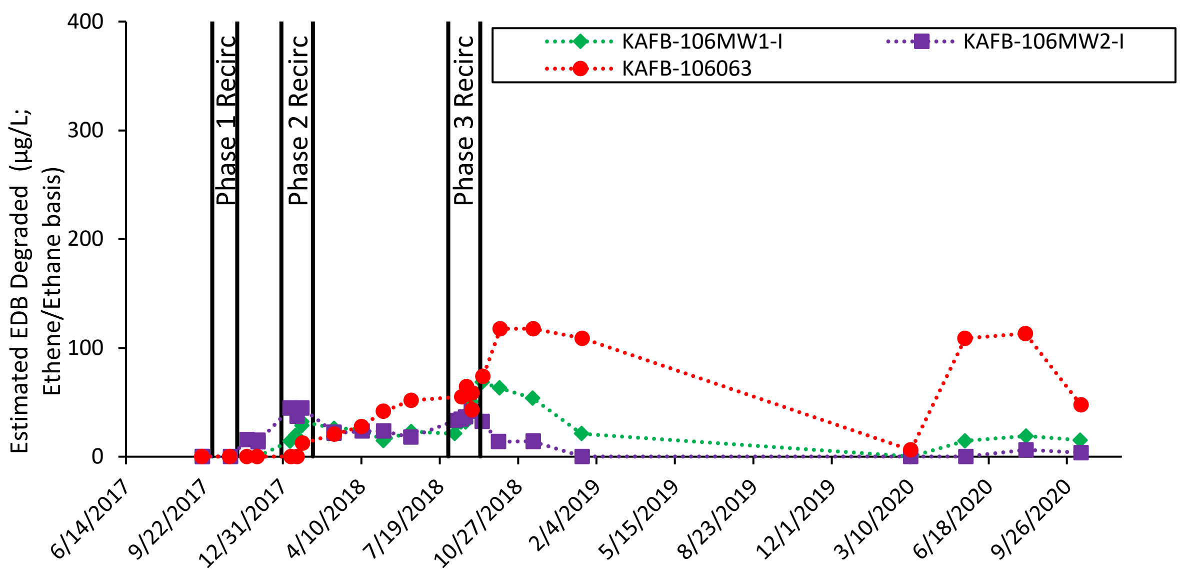

Figure 5.72. Estimates of EDB Degraded at Intermediate Level Monitoring Wells During the ISB Demonstration Assuming Quantitative Conversion to Ethene and Ethane.

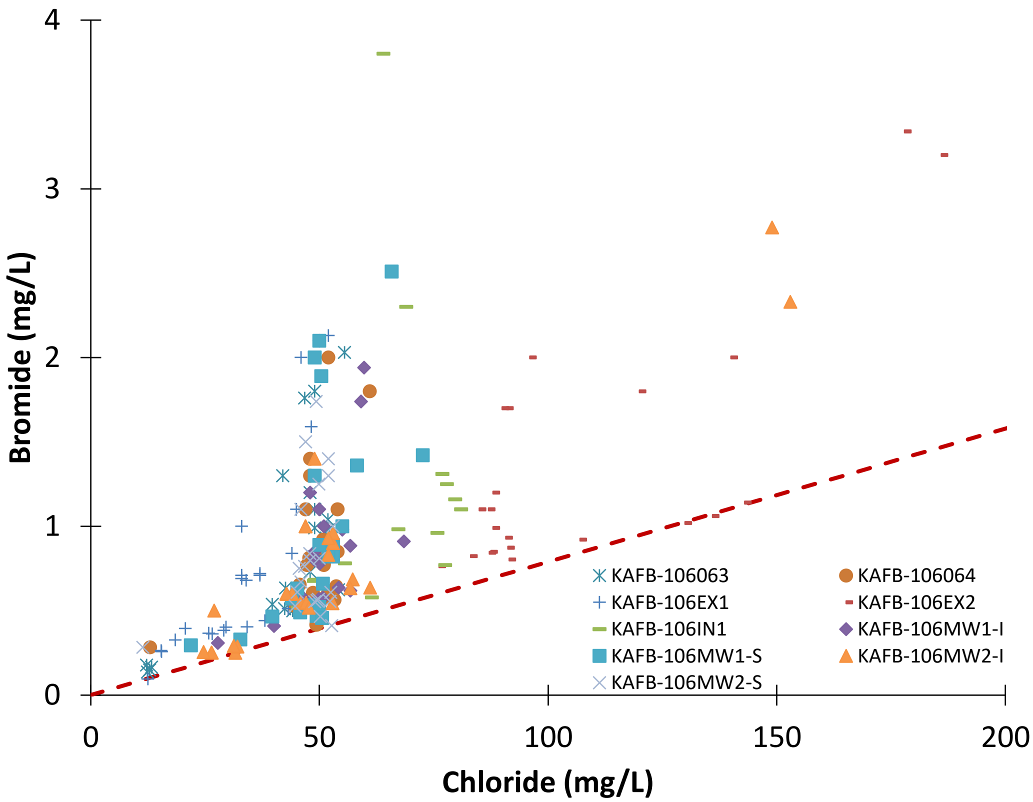

Figure 5.73. Bromide vs. Chloride Concentrations at all the ISB Demonstration Wells.

Significant enrichment of bromide concentrations was observed at many wells relative to the approximate background ratio of 0.0079 (Kirtland AFB, 2016b), indicated by the dashed red line.

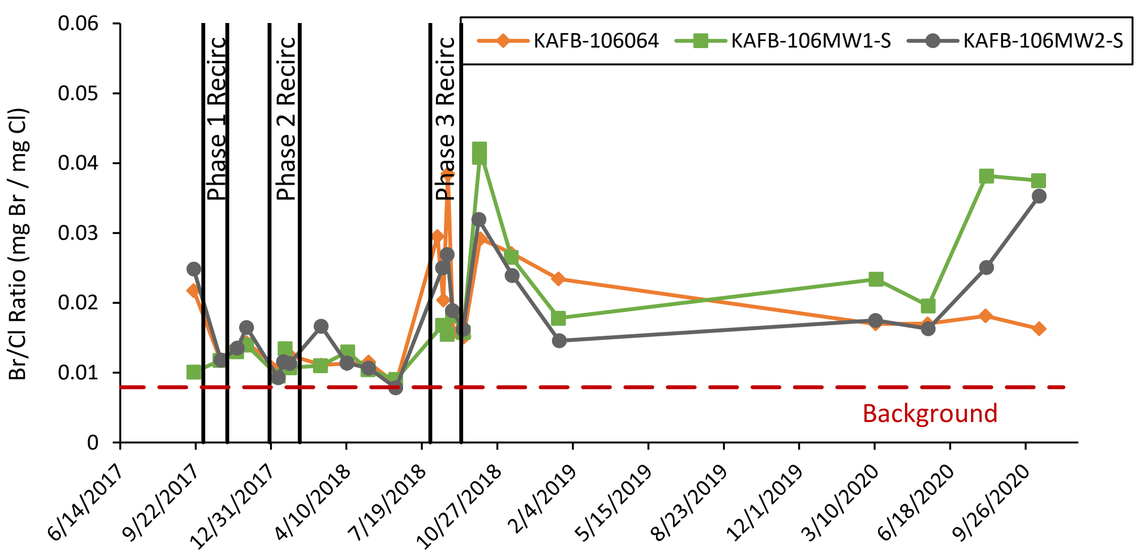

Figure 5.74. Bromide to Chloride Concentration Ratios at the Shallow Monitoring Wells During the ISB Demonstration.

Enrichment of bromide concentrations was observed at many wells relative to the approximate background ratio of 0.0079 (Kirtland AFB, 2016b), indicated by the dashed red line.

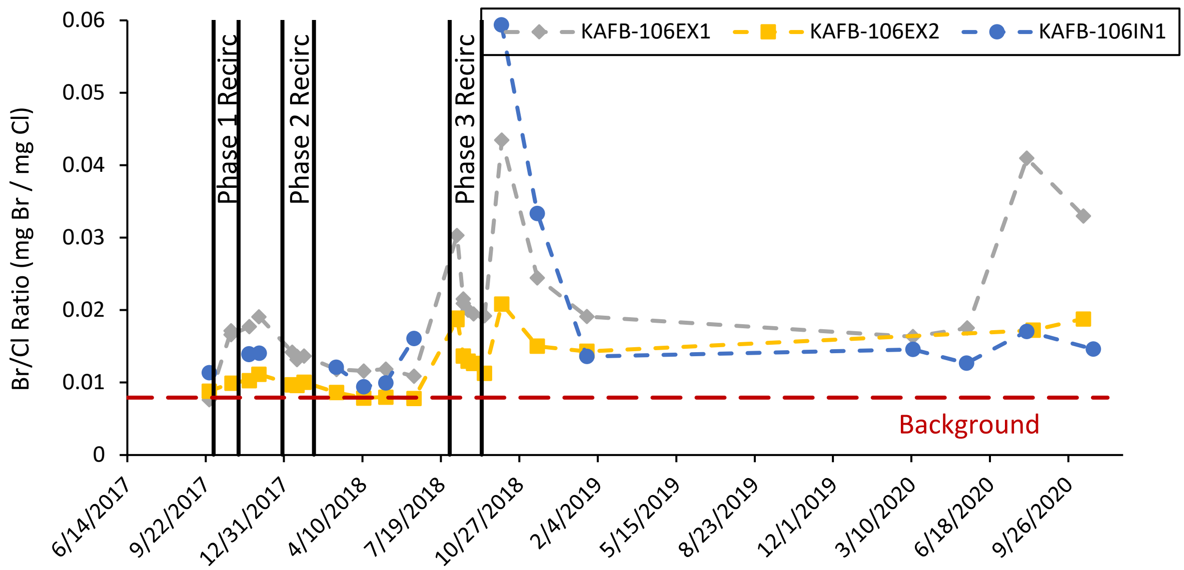

Figure 5.75. Bromide to Chloride Concentration Ratios at the Recirculation Wells During the ISB Demonstration.

Enrichment of bromide concentrations was observed at many wells relative to the approximate background ratio of 0.0079 (Kirtland AFB, 2016b), indicated by the dashed red line.

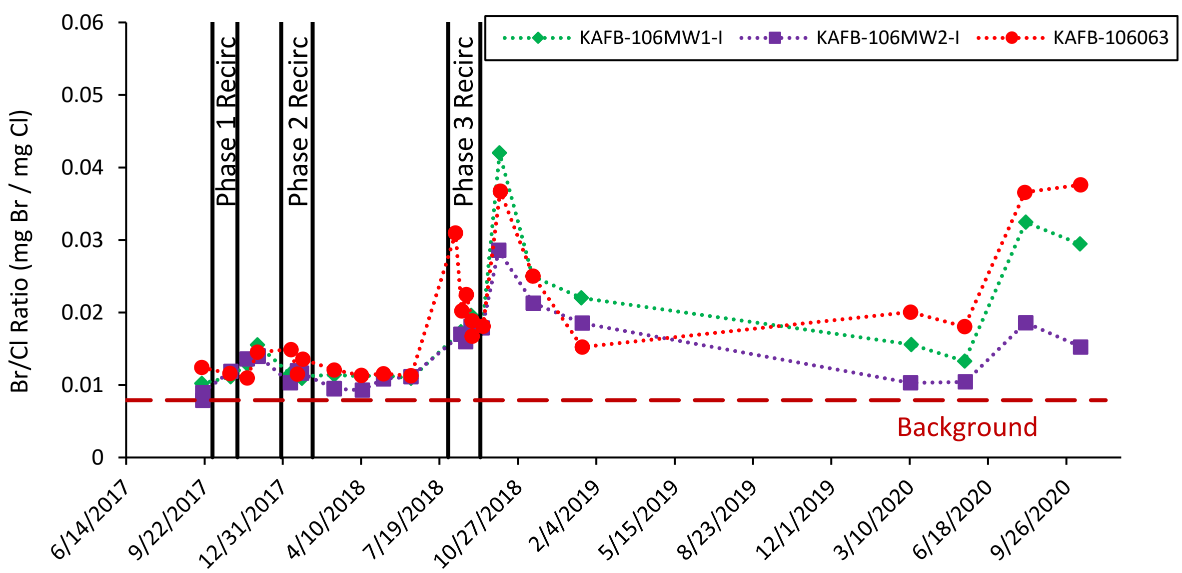

Figure 5.76. Bromide to Chloride Concentration Ratios at the Intermediate Level Monitoring Wells During the ISB Demonstration.

Enrichment of bromide concentrations was observed at many wells relative to the approximate background ratio of 0.0079 (Kirtland AFB, 2016b), indicated by the dashed red line.

5.7.2.6.3 Carbon Isotope Analysis of EDB

As described earlier in this report, a shift in EDB $\delta^{13}C$ from more negative values to more positive values (corresponding to an increase in relative ^{13}C abundance) provides evidence of EDB degradation. Table 5.12 and Figure 5.77 provide $\delta^{13}C$ values of EDB sampled at shallow monitoring and recirculation wells during the pilot test, as well as of EDB extracted from the NAPL recovered at well KAFB-106MW1-S during baseline studies. Due to very low EDB concentrations relative to other VOCs, such as benzene, it was not possible to measure the EDB isotope composition of several samples after treatment. EDB in these cases was more than 4 or 5 orders of magnitude lower in concentration than the VOC, well outside the conditions examined during method development and testing, as described in Section 2.2.2.3. No isotope measurements were successful when EDB was less than 1 µg/L in the hydrocarbon rich matrix.

The $\delta^{13}C$ values of EDB in the NAPL sample and at well KAFB-106EX2 were consistently the most negative with values of -16‰ or lower, which indicated they were the least degraded. Baseline samples collected prior to the pilot test included EDB $\delta^{13}C$ values as high as -5‰, significantly higher than the NAPL and water located at KAFB-106EX2, indicating significant isotope fractionation at the site prior to the demonstration test (as discussed in evaluation of EDB attenuation at the site, Section 5.7.1). Additionally, $\delta^{13}C$ of EDB at KAFB-106064 and KAFB-106MW2-S increased between baseline measurements and the first passive period, suggesting EDB degradation after initial recirculation efforts without biostimulation amendments, consistent with observed decreases in EDB concentration at these locations.

Table 5.12. EDB Concentrations and $\delta^{13}C$ Values Measured at the Demonstration Pilot Test Wells.

Well ID	Sample Date	Test Phase	EDB Concentration (µg/L)	$\delta^{13}C$ of EDB (‰)	$\delta^{13}C$ uncertainty (‰)
KAFB-106064	9/19/2017	Baseline	143 J+	-11.4	2
KAFB-106064	11/28/2017	Phase 1 - Passive	20.3	-1.3	2
KAFB-106064	1/25/2018	Phase 2 - Recirculation	80.3 J+	-9.3	2
KAFB-106064	5/9/2018	Phase 2 - Passive	6.2	-1.2	1.5
KAFB-106064	8/22/2018	Phase 3 - Recirculation	2.5	-10.2	1.5
KAFB-106064	9/12/2018	Phase 3 – Passive	1.5	-4.5	5
NAPL from KAFB-106MW1-S	9/13/2017	Baseline	-	-21	2
KAFB-106MW1-S	9/19/2017	Baseline	432 J+	-19.6	2
KAFB-106MW1-S	11/28/2017	Phase 1 - Passive	47.8	-18.2	2
KAFB-106MW1-S	1/24/2018	Phase 2 - Recirculation	66.4	-11.7	2
KAFB-106MW1-S	5/8/2018	Phase 2 - Passive	24.7	-9.3	1
KAFB-106MW1-S	8/21/218	Phase 3 - Recirculation	8.4	-4.1	1.5
KAFB-106MW1-S	9/11/2018	Phase 3 – Passive	5.5	-5.6	1.5
KAFB-106MW2-S	8/7/2017	Baseline	42.5 J+	-8.9	2
KAFB-106MW2-S	9/19/2017	Baseline	84.9 J+	-8.7	2
KAFB-106MW2-S	11/28/2017	Phase 1 - Passive	15	-1.6	2
KAFB-106MW2-S	1/24/2018	Phase 2 - Recirculation	68.1	-11.7	2
KAFB-106MW2-S	5/9/2018	Phase 2 - Passive	0.0331 J	-	-
KAFB-106MW2-S	8/21/218	Phase 3 - Recirculation	6.7 J	-9.0	1.5
KAFB-106MW2-S	9/11/2018	Phase 3 – Passive	1.2	-4.6	8
KAFB-106EX1	9/26/2017	Baseline	31.3 J+	-9.0	2
KAFB-106EX1	11/29/2017	Phase 1 - Passive	12.9	-7.2	2
KAFB-106EX1	1/25/2018	Phase 2 - Recirculation	69.7 J+	-9.7	2
KAFB-106EX1	5/9/2018	Phase 2 - Passive	2.8	6	1.5
KAFB-106EX1	8/22/218	Phase 3 - Recirculation	11	-8.0	1.5
KAFB-106EX1	9/12/2018	Phase 3 – Passive	9.3	-3.4	1.5
KAFB-106EX2	6/29/2017	Baseline	143	-19.5	2
KAFB-106EX2	9/26/2017	Baseline	143 J+	-18.1	2
KAFB-106EX2	11/29/2017	Phase 1 - Passive	118	-17.3	2
KAFB-106EX2	1/25/2018	Phase 2 - Recirculation	90.9 J+	-17.1	2
KAFB-106EX2	5/9/2018	Phase 2 - Passive	92.5	-17.9	1
KAFB-106EX2	8/22/2018	Phase 3 - Recirculation	47	-19.2	1.5
KAFB-106EX2	9/11/2018	Phase 3 – Passive	60	-18.0	1.5
KAFB-106IN1	9/26/2017	Baseline	20.1 J+	-5.0	2
KAFB-106IN1	11/29/2017	Phase 1 - Passive	23.8	-7.7	2
KAFB-106IN1	5/9/2018	Phase 2 - Passive	ND	-	-
KAFB-106IN1	10/4/2018	Phase 3 - Passive	0.38	-	-

Almost all $\delta^{13}C$ values of EDB during passive periods of the pilot test were more positive than preceding recirculation periods, providing evidence of EDB degradation during passive periods. Consistent with determinations with Zone 1 estimates described in section 5.7.1.4.3, the extent of EDB degradation was estimated using the Rayleigh equation and ε_{bulk} of -8.2‰. Relative to the observed $\delta^{13}C$ value of -21‰ of EDB in NAPL collected at KAFB-106MW1-S prior to the demonstration, between 17 and 96% of EDB was estimated to have degraded in samples where CSIA was performed (Figure 5.78). As mentioned earlier, reliable C isotope measurements of EDB were not successful when concentrations were below 1 µg/L, but we strongly suspect that samples with lower EDB concentrations would have exhibited more positive $\delta^{13}C$ values than observed here. Overall, the increases in $\delta^{13}C$ values of EDB observed provide strong supporting evidence that EDB degraded during the pilot test. Additionally, while isotope fractionation can result from both biological and abiotic degradation mechanisms (e.g.., hydrolysis), the rapid kinetics observed, and other lines of evidence noted during the pilot test suggest that the shift in isotope composition was likely the result of biodegradation processes.

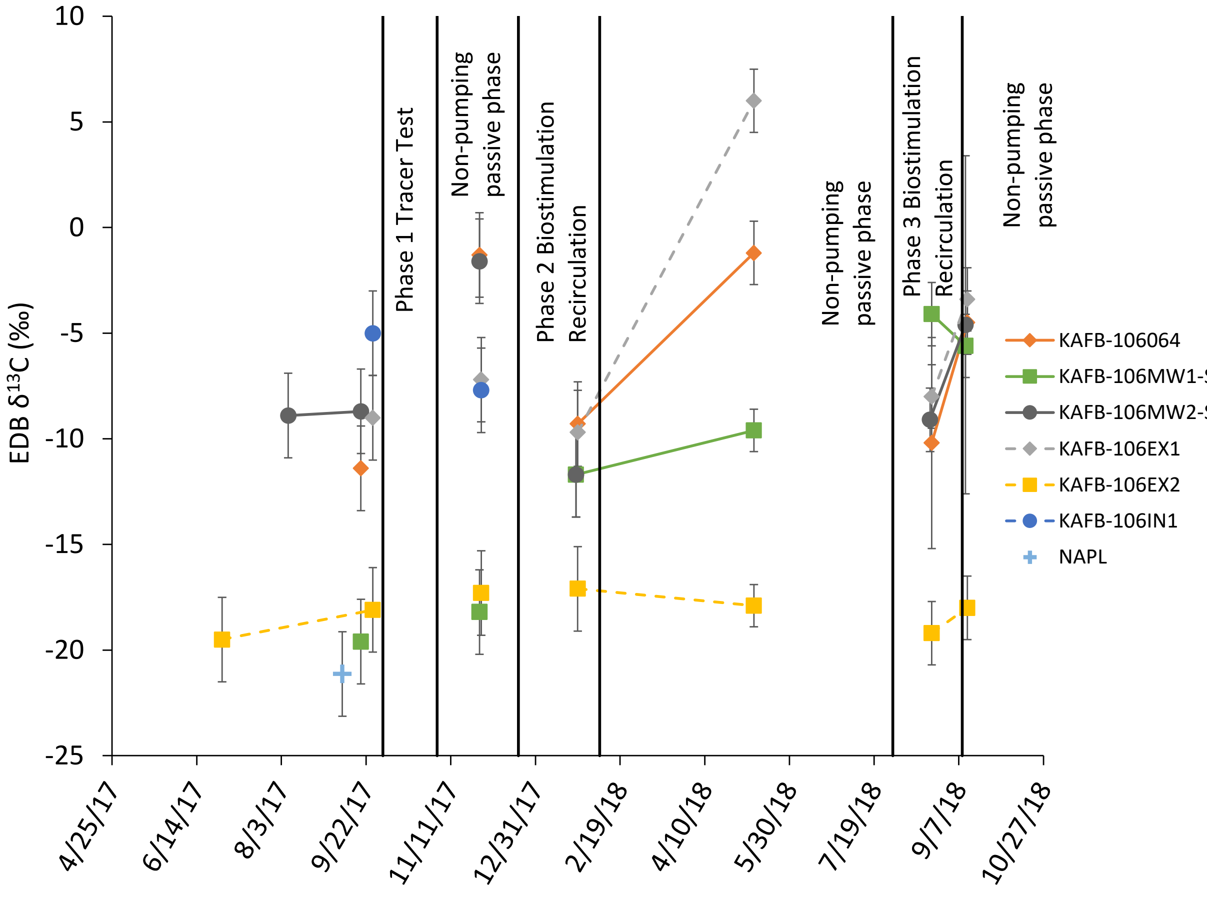

Figure 5.77. Measured $\delta^{13}C$ Values for EDB Collected at the Shallow Monitoring and Recirculation Wells During the ISB Demonstration.

An increase in $\delta^{13}C$ values indicates EDB degradation, which was evident for many wells after recirculation activities.

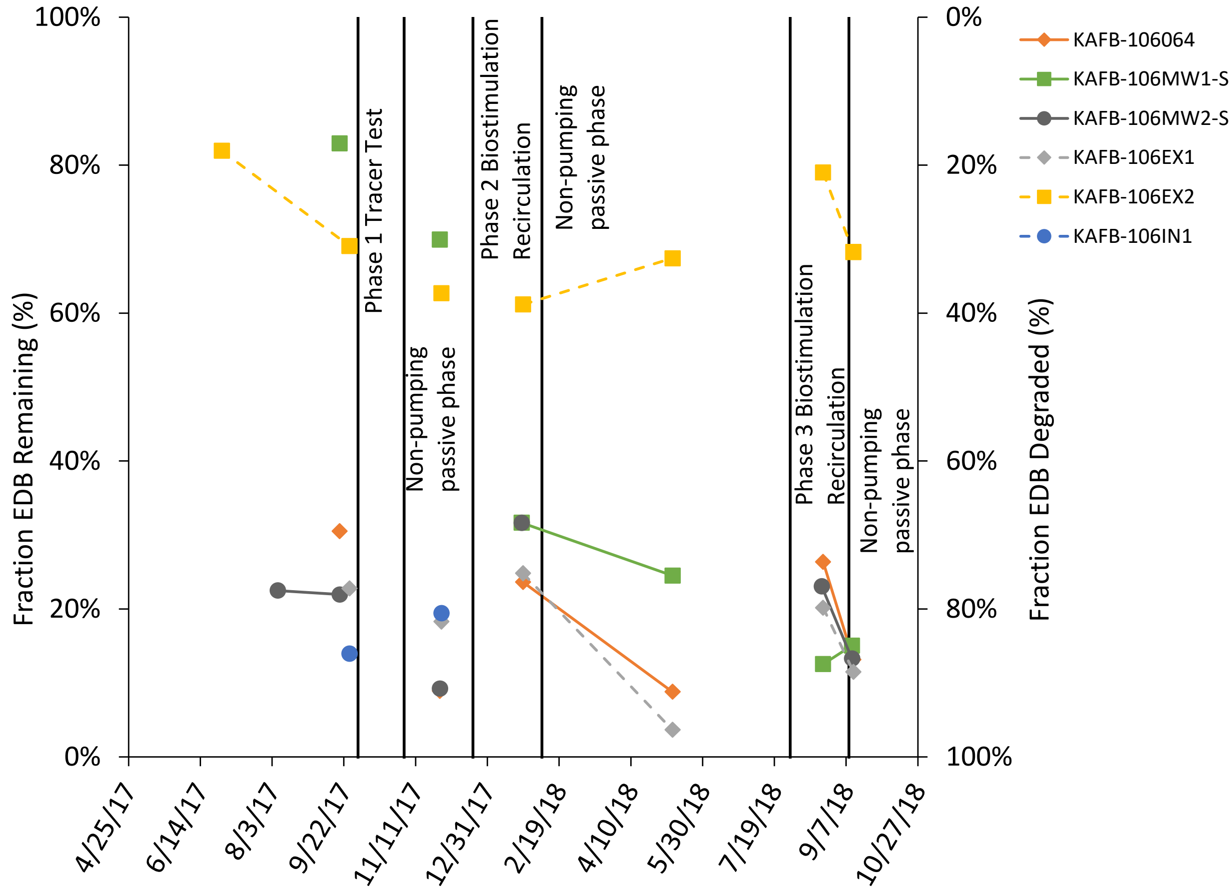

Figure 5.78. Estimates of EDB Degraded Based on CSIA Measurements, ε_{bulk} Value for Reductive Debromination (ε_{bulk} = -8.2‰), and Initial $\delta^{13}C$ values of -21‰ Representing the NAPL Collected at KAFB-106MW1-S.

CSIA estimates of overall degradation were limited by inability to perform CSIA measurements when EDB concentrations were below 1 µg/L due to interferences for other VOCs (e.g., benzene).

6.0 PERFORMANCE ASSESSMENT

6.1 CSIA MEASUREMENTS OF EDB AT <1 μG/L

During this project, carbon isotope compositions of EDB were successfully measured by CSIA. This is described in Sections 2.2.2, 5.7.1.4.3, and 5.7.2.6.3. As described in Section 2.2.2, two conditions made CSIA measurements difficult when examining EDB resulting from leaded fuels: interest in very low concentrations of EDB, and high concentrations of non-target VOCs (e.g., BTEX).

During the evaluation of natural attenuation described in 5.7.1.4.3, EDB concentrations similar to the low EDB MCL (0.05 μg/L) were encountered that were relatively free of competing VOCs. Increased EDB mass required for the analysis was obtained from larger volumes of groundwater using the closed-loop purge and trap system described in Section 2.2.2.2. This method was successful and the goal of CSIA measurements with less than 1 μg/L of EDB was met, albeit with increased uncertainties. These measurements provided clear evidence of EDB degradation at the site prior to active remediation efforts.

The demonstration of ISB for EDB treatment occurred in an area significantly impacted by non-target VOCs, with concentrations of benzene and toluene more than 1 mg/L. These concentrations exceeded those examined in preliminary lab studies as described in Section 2.2.2.3, and effectively precluded use of the closed-loop purge and trap system used to concentrate EDB from larger sample volumes. The standard purge and trap methodology with two-dimensional chromatography were used for CSIA measurements in this case. As described in Section 5.7.2.6.3, it was not possible to evaluate carbon isotope composition of EDB when concentrations were less than 1 μg/L due to the challenges associated with high VOC concentrations. The CSIA measurements that were performed, however, provided complementary evidence of EDB biodegradation during the pilot test.

6.2 CSIA TO QUANTIFY IN SITU EDB DEGRADATION AND ATTENTUATION

CSIA measurements of EDB during this project were used to evaluate EDB attenuation and in situ degradation, as described in Sections 5.7.1.4.3, and 5.7.2.6.3. The CSIA data clearly demonstrated that EDB degraded at the site prior to remediation efforts (see Figure 5.39). As described in Section 5.7.1, the CSIA data were consistent with EDB degradation and attenuation resulting from slower processes (e.g., hydrolysis) in downgradient stretches (i.e., Zone 3), and with more rapid biodegradation occurring in higher concentration anaerobic zones at the site (e.g., Zone 1). CSIA measurements of EDB collected during the demonstration of ISB for EDB also indicated that EDB degraded during the study (see Figure 5.78). As noted in Section 6.1, CSIA measurements of EDB where not possible from ISB demonstration samples when EDB concentrations were less than 1 μg/L. If these were possible, we expect that significantly greater isotope fractionation of EDB would have been observed resulting from the ISB demonstration.

6.3 BIODEGRADE EDB TO MCL (0.05 μG/L) IN MICROCOSMS

Microcosm testing under anaerobic conditions with an SDC-9 dehalogenating culture indicated that biodegradation of EDB to its MCL (0.05 μg/L) was feasible (see Figure 5.1). Because treatments with biostimulation amendments alone (i.e., without SDC-9) did not result in meaningful degradation of EDB during the treatability testing, the ISB demonstration was designed in a phased approach that would allow testing of biostimulation and bioaugmentation, if necessary. Ultimately, bioaugmentation was not performed during the ISB demonstration at KAFB due to success of biostimulation amendments alone. The microcosm testing also indicated that low concentrations of EDB (~5 µg/L) could degrade under aerobic conditions to levels equivalent to the MCL (see Figure 5.2).

6.4 DEGRADE EDB IN PILOT DEMONSTRATION TO MCL (0.05 µG/L)

Significant degradation of EDB was observed during the pilot demonstration. With the exception of a highly impacted extraction well (KAFB-106EX2), all wells had concentrations at or below 0.05 µg/L within two years of the last addition of amendments (see Figure 5.66 to Figure 5.68). There was perhaps a hint of rebound at one shallow monitoring well (KAFB-106MW2-S), although it is unknown whether this EDB originated from inside the treatment zone (i.e., from residual sources), from groundwater outside the treatment zone, or from the vadose zone.

EDB concentrations during and after each recirculation phase, and complementary CSIA data for EDB, indicated that EDB was degrading, including after the first phase when no external biostimulation amendments were provided. Due to design requirements and schedule of the demonstration, biodegradation after mixing of site groundwater alone (i.e., Phase 1) was evaluated for too short a period to adequately assess this behavior. After all treatment activities of the demonstration (including two rounds with biostimulation amendments), significant quantities of EDB were degraded and concentrations were reduced by more than 99% at all wells. Interestingly, large increases in bromide were observed (in excess of that attributable to aqueous EDB), suggesting possible bromide resulting from degradation of EDB originating from a separate phase (e.g., residual NAPL, see Section 5.7.2.6.2).

6.5 EDB DEGRADATION RESULTING IN <0.05 µG/L AT COMPLIANCE POINT

As described in Section 6.4 above, concentrations at wells within the pilot demonstration treatment area were below the MCL of 0.05 µg/L after treatment. Assuming no contribution from additional sources (e.g., vertical transport from vadose zone, release from newly submerged residual NAPL), it is anticipated that large-scale implementation of anaerobic ISB can achieve similar results. While additional time may be necessary for impacts of source zone treatment to propagate downgradient, and assuming that extended release from low permeability materials is minimal, it is likely that EDB concentrations below the MCL can be achieved throughout the impacted site and at compliance points.

6.6 LOW-COST TREATMENT

A groundwater treatment system using granular activated carbon adsorption has been used at Kirtland AFB since 2015 to collect and treat EDB in downgradient areas of the plume. Treatment of the source zone, coupled with clear evidence of downgradient attenuation, could help reduce long term costs associated with such treatment. The ISB demonstration during this project indicated that EDB could be targeted and biodegraded in the source zone, although impacts to other site COCs (e.g., benzene) was limited.

Significant complexity at Kirtland AFB, including the large distance to groundwater, and prevalence of other COCs (e.g., BTEX), greatly complicates the assessment of remedial costs.

Such an assessment for Kirtland AFB was not completed, but the depth to groundwater is certainly one of the largest cost drivers, making all active remediation strategies costly in comparison to MNA, if appropriate. As noted in Section 5.7.1.4, there is clear evidence of EDB degradation at the site, and this should be carefully considered when remediation approaches for EDB are evaluated – particularly as several attenuation processes can be documented using CSIA methods.

Due to widespread application of anaerobic bioremediation approaches targeting chlorinated compounds (e.g., PCE and TCE), associated costs are generally reasonably well understood. Such an approach may be considered for EDB treatment depending on site conditions and goals, although it is important to recognize that possible co-contaminants, such as benzene or other fuel hydrocarbons, are likely unaffected by such treatment. The intent of this performance objective was to assess the cost for implementing bioremediation for EDB. In Section 7.0, we present estimated costs for anaerobic ISB treatment targeting EDB at a hypothetical site with the goal of achieving a plume-wide MNA remedy. CSIA is also applied to support a robust MNA assessment in support of such a remedy.

6.7 SIMPLE AND INFORMATIVE ATTENUATION AND TREATMENT MODEL

As described in Section 5.7.1.5, a simple model was developed using RemChlor (Falta et al., 2007). It used simplified parameters representing past conditions at Kirtland AFB to evaluate degradation and isotope fractionation. This model described the overall trends in EDB concentration and isotope composition at Kirtland AFB reasonably well (see Figure 5.44 and Figure 5.45) and helped illustrate the relative importance of biological and abiotic attenuation processes. While such simple models can be used to guide the evaluation of remedies and otherwise provide informative insights, they appear unlikely to supplant more advanced and complex modeling efforts when these are available. For example, parties at Kirtland AFB have invested significant resources in more complex and site-specific models that are able to represent much more dynamic conditions; and these are being used to evaluate ongoing efforts (USACE, 2020).

7.0 COST ASSESSMENT

This section is intended to provide a reasonable cost estimate for achieving a plume-wide MNA remedy at a hypothetical site where EDB is the main regulatory driver. For purposes of this estimate, this is accomplished through anaerobic ISB treatment in the source area together with advanced characterization of downgradient areas of the plume. Due to the depth of groundwater table at Kirtland AFB, it was not considered a model site for the purpose of this cost assessment.

The cost estimate described here includes labor for remedial design; labor and per diem for bioremediation amendment injection and field sampling personnel; materials and supplies for amendment injection and groundwater sample collection; driller subcontract costs for amendment injection; and basic geochemistry, VOC/EDB, microbial, and CSIA laboratory analysis. The assessment does not include monies spent during the remedial investigation phase, including initial site characterization and monitoring well installation; work plan development; project management; and site-specific costs such as permitting and IDW management, as all these costs are assumed to be similar for projects of this size.

Figure 7.1 presents a layout for the hypothetical site used for the cost assessment. The source area is approximately 100 ft in length and 70 ft wide (~5,500 ft2) and includes EDB at concentrations similar to that measured at KAFB pilot test area (~50-400 µg/L) in the saturated zone, while the downgradient plume extends approximately one-half mile from the source area and contains lower EDB concentrations (generally less than 1 µg/L but greater than the MCL) than the source area. While not remediation drivers, co-mingled petroleum hydrocarbons are assumed to be present in the source area, causing reducing conditions in the source area groundwater. For purposes of this estimate, vadose zone impacts are expected to no longer impact the groundwater. Site geology is assumed to be sands with some silt, easily accessed with direct push technology (DPT) drilling techniques. Depth to groundwater is assumed to be shallow (~15 ft) and the saturated contaminant zone thickness is approximately 15 ft. We assume that a total of 20 groundwater monitoring wells (see Figure 7.1) were installed to delineate the source area and downgradient plume during prior site investigations, and these same wells will be sampled during the source area biostimulation remedial monitoring period and the advanced characterization sampling required to achieve an MNA remedy for the entire plume.

Based on application rates utilized during the pilot test at KAFB, a solution of WilClear Plus (lactate equivalent of 300 mg/L), DAP (50 mg/L) and water will be injected into the treatment zone of the source area through 14 DPT injection points (see Figure 7.1). Approximately 300 gallons of WilClear Plus and 150 kg of DAP will be mixed with water to a total volume of approximately 38,000 gallons of injectate solution (1/4 of the treatment zone pore volume), which is estimated to be injected over a 5-day period (2 GPM per DPT injection point, injecting into 7 points simultaneously). While bioaugmentation with a known dehalogenating culture (e.g., SDC-9) capable of degrading EDB was not required/utilized at KAFB for the pilot study, the need for bioaugmentation at sites may depend on the outcome of the baseline sampling and remedial design. For the purposes of this cost estimate, bioaugmentation with SDC-9 was included, in order to capture the cost.

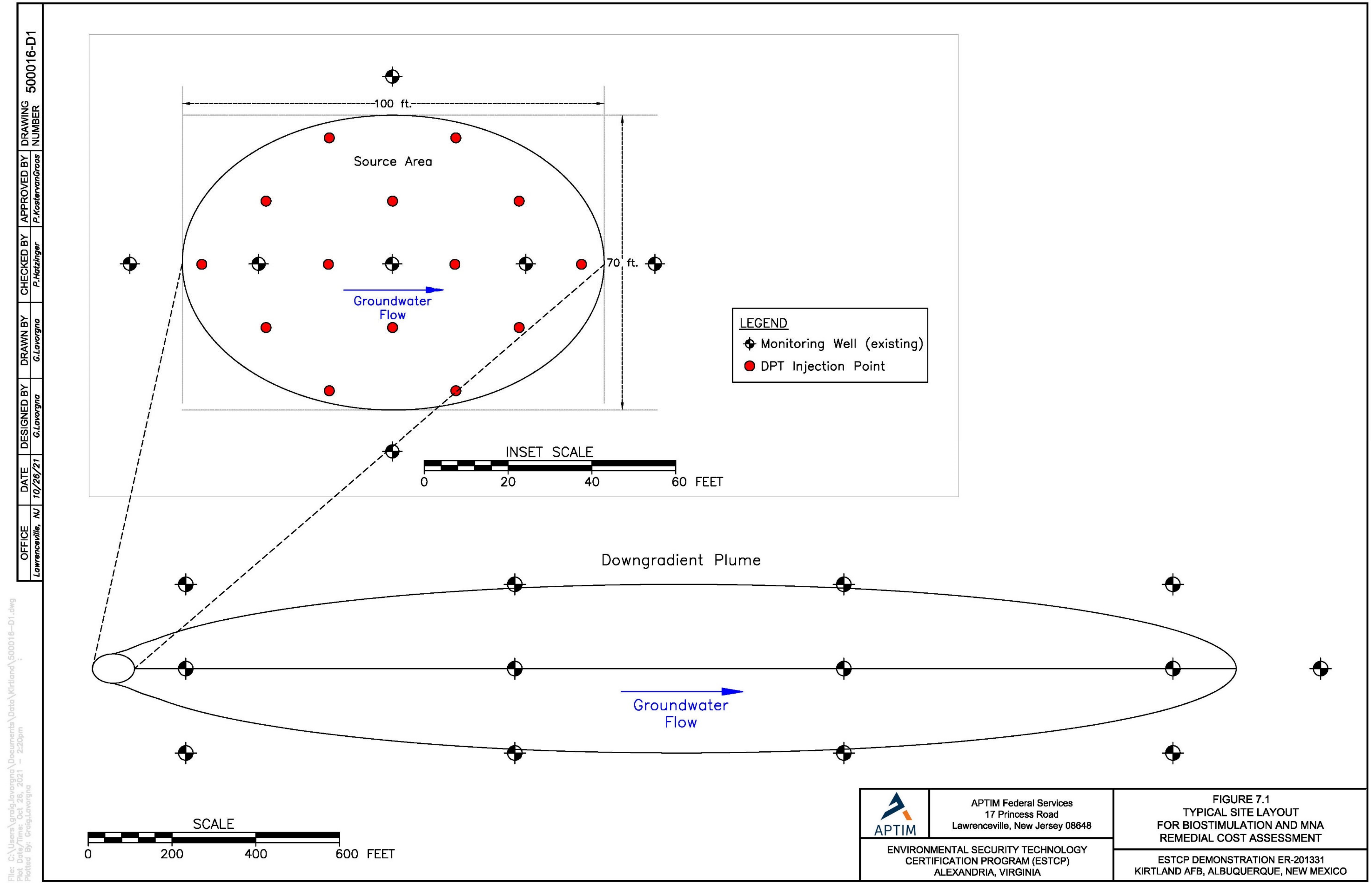

Figure 7.1. Hypothetical Site Layout

The cost estimate includes the mobilization and demobilization of both the DPT rig and necessary injection rig/equipment, along with the daily rates for this equipment to be on-site for 5 days. Costs for WilClear Plus, DAP, and SDC-9 (estimated freight included) are also included in the cost estimate. A second injection event, identical to the initial event, is included at the beginning of Year 2. WilClear Plus (lactate-based substrate) was the selected amendment for the KAFB pilot study and was used for this cost estimate, but other sites could consider emulsified vegetable oil (EVO) or other amendments that have been demonstrated to enhance ISB for chlorinated solvents.

Monitoring of the source area ISB treatment area and downgradient plume are assumed to consist of one baseline sampling event and eight quarterly remedial monitoring events, sampling all twenty site monitoring wells. The intent of this monitoring is to support a site-wide MNA remedy at the end of the two-year remedial monitoring period with strong evidence of EDB degradation.

Presented costs assume that each sampling event will be performed by two field technicians using low-flow sampling techniques, sampling seven wells per day, making each sampling event a duration of three days on-site (five days total including mobilization and demobilization). At each well, basic field parameters (dissolved oxygen, oxidation-reduction potential, pH, conductivity) will be determined using a field meter, and samples will be collected for VOCs (EPA Method 8260), EDB (EPA Method 8011), and anions (EPA Method 300). A subset of wells will be sampled for CSIA of EDB and molecular analysis of important dehalogenating organisms and genes. For the baseline event, it is assumed that three wells in the source area and nine wells in the downgradient plume will be sampled for CSIA of EDB, while all source area wells, and six downgradient wells will be sampled for microbial analysis (QuantArray). QuantArray and CSIA samples will also be collected during the fourth quarter sampling events in each of the two years of remedial monitoring, at four source area wells and two downgradient plume wells. Shipping of sample coolers will occur at the end of each day of sample collection.

Analytical costs for EPA Method 300 ($55 per sample for analysis of 5 anions), EPA Method 8260 ($131 per sample), and EPA Method 8011 ($160 per sample) represent GSA pricing from a national analytical laboratory. The cost of stable isotope analysis of $\delta^{13}C$ values of EDB via 2DGC-CSIA is provided by the University of Oklahoma. Estimated CSIA costs were $500 for source area samples and $600 for low level EDB samples in the downgradient plume. The price for QuantArray is provided by Microbial Insights at $750 per sample.

Table 7.1 provides a breakdown of the total cost by task, including baseline sampling, remedial design, biostimulation injections in Years 1 and 2, and eight quarterly groundwater monitoring events. Costs included are inclusive of all labor costs (base costs, fringe, and overhead), general and administrative (G&A) costs for labor and other direct costs (ODCs; not including travel), and an assumed 7% project fee. The total estimated cost to achieve an MNA remedy for the hypothetical site (source area biostimulation remedy and advanced characterization of the entire plume to achieve a site-wide MNA remedy) is $368,808.

Table 7.1. Cost Estimate Summary for the Hypothetical Site

Task	Descriptive Task Name	Year 1	Year 2	Total
Task 1	Baseline Sampling	$ 37,644	$ -	$ 37,644
Task 2	Remedial Design	$ 11,143	$ -	$ 11,143
Task 3	Biostimulation Injection Year 1	$ 75,327	$ -	$ 75,327
Task 4	Quarterly Sampling Event #1	$ 18,939	$ -	$ 18,939
Task 5	Quarterly Sampling Event #2	$ 18,939	$ -	$ 18,939
Task 6	Quarterly Sampling Event #3	$ 18,939	$ -	$ 18,939
Task 7	Quarterly Sampling Event #4	$ 27,589	$ -	$ 27,589
Task 8	Biostimulation Injection Year 2	$ -	$ 75,439	$ 75,439
Task 9	Quarterly Sampling Event #5	$ -	$ 19,051	$ 19,051
Task 10	Quarterly Sampling Event #6	$ -	$ 19,051	$ 19,051
Task 11	Quarterly Sampling Event #7	$ -	$ 19,051	$ 19,051
Task 12	Quarterly Sampling Event #8	$ -	$ 27,696	$ 27,696
	Total	**$ 208,521**	**$ 160,287**	**$ 368,808**

8.0 IMPLEMENTATION ISSUES

Issues encountered during this project did not impact any conclusions drawn. Implementation issues encountered that may deserve consideration included the following:

- ***CSIA measurements affected by high concentrations of non-target VOCs.*** The improved CSIA method targeting low concentrations of EDB was effective when non-target VOC concentrations were low, such as in downgradient zones. Use of this more sensitive CSIA method was very effective for documenting past EDB degradation in more dilute zones where EDB approached its MCL of 0.05 μg/L. In more impacted source zones, however, high concentrations of non-target VOCs (e.g., benzene > 1 mg/L) precluded use of the low-concentration CSIA approach and isotopic evidence of EDB degradation was more limited as a result.

- ***Fouling of the groundwater recirculation system***. Fouling can impact in situ treatment systems, and fouling of inline filters and extraction/injection wells became a challenge towards the end of this demonstration. To mitigate such issues during future bioremediation applications, automated or periodic biocide treatments to limit microbial biomass accumulation within filters and injection wells can be considered. Careful consideration of biocide type, dosage concentration, and volume is necessary to avoid adversely affecting the ISB remedy. The injection and extraction well heads should be constructed in such a manner that the piping can be easily removed for periodic well rehabilitation efforts, if/when needed. At shallower sites, alternative approaches for distributing amendments less sensitive to fouling, such as direct-push technology, can also be considered.

- ***Crystallization within the amendment distribution system pump/piping and the injection well***. Upon startup of the amendment distribution system, a leak was observed at the chemical feed pump. The pump head and four-way valve were dismantled, and small crystals were observed within the check ball housings and on the check balls within the four-way valve. This crystallization likely occurred due to high concentrations of potassium iodide, DAP, and WilClear Plus in the amendment tank. To avoid the crystallization issue while continuing introduction of the amendments at the target rates, amendment concentrations were decreased, and the chemical feed pump was operated more frequently. To avoid such issues, amendments mixtures should be tested in advance, or otherwise introduced at separate points in the process stream. Careful consideration regarding the amendment dosage and pumping frequency should be made during system design to avoid these crystallization issues while still adding the desired quantities of the amendments to the subsurface.

- ***Dedicated bladder pump materials of construction failure***. Dedicated stainless-steel bladder sampling pumps were originally installed at pilot test monitoring wells. Multiple failure points were observed soon after pump installation and initial testing. The pumps were constructed of primarily stainless-steel parts, but corrosion of some of the individual stainless-steel parts (including the check valve balls and intake screens) was observed and presumed to have led to failure (inability to pump groundwater to the ground surface for sampling). These pumps were replaced with another make/model with different materials of construction (PVC). It was unusual to observe such failure of stainless-steel pumps, but it demonstrates that pump selection and testing using site materials/water may be beneficial during design.

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APPENDIX B ETHYLENE DIBROMIDE IN SITU BIODEGRADATION PILOT TEST REPORT (USACE, 2021)

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

FINAL
ETHYLENE DIBROMIDE *IN SITU* BIODEGRADATION PILOT TEST REPORT, REVISION 1
BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111
KIRTLAND AIR FORCE BASE, NEW MEXICO

March 2021

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KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

FINAL
ETHYLENE DIBROMIDE *IN SITU* BIODEGRADATION PILOT TEST REPORT, REVISION 1

BULK FUELS FACILITY
SOLID WASTE MANAGEMENT UNITS ST-106 AND SS-111

March 2021

Prepared for
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14. ABSTRACT

This Ethylene Dibromide *In Situ* Biodegradation Pilot Test Report has been prepared to describe activities and data associated with the ethylene dibromide (EDB) *in situ* biodegradation pilot test. The pilot test described herein was conducted to investigate anaerobic *in situ* bioremediation (ISB) of 1,2-dibromoethane (i.e., ethylene dibromide; EDB). ISB, with and without bioaugmentation, is a common remedial approach to treat chlorinated solvents such as trichloroethene and is a promising technology for promoting the degradation of EDB to nontoxic products. The efforts described herein evaluated the extent to which potential treatment amendments for *in situ* biostimulation enhanced anaerobic EDB biodegradation processes.

EDB degradation was evident during the pilot test with a greater than three-log reduction (99.9 percent) to below the United States Environmental Protection Agency maximum contaminant level of 0.05 micrograms per liter at wells KAFB-106MW2-S and KAFB-106064 after biostimulation efforts. EDB degradation was evident through comparison with benzene and toluene concentrations, and the production of EDB degradation products ethene, ethane, and bromide suggested that this degradation occurred by reductive debromination. Higher EDB delta carbon-13 values (observed to be as high as +5‰ or per mil) provided additional isotopic evidence of EDB degradation.

15. SUBJECT TERMS

Bulk Fuels Facility; Pilot Test Report; well installation; well development; surveying; treatment system design, construction, and operation; groundwater sampling; analytical results.

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14 March 2021

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Date

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KIRTLAND AIR FORCE BASE
377th Air Base Wing Public Affairs

Date

PREFACE

This Ethylene Dibromide *In Situ* Biodegradation Pilot Test Report has been prepared by Aptim Federal Services, LLC (APTIM) for Kirtland Air Force Base under U.S. Army Corps of Engineers (USACE), Contract Number W912DY16D0022, Delivery Order W912PP19F0053. It pertains to the Kirtland Air Force Base Bulk Fuels Facility, Solid Waste Management Units ST-106 and SS-111 located in Albuquerque, New Mexico. This report was prepared in accordance with applicable federal, state, and local laws and regulations, including the New Mexico Hazardous Waste Act, New Mexico Statutes Annotated 1978, the New Mexico Water Quality Act, New Mexico Hazardous Waste Management Regulations, Resource Conservation and Recovery Act, and the Water Quality Control Commission Regulations.

This Pilot Test Report presents and describes all activities and data associated with the ethylene dibromide *in situ* biodegradation pilot test.

Kathleen E Romalia

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Kathleen Romalia
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Project Manager

CONTENTS

Section **Page**

APPENDICES

FIGURES

Figure

FIGURES (concluded)

Figure

TABLES

Table

ACRONYMS AND ABBREVIATIONS

%	percent
µg/L	microgram per liter
µm	micron
‰	per mil
^{13}C	carbon-13, stable isotope of carbon
$^{2}H_2O$	deuterium oxide, deuterated water
AFB	Air Force Base
APS	sulfate reducing bacteria
APTIM	Aptim Federal Services, LLC
ARCH	Air Rotary Casing Hammer
AvGas	aviation gasoline
BFF	Bulk Fuels Facility
bgs	below ground surface
Calcon	Systems Inc.
cells/mL	cells per milliliter
CSIA	compound-specific isotope analysis
DAP	diammonium phosphate
DCM	*Dehalobacter* DCM
DHBt	*Dehalobacter* spp.
DHC	*Dehalococcoides*
DHG	*Dehalogenimonas* spp.
DI	deionized
DO	dissolved oxygen
DSB	*Desulfitobacterium* spp.
DTIC	Defense Technical Information Center
EBAC	total eubacteria
EDB	ethylene dibromide/1,2-dibromoethane
EPA	United States Environmental Protection Agency
ESTCP	Environmental Security Technology Certification Program
FCV	flow control valve
Fe	iron
FFOR	Former Fuel Offloading Rack
gpm	gallon per minute
IDW	investigation-derived waste
ISB	*in situ* bioremediation
JP-4	jet propellant fuel grade 4
JP-8	jet propellant fuel grade 8
KAFB	Kirtland Air Force Base

KI	potassium iodide
MCL	maximum contaminant level
mg/kg	milligram per kilogram
mg/L	milligram per liter
MGN	methanogens
NAPL	non-aqueous phase liquid
NMED	New Mexico Environment Department
No.	number
OOM	order of magnitude
ORP	oxidation-reduction potential
OSE	Office of the State Engineer
P&ID	piping and instrumentation diagram
Pace	Pace Analytical®
PID	photo ionization detector
PM	Project Manager
PVC	polyvinylchloride
QED	QED Environmental Systems
RCRA	Resource Conservation and Recovery Act
Report	Ethylene Dibromide *In Situ* Biodegradation Pilot Test Report
SCADA	Supervisory Control and Data Acquisition
SDC-9	debrominating culture
SWMU	Solid Waste Management Unit
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VOC	volatile organic compound
Work Plan	Ethylene Dibromide *In Situ* Biodegradation Pilot Test Work Plan
$\delta^{13}C$	delta carbon-13 (measure of carbon isotope composition)
$\delta^{2}H$	delta deuterium (measure of hydrogen isotope composition)

EXECUTIVE SUMMARY

This Ethylene Dibromide *In Situ* Biodegradation Pilot Test Report (Report) was prepared to describe activities and data associated with the pilot test conducted at the Bulk Fuels Facility (BFF) on Kirtland Air Force Base (AFB) in accordance with the New Mexico Environment Department (NMED) letter dated February 25, 2019 (NMED, 2019). The BFF site was the location of an accidental leak of aviation gasoline and jet propellant fuel grades 4 and 8 that was discovered in 1999. Based on historical Air Force fuel usage, aviation gasoline containing ethylene dibromide/1,2-dibromoethane (EDB) as a lead scavenger would have been in use from approximately the 1940s to 1975 (Kirtland AFB, 2011a). The investigation and remediation of the BFF leak (Solid Waste Management Units ST-106 and SS-111) is being implemented pursuant to the Resource Conservation and Recovery Act (RCRA) corrective action provisions in Part 6 of the Kirtland AFB Hazardous Waste Treatment Facility Operating Permit (Permit Number NM9570024423, referred to as the RCRA Permit) (NMED, 2010). This pilot test was performed pursuant to the NMED-approved Ethylene Dibromide *In Situ* Biodegradation Pilot Test Work Plan (Work Plan; Kirtland AFB, 2016a) and Phase 3 Notification Letter (Kirtland AFB, 2018a).

This stand-alone Executive Summary briefly summarizes the pilot test objectives, construction activities, results, and conclusions of this Report. Sections 1 through 3 of the main Report describe the activities performed during the implementation of the pilot test. Section 4 describes pilot test analytical results and performance. Section 5 provides conclusions.

The pilot test was conducted to investigate anaerobic *in situ* bioremediation of EDB in groundwater associated with the BFF site. *In situ* bioremediation, with and without bioaugmentation, is a common remedial approach to treat chlorinated solvents such as trichloroethene and is a promising technology for promoting the degradation of EDB to nontoxic products. The pilot test was primarily designed to evaluate the extent to which potential treatment amendments for *in situ* biostimulation and bioaugmentation enhance anaerobic EDB biodegradation processes.

Site preparation activities, mobilization, and installation of the Pilot Test System were performed from September 2016 through May 2017. Construction of the Pilot Test System consisted of the installation and development of seven wells; construction of underground piping, conduit, and direct buried electrical lines, and the installation of the system control building with required electrical service and components.

The pilot test utilized one injection, two extraction, and six monitoring wells, including existing monitoring wells KAFB-106064 and KAFB-106063 (nine wells total) (Figure ES-1). Well KAFB-106IN1 was installed and used as an injection well for recirculated groundwater and amendment injection; wells KAFB-106EX1 and KAFB-106EX2 were installed and used as groundwater extraction wells; and existing wells KAFB-106064 and KAFB-106063, and new nested wells KAFB-106MW1-S, KAFB-106MW1-I, KAFB-106MW2-S, and KAFB-106MW2-I were used as monitoring wells. The new shallow groundwater monitoring wells (KAFB-106MW1-S and KAFB-106MW2-S) are screened with 15 feet above the static water table and 20 feet extending below the water table, as measured at the time of well installation. The new intermediate wells (KAFB-106MW1-I and KAFB-106MW2-I) were installed within the intermediate groundwater zone are screened 35 feet below the water table.

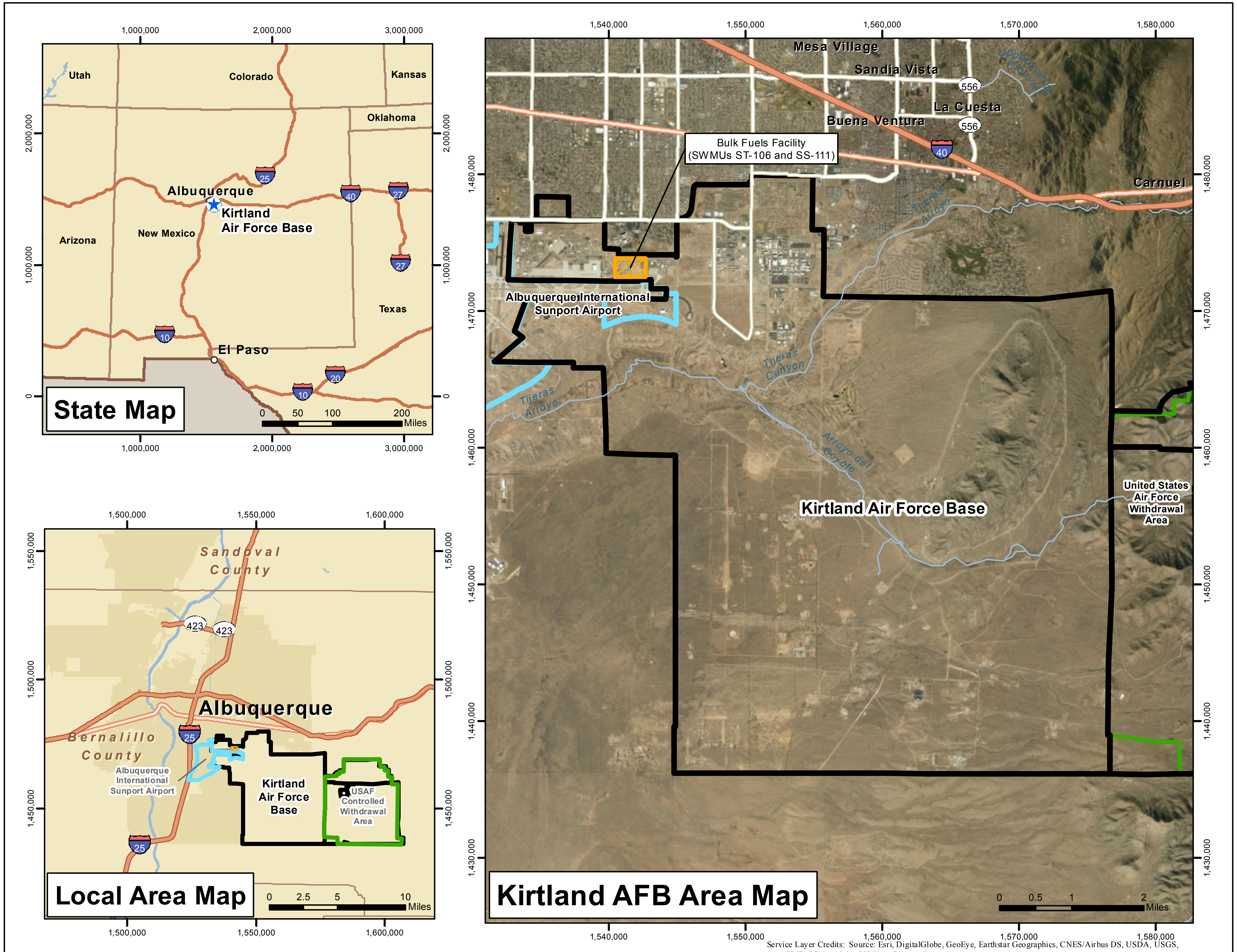
The system for amending and recirculating groundwater was designed by Aptim Federal Services, LLC, together with subcontractors, and was fabricated by Calcon Systems Inc. The system is contained within a 20-foot long Conex box. The Conex box has a partition wall, separating the enclosure into two spaces. The smaller of the two spaces is the system control room that houses the supervisory control and data acquisition system with integrated computer, electrical control panel, Baski flow control valve controls and associated nitrogen cylinder, and a combination air conditioner/heater. The larger space houses system process components. Shakedown testing was performed on May 16 through 17, 2017 prior to full system start-up.

The pilot test was implemented in four phases, each briefly described below:

- Phase 1—Evaluation of baseline conditions and the distribution of recirculated water using tracer amendments.
- Phase 2—Evaluation of biostimulation in the subsurface after distribution of treatment amendments in recirculated groundwater.
- Phase 3— Additional evaluation of biostimulation in the subsurface after distribution of treatment amendments in recirculated groundwater.
- Phase 4—Extended monitoring with no addition of amendments or recirculation of groundwater.

Groundwater samples were collected intermittently at extraction, injection, and the six groundwater monitoring wells during the active and the passive portions of the phases, except for Phase 4, which did not include an active recirculation portion. Samples were sent to numerous analytical laboratories for analysis.

Per the Work Plan (Kirtland AFB, 2016a), Phase 3 was to consist of both biostimulation and bioaugmentation with a known debrominating culture (SDC-9); however, after review of field results from both Phase 1 and Phase 2, it was determined that bioaugmentation was not yet warranted. Due to the success of biostimulation during Phase 2, Phase 3 was modified to further evaluate biostimulation and a Phase 3 Notification Letter was submitted to the NMED on July 26, 2018. The modified Phase 3 was approved by the NMED in a letter dated August 7, 2018 (NMED, 2018), which also stated that "bioaugmentation shall remain as an approved, but deferred component of the pilot test."



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Installation Location
- Kirtland Air Force Base Installation Boundary
- Bulk Fuels Facility (SWMUs ST-106 and SS-111)
- Albuquerque International Sunport Airport
- United States Air Force Withdrawal Area
- Major Highways
- Highways
- Major Roads
- Rivers
- Urban Areas
- Counties
- States

SWMUs = Solid Waste Management Unit
AFB = Air Force Base
USAF = United States Air Force

N

Revision Date: 02/20/19

Projection : NAD83 State Plane New Mexico Central FIPS3002 Feet

ETHYLENE DIBROMIDE IN SITU BIODEGRADATION
PILOT TEST REPORT
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE ES-1

AREA LOCATION MAP

H:\Kirtland_AFB\GIS_Documents\Project_Maps_bak\EDIB_Pilot_Test_Report\KAFB_001_loc_map.mxd 02/20/19

The results for the four phases of the pilot test are summarized below:

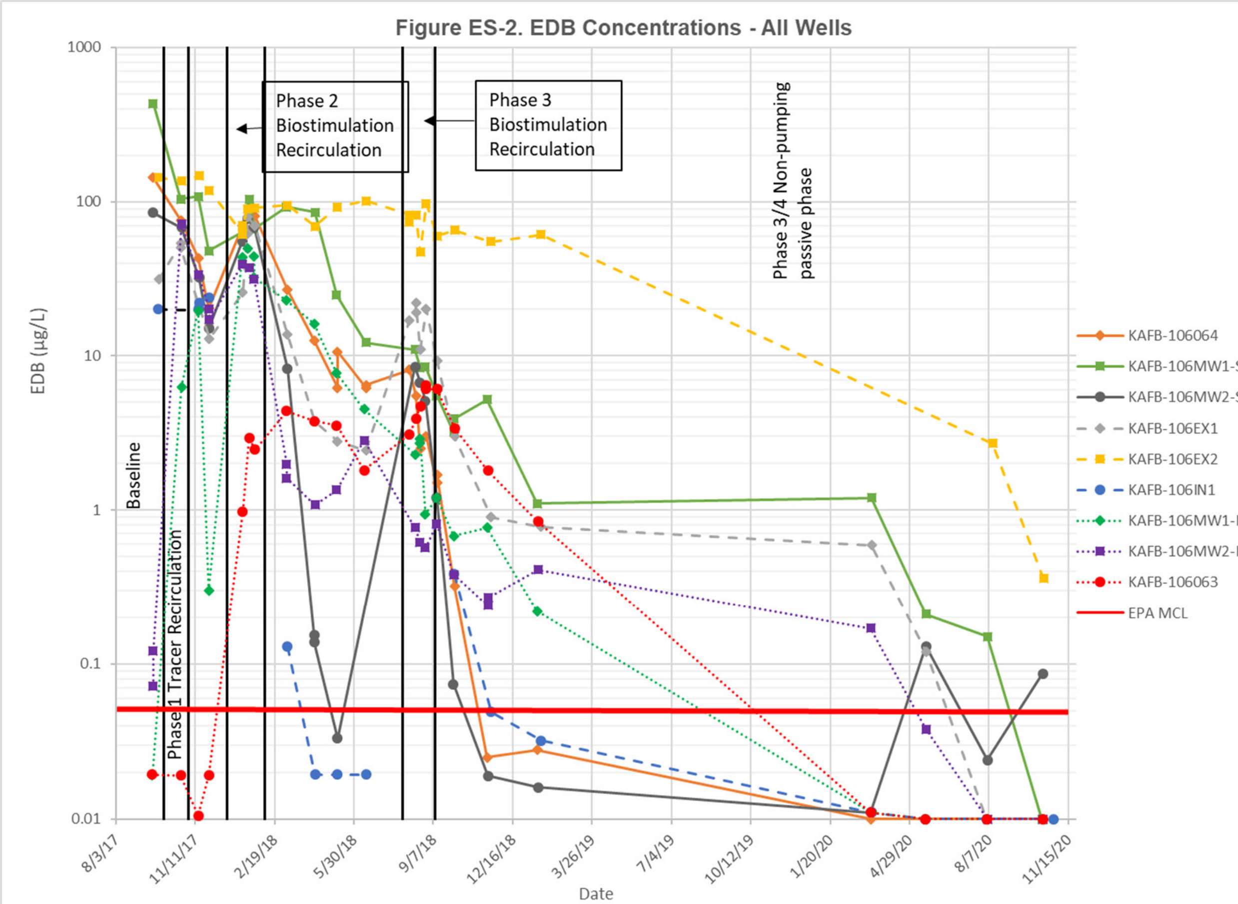
- EDB concentrations at shallow monitoring wells during the baseline evaluation ranged from 20.1 micrograms per liter (µg/L) at KAFB-106IN1 to 432 µg/L at KAFB-106MW1-S, and among the intermediate wells EDB was only detected at KAFB-106MW2-I with a concentration of 0.122 µg/L. EDB concentrations are shown on Figure ES-2. Baseline microbial results indicated that the subsurface was biologically active prior to pilot test activities.

- EDB concentrations at shallow monitoring wells during the Phase 1 (tracer test) recirculation period ranged from 50.4 µg/L (KAFB-106EX1) to 137 µg/L (KAFB-106EX2) (Figure ES-2). EDB concentrations at the shallow monitoring wells decreased during the following Phase 1 passive period, with EDB reductions of approximately 75 percent (%) observed at wells KAFB-106064 (20.1 µg/L), KAFB-106EX1 (12.9 µg/L), and KAFB-106MW2-S (15 µg/L) after the one-month passive period (Figure ES-2). Biostimulation amendments were not added during Phase 1. The results from tracer test during Phase 1 indicated that the targeted treatment zone encompassing the shallow groundwater monitoring wells were hydraulically connected with the injection well. Distribution of tracers to groundwater sampled by monitoring wells nearest to the injection well (KAFB-106MW2-S and KAFB-106064) occurred within 5 days of operation, suggesting a high likelihood of successfully distributing biostimulation amendments that help facilitate reductive debromination of EDB.

- During the Phase 2 (biostimulation) recirculation period, the range of EDB concentrations observed at shallow monitoring wells was less variable, ranging from 66.4 µg/L at KAFB-106MW1-S to a maximum of 90.9 µg/L at KAFB-106EX2 (Figure ES-2). EDB was detected at the intermediate monitoring wells during the Phase 2 recirculation period. Except for KAFB-106EX2, EDB concentrations decreased during the Phase 2 passive period by approximately 90 percent (%) or more with concentrations down to below detection limits (KAFB-106IN1, KAFB-106MW2-S).

- During the Phase 3 (biostimulation) recirculation period, the range of EDB concentrations observed at shallow monitoring wells was more variable than during the Phase 2 recirculation period, ranging from approximately 3 µg/L at KAFB-106064 to a maximum of 97 µg/L KAFB-106EX2 (Figure ES-2). Except for KAFB-106EX2, EDB concentrations during the subsequent passive period decreased by 95% or more relative to maximums observed during the preceding recirculation period, with concentrations ranging down to 0.019 µg/L (KAFB-106MW2-S).

- There was little evidence of significant increases in EDB concentrations (i.e., rebound) during Phase 4 sampling events, which concluded in October 2020. Based on iodide tracer concentrations, groundwater transport in the vicinity of the pilot test appeared limited during this period. During Phase 4, EDB concentrations ranged from 0.016 µg/L at KAFB-106MW2-S to 62 µg/L at KAFB-106EX2. EDB decreased at KAFB-106EX2 relative to the concentration measured during the first Phase 4 sampling event in January 2019 (62 µg/L) with a final EDB concentration of 0.36 µg/L measured during the October 2020 sampling event.



EDB degradation was evident during the pilot test with a greater than two-log reduction (>99%) at all wells examined. In October 2020, EDB concentrations at all but two wells were below the United States Environmental Protection Agency (EPA) maximum contaminant level (MCL) of 0.05 µg/L (EPA, 2009). The two wells exceeding the EPA MCL for EDB in October 2020 were KAFB-106MW2-S (0.087 µg/L) and KAFB-106EX2 (0.36 µg/L). EDB degradation was evident through comparison with benzene and toluene concentrations, and the production of EDB degradation products ethene, ethane, and bromide suggested that this degradation occurred by reductive debromination. Dissolved oxygen, sulfate, iron, and methane concentrations observed throughout much of the pilot test indicated that bulk anaerobic conditions generally considered to be necessary for reductive debromination were present. Higher EDB delta carbon-13 values (observed to be as high as +5 per mil) provided additional isotopic evidence of EDB degradation.

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1. INTRODUCTION

This *Ethylene Dibromide In Situ Biodegradation Pilot Test Report* (Report) has been prepared by Aptim Federal Services, LLC (APTIM) for Kirtland Air Force Base (AFB) under the U.S. Army Corps of Engineers (USACE) Contract Number (No.) W912DY16D0022, Delivery Order W912PP19F0053. The test described in this Report was implemented at the Kirtland AFB Bulk Fuels Facility (BFF) site, Solid Waste Management Units (SWMUs) ST-106 and SS-111. The investigation and remediation of the BFF leak (SWMUs ST-106 and SS-111) is being implemented pursuant to the Resource Conservation and Recovery Act (RCRA) corrective action provisions in Part 6 of the Kirtland AFB Hazardous Waste Treatment Facility Operating Permit (Permit No. NM9570024423, referred to as the RCRA Permit) (New Mexico Environment Department [NMED], 2010). This pilot test was performed pursuant to the *Ethylene Dibromide In Situ Biodegradation Pilot Test Work Plan* (Work Plan; Kirtland AFB, 2016a) and the Phase 3 Notification Letter (Kirtland AFB, 2018a).

This pilot test was conducted to investigate anaerobic *in situ* bioremediation (ISB) of 1,2-dibromoethane (i.e., ethylene dibromide [EDB]). ISB, with and without bioaugmentation, is a common remedial approach to treat chlorinated solvents such as trichloroethene and is a promising technology for promoting the degradation of EDB to nontoxic products. This pilot test was designed to evaluate the use of *in situ* biostimulation to enhance anaerobic EDB biodegradation processes.

1.1 Pilot Test Objectives

The primary objective of this pilot test was to evaluate the extent to which potential treatment amendments for ISB enhance anaerobic EDB biodegradation processes. Evaluation of the test was completed through comprehensive groundwater sampling that assessed both direct and indirect indicators of EDB biodegradation.

1.2 Site Description

Kirtland AFB is located in Bernalillo County, in central New Mexico, southeast of and adjacent to the City of Albuquerque and the Albuquerque International Sunport (Figure 1). The approximate area of the base is 52,287 acres, and it is bordered by Albuquerque to the north and west, the Isleta Pueblo Reservation to the south, and the Cibola National Forest to the east. The BFF site is located in the northwestern part of Kirtland AFB, and is comprised of two SWMUs, designated as ST-106 and SS-111. The pilot test was performed near the EDB contaminant source in an undeveloped area just south of Randolph Road, at the location identified on Figure 2.

The pilot test area included groundwater injection, extraction, and monitoring wells installed near the existing monitoring well cluster that includes Kirtland AFB (KAFB)-106062, KAFB-106063, and KAFB-106064, approximately 300 feet to the east of Building 1024 (Figure 2). The water table at the test location occurs at approximately 480 feet below ground surface (bgs), and the pilot test groundwater wells are screened in the shallow and intermediate zones of the aquifer within the Santa Fe Group. Well screens of the shallow monitoring wells were placed to target the highest EDB concentrations (i.e., approximately the top 20 feet of the aquifer), located in a zone of inter-bedded sands and gravels with occasional finer layers, and groundwater extraction and injection primarily facilitated flow in the soil materials of greatest hydraulic conductivity.

1.3 Site History

The BFF site was the location of a historical, accidental release of aviation gasoline (AvGas) and jet propellant fuel grades 4 (JP-4) and 8 (JP-8). Historical aerial photography revealed that the area was used for fuel storage and processing as early as 1951 (CH2M HILL, 2001). From 1953 to late 1975, the primary fuel stored and used at the BFF was AvGas. The use of AvGas and JP-4 at Kirtland AFB was phased out in 1975 and 1993, respectively (Kirtland AFB, 2011a). JP-8 was handled through the Former Fuel Offloading Rack (FFOR) until the leak was discovered in 1999.

Based on historical Air Force fuel usage, AvGas containing EDB as a lead scavenger would have been in use from approximately the 1940s to 1975. EDB is a suspected human carcinogen that was historically added to leaded fuels to prevent the build-up of lead oxide deposits in engines, including aircraft engines.

The fuels are thought to have leaked undetected over approximately 3 to 4 decades at the FFOR through leak points during fuel transfer. The released fuel migrated through the vadose zone to eventually reach the water table. The migration followed a disjointed, meandering path caused by subsurface heterogeneity, where frequent changes in the alluvial lithology and confining layers created preferential flow pathways. This resulted in non-uniform residual contamination of the vadose zone and measurable non-aqueous phase liquid (NAPL) on the surface of the underlying unconfined aquifer. The presence of NAPL fuel hydrocarbons on the water table indicated that substantial releases had occurred.

1.4 Site Conditions

The historical water table in the vicinity of Kirtland AFB was estimated to be approximately 350 feet bgs before extensive groundwater pumping from the regional aquifer occurred. Throughout the history of the BFF site, the water table has fallen due to groundwater pumping to supply drinking water to the residents of Albuquerque. The deepest depth to water, representing the lowest historical groundwater elevation, measured at groundwater wells in the BFF source area ranged from approximately 500 to 502 feet bgs in 2009. In recent years, the water table has been rising due to water-conservation efforts by the Albuquerque community and reduction of pumping of production wells by Albuquerque Bernalillo County Water Utility Authority. As a result, the current vadose zone at the BFF site is approximately 455 to 480 feet thick.

The background gradient at the pilot test location is small and pumping of wells and reinjection during pilot test operations induced gradients exceeding that of the background. Based on data reviewed for the pilot test design, the groundwater gradient in the pilot test area was less than 0.002 foot/foot (First Quarter

2016), and the direction of groundwater flow had shifted from north-northeast to a more east-southeast direction, likely due to continuing water-conservation practices and seasonal fluctuations, as discussed in the Second Quarter 2018 Quarterly Monitoring Report (Kirtland AFB, 2018b).

Prior to the pilot test during quarterly sampling in 2014 and 2015, groundwater samples were collected from 13 monitoring wells to analyze the *in situ* microbial community at Kirtland AFB using Microbial Insight's QuantArray-Chlor protocol. The method of collection and analysis has been discussed in previous quarterly reports, which can be found on the Air Force Administrative Records site (http://afcec.publicadmin-record.us.af.mil/Search.aspx). Results indicated that microorganisms likely to dehalogenate EDB, or its chlorinated analog 1,2-dichloroethane, are present in the subsurface. EDB biodegradation activity, however, was not readily stimulated during ex situ treatability tests, but bioaugmentation with a known debrominating culture (SDC-9) significantly enhanced EDB degradation rates during the same tests (Figure 3). The inability to stimulate biodegradation activity during treatability tests may have resulted from the lack of viable debrominating organisms in the collected samples or other challenges simulating subsurface conditions in the lab. The success with a bioaugmentation culture, however, demonstrated that viable debrominating organisms could degrade EDB in the presence of site soils and groundwater. These results indicated that ISB showed promise for enhancing EDB degradation at Kirtland AFB, either through stimulation of the indigenous dehalogenating organisms that were observed to be present *in situ*, or through bioaugmentation with an exogenous debrominating culture (e.g., SDC-9). The pilot test performed here was designed to test both biostimulation and bioaugmentation options, as appropriate. Biostimulation was successful at pilot test scale in the field and bioaugmentation with an exogenous culture was not performed.

1.5 Report Organization

This Report contains a detailed summary of the pilot test implementation, including design considerations, field activities, and a comprehensive documentation of results. The remainder of this Report contains the following sections:

- Section 2 – Pilot System Design and Construction
- Section 3 – Pilot System Operation and Monitoring
- Section 4 – Pilot Test Results
- Section 5 – Conclusions

Figures, tables, and appendices are available following the body of this Report.

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2. PILOT SYSTEM DESIGN AND CONSTRUCTION

Site preparation activities, mobilization, and installation of the Pilot Test System were performed from September 2016 through May 2017. Construction of the Pilot Test System consisted of well installation and development; installation of underground piping, conduit, and direct buried electrical lines; and installation of the system control building with required electrical service and components. Appendix B includes 20 representative photographs of various site activities.

2.1 Permitting

Prior to initiating construction activities, the following permits were obtained:

- Kirtland AFB Dig Permit (utility clearance)
- Kirtland AFB Civil Engineer Work Permit
- Office of the State Engineer (OSE) Drill and Install Permit
- OSE Change of Water Rights
- Albuquerque Environmental Health Department Fugitive Dust Permit

One dig permit (Air Force Form 103) was submitted to Kirtland AFB on July 20, 2016 for well installation and trenching for utilities associated with the system. The dig permit was approved on August 15, 2016, and a permit number was issued (1607-014).

Surface disturbances at the pilot test location totaled an area greater than ¾ acre and required submittal of a Fugitive Dust Permit Application, which was submitted to the Albuquerque Environmental Health Department on May 12, 2014, prior to initiation of excavation activities, in accordance with 20.11.20

New Mexico Administrative Code. The permit application was approved, and the Fugitive Dust Permit (6621-C) was issued on May 14, 2014.

Two separate permits to “Drill a Well with No Consumptive Use of Water” were submitted to the OSE for monitoring wells, and extraction and injection wells, respectively. Permits were issued for the monitoring wells on November 17, 2016 and for the extraction and injection wells on August 15, 2016. An “Application for Permit to Change an Existing Water Right” was also submitted to the OSE for the extraction and injection wells. The intention of the change of water rights permit was not to increase the allowable groundwater diversion described in RG-1579 through RG-1589, but rather to change the purpose of use to pollution control and recovery, and by adding places of use not currently described in the Kirtland AFB water rights (RG-1579 through RG-1589) for the extraction and injection wells. The change of water rights application was approved by the OSE on December 7, 2016.

Additionally, a Notice of Intent was submitted to the NMED Ground Water Quality Bureau on October 26, 2016 to determine whether a Discharge Permit was required, in accordance with the requirements found in 20.6.2.1201.A New Mexico Administrative Code. NMED Ground Water Quality Bureau determined that a Discharge Permit was not required for pilot test activities in a letter dated December 16, 2016. Appendix C includes all relevant permits.

2.2 Utility Clearance

Prior to the initiation of construction activities, a utility clearance was undertaken at the pilot test site by High Mesa Consulting Group (under subcontract to APTIM) in September 2016. Kirtland AFB utility representatives also performed a utility locate in order to process the submitted dig permits.

2.3 Well Design and Installation

The pilot test utilized one injection, two extraction, and six monitoring wells, including existing monitoring wells KAFB-106064 and KAFB-106063 (nine wells total). Well KAFB-106IN1 was installed and used as an injection well for recirculated groundwater, tracer, and amendment injection; wells KAFB-106EX1 and KAFB-106EX2 were installed and used as groundwater extraction wells; and existing wells KAFB-106064 and KAFB-106063, and new nested wells KAFB-106MW1-S, KAFB-106MW1-I, KAFB-106MW2-S, and KAFB-106MW2-I were used as groundwater monitoring wells. The pilot test wells, which included KAFB-106063, KAFB-106064, and the seven newly installed wells, are shown on Figure 2. A cross-sectional view illustrating the depths of the pilot test wells is shown on Figure 4.

The pilot test wells were sited to accommodate existing well infrastructure, site utilities, and to facilitate use of existing wells for monitoring. The two extraction wells were located 75 to 92 feet from the single injection well, as shown in Figure 2. As detailed later in this Report, the extraction wells were used to periodically recirculate groundwater during individual phases of the pilot test. The periods of active groundwater recirculation were designed to facilitate the distribution of amendments at the test location. Pumping was halted after sufficient amendment distribution and ISB treatment performance was monitored.

Existing monitoring wells KAFB-106063 (screened from 505 to 520 feet bgs, with top of screen approximately 25 feet below the water table) and KAFB-106064 (screened from 485 to 505 feet bgs, with top of screen approximately 5 feet below the water table) were used for groundwater monitoring during the pilot test, along with the other newly installed wells. The design and locations of the new wells were selected to evaluate EDB biodegradation and were located near the injection well to facilitate evaluating the impacts of biostimulation amendments. The four new monitoring wells were installed within two boreholes utilizing a nested configuration with two wells in each borehole in accordance with the Work

Plan (Kirtland AFB, 2016a). Each borehole contained a shallow well with approximately 15 feet of screen in the vadose zone and 20 feet of screen in the aquifer, along with a deeper well (intermediate) with the top of a 10-foot screen set approximately 35 feet below the water table. Well screen intervals were isolated within the borehole using bentonite seals. Well construction diagrams are presented in Appendix D and general construction information for each well is summarized in Table 1.

The two pairs of nested groundwater monitoring wells, two extraction wells, and one injection well were installed by Cascade Drilling (formerly National Exploration Wells & Pumps) using an Air Rotary Casing Hammer (ARCH) drill rig from January through March 2017.

During borehole advancement, soil cuttings were logged every 5 feet by the site geologist in accordance with the Unified Soil Classification System and American Standard Test Method International D1586-84. Soil drill cuttings from just above and in the saturated zone were screened for presence of NAPL and volatile organic compounds (VOCs) using a photo ionization detector (PID) to collect headspace measurements. Drill cuttings were also visually inspected for evidence of staining. PID readings were recorded on the soil boring logs (Appendix D). Staining was not observed during drilling activities; however, elevated PID readings and fuel-like odors were recorded from depths ranging from 473 feet bgs to 515 feet bgs at the wells.

Soil boring logs and well construction diagrams for monitoring, extraction, and injection wells installed during the pilot test are located in Appendix D. Soil borings were reviewed by a professional geologist and submitted to the OSE, in accordance with well permit requirements. Table 1 presents the completion details for the wells, including surveyed elevations and coordinates, and screen depths. All newly installed well locations are depicted on Figure 2.

2.3.1 Groundwater Monitoring Well Installation

Drilling of groundwater monitoring wells began on January 8, 2017, and was completed on February 16, 2017, using Cascade's ARCH drill rig. The four monitoring wells were installed within two boreholes, utilizing a nested well design in accordance with the Work Plan (Kirtland AFB, 2016a). Well construction diagrams are presented in Appendix D and general construction information for each well is summarized in Table 1.

The two shallow monitoring wells (KAFB-106MW1-S and KAFB-106MW2-S) were constructed with 4-inch diameter, Schedule 80, polyvinyl chloride (PVC) riser pipe; and the two intermediate wells (KAFB-106MW1-I and KAFB-106MW2-I) were constructed with 3-inch diameter, Schedule 80, PVC riser pipe. The shallow and intermediate monitoring wells are nested within a telescoping borehole (13-3/8-inch upper and 11-3/4-inch lower diameter) to a depth of approximately 535 feet bgs. The shallow wells were fitted with 35-foot screens, set with 15 feet of screen in the vadose zone and 20 feet in the aquifer. The placement of the shallow monitoring well screens was intended to account for potential water table rise and allow for future monitoring and characterization activities after the completion of this pilot test in the event it is necessary to support the Corrective Measures Evaluation. The intermediate wells are fitted with 10-foot screens, with top of screen installed approximately 35 feet below the water table. Monitoring wells were equipped with a Schedule 80 PVC flush-threaded end cap installed below the screened interval. Additional well construction details are summarized in Table 1 and Appendix D.

2.3.2 Borehole Deviation and Borehole Abandonment

Upon achievement of total depth at the intended borehole location for KAFB-106MW2 (see Figure 6 of the Work Plan), borehole deviation was evaluated using several tools, including a Reflex EZ-Trac 6122 digital field instrument, a mechanical drift detector (Eastman Whipstock Eastco), and a gyroscopic deviation tool. The deviation was measured and evaluated while the drive casing was in the borehole prior to any well installation activities. The bottom of the borehole was measured to be deviated 26.35 feet, on an azimuth of 113.5 degrees from the north, using the gyroscopic deviation tool. The results from this gyroscopic deviation survey are included in Appendix E. The deviation was likely caused by the casing entry angle, coupled with a change in lithology at 225 feet bgs. Because this borehole was determined to have too large of a vertical deviation, no well infrastructure was installed, and it was abandoned on January 30, 2017. The Borehole Abandonment Activity Report (Kirtland AFB, 2017a) and NMED approval letter have been included in Appendix E.

A second borehole was drilled for well KAFB-106MW2 approximately 10 feet to the northwest of the original, abandoned borehole. The deviation of this second borehole at 520 feet bgs was measured to be 89.7 degrees, which was approximately 3 feet from plumb, within the project specifications of less than 5 feet deviation over the entire depth of the borehole. All other pilot test boreholes were advanced with minor, acceptable deviations that met specifications.

2.3.3 Extraction Well Installation

Drilling of the extraction wells (KAFB-106EX1 and KAFB-106EX2) began on February 21, 2017 and was completed on March 12, 2017, using Cascade's ARCH drill rig. Well construction was completed in accordance with the Work Plan (Kirtland AFB, 2016a). Well construction diagrams are presented in Appendix D and general construction information for each well is summarized in Table 1.

Each extraction well was installed to a total depth of approximately 537 feet bgs. To minimize the likelihood of aeration of extracted water through water table depression during system operation, the two extraction wells were installed with 15-foot long screens, the top of which are located 10 feet below the static groundwater level. Additional design and construction details for the extraction wells are provided in Table 1 and Appendix D. Well vaults are discussed in Section 2.3.5. A KSPI 700 submersible hydrostatic level transducer was installed in the 1.25-inch PVC drop tube at each extraction well.

2.3.4 Injection Well Installation

Drilling of the injection well (KAFB-106IN1) began on March 16, 2017 and was completed on March 20, 2017, using Cascade's ARCH drill rig. The injection well was constructed in the same manner as the extraction wells (see Section 2.3.3) in accordance with the Work Plan (Kirtland AFB, 2016a); however, the injection well was installed with 20 feet of Schedule 80 PVC, 0.010-inch machine slotted screen, with the top of screen at the static groundwater level and extending 20 feet into the water column. A well construction diagram is presented in Appendix D and general construction information for the well is summarized in Table 1. Similar to the extraction wells, a KSPI 700 submersible hydrostatic level transducer was installed in the 1.25-inch PVC drop tube at the injection well.

2.3.5 Extraction and Injection Well Vaults

Fiberglass well vaults were installed to house extraction and injection wellheads, plumbing, fittings, and remote instrumentation necessary for operation and monitoring of the recirculation system. The floor of each vault consists of a poured concrete slab to provide water containment in the event of a leak. An integrated leak detection sensor was installed in each of the three well vaults, to automatically alert system operators and shut down the system in case of a leak. Each vault is approximately 5 feet long, 4 feet wide, and 3.8 feet deep. Each wellhead is located approximately 6 inches from the wall of the vault, and the top of the sanitary seal is located approximately 8 inches from the concrete floor.

Due to the location of the pilot test area being in an open field, traffic-rated vaults were not required. The upper edge of each vault extends approximately 4 inches above grade to protect the vault from surface runoff water intrusion, and has a hinged, locking cover. The well vaults are protected by four steel concrete bollards located at each corner of the vaults.

2.4 Well Development

Development of the groundwater monitoring, extraction, and injection wells was initiated after drilling and construction of all new wells was completed. Because development close to active drilling could cause poor or incomplete well development of the wells, NMED approved postponement of well development until after completion of all well installation activities in an email dated January 30, 2017 (NMED, 2017). Details regarding development of the monitoring, extraction, and injection wells are discussed in the sections below. Well development logs are provided in Appendix D.

2.4.1 Groundwater Monitoring Well Development

Groundwater monitoring well development was conducted in accordance with the Groundwater Investigation Work Plan (Kirtland AFB, 2011b). Well development consisted of surging, bailing, and pumping to remove fine sediment using a small drill rig equipped with a surge block, stainless steel bailer, and electric submersible pump. Development was considered complete when a turbidity of less than 10 nephelometric turbidity units was achieved for water clarity, at least five well volumes were removed from the well plus any additional water that was added to the well during drilling, and field parameters had stabilized. Field water quality parameters were monitored at regular (5- to 10-minute) intervals during pumping and were considered stabilized when the following criteria were met for three consecutive readings: pH within 0.1 pH units, temperature within 1 degree Celsius, and specific conductance within 10 percent (%). Field data were recorded on well development forms by APTIM scientists, as presented in Appendix D.

Liquid investigation-derived waste (IDW) generated during monitoring well development was stored in 275-gallon totes. Waste management and disposal are discussed in Section 3.11.

2.4.2 Extraction Well Development

The extraction wells were developed using Cascade's well development rig. Wells were developed using a combination of methods including bailing, surging, and pumping. Initial bailing was conducted to remove sediment from the borehole and filter pack prior to beginning well development. After initial bailing, mechanical surging and over-pumping was conducted. Field tests for total solids (by Imhoff cone method) were performed, water levels were monitored, and water quality parameters including turbidity measurements were monitored during development. A constant rate test was performed after initial development was completed. Each well was pumped at approximately 20 gallons per minute (gpm) for a period of no less than 180 minutes. Water levels in the extraction well were manually measured to estimate the specific capacity. Additionally, water levels were manually measured in one observation well to monitor drawdown during constant rate testing.

The extraction wells were developed until well efficiency met at least 70% and had a specific capacity of 3 to 5 gpm per foot, at the discretion of the APTIM scientist. Field data were recorded on well development forms by APTIM scientists, as presented in Appendix D.

Purge water IDW generated during development was transferred to 19,000-gallon Baker storage tanks located within the construction yard. Waste management and disposal are discussed in Section 3.11.

2.4.3 Injection Well Development

The injection well was developed using Cascade's well development rig in the same manner as the extraction wells, as described in Section 2.4.2; however, based on the limited effectiveness and low specific capacity (2.3 gpm per foot) achieved after 120 minutes pumping at a rate of 20 gpm, jetting was conducted to further develop the well. The jetting device consisted of four jets and an extraction pump that was attached to the bottom of the device. Jetting was conducted in 1-foot intervals starting at the top of the saturated screen, working downward. Each 1-foot section of screen was jetted for at least 1 minute.

Imhoff cone and water level readings were collected at a frequency of one minute during jetting activities. A 120-minute constant rate test was performed at the injection well after jetting was completed and indicated that the specific capacity of the well had improved. Field data were recorded on well development forms by APTIM scientists, as presented in Appendix D.

Purge water IDW generated during development was transferred to 19,000-gallon Baker storage tanks located within the construction yard. Waste management and disposal are discussed in Section 3.11.

2.4.4 Pump Installation

Dedicated stainless steel Geotech bladder sampling pumps were originally installed in each of the six groundwater monitoring wells being used for the pilot test (KAFB-106064, KAFB-106063, KAFB-106MW1-S, KAFB-106MW1-I, KAFB-106MW2-S, and KAFB-106MW2-I) in March 2017. Multiple failure points were observed on the Geotech pumps during initial pump testing. After numerous unsuccessful attempts to pull, repair, and/or replace faulty pumps, a decision was made to replace the pumps with QED Environmental Systems (QED) MicroPurge® Model P1101HM bladder pumps with PVC bodies. These new QED pumps were installed in the monitoring wells in September 2017 and baseline samples were recollected (Section 3.3). No operational issues were observed from that point forward, except for minor decreases observed in discharge volumes. Decreased discharge volume is common with bladder pumps as the Teflon™ bladder creases overtime with use and is not able to open to full capacity during recharge/filling.

The QED bladder pumps were hung on a poly-coated stainless steel hanging cable such that the pump intake area was set at approximately the middle point of the saturated screen interval. The top of the pump string includes a single aluminum well cap with access to the discharge line, hanging cable, and air-line. This hanging well cap fits into the top of the sanitary well seal. Well tubing is twin-bonded, Teflon™-lined polyethylene tubing and consists of a ¼-inch outside diameter air supply line and a 3/8-inch outside diameter water discharge line. During pump installation at KAFB-106MW1-S, measurable NAPL was detected. A discussion of the NAPL and sampling that occurred is discussed in Section 3.2.

In March 2017 following the successful well development, multi-stage centrifugal stainless steel submersible pumps (Grundfos 25S50-26, 5.5 horsepower) were installed in each extraction well. The extraction well pump intakes were set at 497 feet bgs, approximately 20 feet below the water table (as measured during well installation) and 10 feet above the total depth of the well to allow sufficient room for drawdown during pumping. The pumps are attached to approximately 500 feet of 1.5-inch threaded steel pipe, which were attached to a 6-inch sanitary well seal at the top of each well casing. Corrosion of the pumps and pipe materials was minimized through use of corrosion resistant materials and the installation of sacrificial zinc anodes on the drop pipes.

A 6-inch sanitary well seal and a 1.5-inch-diameter threaded steel pipe were installed in the injection well casing to convey water from the piping exiting the system Conex box to the screened interval of the injection well. The injection pipe extended down into the water column and was fitted with a 4-inch diameter, custom designed and fabricated down-hole flow control valve (FCV, manufactured by Baski, Inc.) which provided backpressure to ensure that piping remained full of water throughout the treatment system. This limited the risk of cavitation within the pipe, minimized volatilization of constituents, and minimized aeration of the anaerobic recirculation water. A check valve was installed at the base of the FCV, with an electric submersible pump (Grundfos 5SQE-10-410, 2.3 horsepower) with variable speed frequency drive installed underneath to sample groundwater in the vicinity of the injection well (when the recirculation system was off, and water was not being injected). The injection well sampling pump intake was set at 492 feet bgs, approximately 10 feet above the total depth of the well. Corrosion of the FCV was also minimized through use of corrosion resistant materials and the installation of sacrificial zinc anodes on the drop pipe.

The extraction and injection well pumps were connected to the control room via power supply lines that were run up along-side the drop pipe within the well casing, through the well vault and underground to a conduit stuck-up adjacent to the Conex box. These power supply cables then entered the Conex box and landed on the terminals of the appropriate variable frequency drives. In 2020, downhole equipment (drop pipe, valves, and transducer) and Grundfos pumps were removed from extraction and injection wells (KAFB-106EX1, KAFB-106EX2, and KAFB-106IN1) to assess the condition of the wells and equipment. The well maintenance performed at the extraction and injection wells is discussed in Section 3.7.

2.5 Well Survey

The location and elevation of each well casing was surveyed by a New Mexico-licensed professional land surveyor from High Mesa Consulting Group in accordance with the United States Geological Survey Standard Operating Procedure developed for all monitoring wells on Kirtland AFB (U.S. Geological Survey [USGS], 2016).

Coordinates are based on the North American Datum of 1983 New Mexico State Plane Coordinate System. Elevations are based on the North American Vertical Datum of 1988. The elevation and horizontal location measurements were made to an accuracy of 0.01 and 0.1 foot, respectively. Results of the survey are summarized in Table 1.

2.6 Recirculation Pilot System Equipment and Materials

The pilot test involved multiple test phases requiring recirculation of anaerobic groundwater and addition of tracers and amendments to this water. The equipment necessary to perform the pilot test was installed in the appropriate wells (as detailed above) and a portable shipping (Conex-type) container, and included the necessary pumps, filters, mixers, meters, electrical, and piping to add tracers/amendments and distribute them in the subsurface (as detailed in this section). The container was also used for security and environmental control and was located adjacent to the well field test area, see Figure 2.

The system for amending and recirculating water was designed by APTIM, together with subcontractors, and was fabricated by Calcon Systems Inc. (Calcon). As discussed in Section 3.1, APTIM and the Calcon performed all necessary system installation, shakedown verification testing (including, but not limited to, pressure testing and alarm functionality testing), and start-up tasks. The system as-built drawings and component specification sheets are presented in Appendix F.

A 20-ft long Conex box was used to house the recirculation and tracer/ amendment delivery system components. Figure 5 presents a schematic of the Conex box treatment system. The box has a partition wall, separating the enclosure into two spaces. The smaller of the two spaces is the system control room, which is rated as a non-hazardous atmosphere, and houses the supervisory control and data acquisition (SCADA) system with integrated computer, electrical control panel, Baski FCV controls and associated nitrogen cylinder, and a combination air conditioner/heater. The larger space, which includes the recirculation water piping/fittings, flowmeters, pressure transmitters, tracer/amendment tanks, chemical feed pump, and other system process components, is rated as a Class 1, Division 2 atmosphere, due to the possible presence of fuel hydrocarbons in the recirculation water flowing through the piping in this portion of the enclosure. All electrical components and connections in this portion of the enclosure are intrinsically safe to meet the hazardous atmosphere classification. This space also contains a floor leak sensor, which continuously monitors for water on the floor of the enclosure (in the case of a pipe failure or other leak), having the ability to shut down the system and notify appropriate personnel in the case of an alarm condition.

The main components of the recirculation system are identified on a process flow diagram (see Figure 6), while a more detailed design is presented on the piping and instrumentation diagram (P&ID), which is shown on Figure 5. To maintain the anaerobic conditions of the groundwater and aquifer and to prevent the loss of volatile components within the groundwater, the system was designed to minimize gas exchange between the recirculated groundwater and the atmosphere. The system was designed to extract groundwater from the two extraction well locations and reinject that groundwater in the injection well after tracer or amendment addition, at a design flow rate of up to 24 gpm. This design flow rate was achieved by the system, but operational flowrates changed during the pilot test based on tracer results and other site conditions, as discussed further in Section 3.

Electrical power for system operation was supplied by on-base grid power through an electrical line that runs from the power source on the east side of the site to the recirculation system (see Figure 2). A 480-volt, 3-phase electrical service was required to operate the 60-horsepower extraction well pump motors. APTIM worked with base civil engineering personnel and a licensed electrical subcontractor to procure and install the necessary transformer and underground service line to the main disconnect switch on the system enclosure (Conex box). Trenching of the main power supply cable to the Conex box was required. Appropriate dig and base civil engineer permits were acquired prior to starting. Trenching and installation of the electrical power line was completed from April 17 to April 21, 2017. The electrical line was installed in a 3-foot deep trench. The route of the electrical power line is presented on Figure 2.

The treatment system includes a SCADA system for remote monitoring of flow rates and other parameters, to compliment on-site adjustments and regular operation and maintenance. Process instrumentation, including pressure, level, and flow gauges/switches, were installed at critical locations in the system, as shown on the P&ID (Figure 5), to ensure safe and controlled operation. The programmable SCADA and logic controllers contain the process control logic to monitor and regulate the operation of the various system components, both locally and remotely. The SCADA enables the application of power to the pumps, regulates flowrates, pressures and operation of the FCV, while continuously monitoring the system safety interlocks and making emergency call outs when the system was offline or in alarm mode.

Water conveyance pipelines connecting the Conex box to the extraction and injection wells were installed in trenches approximately 4 feet deep (below the frost line). The underground conveyance piping consists of double containment system that houses the 2-inch piping. The conveyance piping, injection valve pneumatic tubing, pump electrical leads, well vault leak detection wire, Baski nitrogen line, and water level transducer wire leading from the Conex box to the wells are all located within the trenches. Where extraction and injection well piping breaches the ground surface and enters the container (above grade), the piping transitions to 1.5-inch single-walled Schedule 80 PVC, and was insulated to prevent freezing. Trenching began in April 2017 and well pipelines were connected to the system container and pressure tested on April 20, 2017.

Groundwater extraction occurred through the use of electric submersible well pumps (Grundfos 25S50-26) with variable speed frequency drives. Each of the two 4-inch-diameter pumps are fully submersible and capable of maintaining design flows. The variable speed frequency drives were controlled by input values from the SCADA system to fine tune motor operation to adjust flow rates, as needed. Once groundwater was extracted from each of the two extraction wells, it was directed through a pair of particle filters prior to combining flows. These filters were used to prevent undesired particulates from entering the amendment and reinjection portions of the system. Generally, 100-micron (µm) polyethylene woven (poly-woven) filters were used in the lead canisters, while 50-µm poly-woven filters were used in the lag canisters. During system operation, it was determined that the 100- and 50-µm filters had a longer operation lifetime. Earlier use of 50- and 20-µm pleated cellulose filters at the onset of the demonstration resulted in frequent filter changes and quick pressure build-up. The change to poly-woven filters with larger nominal pore sizes significantly improved filter runtimes.

Bourdon tube pressure gauges and switches were installed on the upstream side of the particle filters (as shown on the P&ID, Figure 5), between filters, and on the downstream side of the filters to sense back pressure on the filters. The SCADA system had two alarm set points associated with these pressure switches. The first (high pressure alarm) was an indicator to the system operator that the filters are in need of cleaning/changing, while the second (high-high pressure alarm) shuts-down the system until the filters are cleaned/changed and the system was manually restarted. The poly-woven filters were housed within 20-inch polypropylene Pentek canisters that are pressure rated to 100 pounds per square inch. ProSense® pressure transmitters are installed along the aboveground extraction well piping, upstream of the filters. Additionally, a pressure transmitter was connected to the injection well manifold within the well vault. These monitored the pressures of the system and are connected to the SCADA. Once the groundwater exits the filters from each pipeline, the flows from each extraction well was combined into one 2-inch Schedule 80 PVC pipeline that discharged to the injection well.

Signet 2551 Magmeter flow meters were installed along each extraction and injection well pipeline, just downstream of the filters (three flow meters, one on each pipeline). Totalizing meter installation reports, calibration documentation, and specification sheets were submitted to the OSE, as required by the Change of Water Rights Conditions of Approval for permitted wells RG-1579 POD316 through POD318. This documentation is contained in Appendix C.

Prior to reaching the injection well, extracted groundwater was mixed with either tracers or other amendments (depending on the phase of operation, as discussed in Section 3) using an amendment delivery system consisting of a 550-gallon amendment tank, control valves, pressure gauges, positive displacement variable speed metering pumps (chemical feed pump; LMI E711-368SI), and a pressure regulating tank.

The amendment tank was fitted with an EchoSonic® ultrasonic level sensor that was programmed with the SCADA. The level sensor was a non-contact sensor installed on the top of the amendment tank. The tank has an 8-inch opening with vented lid. Mixtures of water and fluorescein/deuterated water tracer or water and sodium lactate, diammonium phosphate (DAP), and potassium iodide (KI) were batched/mixed within the amendment tank prior to distribution, via the chemical feed pump, into the injection well piping. Tracer/amendment storage and mixing is further discussed in Section 3. The amendment tank was fitted with an outlet port and tubing that connects to the chemical feed pump and calibration column (4,000 milliliter graduated cylinder). The calibration column was connected to the chemical feed pump via a gate valve and tubing connections. Pump tests were performed using the calibration cylinder and deionized (DI) water to determine and dial-in the appropriate flowrate of the chemical feed pump. The chemical feed pump was used to pulse concentrated amendment solution from the amendment tank into the injection well piping. This in-line injection allowed for introduction of amendments to the recirculation water stream under pressure.

After concentrated amendment solution entered the injection well piping, it flowed through a 19-inch PVC static mixer to help dilute and mix the amendments with the groundwater (Figure 6). A 31.8-gallon HydroPro pressure tank was connected to the recirculation piping within the system container, to regulate the pressure spikes within the recirculation system. A wall-mounted Rosemount™ pressure transmitter was connected to the pressure tank piping.

A down-hole FCV and submersible pump, both installed in the injection well (as discussed in Section 2.4.4), was controlled by input values from the SCADA system, as needed. The system was designed to shut down automatically if the water level transducer in the injection well indicated that the water level in the well casing has risen to a predetermined level, or if the water level transducer in one or both of the extraction wells indicated that the water level has dropped to within approximately 2 feet of the top of the extraction well screen.

The Conex box was pre-fabricated by Calcon at their facility in San Ramon, California and delivered on April 13, 2017 to the pilot test site. Final design as-builts and specification sheets for system components are included in Appendix F.

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3. PILOT SYSTEM OPERATION AND MONITORING

The pilot testing was performed in four phases. The duration and a timeline of each of these phases are summarized in Table 2. Data were collected and evaluated during each phase of the pilot test and the results were used to adjust each phase duration, as needed. The first phase (Phase 1) started after installation, development, and testing of the wells and equipment associated with the Pilot Test System. Phase 1 included an evaluation of baseline conditions, and operation of the recirculation system while performing a tracer test to evaluate distribution of injected water in the subsurface. The second phase (Phase 2) included an evaluation of biostimulation on EDB degradation through operation of the recirculation system and the addition of nutrients and a fermentable substrate to the subsurface. The third phase (Phase 3) of the pilot testing was originally proposed to include bioaugmentation with an exogenous debrominating culture (SDC-9), and an evaluation of enhanced EDB degradation. However, as discussed in Section 3.6, bioaugmentation was deemed not necessary based on results during Phase 2, and a further evaluation of biostimulation was performed as Phase 3. The modified Phase 3 was approved by the NMED in a letter dated August 7, 2018 (NMED, 2018), which also stated that "bioaugmentation shall remain as an approved, but deferred component of the pilot test". The fourth and final phase (Phase 4) continued groundwater monitoring without recirculation or addition of amendments. Phase 4 monitoring was concluded in October 2020. For reference, Safety Data Sheets (SDSs) for all tracers and amendments used during the pilot test are included in Appendix G.

3.1 Pilot System Start-up Testing

Final electrical and piping connections, including power and control wiring between the Conex box control panel and the extraction/injection well pumps and vault control components/sensors, and final pipe connections between the stubbed-up extraction/injection well piping and the Conex box were made by Calcon and APTIM from May 11 through 16, 2017. Shakedown testing of the Pilot Test System, which included testing the extraction well pumps; pressure and flow transmitters; leak detection and level sensors; chemical feed pump; Baski FCV and control system; injection well sample pump; remote telemetry; and alarm interlocks was performed on May 16 and 17, 2017 prior to full system start-up. There were no notable operational issues with the system during shakedown testing, with all interlocks and associated alarms working properly. The Pilot Test System was started on June 29, 2017 during the first baseline sampling event at the extraction and injection wells. The Pilot Test System was restarted and retested on September 26, 2017, after a three-month project delay caused by faulty monitoring well sampling pumps (discussed in Section 2.4.4) and just prior to initiation of tracer testing (Phase 1).

3.2 2017 NAPL Sampling

Measurable NAPL was detected in the shallow nested well KAFB-106MW1-S during QED pump installation on September 5, 2017. Three separate measurements were collected using a Solinst oil-water interface probe and confirmed a thickness of approximately 0.27 to 0.31 feet. NAPL was not detected at any other shallow monitoring wells within or around the treatment zone, or in the injection well on September 5, 2017. The extraction wells were not gauged for NAPL at this time, as the top of the well screens were designed to be installed below the static water level. Well KAFB-106MW1-S was bailed on September 8, 2017 and approximately 60 milliliters of product were recovered. The product was containerized and submitted to Pace Analytical® (Pace) for the following analysis:

- C3-C12 PIANO Quantitative Molecular Characterization by gas chromatography-mass spectrometry (VOC Fingerprinting)
- C8-C40 Full Scan Qualitative Molecular Characterization by gas chromatography-mass spectrometry (semivolatile organic compound Fingerprinting)
- Density and Viscosity

Density and viscosity analyses were subcontracted to Clark Testing. Additional product recovery occurred on September 13 and 14, 2017, and approximately 60 milliliters sent to the APTIM Biotechnology Development and Applications Group in Lawrenceville, New Jersey to facilitate EDB compound-specific isotope analysis (CSIA) efforts funded under Environmental Security Technology Certification Program (ESTCP). NAPL has not been detected in KAFB-106MW1-S since October 2017 (Table 3), but KAFB-106MW1-S was continually monitored for its presence on a weekly basis.

The NAPL analysis by Pace indicated a great variety of hydrocarbons, but notably benzene (31.8 milligrams per kilogram [mg/kg]) and EDB (20.5 mg/kg) concentrations were low compared to toluene (7,396 mg/kg) and ethylbenzene (6,098 mg/kg). This laboratory report is included in Appendix I-3. The delta carbon-13 ($\delta^{13}C$) value of EDB in the NAPL, as determined by the University of Oklahoma, was approximately -21±2 per mil (‰). Brief discussion of the carbon isotope composition of EDB in the NAPL is provided in Section 4.5.2.

The fall and rise of the water table during well installation and development may have impacted the vertical transport and subsequent distribution of NAPL in the lower vadose zone, capillary fringe, and top of the unconfined aquifer; causing the measurable NAPL at KAFB-106MW1-S.

3.3 Baseline Sampling

Initial baseline sampling occurred from June 29 through August 16, 2017 using Geotech dedicated bladder pumps at the monitoring wells and submersible Grundfos pumps at the extraction and injection wells. During this time, KAFB-106MW1-S was not sampled due to numerous pump failures (Section 2.4.4). Baseline samples were recollected for all analyses except for Microbial Insights QuantArray-Chlor from September 18 through September 26, 2017. All pilot test wells were sampled prior to Phase 1 recirculation activities to establish pre-test baseline conditions. Purged groundwater was passed through a flow-through cell equipped with a YSI™ ProDSS multi-parameter water quality meter for evaluation of geochemical stabilization parameters (pH, dissolved oxygen [DO], oxidation-reduction potential [ORP], temperature, and specific conductivity). Turbidity was measured with a Hach™ Model 2100Q turbidity meter. Water quality meters were calibrated prior to each sampling event, in accordance with manufacture's recommendations. Table 3 summarizes the field water quality measurements collected prior to sampling. Table 4 presents the suite of analytes that were measured by the certified analytical laboratories and the sampling frequency. An evaluation of baseline and other analytical testing results are presented in Section 4.

3.4 Phase 1 – Tracer Testing

The purpose of Phase 1 was to evaluate baseline conditions and the distribution of recirculated water using tracer amendments. Groundwater (without biostimulation or bioaugmentation amendments) was extracted from the two extraction wells at flow rates of 10 gpm from each well, combined, and after tracers were added (during a 24-hour period), the water was reinjected back into the subsurface at the injection well. The recirculation portion of Phase 1, which was conducted for four weeks from October 2 to November 3, 2017, distributed injected water throughout the pilot testing zone and established new experimental baseline measurements for comparison to later biostimulation phases. The passive portion of Phase 1 began on November 3, 2017, upon shutdown of the recirculation system, and concluded on December 21, 2017.

During Phase 1, two conservative (i.e., non-reactive) tracers of water flow were used to evaluate subsurface transport characteristics. The two tracers used were fluorescein and water labeled with additional deuterium, a stable isotope (i.e., non-radioactive) of hydrogen (Appendix G). Prior to injection, the fluorescein and deuterated water were homogenized with 22 gallons of deionized water in a 55-gallon drum. The drum was plumbed to the inlet of the chemical feed pump via 3/8-inch diameter polyethylene tubing. Over a period of approximately 24 hours, from October 2 through 3, 2017, approximately 54 grams of fluorescein and 15 kilograms of deuterium oxide (^2H_2O) were injected into the treatment zone through the recirculated groundwater. During the entire Phase 1 recirculation period, approximately 887,000 gallons of water were extracted and reinjected.

During Phase 1 recirculation system operation, increased back pressure upstream of the sediment filters at pressure transmitters PIT-103 and PIT-109 (Figure 5) was observed, caused by an increased loading on the filters, resulting in more frequent filter changes than was originally anticipated, with KAFB-106EX1 experiencing a faster sediment loading rate. Initially, sediment was observed on the 10-inch long pleated cellulose filters CF-1-1 and CF-1-3; though this diminished in the short-term. A number of what appeared to be biological masses were also observed on filters during this time. Several approaches were used to mitigate the heavy filter loading and frequent filter change-out rate by increasing the effective filter surface area. The 10-inch long canister housings at CF-1-1 through CF-1-4 were replaced with 20-inch long canister housings, and woven polyethylene filter cartridges replaced the existing pleated cellulose. During the majority of Phase 1, 100- and 50-µm woven polyethylene filters were ultimately used on both extraction well lines in the lead and lag positions, respectively, with much improved runtimes.

Water level readings in the extraction and injection wells were continuously monitored by the SCADA system and monitored manually periodically. During recirculation system operation, it became apparent that the water level readings from pressure transducers located in the extraction well drop pipes were not accurate. The likely cause of the inaccurate readings was electrical interference from the extraction well pumps' power leads running down the well to the pump near the drop tubes where the transducers and their control wires were housed. As a result, manual water level readings were periodically measured using the Solinst water level meter to avoid unnecessarily drawing down below the top of the screened interval in the extraction wells. Manual water level readings are summarized in Table 5.

Eight groundwater sampling events designed to quantify transport properties during active recirculation were conducted during Phase 1, with two additional sampling events conducted approximately 2 and

4 weeks after recirculation activities ceased. Groundwater fluorescein concentrations and delta deuterium (measure of hydrogen isotope composition) (δ^2H) values were determined for these samples. In addition, groundwater measurements were collected during one subset of the recirculation sampling events (Day 23, collected on October 24 and 25, 2017) to determine baseline conditions for the other analytes presented in Table 4.

Groundwater samples were collected intermittently at extraction, injection, and the six groundwater monitoring wells during the active portion of Phase 1, and biweekly during the passive portion. KAFB-106MW1-S/I, KAFB-106MW2-S/I, KAFB-106064, KAFB-106063, KAFB-106EX1, KAFB 106EX2, and KAFB-106IN1 were sampled using either dedicated QED MicroPurge® Model P1101HM bladder pumps (monitoring wells) or the down-hole extraction pumps or injection well sampling pump (the injection well was not sampled during active recirculation). Prior to purging, depth to water measurements and depth to NAPL (if present) were collected at groundwater monitoring wells KAFB-106MW1-S, KAFB-106064, and KAFB-106063; extraction wells, and the injection well. Water level measurements were also collected during purging to monitor for drawdown. Water levels were measured using a portable water level indicator and interface probe (Solinst). Both manual water level measurements (Solinst probe) and transducer measurements were collected from extraction and injection wells. Due to the size of the well casing and placement of the dedicated tubing bundle, water level measurements could not be obtained from KAFB-106MW1-I, KAFB-106MW2-I, and KAFB-106MW2-S. The field water quality parameters, NAPL, and water level measurements were recorded on the purge logs for each well. Purge logs and sample collection logs are included as Appendix H.

Each well was purged to remove stagnant water from the well in order to collect a representative groundwater sample. Purged groundwater passed through a flow-through cell equipped with a YSI™ ProDSS multi-parameter water quality meter for evaluation of geochemical stabilization parameters (pH, DO, ORP, temperature, and specific conductivity). Turbidity was measured with a Hach™ Model 2100Q turbidity meter. Purging continued until three stable field measurements for DO, pH, ORP, specific conductivity, temperature, and turbidity were obtained. Stabilization criteria for field measurements were three consecutive readings within 10% of each other. Water quality meters were calibrated prior to each sampling event, or after anomalous readings were observed. Samples from the extraction and injection wells were collected from sample ports located along the system piping, upstream of the sediment filters. Table 3 summarizes the field water quality measurements collected prior to sampling. Table 4 presents the suite of analytes that were measured by the certified analytical laboratories. Both hydrogen and carbon isotopes were reported using (δ) notation, where δ^2H or $\delta^{13}C = R_{sample}/R_{standard}-1$ and R is the $^2H/^1H$ or $^{13}C/^{12}C$ ratio of the sample and the standard (Vienna Standard Mean Ocean Water for δ^2H, and Vienna Pee Dee Belemnite for $\delta^{13}C$), respectively. Note that the commonly included multiplier of 10^3 has been omitted from the equation but should be incorporated to report δ values as ‰. CSIA of EDB in samples was performed by Dr. Tomasz Kuder at the University of Oklahoma, through funding provided by ESTCP Project ER-201331.

Ten sampling events were conducted during Phase 1. Additionally, three samples were collected from the injection well sampling port, which was representative of the groundwater being injected on October 2 and 3, 2017. Fluorescein and δ^2H data suggested good hydrologic control and connectivity at the test site. Tracer testing results are further discussed in Section 4.

3.5 Phase 2 – Biostimulation

The purpose of Phase 2 was to evaluate biostimulation in the subsurface after distribution of treatment amendments in recirculated groundwater. Phase 2 consisted of two operational periods, a recirculation/mixing (active) period, and a subsequent passive monitoring period (no recirculation). During the recirculation period, groundwater was extracted and an easily fermentable sodium lactate-based substrate (WilClear Plus®, manufactured by JRW Bioremediation), nutrient (DAP), and conservative tracer (KI) were added to the recirculated process water stream. The amended water was reinjected to distribute the amendments throughout the pilot testing zone. The goal of these amendments was to stimulate activity of native microbial populations capable of debrominating EDB. For reference, SDSs for the amendments are included in Appendix G.

Upon completion of the passive Phase 1 monitoring period, the recirculation system was restarted on December 11, 2017 and allowed to run at extraction rates of 10 gpm (each well) prior to introducing amendments. The active portion of Phase 2 began on December 21, 2017 with the injection of treatment amendments for biostimulation and continued until February 7, 2018. A concentrated solution of the amendments was prepared in the amendment mixing tank (AT-1, see Figure 5) and added to the process stream by the chemical feed pump manufactured by LMI (P-2-1).

The concentrated amendment solution was prepared using water obtained from the Kirtland AFB potable water plant located on Texas Drive and transferred to the project site in 275-gallon totes. The water was transferred from the totes into the amendment tank via a sump pump and garden hose. Volume marks on the tank were used to bring the water up to the desired level. DAP and KI were weighed using a kitchen scale and poured into the tank. The sodium lactate was pumped from 55-gallon drums into the tank using a drum pump and tubing. A Goulds submersible mixing pump was deployed within the amendment tank to mix the amendments and keep the constituents in solution. During this homogenization, specific conductivity in the tank was measured at regular intervals until it was determined that the readings had stabilized. After reaching stabilization, the chemical feed pump was turned on to start amendment injection. During operation, amendment delivery into the recirculation water process stream, and subsequently delivered to the injection well, was pulsed such that there were periods of time when the recirculation process water contained amendments and other times flow contained only recirculated groundwater. The pulsed amendment injection scenario was implemented to minimize biofouling in the injection well by flushing the well screen and filter pack with water less conductive to biological growth and fouling. Additional batches of amendments were mixed once the level within the amendment tank reached a predetermined low level. A new batch was typically mixed every 4 to 7 days during recirculation. Over the approximately 7-week active injection period in Phase 2, approximately 290 gallons of WilClear Plus®, 150 kilograms of DAP, and 71 kilograms of KI were injected into the treatment zone. Table 6 summarizes the injected quantities for each Phase of the pilot test. The targeted concentration of fermentable substrate (300 mg/L) was consistent with that outlined in Work Plan (Kirtland AFB, 2016a), albeit using broader diversity of fermentable substrates rather than lactate alone. The targeted concentration of DAP (50 mg/L) was approximately half that of the Work Plan due to concerns regarding precipitation of solids. These targeted concentrations were consistent with contractor experience, typical substrate loading rates (AFCEE et al., 2004), and treatability testing performed using site materials (100 mg/L lactate and 50 mg/L DAP). The targeted KI concentration was consistent with the Work Plan (Kirtland AFB, 2016a). During the entire Phase 2 recirculation period, approximately 1,467,000 gallons of water were extracted and reinjected, but due to testing of the system and the challenges described in the following paragraph, only approximately 927,000 gallons were recirculated during the period that carbon substrate, DAP, and KI were introduced.

Approximately two hours after amendment injection began on December 21, 2017, a leak was observed originating from the chemical feed pump. The system was shut down and the chemical feed pump head and four-way valve were dismantled to determine the cause of the leak. Small crystals were observed within the check ball housings and on the check balls within the four-way valve. The affected areas were cleaned with cotton swabs and deionized water, reassembled, and the system was restarted. During a system check on December 23, 2017, it was observed that while the chemical feed pump was running, no amendment fluid was being conveyed through the tubing to the injection point on the recirculation process piping. Coincident to this, an increase in mounding (up to 9 feet above static [476 feet bgs]) at the injection well was observed. The system was shut down to diagnose and rectify the crystallization issue. It was determined that amendment concentrations needed to be decreased in the amendment tank. Lower amendment concentrations and running the chemical feed pump more frequently rectified the crystallization issue, and facilitated the introduction of amendments at target rates. Introduction of amendments using the new concentrations began on December 29, 2017. The active portion of Phase 2 was extended until February 7, 2018 to deliver the planned mass of amendments.

During Phase 2, approximately 11 feet of water level drawdown was observed at KAFB-106EX2 during active Phase 2 system operations. The flowrate at KAFB-106EX2 was incrementally reduced to 7 gpm beginning on January 8 through January 22, 2018 to prevent drawdown of water below the top of the screened interval. Extraction well KAFB-106EX1 did not display a similar drawdown trend, and thus, remained at 10 gpm throughout Phase 2. Table 5 presents the measured water levels and flowrates for the two extraction wells during Phase 2.

The passive portion of Phase 2 began on February 7, 2018, when the recirculation system was shut down, and concluded in July 2018. After the chemical feed pump was turned off and injection of the amendments ceased, the extraction wells were allowed to run for several hours to flush the injection well screen and filter pack. During the passive period of Phase 2, groundwater in the treatment zone was monitored for approximately 4 months to evaluate whether EDB degradation was enhanced (as further described in Section 4).

Groundwater samples were collected on a weekly basis during active recirculation and on a monthly basis during the passive portion of Phase 2 at extraction, injection, and monitoring wells, to evaluate the effectiveness of biostimulation. An additional passive sampling event was conducted, resulting in seven total sampling events for Phase 2. Groundwater sampling was performed as described in Section 3.4. Table 3 summarizes the field water quality measurements collected prior to sampling. Table 4 presents the suite of analytes measured by the certified analytical laboratories. An evaluation of the Phase 2 sampling results is presented in Section 4.

3.6 Phase 3 – Biostimulation

As described in the Work Plan (Kirtland AFB, 2016a), Phase 3 originally included a recirculation period that included both biostimulation and bioaugmentation. The Work Plan proposed that the biostimulation-portion of Phase 3 be similar to Phase 2 and that a debrominating bioaugmentation culture (SDC-9) would be injected into KAFB-106IN1 and distributed with the recirculation system. As presented in the *Phase 3 Ethylene Dibromide In Situ Biodegradation Pilot Test Notification Letter, Bulk Fuels Facility, Kirtland AFB, New Mexico* (Kirtland AFB, 2018a), after evaluating analytical data from the passive period for Phase 2, it became evident that the rate of anaerobic EDB biodegradation was significantly enhanced as a result of biostimulation, and that bioaugmentation was not warranted as a part of Phase 3. Analytical results from the passive period of Phase 2 were discussed in the letter. NMED approved removal of bioaugmentation from Phase 3 in their letter dated August 7, 2018 (NMED, 2018), concluding that bioaugmentation remain an approved, but deferred, component of the pilot test.

Therefore, similar to Phase 2, the purpose of Phase 3 was to continue to evaluate biostimulation in the subsurface after distribution of treatment amendments in recirculated groundwater. Phase 3 also consisted of two operational periods, a recirculation/mixing (active) period, and a subsequent passive monitoring period (no recirculation). During the recirculation period, groundwater was extracted and WilClear Plus® and DAP were added to the process water stream before reinjecting it to distribute the amendments throughout the pilot testing zone.

Upon completion of the passive Phase 2 monitoring period, the active portion of Phase 3 began on July 30, 2018, with the groundwater extraction rates of 10 gpm at KAFB-106EX1 and 7 gpm at KAFB-106EX2. The injection of treatment amendments for biostimulation continued until September 9, 2018. A concentrated solution of the amendments was prepared in a similar fashion to that in Phase 2 (discussed in Section 3.5). A pulsed amendment injection scenario was again implemented in an attempt to minimize biofouling in the injection well. Over the approximately 5-week active injection period in

Phase 3, approximately 340 gallons of WilClear Plus® and 143 kilograms of DAP were injected into the treatment zone. Table 6 summarizes the actual injected quantities for each Phase of the pilot test. During the entire Phase 3 recirculation period, approximately 926,000 gallons of water were extracted, amended, and then reinjected.

The water table drawdown measured at KAFB-106EX2 during the active portion of Phase 2 became apparent again during Phase 3 system operations (as shown on Figure 7). The extraction flow rate at KAFB-106EX2 was incrementally reduced from 7 to 4 gpm during Phase 3 (beginning on August 6 through August 30, 2018) to prevent drawdown of water below the top of the screened interval. Extraction well KAFB-106EX1 remained at 10 gpm during Phase 3. Increased mounding was also observed throughout the active portion of Phase 3 at the injection well (see Figure 7), increasing to approximately 35 feet above the static level by the end of Phase 3 active recirculation.

The recirculation system was shut down on September 9, 2018, initiating the passive portion of Phase 3 that concluded on November 19, 2018. After the chemical feed pump was turned off and injection of the amendments ceased, the extraction wells were allowed to run for several hours to flush the injection well screen and filter pack. During the passive period of Phase 3, groundwater in the treatment zone was monitored for approximately 3 months to evaluate whether EDB degradation was enhanced (as further described in Section 4).

Groundwater samples were collected weekly during active recirculation and monthly during the passive portion of Phase 3 at extraction, injection, and monitoring wells to evaluate the effectiveness of biostimulation. An additional recirculation sampling event was conducted, resulting in seven sampling events for Phase 3 (Table 4).

During the first Phase 3 passive sampling event (September 2018), the injection well sampling pump mounted below the FCV failed to pump water to the surface. After approximately 40 minutes of pumping, the water level in the well was manually checked and found to have drawn down below the transducer to the level of the pump intake (492 feet bgs). Thus, it seemed the loss of well capacity suggested by the increased mounding at the injection well (shown on Figure 7) was preventing groundwater from flowing into the well to sustain pumped flow to the surface; likely due to fouling of the well screen. Fine sand, silt, and grey biological-like growth were observed on the transducer cable and probe when it was pulled to collect manual water level measurement. As a result, of the decreased well capacity, sample collection using the injection well pump was no longer possible, and samples from KAFB-106IN1 were collected using a 0.85-inch by 36-inch stainless steel bailer lowered to the groundwater through the transducer drop tube. Samples were collected with the bailer during the Phase 3 passive sampling events conducted on October 4 and November 19, 2018.

Groundwater sampling methods were performed as described in Section 3.4. Table 3 summarizes the field water quality measurements collected prior to sampling. Table 4 presents the suite of analytes measured by the certified analytical laboratories. An evaluation of Phase 3 sampling results is presented in Section 4.

3.7 Phase 4 – Extended Monitoring

Phase 4 consisted of continued groundwater monitoring with no active recirculation and began upon completion of the final Phase 3 sampling event on November 19, 2018. The recirculation system was not operated during Phase 4, except briefly during extraction well sampling during the January 2019 monitoring event. During this Phase and in accordance with the Work Plan (Kirtland AFB, 2016a), groundwater samples are to be collected regularly at extraction, injection, and monitoring wells to evaluate the performance of the technology and quantify any rebound of EDB. One sampling event was conducted as a part of Phase 4 in 2019, from January 16 through January 21. This sampling event occurred approximately 2 months after the Phase 3 passive period was concluded, in accordance with the Work Plan (Kirtland AFB, 2016a). After a period of time that allowed for greater water infiltration into the pilot test area, sampling of the groundwater monitoring, extraction, and injection wells resumed in March 2020 after the extraction and injection well pumps were removed and the wells surveyed with a camera to assess downhole equipment and well conditions. Starting in 2020, samples were collected quarterly and analyzed for the same constituents as approved in the Work Plan (Kirtland AFB, 2016a). Extraction and injection well maintenance activities are discussed in the following subsections. Phase 4 monitoring continued through October 2020 and a total of five sampling events were conducted during Phase 4. Groundwater sampling methods were performed as described in Section 3.4; however, samples were collected using dedicated bladder pumps rather than Grundfos pumps at the two extraction wells and injection well in 2020. Table 3 summarizes the field water quality measurements collected prior to sampling. Table 4 presents the suite of analytes measured by the certified analytical laboratories. An evaluation of Phase 4 sampling results through 2020 is presented in Section 4.

3.7.1 Extraction and Injection Well Maintenance

To assess the condition of extraction and injections wells of the pilot test (KAFB-106EX1, KAFB-106EX2, and KAFB-106IN1), well manifolds and all downhole equipment (drop pipe, valves, transducer, and pump) were removed and video camera survey was performed.

The downhole well infrastructure from KAFB-106EX1, KAFB-106EX2, and KAFB-106IN1 were removed by a drilling subcontractor using a pump rig from January 27 through January 30, 2020. All three wells were video surveyed on February 13, 2020. The video showed that KAFB-106IN1 had moderate to severe build-up of viscous semi-solid materials throughout most of the screened interval. Video logs from the two extraction wells (KAFB-106EX1 and KAFB-106EX2) showed minor build-up on the screen slots. This type of buildup is commonly observed with *in situ* remedial projects, as a result from microbial growth. Both extraction wells contained a yellow-orange liquid floating on the water surface, which was interpreted to be NAPL. The thickness of the suspected NAPL was visually estimated during video logging to be 0.5 feet at KAFB-106EX1 and 12 feet at KAFB-106EX2. The presence of NAPL was confirmed with a Solinst oil-water interface probe on February 17, 2020, when the NAPL thickness was measured at 11.2 feet at KAFB-106EX2 and 0.65 feet at KAFB-106EX1. No NAPL was present in KAFB-106IN1. A dedicated QED MicroPurge® Model P1101HM bladder pump was installed in KAFB-106IN1 on March 4, 2020.

3.7.2 2020 NAPL Removal Activities

NAPL was bailed by hand from KAFB-106EX1 and a dedicated QED MicroPurge® Model P1101HM bladder pump was installed on March 4, 2020 to resume quarterly sampling activities. The pump was subsequently removed from KAFB-106EX1 to allow for NAPL removal via a large mechanical bailer. Pump installation and groundwater sampling was delayed at KAFB-106EX2 to avoid coating the dedicated pump with NAPL and to allow for collection of representative groundwater samples without bias that can be caused by an NAPL source present in the well.

On June 30 and July 1, 2020 a large bailer operated by a pump rig was used to remove NAPL from extraction wells KAFB-106EX1 and KAFB-106EX2. NAPL was effectively removed using the large bailer, with less than a tenth of a foot remaining. Approximately one gallon was removed from KAFB-106EX1 and 16 gallons were removed from KAFB-106EX2. A dedicated QED MicroPurge® Model P1101HM bladder pump was installed in KAFB-106EX2 on July 1, 2020 and sampling of KAFB-106EX2 resumed during third quarter 2020. KAFB-106EX2 was not sampled during previous quarters in 2020 to avoid coating the dedicated pump with NAPL during pump installation and to allow for collection of representative groundwater samples without bias that can be caused by an NAPL source present in the well. The dedicated bladder pump was also reinstalled in KAFB-106EX1 on July 1, 2020.

Once mechanical NAPL removal activities were completed, the shallow groundwater monitoring wells and injection well (KAFB-106IN1) were gauged for NAPL using a Solinst Model 122 oil-water interface probe. Two of the three shallow groundwater monitoring wells (KAFB-106MW1-S and KAFB-106MW2-S) and the injection well (KAFB-106IN1) are screened within the vadose zone (screens intersect the current water table). Groundwater monitoring well KAFB-106064 has a submerged screen. NAPL was not observed during this gauging event at the injection well or surrounding shallow groundwater monitoring wells.

To further remove possible trace NAPL from extraction wells KAFB-106EX1 and KAFB-106EX2, absorbent socks were installed in both wells on September 22, 2020 and socks remained emplaced for several weeks. The absorbent socks were removed from both extraction wells on October 1, 2020 and a Solinst oil-water interface probe was used to evaluate NAPL presence. NAPL was not detected in either KAFB-106EX1 or KAFB-106EX2 after the absorbent socks were removed.

It should be noted that the goal of the pilot test was not to treat or characterize the nature and extent of NAPL. NAPL characterization efforts are included in the Source Zone Characterization Report that will be revised for delivery to NMED in April 2021.

3.8 Sample Analysis

All sampling activities were conducted in accordance with Sections 5.2.4 and 5.2.5 of the Groundwater Investigation Work Plan (Kirtland AFB, 2011b), and the site-specific Quality Assurance Project Plan, which is an appendix to the Groundwater Investigation Work Plan. Evaluation of EDB carbon isotopes was performed by CSIA as part of a U.S. Department of Defense ESTCP Project ER-201331 entitled, "Natural Attenuation and Biostimulation for *In Situ* Treatment of 1,2-Dibromoethane (EDB)." The monitoring, extraction, and injection wells were sampled for baseline conditions in June 2017. Samples were submitted for the following analyses:

- VOCs (United States Environmental Protection Agency [EPA] Method 8260B)
- EDB (EPA Method 8011)
- Dissolved iron and manganese (EPA Method 6010C)
- Anions – bromide, nitrate, nitrite, chloride, and sulfate (EPA Method 9056A)
- Nitrate and nitrite as nitrogen (EPA Method 353.2)
- Iodide (EPA Method 300.0)
- Reduced Gases (RSK SOP-175; EPA 3810)
- Volatile Fatty Acids (EPA Method 300 Modified)
- Alkalinity (Standard Method 2320B)
- Microbial Community (QuantArray-Chlor)
- Dissolved ortho-phosphate (Standard Method 4500 PE and EPA Method 9056A)
- EDB CSIA (Kuder et al, 2012)
- δ^2H (Hydrogen/H_2O Equilibration Isotope Ratio Mass Spectrometry)
- Fluorescein Dye Tracer (Spectrofluorophotometry)

Due to ultimate replacement of the Geotech bladder pumps with the QED MicroPurge® Model P1101HM bladder pumps in September 2017, baseline samples were recollected from September 18 through 26,

2017. Baseline samples were not originally collected at KAFB-106MW1-S in June 2017 due to repeated pump failures. Analytical results from baseline samples are discussed in Section 4.0. Table 4 presents the suite of analytes that were measured by the analytical laboratories and the sampling frequency for the remaining phases of the pilot test.

3.9 Sample Documentation

Sample collection logs, purge logs, and chain-of-custody form were completed by field personnel during monitoring and sampling activities. Sample collection logs and purge logs are included in Appendix H. Chain-of-custody forms are included with the laboratory reports (Appendix I-3).

3.10 Quality Control

Field quality control samples were collected as part of each sampling event and included field duplicate and trip blank samples. Duplicate samples were analyzed to estimate the overall reproducibility of the sampling and analysis process and were collected immediately after the original/parent sample to reduce variability. Trip blank samples were used to evaluate potential contamination by VOCs during sampling, shipment, and laboratory processing. Additionally, internal laboratory quality control samples, including laboratory control samples, replicates, matrix spikes, matrix spike duplicates, and surrogate spike samples were analyzed concurrently with the groundwater samples.

The groundwater analytical data were validated for precision, bias, accuracy, representativeness, comparability, and completeness, and appropriate data qualifiers were appended to the analytical data in the project database. The data validation results are presented in the Data Quality Evaluation Reports, which are included as Appendix I-1 (June 2017 through January 2019 data) and Appendix I-2 (March 2020 through October 2020 data). Laboratory data packages are also provided in Appendix I-3.

3.11 Waste Management

IDW generated during the pilot test included soil generated from drilling activities; liquid IDW generated during drilling operations, well development, equipment decontamination, and groundwater sampling; solid and liquid IDW generated during NAPL removal activities at the extraction wells. All IDW generated during implementation of the pilot test was handled and disposed of in accordance with the Waste Management Plan of the Groundwater Investigation Work Plan (Kirtland AFB, 2011b) and the Work Plan (Kirtland AFB, 2016a). Kirtland AFB Landfill disposal letters and approvals; waste profiles; and hazardous and non-hazardous waste manifests for liquid IDW are provided in Appendix J.

3.11.1 Soil IDW

Soil IDW was generated during drilling and well installation activities at two nested monitoring wells, two extraction wells, and one injection well. All drill cuttings were containerized in plastic-lined, steel roll-off containers pending laboratory analysis for waste characterization and disposal. The field geologist collected soil cuttings from each 5 to 10-foot interval during drilling activities, which represented a composite of the depth interval contained within the specific roll-off container. The cuttings were stored in sealable gallon-sized bags which were labelled with the associated depth interval and roll-off. The sealable bags were stored on ice in a cooler until they were sampled for waste characterization to provide protection from loss of volatiles, despite the roll-off being exposed during the same time period. A sample was collected from each sealable gallon-sized bag (representing soil contained in a specific roll-off) without homogenization for waste characterization. IDW soil samples collected for VOC analysis were collected in jars, filled with no headspace. Approximately 16 ounces were collected per composite sample. Once the analytical results were received, reviewed, and determined to meet landfill requirements, a “Request for Disposal” letter was provided to Kirtland AFB for approval to dispose of the contents of each container. Analytical results for all roll-off containers confirmed that the drill cuttings were not a hazardous waste, and they met the requirement for disposal at the Kirtland AFB Construction and Demolition Landfill. Soil IDW disposal letters generated for the roll-off containers and associated approval letters are provided in Appendix J-1.

On January 25, 2017 at 12:30 p.m. approximately ¼ to ½ cubic yards of semi-saturated soil was released to the ground surface within the pilot test construction area while attempting to move a roll-off bin. The spill was reported by Kirtland AFB both verbally and in written format to the NMED Hazardous Waste Bureau within twenty-four hours. A Corrective Action Report was submitted to both the NMED Hazardous Waste Bureau and Ground Water Quality Bureau on February 9, 2017 (Kirtland AFB, 2017b) and is included in Appendix J-2.

3.11.2 Liquid IDW – Development and Decontamination

Liquid IDW was generated during decontamination resulting from drilling activities, and during development. The following steps were followed during IDW liquid handling, storage, and characterization for liquid IDW generated during drilling and well development activities:

1. Development and decontamination water were transferred into appropriately sized storage tanks located at the drill site for temporary accumulation, pending laboratory analysis.

    a. For monitoring wells, liquid IDW generated from development activities was typically accumulated in 275 gallons totes. During development of the pilot test monitoring wells, an average of two totes were filled per well. Water from different wells was not combined.

    b. For extraction and injection wells, liquid IDW was accumulated in 19,000-gallon Baker tanks, since the development procedures for these tanks are more intensive and produced a greater amount of water. During development of the extraction and injection wells, one Baker tank was filled for each extraction well, and two Baker tanks were filled for the injection well. Jetting was performed at the injection well as part of the development process and the procedure created a greater volume of liquid IDW.

2. Storage tank and totes were labeled with pending analysis stickers containing the dates of accumulation, well identification, and generator point of contact information.

3. Once development of a specific well was complete, a composite water sample was collected from the storage container(s) using a disposable bailer and analyzed for the following: anions (EPA Method 300), nitrate (EPA Method 353.2), dissolved metals (EPA Method 6010), total lead (EPA Method 6010), semivolatile organic compounds (EPA Method 8270), VOCs (EPA Method 8260), and EDB (EPA Method 8011).

4. Liquid IDW containerized in totes (from monitoring well development) that was determined to be hazardous was transferred into 55-gallon drums and moved to the less than 90-day accumulation area. Hazardous waste labels were affixed to the drums showing generator information, accumulation dates, waste numbers, and the Kirtland EPA identification number. Drums were stored on appropriately sized secondary containment.

Non-hazardous liquid IDW generated from development and decontamination activities was disposed of by Chemical Transportation, Inc. and Clean Harbors at their respective facility located in Albuquerque, New Mexico. Non-hazardous waste manifests are included in Appendix J-3. Hazardous liquid IDW generated from development and decontamination activities was disposed of by Chemical Transportation, Inc. and Clean Harbors at Clean Harbors Deer Trail, LLC in Colorado. Hazardous waste manifests are included in Appendix J-4.

3.11.3 Liquid IDW – Purge Water

Analytical data from groundwater sampling was incorporated with the data collected during liquid IDW sampling of the development/decontamination water to generate both hazardous and non-hazardous waste profiles for disposal of purge water (Appendix J-5). The highest concentrations observed in IDW and groundwater samples were used to generate the waste profiles, thus eliminating the need to frequently sample liquid IDW generated during sampling activities. Hazardous purge water was transferred into 55-gallon, open-top metal drums placed on secondary containment pads located within the less than 90-day accumulation area. Non-hazardous purge water was placed in a single 275-gallon tote.

Hazardous liquid IDW generated from groundwater sampling activities conducted prior to 2020 was disposed of by Chemical Transportation, Inc. and Clean Harbors at Clean Harbors Aragonite, LLC in Grantsville, Utah and by Advanced Chemical Transportation at their local facility. The non-hazardous liquid IDW generated from groundwater sampling activities conducted prior to 2020 was disposed of by Advanced Chemical Transportation at their local facility on March 19, 2019. Hazardous liquid IDW generated from groundwater sampling activities conducted from March through October 2020 was disposed of by ACTenviro (formerly Advanced Chemical Transportation) at their Albuquerque facility.

3.11.4 NAPL IDW

Liquid IDW consisting of groundwater and NAPL bailed from extraction wells KAFB-106EX1 and KAFB-106EX2 in June/July 2020 was transferred into two 55-gallon, open-top metal drums placed on secondary containment pads located within the less than 90-day accumulation area. A new profile was generated for the waste consisting of NAPL comingled with groundwater (Appendix J-5) and the waste was removed by ACTenviro on September 29, 2020. The hazardous waste manifest is included in Appendix J-4.

The absorbent socks used to remove residual NAPL remaining in the extraction wells were contained within a U.S. Department of Transportation-approved 5-gallon pail on a secondary containment pad located within the less than 90-day accumulation area. The absorbent sock waste was removed on

December 26, 2020 by ACTenviro under a new profile (Appendix J-5). The hazardous waste manifest is included in Appendix J-4.

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4. PILOT TEST RESULTS

This section describes the analytical results associated with the pilot test. Analytical data tables for each well are included as Tables 7 through 15.

4.1 Baseline Conditions

All pilot test wells were sampled prior to Phase 1 recirculation activities to establish pre-test baseline conditions, including measures of various tracers used, microbial community, geochemistry, contaminants (e.g., benzene and EDB), EDB degradation products (e.g., ethene, ethane, bromide), and EDB CSIA. As noted in Section 3.2, NAPL was observed at KAFB-106MW1-S during this period, and a sample of the NAPL was collected for analysis.

The pilot test was sited near existing well KAFB-106064, which contained EDB at concentrations of 17 µg/L (Second Quarter 2016; Kirtland AFB, 2016c) and 9.3 µg/L (Fourth Quarter 2016; Kirtland AFB, 2017c) and benzene at concentrations of 1,100 µg/L (Second Quarter 2016) and 1,000 µg/L (Fourth Quarter 2016) prior to installation of the new pilot test wells. After installation and development of the new pilot test wells, EDB and benzene concentrations of baseline groundwater samples at KAFB-106064 were measured at 143 µg/L and 4,730 µg/L, respectively. These increases at KAFB-106064 may have been the result of different types of sample pumps (bladder pumps) placed at different depths, heterogenous distribution of EDB and benzene in the subsurface, or perhaps due to increased mass transfer from residual NAPL during well installation and development. Higher concentrations were also observed at the other newly installed wells, where EDB ranged from 20.1 µg/L (KAFB-106IN1) to 432 µg/L (KAFB-106MW1-S) and benzene ranged from 586 µg/L (KAFB-106MW2-S) to 7,320 µg/L (KAFB-106MW1-S). The highest EDB and benzene concentrations observed were at KAFB-106MW1-S where NAPL was previously observed and collected (September 2017). EDB concentrations from baseline sampling and during the most recent sampling during the pilot test (Phase 4) are presented in Figure 8.

As will be further described below, representative microorganisms likely capable of EDB debromination were present in large numbers at shallow wells during the baseline evaluation, together with a reducing environment favorable for reductive debromination. Elevated concentrations of the EDB degradation products ethene, ethene, and bromide, together with more positive EDB $\delta^{13}C$ values (up to -5‰) at wells during the baseline evaluation, indicated that EDB degradation was likely ongoing or had previously occurred at the pilot test location. In a phased approach, the pilot test evaluated whether EDB degradation could be enhanced through addition of biostimulation amendments.

4.2 Amendment Distribution

Various tracers were amended to the recirculated groundwater to evaluate and verify the distribution and transport times between wells during the pilot test. These tracers included fluorescein dye (Phase 1), deuterium labeled water (^2H_2O, Phase 1), and iodide (Phase 2). Fluorescein is a fluorescent tracer often used in studies of groundwater flow in karst systems, ^2H_2O occurs as approximately 0.03% of water, and iodide is perhaps best known as an additive in iodized table salt, albeit at low concentrations. In addition to these tracers, biostimulation amendments added to the groundwater included a fermentable sodium lactate-based substrate with nutrients (WilClear Plus®) and DAP.

4.2.1 Tracer Distribution During Phase 1

Fluorescein was added together with deuterated water over a period of 24 hours while the recirculation system operated at 20 gpm (10 gpm at KAFB-106EX1, and 10 gpm at KAFB-106EX2). Three measurements of fluorescein concentrations of injected water collected directly from the KAFB-106IN1 sample port averaged 570 µg/L during the 24 hours of tracer injection, while background concentrations were non-detectable.

Figures 9 and 10 show measured fluorescein concentrations in samples collected from shallow and intermediate wells, respectively. The average transport times for the anaerobic shallow wells with high EDB concentrations, as indicated by the date of maximum tracer contribution, were of primary interest and are provided in Table 16. These indicate that transport times increased with increasing distance, and no strong indications of preferential flow were apparent. Decreases in maximum concentrations with increasing distances from the injection well were indicative of dispersion within the subsurface as expected. After the 30 days of groundwater recirculation and fluorescein distribution, fluorescein concentrations among the shallow wells of the pilot test ranged from 3.7 µg/L (KAFB-106EX1) to 8.2 µg/L (KAFB-106EX2). After an additional month without groundwater recirculation (passive portion of Phase 1), fluorescein concentrations in the groundwater ranged from 4.1 µg/L (KAFB-106MW1-S) to 5.5 µg/L (KAFB-106064) among the shallow wells. Among the intermediate monitoring wells, fluorescein was observed at a maximum of 92 µg/L at KAFB-106MW2-I after 7 days of recirculation, and at a maximum of 50 µg/L at KAFB-106MW1-I after 30 days of recirculation. No fluorescein was observed at the existing intermediate monitoring well KAFB-106063 during Phase 1.

Deuterium labeled water was added at the same time as the fluorescein to ensure that at least one tracer was measurable during the tracer test. Three measurements of δ^2H values of the injected water averaged +590‰ during the 24 hours of tracer injection, while background δ^2H values at the test area ranged from -97‰ to -92‰. Figures 11 and 12 show measured δ^2H values of the water samples collected from shallow and intermediate wells. There is clear agreement between the fluorescein and δ^2H data, which provides confidence in observed transport times and water distribution. After the 30 days of groundwater recirculation, the deuterated water was redistributed in the groundwater and δ^2H values among the shallow wells of the pilot test ranged from -90‰ (KAFB-106EX1) to -84‰ (KAFB-106EX2). After an additional month without groundwater recirculation (passive portion of Phase 1), δ^2H values in the groundwater ranged from -89‰ (KAFB-106MW1-S) to -86‰ (KAFB-106MW2-S) among the shallow wells. Among the intermediate monitoring wells, δ^2H was observed at a maximum of +19‰ at KAFB-

106MW2-I after 7 days of recirculation, and at a maximum of -62‰ at KAFB-106MW1-I after 30 days of recirculation. For reference, Vienna Standard Mean Ocean Water has a δ^2H value of 0‰, by definition. As with fluorescein, no significant shift in δ^2H values was observed at the existing intermediate monitoring well KAFB-106063 during Phase 1.

The results from the Phase 1 tracer test indicated that the targeted treatment zone encompassing the shallow groundwater monitoring wells were hydraulically connected with the injection well. Additionally, it was evident that amendments were distributed in the treatment zone under the planned operating conditions. In particular, distribution of amendments to groundwater sampled by monitoring wells nearest to the injection well (KAFB-106MW2-S and KAFB-106064) occurred within 5 days of operation, suggesting a high likelihood of successfully distributing biostimulation amendments that favor reductive debromination of EDB. Based on these observations during Phase 1 operations, the recirculation system was operated similarly to distribute biostimulation amendments during Phases 2 and 3.

4.2.2 Tracer Distribution During Phase 2, 3, and 4

Phase 2

Iodide, introduced as KI, was used as conservative tracer to verify distribution of water containing biostimulation amendments, and to allow for distinction between recirculated waters and background water. During the Phase 2 recirculation period, four samples of the injected groundwater were collected directly from the KAFB-106IN1 sample port while the chemical feed pump was operating. Iodide results from the injectate ranged from 18 to 26 mg/L. Adjusting for the timing of amendment cycles, the average concentration of iodide in reinjected water ranged from 15 to 18.6 mg/L.

Figures 13 and 14 show iodide concentrations of samples collected from shallow and intermediate wells, respectively, during the pilot test. The iodide data are consistent with observations made using other tracers during Phase 1, showing more rapid transport to the shallow monitoring wells nearest to the injection well (KAFB-106MW2-S and KAFB-106064), with amendments arriving at the more distant extraction wells last. Also evident in the iodide data is that final concentrations observed at the nearest monitoring wells of 17 mg/L (KAFB-106MW2-S) and 18 mg/L (KAFB-106064) are equivalent with injected iodide concentrations (KAFB-106IN), which indicates that most of the groundwater observed at these wells was previously amended and reinjected. Groundwater at the more distant shallow groundwater monitoring well (KAFB-106MW1-S) was measured at 11 mg/L during the recirculation period, slightly lower than injected concentrations, indicating that a fraction of that water represented background conditions, or water that had previously been recirculated (during Phase 1) without iodide amendments. Lower concentrations of iodide observed at the extraction wells, 2.7 mg/L at KAFB-106EX2 and 1.3 mg/L at KAFB-106EX1, indicate longer transport times and dispersion consistent with Phase 1 results, and dilution due to extraction of water from both inside and outside the treatment zone. Consistent with Phase 1 tracer study results, elevated iodide concentrations up to 7.3 mg/L were observed at the nearest intermediate monitoring well (KAFB-106MW2-I), while transport to the other intermediate monitoring wells were slower, with an iodide measurement of 1.2 mg/L at KAFB-106MW1-I and no detections of iodide at KAFB-106063. Overall, iodide concentrations observed during the Phase 2 recirculation period indicated good distribution of injected waters, particularly within the treatment zone encompassing the shallow monitoring wells nearest to the injection well.

After recirculation of amendments at the start of Phase 2, a passive period without recirculation, but with continued monitoring, commenced and lasted more than four months and included four sampling events. Changes in iodide concentrations during the Phase 2 passive period were also informative. Iodide concentrations among the shallow groundwater monitoring wells nearest the injection well were fairly constant, with concentrations ranging from 17 to 22 mg/L for wells KAFB-106064 and KAFB-106MW2-S, and concentrations ranging from 13 to 16 mg/L for KAFB-106MW1-S. These iodide concentrations indicated that the sampled groundwater remained heavily influenced by treatment activities. Interestingly, iodide concentrations at KAFB-106EX1 increased from 1.3 mg/L at the end of recirculation to 8.3 mg/L during the Phase 2 passive period, and iodide concentrations at KAFB-106EX2 decreased from 2.7 mg/L at the end of recirculation to 0.3 mg/L during the Phase 2 passive period. While a decrease in iodide concentrations can result from iodide oxidation to iodate, the reducing conditions present at the site suggest this process should be limited. Rather the shifts in iodide concentrations at the outer boundaries of the treatment zone provide evidence that groundwater from outside the treatment zone is entering the treatment zone at KAFB-106EX2, and that groundwater with higher iodide concentrations from within the treatment zone are continuing to flow toward KAFB-106EX1. These data are consistent with a general west to east groundwater flow at the pilot site under ambient conditions at the time of the pilot test. A similar decrease in iodide concentrations was also observed at the intermediate monitoring well KAFB-106MW2-I, indicating that this well may also be located close to the upgradient edge of the treatment zone and influenced by groundwater from outside the treatment zone during passive periods.

Phase 3

During Phase 3 amendment and recirculation activities, no additional iodide was added to the aquifer as KI; however, iodide already present in the subsurface after Phase 2 was redistributed. As such, the presence of iodide still served as a conservative tracer to allow for distinction between recirculated waters (from either Phase 2 or 3) and background groundwater with low iodide concentrations. At the end of the Phase 3 recirculation period, iodide concentrations among the shallow groundwater monitoring wells ranged from 4.5 mg/L (KAFB-106MW2-S) to 6.2 mg/L (KAFB-106MW1-S). This tight range indicates that amendments continued to be distributed well in the treatment zone during Phase 3. Interestingly, iodide concentrations of the intermediate monitoring wells increased during Phase 3 recirculation, with concentrations increasing to 15 mg/L (KAFB-106MW1-I), 10 mg/L (KAFB-106MW2-I), and 5.2 mg/L (KAFB-106063). While some redistribution of iodide was apparent during Phase 2 passive periods, these increases in iodide concentrations at the intermediate monitoring wells indicate that transport to these locations generally took longer than the period of active recirculation with iodide amendments during

Phase 2 and continued to be redistributed to deeper locations during Phase 3 recirculation activities. This is logical considering the shallower screen intervals of both the injection well and extraction wells.

As during Phase 2, a passive period without recirculation, but with continued monitoring, commenced after recirculation ended. Iodide concentrations among the shallow groundwater monitoring wells nearest to the injection well varied little, with concentrations ranging from 6.3 mg/L (KAFB-106MW1-S) to 3.6 mg/L (KAFB-106MW2-S). These concentrations of iodide during the passive period indicated that the sampled groundwater remained heavily influenced by treatment activities. As before, iodide concentrations at KAFB-106EX1 increased from 4.6 mg/L at the end of recirculation to 6.2 mg/L during the Phase 3 passive period, and iodide concentrations at KAFB-106EX2 decreased from 4.6 mg/L at the end of recirculation to 0.5 mg/L during the Phase 3 passive period. These data remain consistent with a general west to east groundwater flow at the pilot site under ambient conditions. As during Phase 2, a similar decrease in iodide concentrations was also observed at the intermediate monitoring well KAFB-106MW2-I, again indicating that this well may be located close to the upgradient edge of the treatment zone and influenced by groundwater from outside the treatment zone during passive periods.

Phase 4

As described previously, Phase 4 of the pilot test did not include any groundwater recirculation efforts, or introduction of additional amendments to the subsurface. The presence of iodide served as a conservative tracer of groundwater that had previously been amended and recirculated. During Phase 4, iodide concentrations among the shallow monitoring wells ranged from 3.8 mg/L (KAFB-106064) to 6.3 mg/L (KAFB-106MW2-S); iodide concentrations at KAFB-106EX1 ranged from 6.8 mg/L (August 2020) to 10 mg/L (March 2020); iodide concentrations at KAFB-106EX2 ranged from non-detections to 0.35 (October 2020); and iodide concentrations at the injection well (KAFB-106IN1) ranged from 2.6 mg/L (October 2020) to 5.1 mg/L (August 2020). Detectable concentrations of iodide among the intermediate groundwater monitoring wells ranged from 0.35 mg/L (KAFB-106MW2-I) to 13 mg/L (KAFB-106MW1-I) during Phase 4.

Iodide concentrations observed at shallower wells during Phase 4 passive period were consistent with those observed during Phase 3. This consistency indicates limited groundwater flux across the pilot test location over the approximately two-year period that passed since water was last recirculated. The sampled groundwater remained heavily influenced by treatment activities. During Phase 4, iodide concentrations at intermediate depth groundwater monitoring wells were more variable and a decrease in iodide concentrations was evident in at least two (KAFB-106MW1-I and KAFB-106MW2-I) of the three wells (Figure 14). Sulfate and methane concentrations at KAFB-106MW1-I and KAFB-106MW2-I during Phase 4 (see Section 4.4) indicate less reducing conditions at these wells, and the decrease in iodide at these wells may have resulted from possible oxidation of iodide to iodate, or influx of groundwater from outside the treatment zone.

4.2.3 Distribution of Fermentable Substrate

Recirculated groundwater during Phase 2 and Phase 3 was amended with WilClear Plus®, which served as a fermentable substrate to stimulate debrominating organisms in the subsurface during the pilot test. As noted in the discussion of tracers above, reinjected groundwater was distributed throughout the treatment zone of the pilot test. However, due to possible sorption and retardation of organic compounds, the distribution of this fermentable substrate may have been slower than that of the tracers and observations of substrate and its immediate transformation products (e.g., acetate and propionate) provide additional insight regarding substrate distribution. During the Phase 2 recirculation period, three samples of the injected groundwater were collected directly from the KAFB-106IN1 sample port while the chemical feed pump was operating. Lactate concentrations of the injectate ranged from 140 to 154 mg/L. Adjusting for the timing of amendment cycles, the average concentration of lactate in reinjected water was approximately 110 mg/L. While measurements of reinjected substrate concentrations at KAFB-106IN1 were not made during Phase 3 recirculation activities, the system was operated under similar conditions, and lactate concentrations likely averaged between 100 and 150 mg/L as observed during Phase 2 recirculation.

Figures 15, 16, and 17 show measured lactate, acetate, and propionate concentrations of samples collected at all the monitoring wells during the pilot test. All three compounds were observed in baseline samples, perhaps as a result of low-level fermentation of organics present in the aquifer. While lactate was introduced to the subsurface at concentrations between 100 and 150 mg/L, concentrations at monitoring wells never exceeded 4 mg/L. Biological transformation of lactate, however, results in the production of both acetate and propionate. While acetate and propionate were detected in the amended and reinjected groundwater at concentrations of less than 30 mg/L during Phase 2, significantly higher concentrations were observed at monitoring wells, presumably as a result of *in situ* transformation of the amended carbon substrate. All wells showed clear increases in acetate concentrations, ranging from a lowest maximum of 44 mg/L in KAFB-106EX2 to a highest maximum of 151 mg/L in KAFB-106MW2-S. Likewise, propionate concentrations increased after biostimulation amendments, with only KAFB-106063 having no detections. Propionate concentrations in the wells ranged from a lowest maximum of 6.8 mg/L in KAFB-106MW1-I to a highest maximum of 74.9 mg/L in KAFB-106064. The observed decrease in lactate concentrations, together with increases in acetate and propionate suggest that lactate fermentative conditions conducive to reductive debromination of EDB were present at most wells during the pilot test. As expected, concentrations of acetate and propionate decreased at many of the wells during passive periods.

4.3 Microbial Analysis

As described in Section 4.2.3, amendments were supplied in the treatment area during Phase 2 and 3 to stimulate biological activity capable of reductive debromination of EDB. Figures 18 to 24 show populations of total eubacteria (EBAC), sulfate reducing bacteria (APS), methanogens (MGN), *Dehalobacter* spp. (DHBt), *Dehalobacter* DCM (DCM), *Dehalogenimonas* spp. (DHG), and *Desulfitobacterium* spp. (DSB) as determined by Microbial Insights' QuantArray-Chlor assay analysis. Generally, the results indicated that the groundwater contained large populations of microorganisms prior to pilot test activities, with EBAC counts ranging from around 10^6 cells per milliliter (cells/mL) to 10^7 cells/mL, APS counts ranging from 10^4 cells/mL to 10^5 cells/mL, and representative organisms likely capable of EDB debromination (i.e., DHBt and DSB) ranging from around 10^4 to 10^5 cells/mL in baseline samples. This is consistent with microbial analyses from at KAFB-106064 in 2015 and an order of magnitude (OOM) or greater than observed at a background well in 2015 (Kirtland AFB, 2016b). Given the large release of hydrocarbons at the site that can provide energy for diverse microbial communities, this high level of activity is not surprising. With one exception during Phase 4 (KAFB-106IN1), populations of *Dehalococcoides* spp. (DHC), a well-known dehalogenating species, were below 30 cells/mL throughout the pilot test and these DHC populations were not expected to contribute to EDB degradation during the pilot test without bioaugmentation. Fortunately, for the pilot test, the high number of other likely debrominating organisms suggested that biostimulation to increase their activity was possible.

During the various phases of the pilot test, the measured populations increased by as much as two OOM depending on the organism and monitoring well examined. Increased microbial populations were particularly apparent at the deeper wells (i.e., KAFB-106063, KAFB-106MW1-I and KAFB-106MW2-I), likely because conditions at these locations were more oligotrophic prior to recirculation. For populations of EBAC, much of the observed increase in population size occurred during Phase 1 recirculation activities. As with the deeper wells, this increase in EBAC after Phase 1 recirculation activity may be the result of organic carbon and nutrient redistribution in the treatment zone along with the increased groundwater flows due to recirculation. As with the high cell numbers prior to recirculation and amendments at the site, the large numbers of organisms likely capable of reductive debromination (10^5 to 10^6 cells/mL for DHBt, and around 10^5 cells/mL for DSB) observed after biostimulation indicated that the microbial capacity for EDB debromination remained very prevalent during the pilot test. Unfortunately, the microbial analyses performed do not provide direct information regarding the biodegradation activity of the microbial community. Such activity must be inferred from other lines of evidence collected during the pilot test, such as changes in EDB concentrations, products of EDB degradation, and shifts in isotope composition of residual EDB.

Three microbial populations that increased by more than 2 OOM during pilot test activities are MGN, DHG, and DCM. Stimulation of methanogens was also evident from increases in methane within the treatment zone, as discussed below in Section 4.4. The increases in DHG and DCM occurred only after the addition of biostimulation amendments, but it is unclear whether these directly impacted EDB degradation. DHG are known to reductively dehalogenate 1,2-dichloroethane (Moe et al., 2009), the chlorinated analog of EDB, and DHG likely also dehalogenate EDB. DCM are particularly known for their ability to grow using dichloromethane (Justicia-Leon et al., 2012), but are also a species of Dehalobacter (DHBt) that may include the ability to reductively dehalogenate other compounds. The growth of DHG and DCM suggest that EDB debromination activity may have been stimulated during the study, but, as with the other microbial data, these data are not conclusive in isolation.

4.4 Geochemistry

DO, sulfate, iron, and methane were monitored during the pilot test as indicators of *in situ* redox conditions (Figures 25 to 28). DO was monitored during purging activities using a water quality meter (YSI™ ProDSS). Samples for sulfate, iron, and methane were collected from pilot test wells and submitted for laboratory analysis. All four parameters indicate that intended anaerobic conditions favoring reductive debromination of EDB occurred during the pilot test.

The pilot test was sited within a zone significantly impacted by hydrocarbons. DO concentrations at the shallow wells most impacted were low (less than 1 mg/L) under baseline conditions presumably due to past aerobic degradation of some of these hydrocarbons. Intermediate wells were not as impacted by hydrocarbons and generally had greater DO concentrations ranging from 1.7 mg/L at KAFB-106MW2-I to 7.4 mg/L at KAFB-106MW1-I. During Phase 1 recirculation without biostimulation amendments, DO decreased to less than 0.5 mg/L in the wells, except for extraction well KAFB-106EX1 (2.1 mg/L) and intermediate wells KAFB-106MW1-I (8.4 mg/L) and 106063 (1.9 mg/L). Extraction well KAFB-106EX1 is located near the eastern edge of the hydrocarbon and EDB plume and pumping may have drawn in more oxygen rich and less impacted groundwater from greater depths or from further east. As indicated by tracer tests, intermediate wells KAFB-106MW1-I and KAFB-106063 were less impacted by recirculated water during the Phase 1 recirculation period. During and after Phase 2 and Phase 3 recirculation periods in which amendments were introduced to groundwater, DO concentrations were below 1 mg/L at all wells, with most concentrations below 0.5 mg/L. Occasional DO concentrations above 1 mg/L were observed at the extraction wells KAFB-106EX1 and KAFB-106EX2 during passive periods. The extraction well samples were collected by briefly turning on the recirculation pumps and the slightly elevated DO concentrations may have resulted from minor introductions of oxygen during this sampling process, or it may have resulted from collection of more oxygenated waters occurring *in situ*. During Phase 4, DO concentrations remained below 1 mg/L except at extraction wells KAFB-106EX1 and KAFB-106EX2 during the final sampling event (October 2020). The elevated DO at the two extraction wells is unexplained and other parameters and analytes at these wells generally appear consistent with previous observations. Overall, the low DO concentrations within the treatment zone reflect favorable conditions for reductive debromination of EDB.

With the exception of KAFB-106EX2 (25 mg/L), sulfate concentrations in shallow wells were low (<5 mg/L) under baseline conditions presumably due to past sulfate reduction to sulfide. Sulfate reduction is indicative of bulk reducing conditions in the aquifer that favor EDB debromination and, under site conditions, the resulting sulfide might interact with other subsurface elements (e.g., iron) to form sulfide minerals. Prior to Phase 4 of the pilot test, sulfate concentrations at KAFB-106EX2 always exceeded

10 mg/L with a maximum concentration of 39.7 mg/L (Phase 2 passive), perhaps as a result of extracting groundwater richer in sulfate from outside the treatment zone. Intermediate wells were not as impacted by hydrocarbons and generally had greater sulfate concentrations under baseline conditions ranging from 16.4 mg/L at KAFB-106063 to 23.8 mg/L at KAFB-106MW1-I. During Phase 1 recirculation without biostimulation amendments, there was an increase in sulfate concentrations among the shallow wells as sulfate was redistributed at the site with concentrations ranging from 13.8 mg/L at KAFB-106064 to 28.5 at KAFB-106EX1, and among the intermediate wells with concentrations ranging from 15.4 mg/L at KAFB-106MW2-I to 26 mg/L at KAFB-106063. During the subsequent Phase 1 passive period, sulfate generally decreased in the wells to less than 5 mg/L due to sulfate reduction, but concentrations exceeding 10 mg/L were still observed at the extraction wells and two of the three intermediate wells (KAFB-106063 and KAFB-106MW1-I). During and after Phase 2 and Phase 3 recirculation periods, sulfate concentrations were below 5 mg/L in the wells (except for KAFB-106EX2) and were often not detected. During the recirculation events themselves, both extraction wells had sulfate concentrations exceeding 5 mg/L, and it is likely that much of this observed sulfate was drawn to the extraction wells from outside the treatment zone. During Phase 4, after observation of NAPL in KAFB-106EX2 and KAFB-106EX1, its subsequent removal, and installation of new sampling pumps, lower sulfate concentrations of less than 1 mg/L were noted in KAFB-106EX2, consistent with more reducing conditions observed at other locations. During Phase 4, sulfate concentrations at intermediate wells KAFB-106MW1-I and KAFB-106MW2-I increased to more than 5 mg/L, perhaps indicating somewhat more oxidized conditions. Overall, the low sulfate concentrations (below 20 mg/L), and observed decreases in sulfate concentrations within the treatment zone reflected reducing conditions favorable for reductive debromination of EDB.

Due to the low solubility of ferric (Fe(III)) iron under circumneutral conditions as found at the site, dissolved iron concentrations are often considered indicative of more reduced ferrous (Fe(II)) iron. Minerals containing oxidized Fe(III) are fairly ubiquitous and elevated dissolved iron concentrations are usually indicative of iron reducing environments. Baseline measurements at the site indicated dissolved iron concentrations ranging from 1 mg/L (KAFB-106MW1-S) to 12 mg/L (KAFB-106MW2-S) in shallow wells, but concentrations at deeper, less impacted wells were all less than 1 mg/L. During and after Phase 2 and Phase 3 recirculation periods, dissolved iron concentrations increased due to iron reduction and maximum concentrations at individual wells ranged from 4.2 mg/L in KAFB-106EX2 to 22.1 mg/L in KAFB-106MW2-I. During Phase 4, dissolved iron concentrations ranged from 0.885 mg/L in KAFB-106MW2-I to 15.2 mg/L in KAFB-106MW2-S. Generally, the elevated dissolved iron concentrations observed during the pilot test are consistent with bulk reducing conditions that facilitate reductive debromination of EDB.

High methane concentrations in the subsurface are frequently indicative of methanogenesis that occurs under anaerobic conditions. Methane was observed during baseline measurements among shallow wells with concentrations ranging from 2 µg/L at KAFB-106MW1-S to 179 µg/L at KAFB-106064. The higher concentrations support the interpretation that the treatment zone was anaerobic prior to pilot test activities. During the Phase 1 recirculation period, methane concentrations dropped to less than 10 µg/L suggesting mixing from less methanogenic regions, increased abiotic losses (e.g., due to degassing under flow conditions), or methane oxidation. During the Phase 1 passive period, methane concentrations rebounded with a maximum concentration of 350 µg/L at KAFB-106MW2-S. During the Phase 2 recirculation period when lactate amendments were introduced, methane concentrations generally fell again, but increased by many OOM at several wells during the following passive period, with concentrations exceeding 10,000 µg/L at the injection well and KAFB-106MW2-S. After the Phase 3 recirculation period where lactate amendments were introduced, methane concentrations increased further and all wells, except for KAFB-106MW1-I, exceeded 100 µg/L. Shallow wells KAFB-106MW2-S and KAFB-106064 exceeded 10,000 µg/L. During Phase 4, while elevated methane concentrations were noted throughout the pilot test area, the lowest methane concentrations were observed at KAFB-106MW1-I and KAFB-106MW2-I, and may indicate somewhat more oxidized conditions at these locations. Methane concentrations measured during Phase 4 were above 100 µg/L in all wells except KAFB-106MW1-I and

KAFB-106MW2-I; and exceeded 10,000 µg/L in shallow monitoring wells KAFB-106MW2-S and KAFB-106064. It should be noted that the aqueous solubility of methane at 1 atmosphere is in the range of 20,000 µg/L, so it is feasible that minor pockets of gas-phase methane existed near wells with highest methane concentrations. These elevated methane concentrations are consistent with the increased populations of methanogens discussed in Section 4.3 and are indicative of reducing conditions favorable for EDB debromination.

4.5 Selected Contaminants of Interest

The primary objective of this pilot test was to evaluate the potential for enhanced anaerobic EDB biodegradation. Degradation of other contaminants co-located with EDB due to the nature of their common sources, including benzene and toluene, was not the objective of this pilot test. However, benzene and toluene were used to help evaluate the fate of EDB. Both benzene and toluene are slightly less water soluble and more volatile than EDB, and their behavior helps constrain expectations for some abiotic EDB loss mechanisms, such as volatilization. Additionally, benzene and toluene are generally less susceptible than EDB to degradation under anaerobic conditions. As such, it is helpful to discuss the behaviors of benzene and toluene prior to discussing EDB degradation observed during the pilot test. Figures 29 to 31 show concentrations of benzene, toluene, and EDB, respectively for all wells of the pilot test, and Table 17 shows the reduction of benzene, toluene, and EDB associated with each Phase of the pilot test, as well as from baseline evaluation to the most recent Phase 4 sampling.

4.5.1 Benzene and Toluene

Benzene concentrations in shallow monitoring wells during the baseline evaluation ranged from 586 µg/L at KAFB-106MW2-S to 8,240 µg/L at KAFB-106MW1-S; benzene was not detected in the intermediate wells during baseline measurements. The measured benzene baseline concentrations were somewhat higher than those measured prior to pilot test well installation and development activities (benzene concentrations were approximately 1,000 µg/L at well KAFB-106064). This increase may have been the result of different types of sample pumps (bladder pumps) placed at different depths, heterogenous distribution of benzene in the subsurface, or perhaps due to increased mass transfer from residual NAPL during well installation and development. It should be noted that the highest benzene concentration was observed at KAFB-106MW1-S where NAPL was present at the start of the pilot test (September 2017). During the Phase 1 recirculation period, benzene concentrations at shallow monitoring wells were more evenly distributed throughout the site and ranged from 2,730 µg/L (KAFB-106MW2-S) to 3,630 µg/L (KAFB-106MW1-S). With the exception of the injection well (KAFB-106IN1) and monitoring well KAFB-106MW1-S, benzene concentrations in shallow monitoring wells for the remainder of the pilot test ranged in concentration from 1,500 µg/L at KAFB-106MW2-S to 6,700 µg/L at KAFB-106EX2, indicating limited losses due to biodegradation or abiotic mechanisms (e.g., volatilization, dilution). Benzene concentrations as low as 590 µg/L were observed at the injection well during Phase 4 sampling. Interestingly, benzene increased during the passive periods at the shallow well KAFB-106MW1-S to concentrations as high as 9,800 µg/L. The higher concentration at KAFB-106MW1-S is similar to baseline conditions prior to recirculation and may be the result of increased mass transfer from residual NAPL phases, as NAPL had previous been observed at that location.

Relative to the shallower monitoring wells, benzene concentrations at the intermediate wells during the pilot test were more variable and interpreting changes in these benzene concentrations is more challenging. As noted earlier, benzene was not detected at the intermediate wells during baseline measurements, but benzene concentrations increased after recirculation activities mixed groundwater over a greater depth. During Phase 2 and Phase 3 recirculation periods, benzene concentrations ranged from 1,200 µg/L to 3,600 µg/L at the intermediate wells. However, these benzene concentrations decreased to approximately 50 µg/L during the Phase 2 passive period at KAFB-106MW1-I and 106MW2-I; and to 0.67 µg/L at KAFB-106MW2-I by the end of Phase 4 passive monitoring. No significant decrease in benzene concentrations was noted at KAFB-106063. The observed decreases in benzene concentrations may be due to sorption in the soils or degradation, but may also be attributed in part to the influx of groundwater not impacted by benzene as decreases in the iodide tracer were also observed in KAFB-106MW2-I.

Toluene concentrations in shallow monitoring wells during the baseline evaluation ranged from 1,540 µg/L at KAFB-106MW2-S to 13,200 µg/L at KAFB-106MW1-S, and toluene concentrations were less than 10 µg/L in all three intermediate monitoring wells, significantly less than the EPA maximum contaminant level (MCL) of 1,000 µg/L (EPA, 2009). As with benzene, the highest toluene concentration was observed at KAFB-106MW1-S where NAPL was present at the start of the pilot test. During the Phase 1 recirculation period, toluene concentrations at shallow monitoring wells were more evenly distributed throughout the site and ranged from 4,740 µg/L (KAFB-106MW2-S) to 9,330 µg/L (KAFB-106MW1-S). Toluene concentrations in the shallow monitoring wells for the remainder of Phases 1 through 3 ranged in concentration from 3,300 µg/L at the injection well to 19,500 µg/L at KAFB-106064, indicating limited losses due to biodegradation or abiotic mechanisms during this time (e.g., volatilization, dilution). Interestingly, toluene concentrations decreased during Phase 4 passive monitoring at many shallow wells (see Figure 30). These decreases were far greater than for benzene and may indicate some anaerobic biodegradation of toluene.

As with benzene, toluene concentrations at the intermediate wells during the pilot test were more variable and interpreting changes in these toluene concentrations is challenging. Toluene impacts at the intermediate wells were limited during the baseline evaluation, but toluene concentrations increased after recirculation activities mixed groundwater over a greater depth. During Phase 2 and Phase 3 recirculation periods, toluene concentrations increased to concentrations as high as 19,000 µg/L at the intermediate wells, but as observed with benzene, toluene concentrations decreased during the following passive periods at wells KAFB-106MW1-I and KAFB-106MW2-I, decreasing to below detectable concentrations at KAFB-106MW2-I during Phase 4 passive monitoring. Toluene concentrations decreased during Phase 4 passive monitoring at KAFB-106063 to a concentration of 1,800 µg/L (from 19,000 µg/L during

Phase 3 passive period). As noted with benzene, the observed decreases in toluene concentrations at the intermediate wells may be due to sorption in the soils or degradation, but may also be attributed in part to the influx of groundwater not impacted by toluene as decreases in iodide tracer were also observed in KAFB-106MW2-I and KAFB-106MW1-I.

Overall, the trends among benzene and toluene concentrations suggest that losses during and after recirculation were limited at the shallower wells, but interpretation of trends at the intermediate wells is more challenging. With the exception of toluene decreases noted among shallow monitoring wells during Phase 4 monitoring, the reasonably constant benzene and toluene concentrations observed in the shallow zone throughout the pilot test provide a good point of comparison to help evaluate EDB degradation. Decreases in EDB concentrations much greater than observed for benzene and toluene provide evidence of EDB degradation, as other abiotic mechanisms leading to lower concentrations would likely be mirrored in benzene and toluene data.

4.5.2 EDB

EDB Concentrations

EDB was the contaminant targeted by these pilot test efforts. EDB concentrations in shallow monitoring wells during the baseline evaluation ranged from 20.1 µg/L at KAFB-106IN1 to 432 µg/L at KAFB-106MW1-S, and among the intermediate wells EDB was only detected at KAFB-106MW2-I with a concentration of approximately 0.1 µg/L. These baseline EDB concentrations were somewhat higher than that measured prior to pilot test well installation, when EDB concentrations at KAFB-106064 were 9.3 µg/L (Fourth Quarter 2016 Kirtland AFB, 2017c) and 17 µg/L (Second Quarter 2016; Kirtland AFB, 2016c). This increase may have been the result of different types of sample pumps (bladder pumps) placed at different depths, heterogenous distribution of EDB in the subsurface, or perhaps due to increased mass transfer from residual NAPL during well installation. As with benzene and toluene, the highest EDB concentration during the baseline evaluation was observed at KAFB-106MW1-S where NAPL was present at the start of the pilot test.

EDB concentrations at shallow monitoring wells were more evenly distributed during the Phase 1 recirculation period and ranged from 50.4 µg/L (KAFB-106EX1) to 137 µg/L (KAFB-106EX2), with EDB concentrations at wells closer to the injection well ranging from 68 µg/L (KAFB-106MW2-S) to 104 µg/L (KAFB-106MW1-S). Compared to the EDB concentrations observed during Phase 1 recirculation, concentrations at the shallow monitoring wells decreased during the following Phase 1 passive period, with EDB reductions of approximately 75% observed at wells KAFB-106064 (20.3 µg/L), KAFB-106EX1 (12.9 µg/L), and KAFB-106MW2-S (15 µg/L) after the one-month passive period. This is slightly less than a one-log reduction (i.e., 90%), as indicated in Table 17. Decreases of similar magnitude were not observed for benzene and toluene, where losses were less than 25% and, in most cases, less than 10% with some increases in concentration. These observations are consistent with some ongoing EDB degradation that may have been further stimulated by groundwater recirculation and nutrient redistribution from other locations within the aquifer. Whether this apparent EDB degradation would have been sustained for longer periods was not assessed during this pilot test as Phase 2 recirculation and biostimulation activities commenced as planned after the approximately one-month passive period. Decreases in EDB concentrations were observed at the intermediate monitoring wells too, with losses up to 95%. However, these EDB reductions were mirrored in benzene and toluene data, and may be due to degradation or other processes, such as sorption in the soils or influx of unimpacted groundwater.

During the last sampling of the Phase 2 recirculation period, the range of EDB concentrations observed at shallow monitoring wells was less variable, ranging from 66.4 µg/L at KAFB-106MW1-S to a maximum of 90.9 µg/L at KAFB-106EX2. This indicated some redistribution of EDB within the treatment zone and provides a point of comparison for changes during the subsequent passive period. Except for KAFB-

106EX2, where no change in EDB concentration was observed, EDB concentrations decreased during the Phase 2 passive period by approximately 90% or more. As indicated in Table 17, this corresponds to one-log (90%) to three-log reduction (99.9%) relative to maximum concentrations measured during Phase 2 recirculation. Notably, EDB was not detected at the injection well (KAFB-106IN1) or KAFB-106MW2-S at the end of the passive period, with detection limits of approximately 0.02 µg/L. As mentioned earlier, no significant decreases of benzene and toluene were observed, providing evidence that abiotic losses (e.g. volatilization) were limited, and that anaerobic EDB degradation was stimulated during this passive period. As during the Phase 1 passive period, decreases in EDB concentrations were observed at the intermediate monitoring wells, but decreases in benzene and toluene were also observed, such that changes were not exclusive to EDB. In addition to EDB, benzene, and toluene degradation, other possible explanations leading to these decreases at intermediate wells include sorption in the soils or influx of unimpacted groundwater.

Due to the large decrease in EDB concentrations during Phase 2 and apparent *in situ* biodegradation activity of indigenous debrominating organisms, a decision was made to delay the planned bioaugmentation of the treatment zone with exogenous debrominating organisms (Kirtland AFB, 2018a). Instead, additional recirculation with more organic substrate and nutrients was performed during Phase 3 with the goal of expanding the biological treatment zone. In contrast to Phase 1 and Phase 2 recirculation activities and in contrast to other solutes (e.g., iodide, benzene, toluene), EDB concentrations observed during Phase 3 recirculation exhibited a new pattern. Measured EDB concentrations at the extraction wells were reasonably constant during this recirculation period, with concentrations at KAFB-106EX1 ranging from 11 µg/L to 20 µg/L, and concentrations at KAFB-106EX2 ranging from 47 µg/L to 97 µg/L. Based on flows through the treatment system from the extraction wells, EDB in the reinjected groundwater ranged from approximately 35 µg/L to 45 µg/L, yet concentrations at the monitoring wells were less, ranging from approximately 3 µg/L at KAFB-106064 to 11 µg/L at KAFB-106MW1-S. Notably, EDB concentrations also decreased at the shallow wells during this recirculation period with time. Observing concentrations lower than injected concentrations and decreasing EDB concentrations during the recirculation period suggests that EDB degradation was stimulated and occurred between the injection well and the shallow monitoring wells during the Phase 3 recirculation period. Similar decreases in concentrations were not observed for benzene or toluene. Except for KAFB-106EX2 and KAFB-106MW1-S, where changes in EDB concentrations were less, EDB concentrations during the subsequent passive period decreased by 95% or more relative to maximums observed during the preceding recirculation period. As indicated in Table 17, these decreases corresponded to one-log (90%) to three-log reduction (99.9%) relative to maximum concentrations measured during Phase 3 recirculation, and EDB was detected at concentrations less than the EPA MCL of 0.05 µg/L (EPA, 2009) at the injection well (KAFB-106IN1) and wells KAFB-106MW2-S and KAFB-106064. As mentioned earlier, no significant losses of benzene and toluene were observed, providing evidence that abiotic losses (e.g. volatilization) were limited, and that anaerobic EDB degradation was stimulated during this passive period. Overall, the footprint of enhanced EDB degradation appeared larger after Phase 3 activities than during Phase 2. As during the Phase 1 and 2 passive periods, decreases in EDB concentrations were observed among the intermediate monitoring wells during Phase 3, but because similar decreases in benzene and toluene were also observed, such changes were not exclusive to EDB and could not be solely attributed to reductive debromination.

Phase 4 extended monitoring of the pilot test performance commenced after Phase 3, and five sampling rounds were performed, the first of which occurred approximately four months after Phase 3 recirculation activities were halted. There was no significant rebound in EDB concentrations during Phase 4. During Phase 4, EDB decreased to non-detectable concentrations at all wells except KAFB-106EX2 and KAFB-106MW2-S. Concentrations of EDB have decreased in KAFB-106EX2 from 55 µg/L (last Phase 3 passive sampling event) to 0.36 µg/L at the end of Phase 4. Concentrations of EDB have increased slightly in KAFB-106MW2-S from 0.019 µg/L (last Phase 3 passive sampling event) to 0.087 µg/L at the end of Phase 4. Figure 8 shows the EDB concentrations measured during baseline and Phase 4 sampling events at all pilot test wells. Table 17 and Figure 32 show the overall extent of reduction in EDB, benzene, and toluene from baseline measurements (or the highest observed concentrations for intermediate wells) to the most recent Phase 4 sampling event (October 2020). EDB reductions were greater than 99% in all six shallow wells, with five of the wells exhibiting greater than three-log reductions (99.9%). Further, four of the shallow wells were below the EPA MCL of 0.05 µg/L (EPA, 2009) for EDB during their most recent sampling event (Figure 8). Reductions of benzene and toluene were more limited. The large and rapid reductions in EDB concentrations in an environment conducive to reductive debromination strongly suggests that *in situ* anaerobic biodegradation of EDB occurred.

EDB Degradation Products

Reductive debromination of EDB by various debrominating organisms often results in stoichiometric production of one mole of ethene and two moles of bromide for each mole of EDB reduced (Koster van Groos et al, 2018). Under reducing conditions, ethene can also be further transformed to ethane, and both gases as well as bromide are reasonably stable under anaerobic conditions. Elevated concentrations of these degradation products can provide additional evidence of reductive debromination of EDB under both baseline conditions and during pilot test efforts. During laboratory studies (Koster van Groos et al, 2018), a minor branching product of tentatively identified vinyl bromide was observed during slower EDB hydrolysis conditions, but vinyl bromide was not detected during anaerobic biodegradation studies. Sequential hydrogenolysis of EDB to bromoethane and then ethane is also possible (Henderson et al., 2008). Accurate measurement of trace concentrations of vinyl bromide or bromoethane products, as might be expected given relatively low parent EDB concentrations, is challenging and was not attempted during this pilot test.

Assuming stoichiometric conversion of EDB to ethene and ethane during reductive debromination and that contributions of ethene and ethane from sources other than EDB were negligible, quantities of EDB degraded by this mechanism were estimated using measured concentrations of ethene and ethane:

$$C_{EDB-degraded} = MW_{EDB} * \left(\frac{C_{ethene}}{MW_{ethene}} + \frac{C_{ethane}}{MW_{ethane}}\right)$$

where *C* indicates concentrations in units of mass per volume, and *MW* indicates the molecular weights of the respective compounds. Figures 33 and 34 show estimated quantities of EDB degraded through this mechanism based on the formation of ethene and ethane products observed at the shallow and intermediate wells, respectively. In shallow wells, estimates of EDB degraded to ethene and ethane during the baseline evaluation ranged from approximately 20 µg/L at KAFB-106EX1 to over 130 µg/L at both KAFB-106064 and KAFB-106MW2-S, indicating that there was likely EDB debromination occurring prior to any pilot test activities. During the Phase 1 recirculation period, these estimates of EDB degraded decreased and ranged from 5 µg/L (KAFB-106MW2-S and KAFB-106EX2) to 24 µg/L (KAFB-106064). Many geochemical measures (e.g., sulfate, iron, methane) indicated more oxidizing conditions during this recirculation period, which may be attributed to redistribution of the low concentrations of DO observed at KAFB-106EX1 throughout the treatment zone. The small quantities of DO introduced during this process may have helped facilitate some ethene and ethane consumption. During the Phase 1 passive period, increases in estimates of EDB degraded based on ethene and ethane were noted, which is consistent with the decreases in EDB concentrations during this period described earlier, providing further evidence of EDB degradation prior to biostimulation efforts.

During and after the Phase 2 recirculation period, estimates of EDB degraded based on ethene and ethane increased to magnitudes similar to initial EDB concentrations, suggesting substantial conversion. The highest such estimate of EDB degraded occurred at KAFB-106MW1-S after Phase 3 biostimulation efforts with an estimated concentration of approximately 270 µg/L. This is also the location where the highest initial EDB concentrations were noted during the baseline evaluation with a concentration of over 400 µg/L. During Phase 4, the highest estimate of EDB degraded occurred at KAB-106EX2 with an estimated maximum concentration of approximately 309 µg/L. Extraction well KAFB-106EX2 also had a high initial EDB concentration of 143 µg/L measured during the baseline evaluation, and NAPL was observed in this well during Phase 4. Decreases in ethene and ethane occurred with time at several wells during passive periods, despite large EDB reductions at these locations. This decrease in ethene and ethane could indicate slowed production of these compounds due to the lower parent EDB concentrations, together with some ethene or ethane degradation or partitioning into gas-phase pockets that may be present due to methanogenesis. As described in Section 4.4, very high methane concentrations were observed at several wells that could reflect the presence of gas-phase methane.

Reductive debromination of EDB can result in the production of two moles of bromide for each mole of EDB degraded. Two challenges for examining bromide released during this process are the presence of bromide in background water and that expected bromide released from EDB could be quite small. For example, degradation of 100 µg/L of EDB results in release of just 0.085 mg/L of bromide, which may be challenging to measure. One method for distinguishing the release of bromide from background water is to examine the ratio of bromide to chloride as these anions are typically correlated due to their frequent common sources. Deviation from a constant ratio in favor of greater bromide might indicate a unique source of bromide, such as EDB debromination.

Figure 35 shows concentrations of bromide vs. chloride for all the wells of the pilot test, and Figures 36 and 37 show the bromide to chloride ratio with time for the shallow and intermediate wells, respectively. The dashed red line in each of these figures approximates the background ratio of 0.0079 based on previous studies (Kirtland AFB, 2016b). Examining these figures, very few samples were enriched in chloride relative to bromide compared to the background, but many samples were enriched in bromide. The largest apparent increase in bromide to chloride ratio occurred during and after the Phase 3 recirculation period. This coincided with use of a new certified analytical laboratory after the original analytical laboratory measuring bromide ceased operations. There was also a significant increase in bromide to chloride ratio in shallow wells KAFB-106EX1, KAFB-106MW2-S, and KAFB-106MW1-S towards the end of Phase 4. Several of the increases in bromide appear to be on the order of 1 mg/L, which corresponds to degradation of approximately 1,200 µg/L of EDB – much more than was observed in aqueous phase measurements during the pilot test. One explanation for this large excess of bromide could be stimulation of debrominating organisms within the treatment zone and continuing release and degradation of EDB from a separate phase source (e.g. NAPL), which would certainly be of interest.

Carbon Isotope Analysis of EDB

Examining the isotope composition of pollutants provides a novel measure of their degradation (Hunkeler et al., 2008, Wilson et al., 2008). As EDB degrades, its carbon (C) stable isotope composition can change as EDB with a heavy C isotope substitution (^{13}C) degrades slightly slower than EDB with only ^{12}C (Koster van Groos et al, 2018). Biological and abiotic degradation of EDB both result in changes in the isotope composition of EDB, and differences in reaction rates between the two EDB species are generally within 4% of each other. The isotope composition of EDB does not shift as a result of dilution and volatilization is expected to have negligible impact on isotope composition under site conditions. As such, a shift in EDB $\delta^{13}C$ from more negative values to more positive values (corresponding to an increase in relative ^{13}C abundance) provides additional evidence of EDB degradation. Figure 38 shows $\delta^{13}C$ values of EDB sampled at shallow monitoring wells during the pilot test, as well as of EDB extracted from the NAPL recovered at well KAFB-106MW1-S during baseline studies. Unfortunately, it was not possible to measure the isotope composition of each sample, as low EDB concentrations and high concentrations of other VOCs, such as benzene and toluene complicated the analyses.

The $\delta^{13}C$ values of EDB in the NAPL sample and at well KAFB-106EX2 were consistently the most negative with values of -16‰ or lower, which indicates they were the least degraded. This is consistent with the other measures of EDB degradation discussed earlier and as shown in Table 17 and Figure 32. The baseline evaluation performed with samples collected prior to the pilot test included EDB $\delta^{13}C$ values as high as -5‰, significantly higher than the EDB of the NAPL and located at KAFB-106EX2, indicating significant isotope fractionation and providing further evidence of EDB degradation under ambient conditions at the site prior to the pilot test. $\delta^{13}C$ values of EDB during passive periods of the pilot test were typically more positive than preceding recirculation periods, providing further evidence of enhanced degradation during passive periods. $\delta^{13}C$ of EDB at KAFB-106064 and KAFB-106MW2-S increased between baseline measurements and the first passive period, suggesting EDB degradation after initial recirculation efforts prior to the introduction of biostimulation amendments, consistent with observed decreases in EDB concentration at these locations. The highest $\delta^{13}C$ value of EDB (+5‰) was from a sample collected at KAFB-106EX1 during the Phase 2 passive period and represents a large shift in isotope composition and significant EDB degradation. We suspect, however, that if isotope analyses were feasible with lower concentration samples, even higher $\delta^{13}C$ values would have been observed at several of the wells. Overall, the increases in $\delta^{13}C$ values of EDB observed provide strong supporting evidence that EDB degraded during the pilot test. Additionally, while isotope fractionation can result from both biological and abiotic degradation mechanisms, the relatively rapid shifts and other lines of evidence noted during the pilot test suggest that the shift in isotope composition was likely the result of biodegradation processes.

5. CONCLUSIONS

5.1 Conclusions

The primary objective of this pilot test was to demonstrate anaerobic ISB as a treatment technology targeting EDB in impacted groundwater at Kirtland AFB. Based on the pilot test data reviewed here, the following conclusions regarding the effectiveness of ISB for EDB treatment were made:

- Enhanced ISB of EDB was successfully demonstrated (see Figure 32 and Figure 8). EDB degradation was evident during the pilot test with a greater than two-log reduction (>99%) at all wells examined. While meeting the EPA MCL of 0.05 µg/L was not a specific objective of the pilot test, only two of the wells, KAFB-106MW2-S (0.087 µg/L) and KAFB-106EX2 (0.36 µg/L), exceeded this level during the October 2020 sampling event. EDB degradation was evident through comparison with benzene and toluene concentrations, and the production of EDB degradation products ethene, ethane, and bromide suggested that this degradation occurred by reductive debromination. Higher EDB $\delta^{13}C$ values (observed to be as high as +5‰ at KAFB-106EX1) provided additional isotopic evidence of EDB degradation.

- Baseline measurements indicated that EDB was likely degrading prior to the pilot test. QuantArray-Chlor analyses indicated that microorganisms likely capable of degrading EDB were present during the baseline assessment and throughout the pilot test. During the baseline assessment, degradation products of reductive debromination (e.g., ethene, ethane, bromide) were present in the groundwater and EDB was observed to have more positive $\delta^{13}C$ values (up to -5‰). These all indicate EDB degradation prior to ISB treatment.

- Tracer and biostimulation amendments were distributed throughout the treatment zone, with highest concentrations of iodide and propionate observed at wells KAFB-106MW1-S, KAFB-106MW2-S, and KAFB-106064 (see Figure 13 and 17). The continued presence and consistency among iodide concentrations through Phase 4 indicates that groundwater influx at the site has been limited.

- Measurements of DO, sulfate, iron, and methane indicate that reducing conditions favorable for reductive debromination of EDB were achieved throughout the site.

- During the pilot test, the performance of one extraction well (KAFB-106EX2) and the injection well (KAFB-106IN1) deteriorated, but the performance of these wells remained sufficient to finish the pilot test. Well maintenance such as mechanical and/or chemical rehabilitation may be required for long-term viability.

- Continued quarterly monitoring at all nine pilot test wells for the parameters specified in the Work Plan (Kirtland AFB, 2016a) may be unnecessary, and it is recommended that future monitoring proceed only at wells KAFB-106063 and KAFB-106064 in accordance with the most recently approved groundwater monitoring work plan. Based on recent groundwater results and in accordance with the Work Plan (Kirtland AFB, 2016a), sampling at seven wells associated with the pilot test should be complete (KAFB-106MW1-S, KAFB-106MW1-I, KAFB-106MW2-S, KAFB-106MW2-I, KAFB-106EX1, KAFB-106EX2, and KAFB-106IN1). Significant rebound of EDB was not observed during Phase 4 passive monitoring and sampling a subset of pilot test groundwater monitoring wells consistent with site-wide monitoring efforts can provide representative information regarding long-term pilot test performance.

- The pilot test is complete and it is recommended that aboveground components of the groundwater recirculation system and other infrastructure be removed from the site. No final remedy has been selected at this time for the BFF site and this equipment is currently not required. All groundwater monitoring, extraction, and injection wells associated with the pilot test will remain in place.

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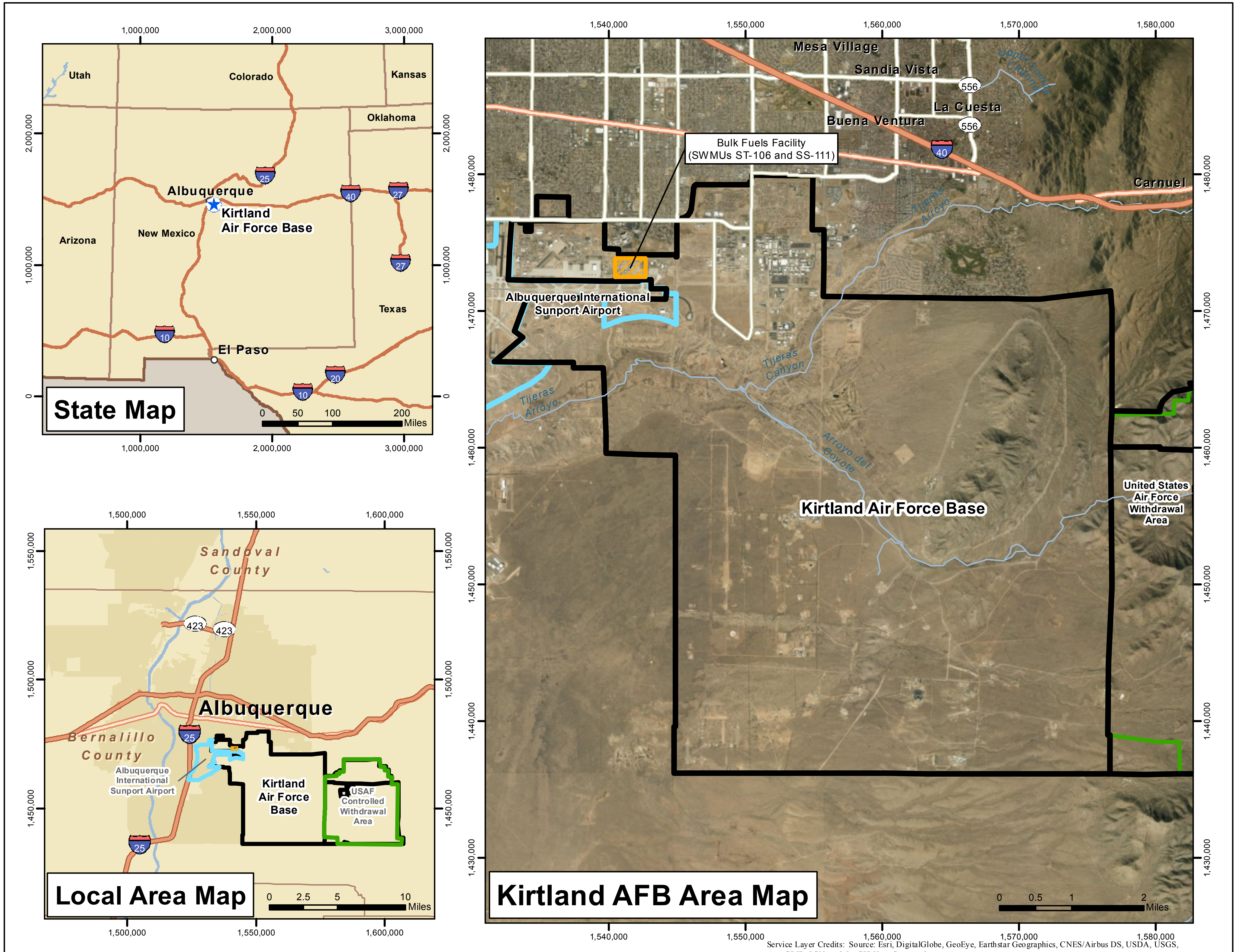
FIGURES



Legend

- Installation Location
- Kirtland Air Force Base Installation Boundary
- Bulk Fuels Facility (SWMUs ST-106 and SS-111)
- Albuquerque International Sunport Airport
- United States Air Force Withdrawal Area
- Major Highways
- Highways
- Major Roads
- Rivers
- Urban Areas
- Counties
- States

SWMUs = Solid Waste Management Unit
AFB = Air Force Base
USAF = United States Air Force

N

Revision Date: 02/20/19

Projection : NAD83 State Plane New Mexico Central FIPS3002 Feet

ETHYLENE DIBROMIDE IN SITU BIODEGRADATION
PILOT TEST REPORT
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 1

AREA LOCATION MAP

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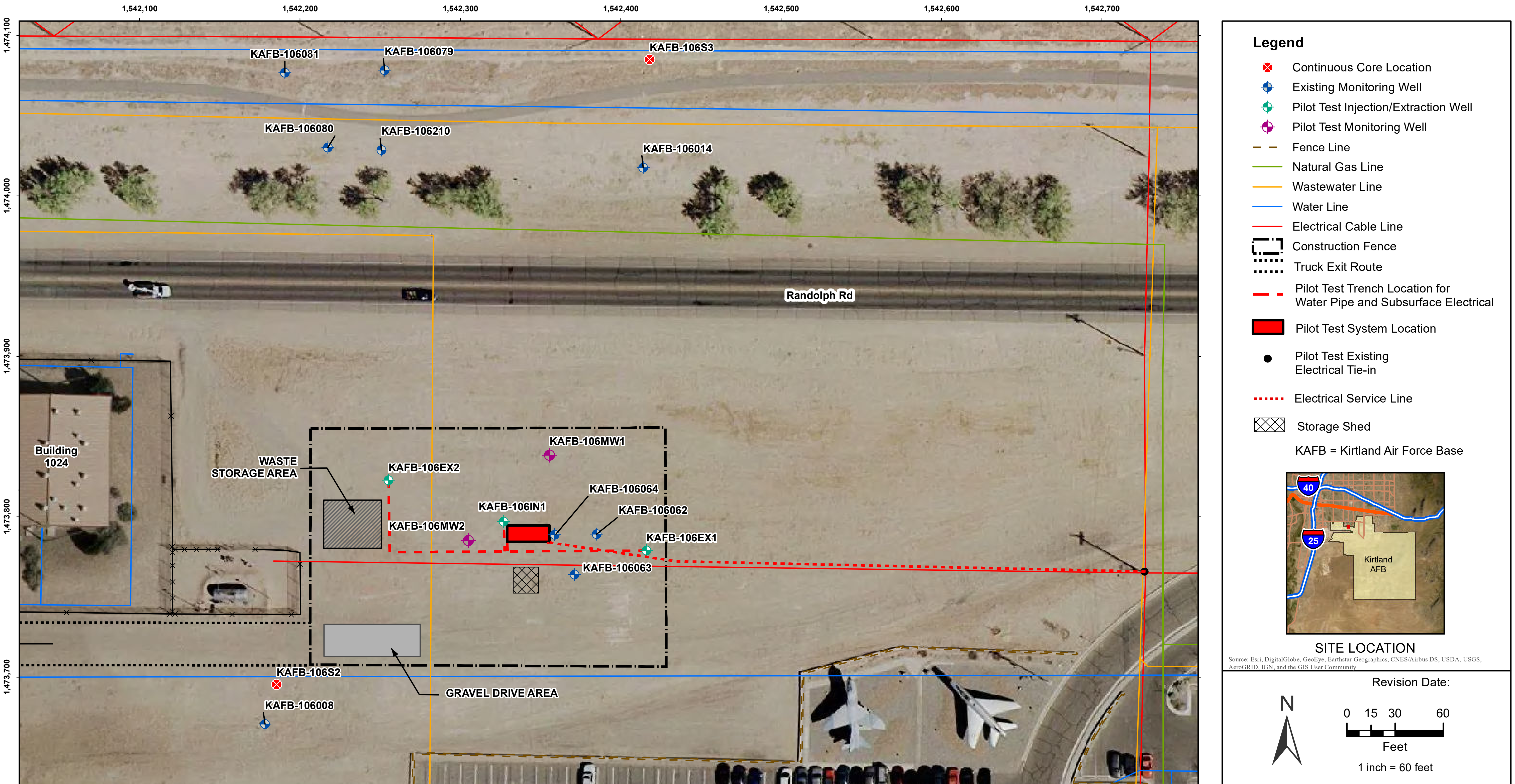

ETHYLENE DIBROMIDE IN SITU BIODEGRADATION
PILOT TEST REPORT
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 2

SITE LOCATION MAP

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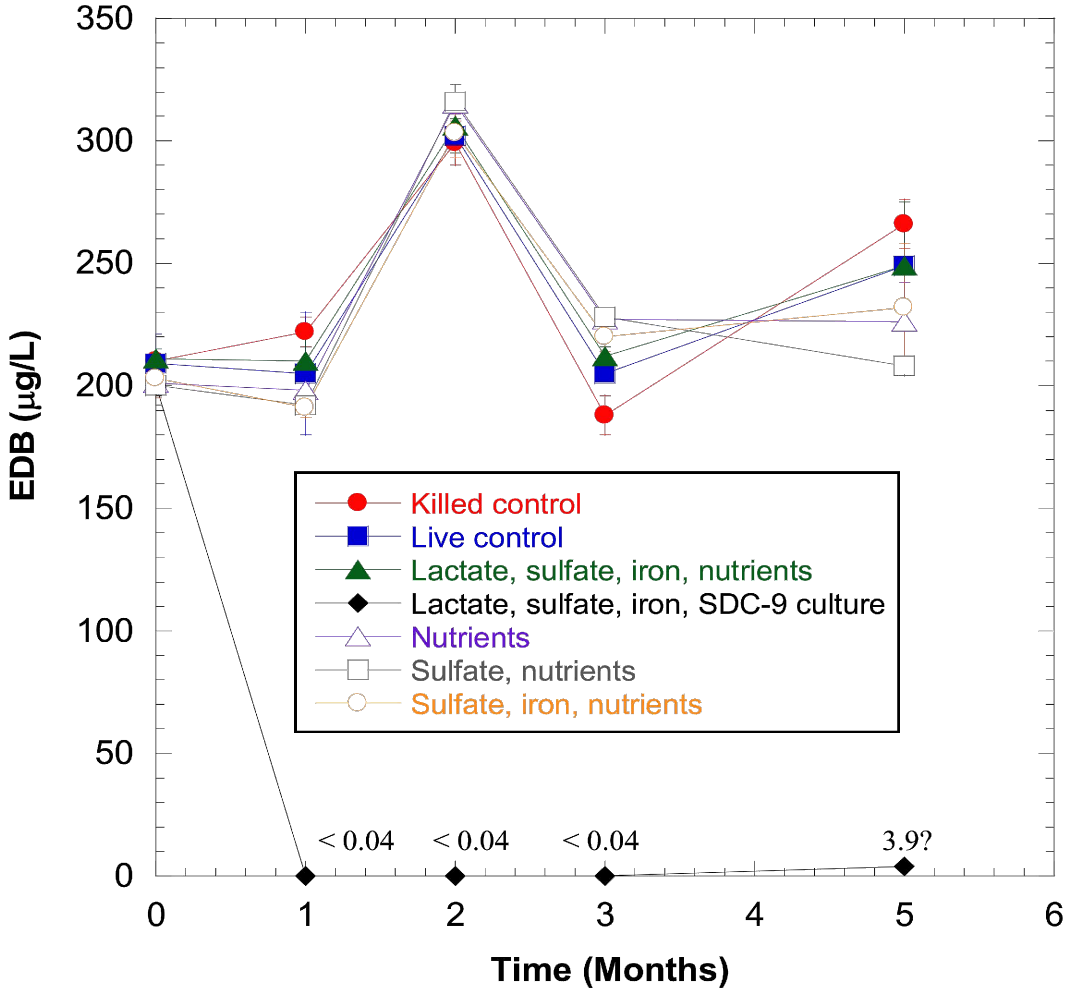

Note: the treatments that were amended with the dehalogenating culture SDC-9 showed increased degradation of EDB.

APTIM
17 Princess Road
Lawerenceville, New Jersey 08648

ETHYLENE DIBROMIDE IN-SITU BIODEGRADATION
PILOT TEST REPORT
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 3
CONCENTRATIONS OF EDB IN ANAEROBIC MICROCOSMS PREPARED WITH AQUIFER SAMPLES COLLECTED FROM THE BFF SOURCE AREA

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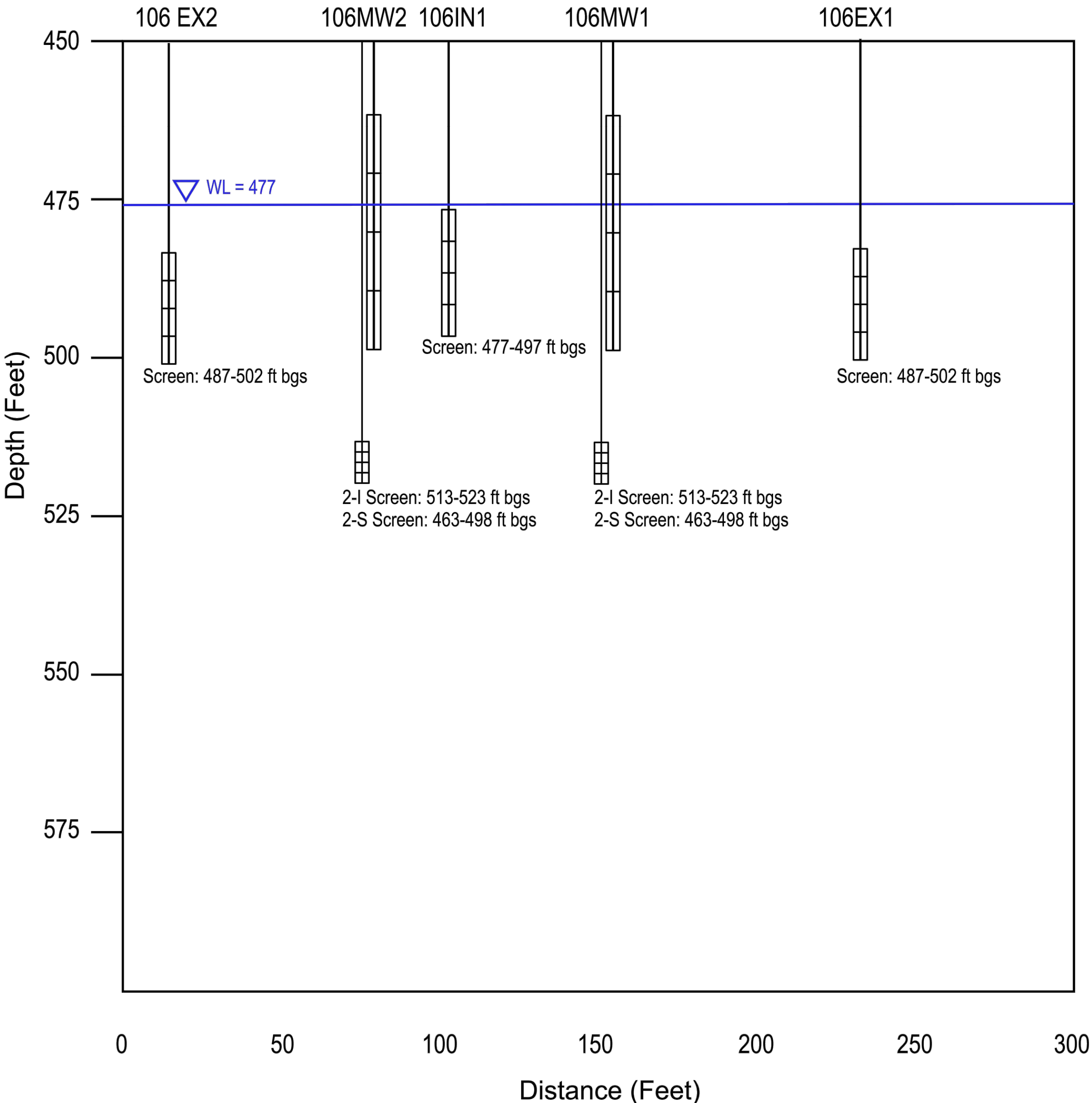

Note: Water level measured during drilling and well installation activities

LEGEND:

SCREEN INTERVAL

EX = Extraction Well
IN = Injection Well
MW = Monitoring Well
ft bgs = feet below ground surface

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ETHYLENE DIBROMIDE IN-SITU BIODEGRADATION
PILOT TEST REPORT
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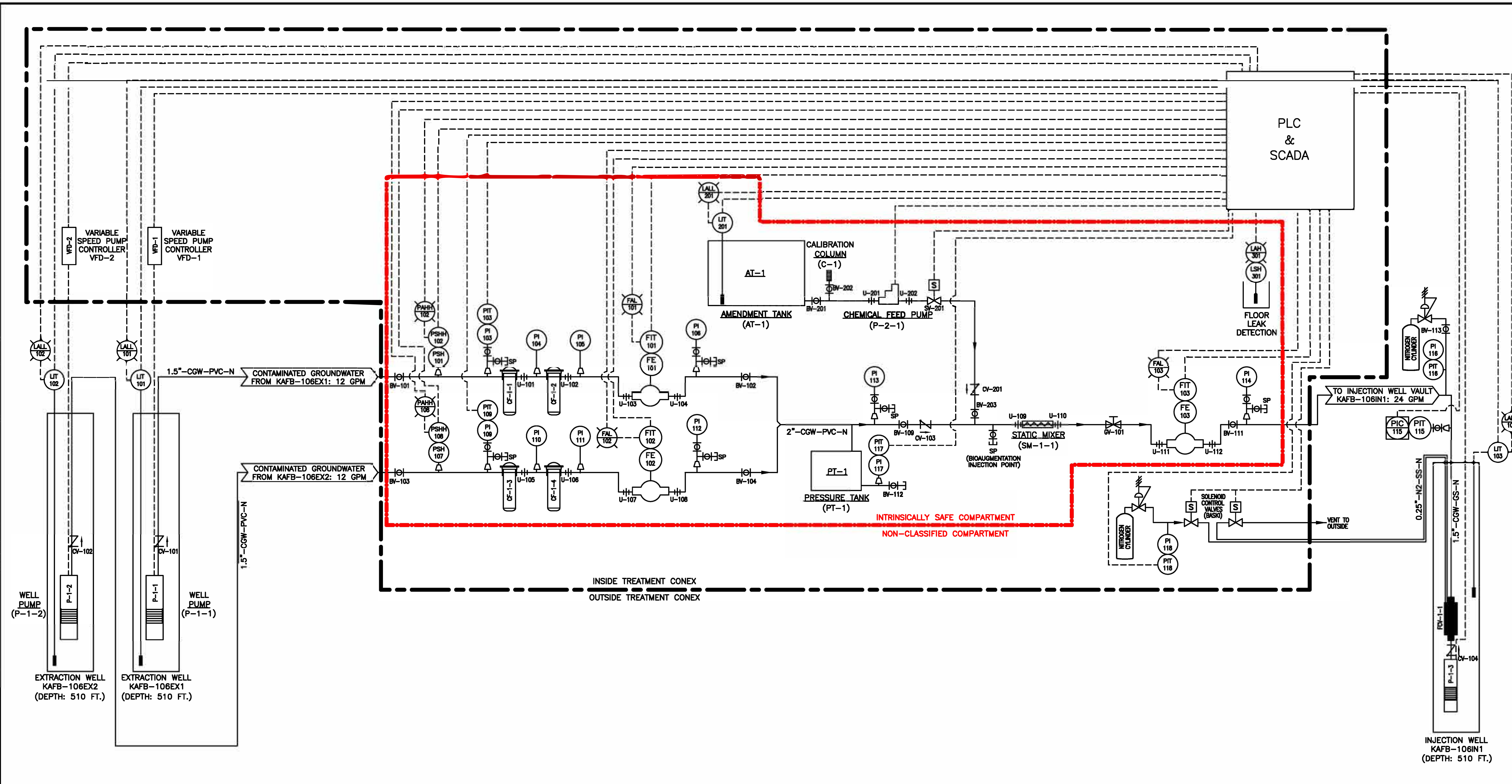
FIGURE 4

PILOT TEST WELL LAYOUT



P-1-1, P-1-2 EXTRACTION WELL PUMP	VFD-1, VFD-2 PUMP CONTROLLER	FIQ-101, FIQ-102, FIQ-103 FLOW METER	PT-1 PRESSURE TANK	AT-1 AMENDMENT TANK	P-3-1 CHEMICAL FEED PUMP	PIT-111 PRESSURE TRANSMITTER	FCV-1-1 FLOW CONTROL VALVE	P-1-3 INJECTION WELL PUMP
TYPE: SUBMERSIBLE FLOW: 15GPM@575' MOTOR:FRANKLIN,5HP,460V,3PH MODEL: 25S50-26 (Teflon) MFR: GRUNDFOS	TYPE: 60HZ FREQ CONVERTER ENCLOSURE: IP55, A5 ELECTRIC: 3X440-500V MODEL: CUE (part#91136938) MFR: GRUNDFOS	TYPE: MAGNETIC FLOW SENSOR PIPE RANGE: ½"-4" MODEL: 2551 MAGMETER PART#: 3-2551-P0-42 MFR: GF SIGNET	TYPE: DIAPHRAGM TANK VOLUME: 31.8 GAL PRE-CHARGE: 12 PSI INLET: 1" NPTF MODEL: V100 MFR: GOULDS	TYPE: VERTICAL POLY TANK DIMENSIONS: 52"x66",550GAL OUTLET: 2" BULKHEAD MODEL: NTO (VT0550-52) MFR: ACE ROTO-MOLD	TYPE: ELECTRONIC METERING CAPACITY: 2.5 GPH, 150 PSI VOLTAGE: 120 VAC MODEL: E71 MFR: LMI	TYPE: INTRINSICALLY SAFE RANGE: 1-30 PSI SETPOINT: 5-10 PSI MODEL: 2088 MFR: ROSEMOUNT	TYPE: PNEUMATIC SIZE: 4" OD MODEL: INFLEX FCV MFR: BASKI INCLUDES CONTROL PANEL WITH NITROGEN REGULATOR	TYPE: SUBMERSIBLE FLOW: 3GPM@550' MOTOR: 1HP,230V,8.1A MODEL: 5SQE10-410 (Teflon) MFR: GRUNDFOS

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Lawrenceville, New Jersey 08648

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

FIGURE 5

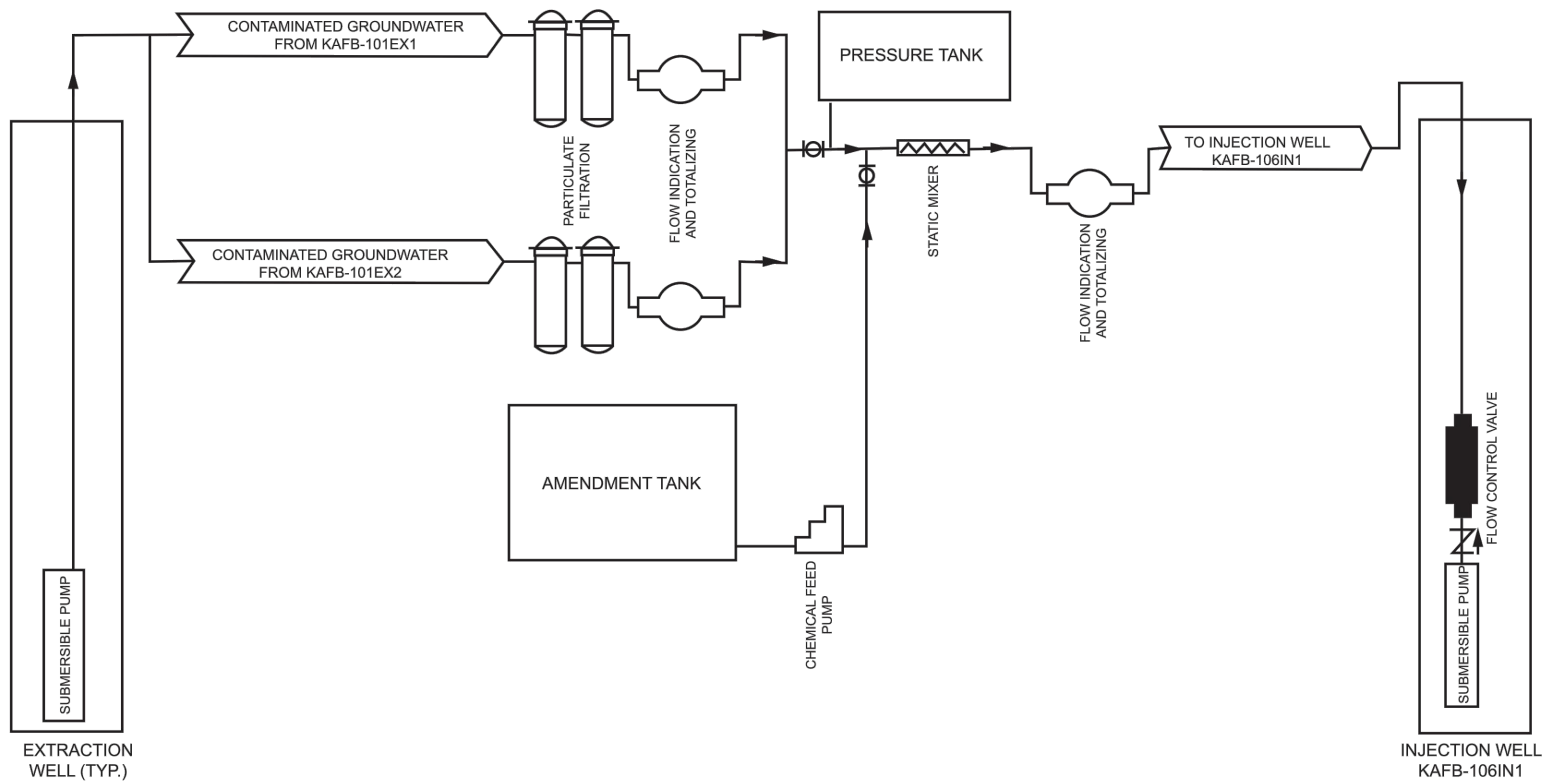
RECIRCULATION AND AMENDMENT SYSTEM
PIPING AND INSTRUMENTATION DIAGRAM

EDB IN SITU BIODEGRADATION PILOT TEST
REPORT, KIRTLAND AFB, NEW MEXICO

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Lawrenceville, NJ	5/9/17	G.Lavorgna	G.Lavorgna	S.Shealy	P.KostervanGroos	500433-D1

File: R:\PROJECTS\500433 -- RAPID Kirtland EDB\Design\500433-D1.dwg
Plot Date/Time: Feb 27, 2019 - 10:05am
Plotted By: Greig.Lavorgna

File: O:\project\LANTDIV\Kirtland AFB\501397\501397-A1.dwg
Plot Date/Time: Feb 23, 2021 - 2:46pm Xref :
Plotted By: bernadette.oconnor Image : APTIM Logo Standard Color.jpg



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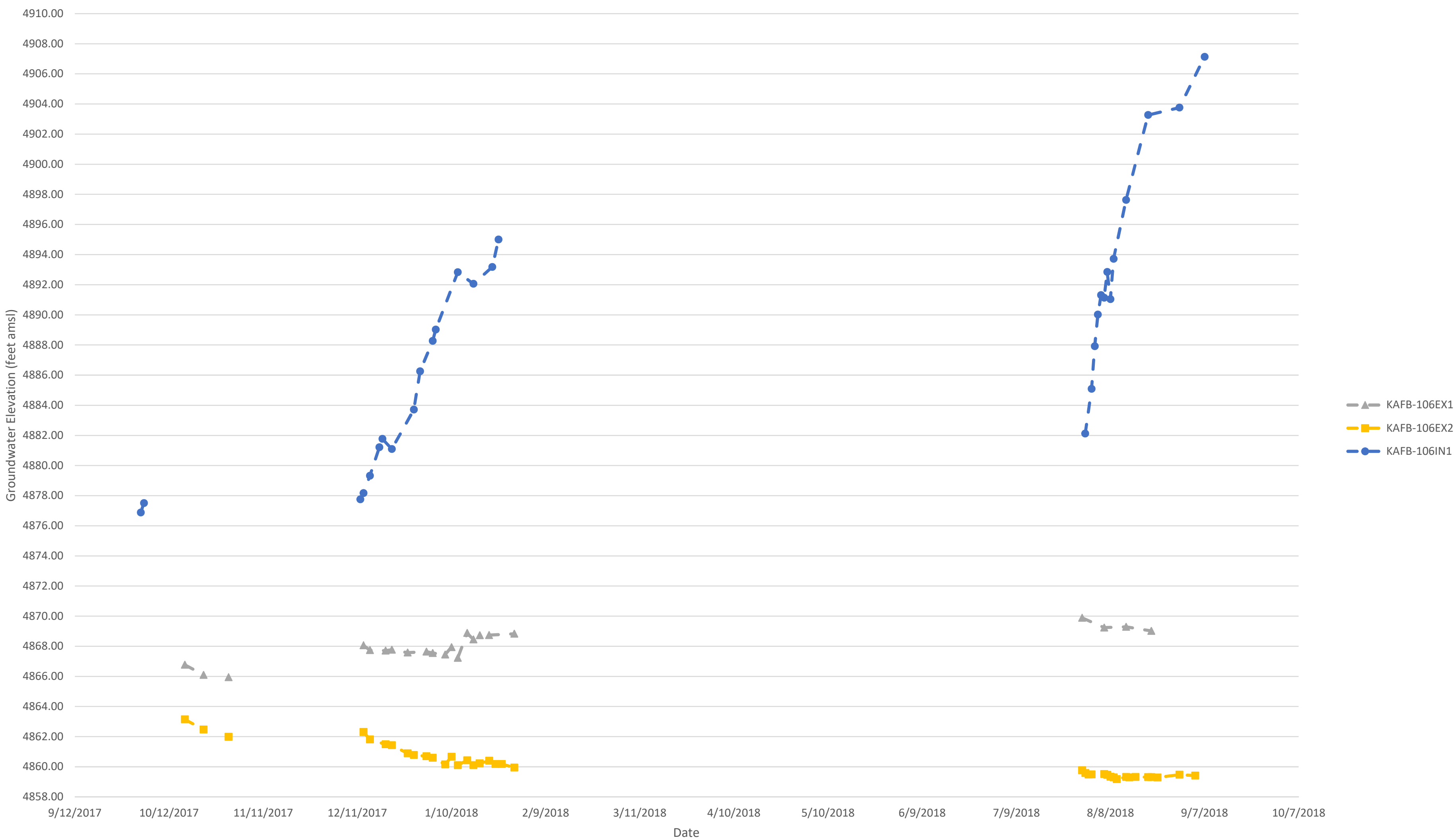
Lawerenceville, New Jersey 08648

ETHYLENE DIBROMIDE IN-SITU BIODEGRADATION PILOT TEST REPORT
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 6

PROCESS FLOW DIAGRAM



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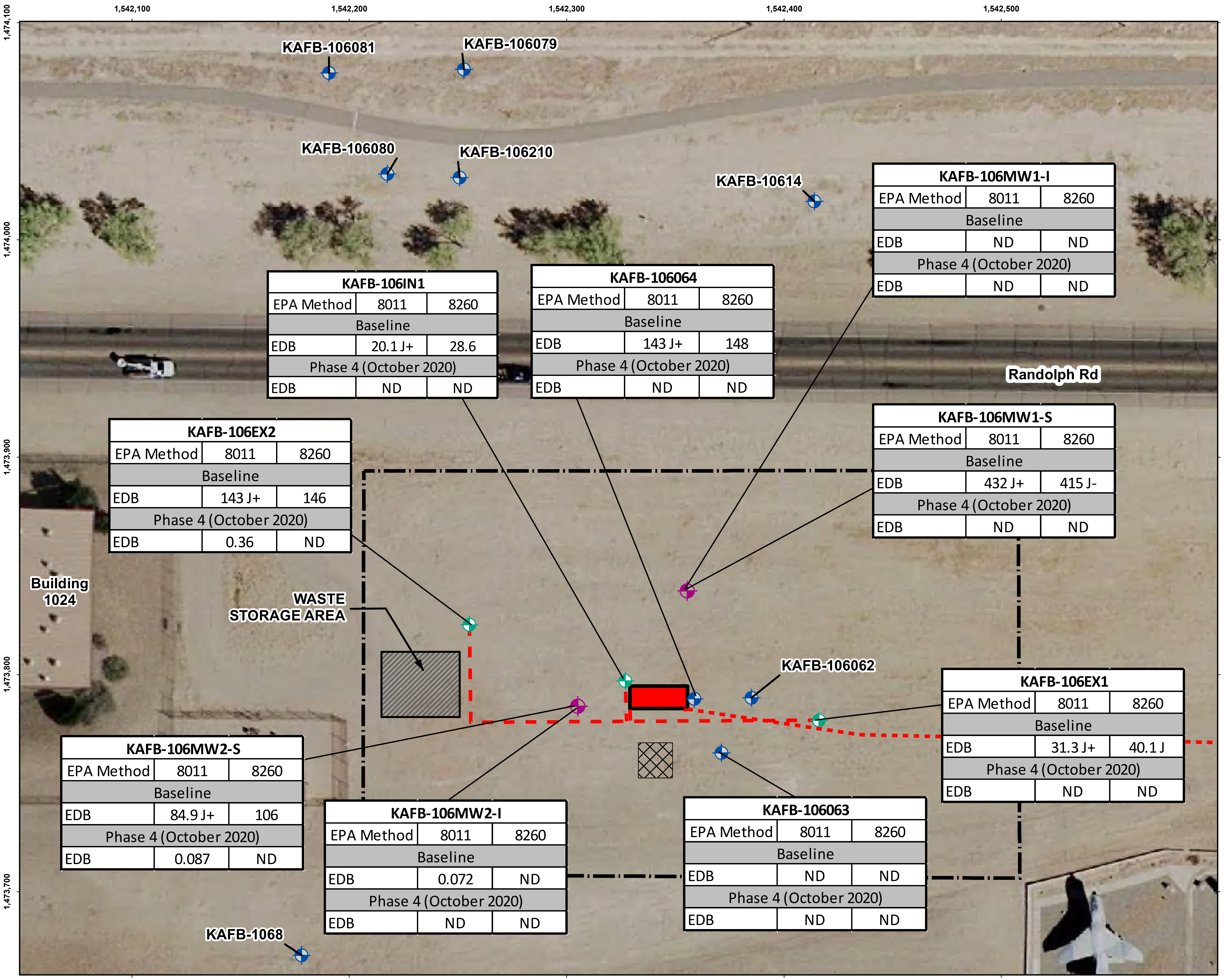
NEW MEXICO

FIGURE 7

RECIRCULATION GROUNDWATER ELEVATIONS



KAFB-106IN1		
EPA Method	8011	8260
Baseline		
EDB	20.1 J+	28.6
Phase 4 (October 2020)		
EDB	ND	ND

KAFB-106064		
EPA Method	8011	8260
Baseline		
EDB	143 J+	148
Phase 4 (October 2020)		
EDB	ND	ND

KAFB-106MW1-I		
EPA Method	8011	8260
Baseline		
EDB	ND	ND
Phase 4 (October 2020)		
EDB	ND	ND

KAFB-106MW1-S		
EPA Method	8011	8260
Baseline		
EDB	432 J+	415 J-
Phase 4 (October 2020)		
EDB	ND	ND

KAFB-106EX2		
EPA Method	8011	8260
Baseline		
EDB	143 J+	146
Phase 4 (October 2020)		
EDB	0.36	ND

KAFB-106EX1		
EPA Method	8011	8260
Baseline		
EDB	31.3 J+	40.1 J
Phase 4 (October 2020)		
EDB	ND	ND

KAFB-106MW2-S		
EPA Method	8011	8260
Baseline		
EDB	84.9 J+	106
Phase 4 (October 2020)		
EDB	0.087	ND

KAFB-106MW2-I		
EPA Method	8011	8260
Baseline		
EDB	0.072	ND
Phase 4 (October 2020)		
EDB	ND	ND

KAFB-106063		
EPA Method	8011	8260
Baseline		
EDB	ND	ND
Phase 4 (October 2020)		
EDB	ND	ND

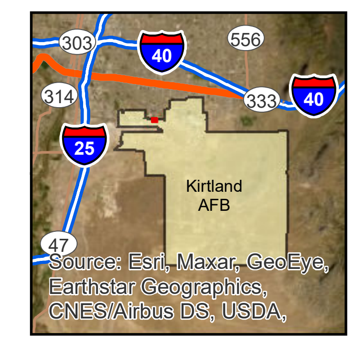
J:\Kirtland_AFB\GIS_Documents\Project_Maps_bak\EDIB_Pilot_Test_Report\KAFB_E005_edb_conc_BL_Ph4.mxd

Legend

- Existing Monitoring Well
- Pilot Test Injection/Extraction Well
- Pilot Test Monitoring Well
- Construction Fence
- Pilot Test Trench Location for Water Pipe and Subsurface Electrical
- Pilot Test System Location
- Electrical Service Line
- Storage Shed

EPA = United States Environmental Protection Agency
KAFB = Kirtland Air Force Base
ND = Not Detected

Units are in micrograms per liter.



SITE LOCATION

Revision Date:

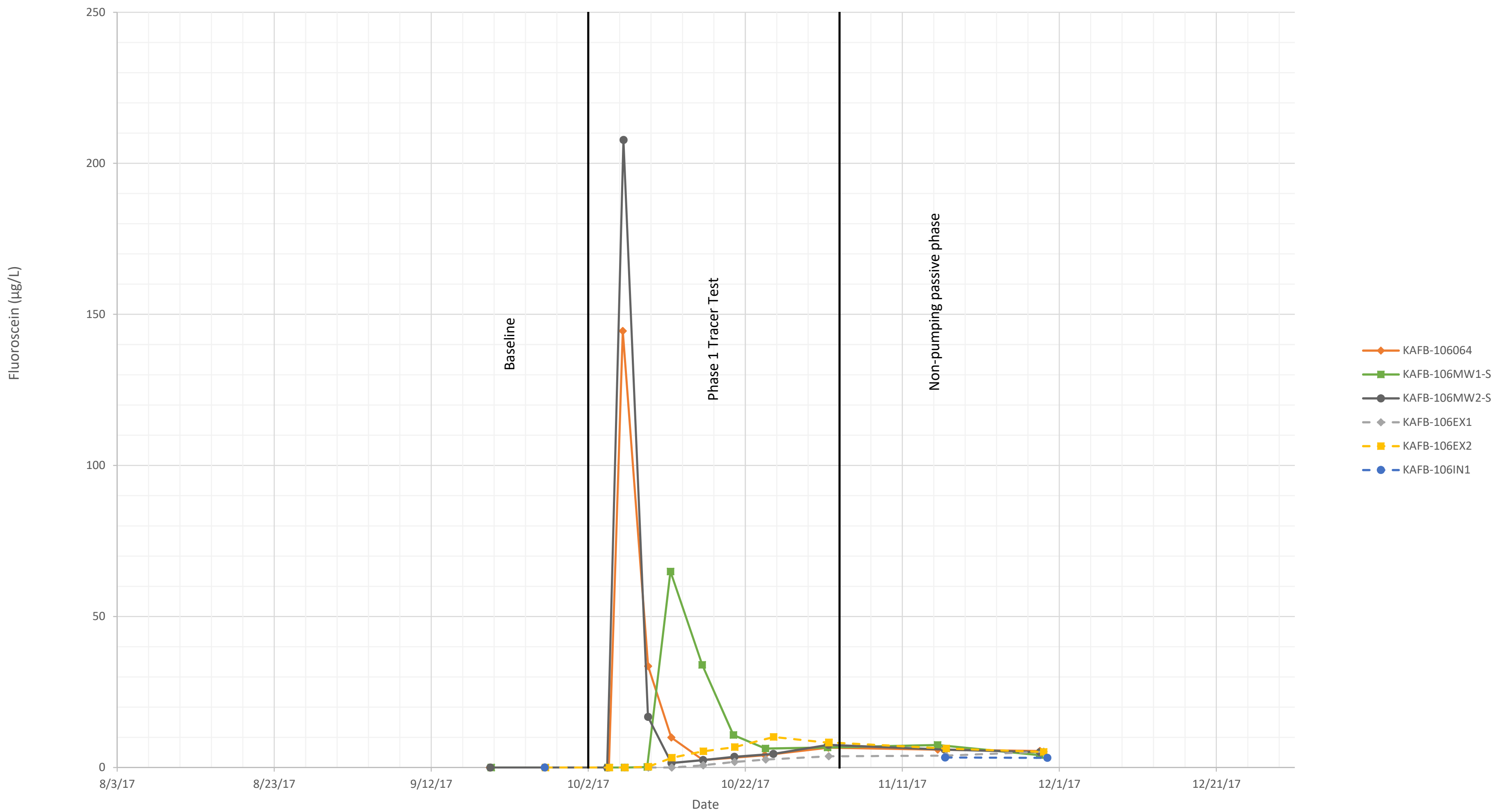
N

0 15 30 60
Feet
1 inch = 45 feet

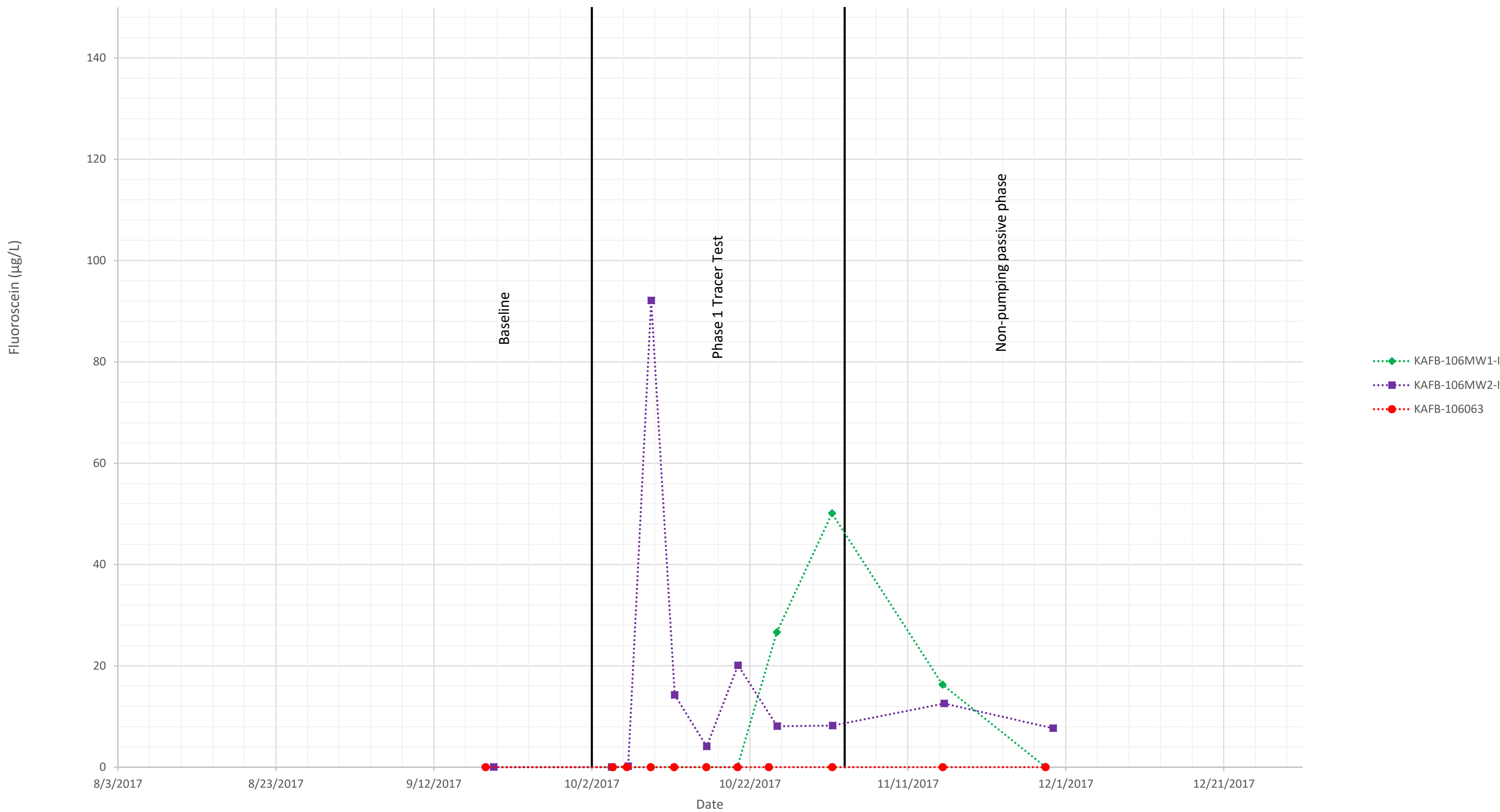
ETHYLENE DIBROMIDE IN SITU BIODEGRADATION
PILOT TEST REPORT
KIRTLAND AIR FORCE BASE, NEW MEXICO

FIGURE 8

EDB CONCENTRATIONS FOR BASELINE AND PHASE 4 SAMPLING EVENTS



APTIM — Aptim Federal Services, LLC	FIGURE 9
KIRTLAND AIR FORCE BASE NEW MEXICO	FLUOROSCEIN CONCENTRATIONS – SHALLOW WELLS



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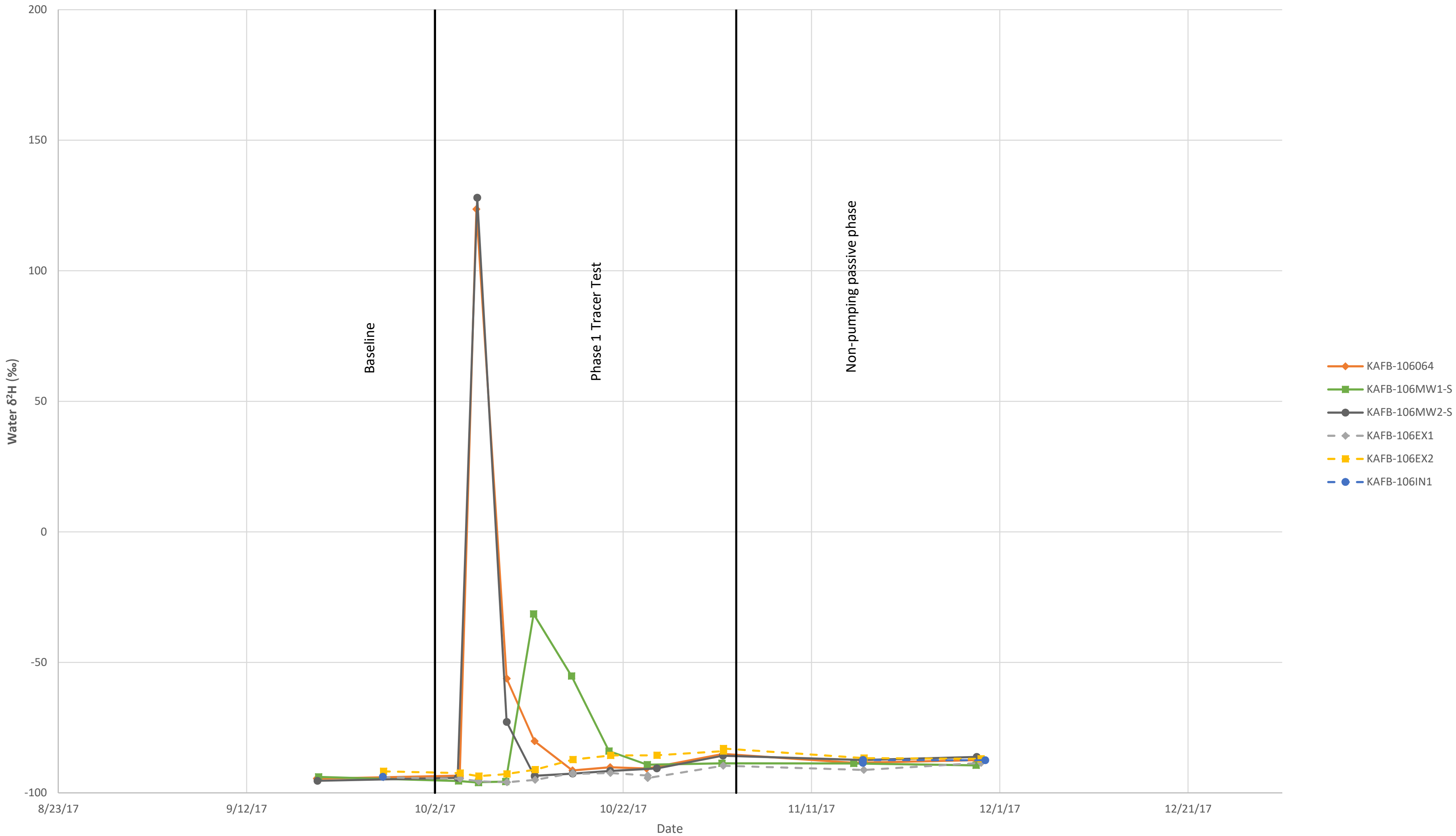
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 10

FLUOROSCEIN CONCENTRATIONS – INTERMEDIATE WELLS



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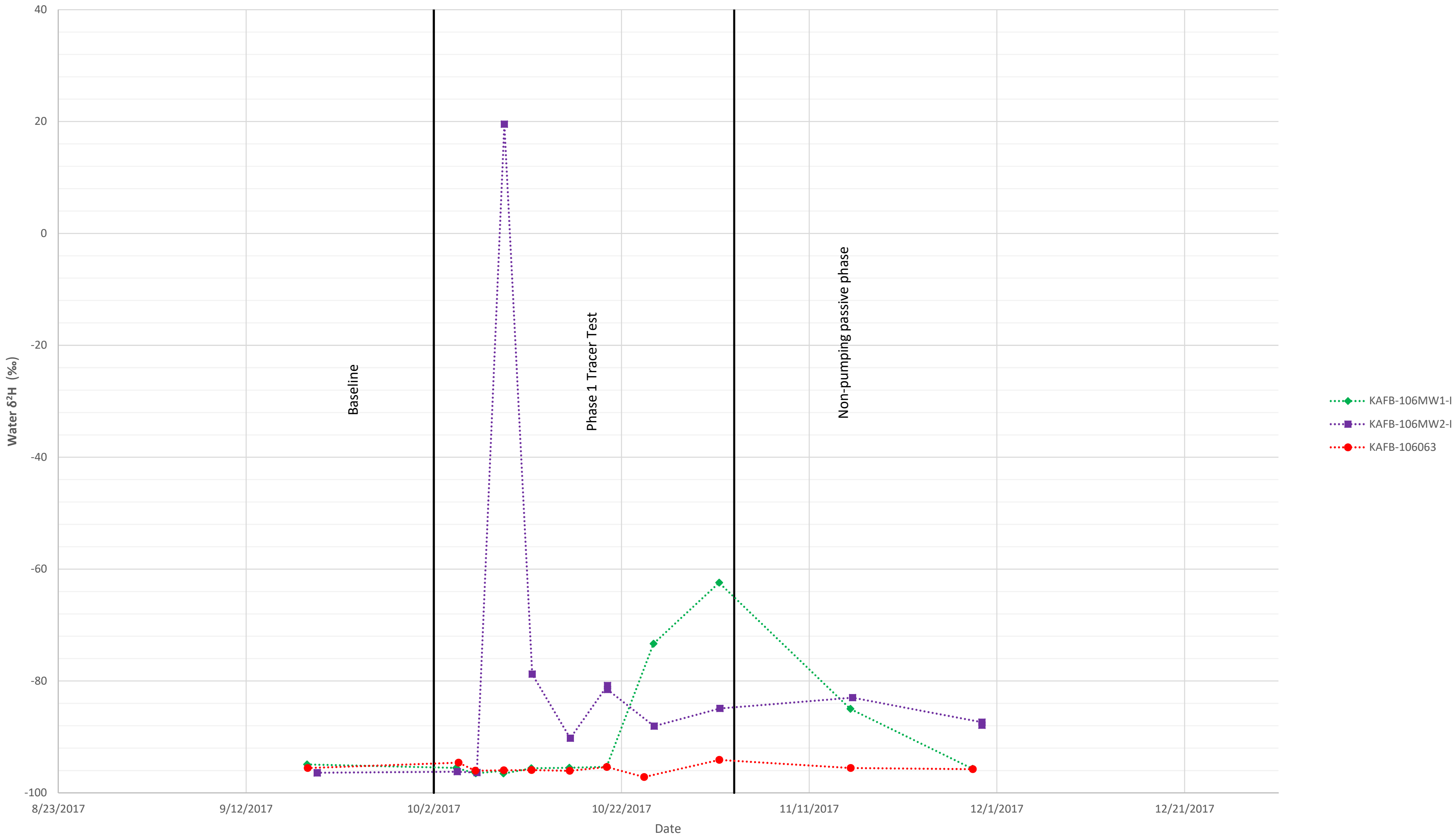
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 11

WATER Δ^{2}H - SHALLOW WELLS



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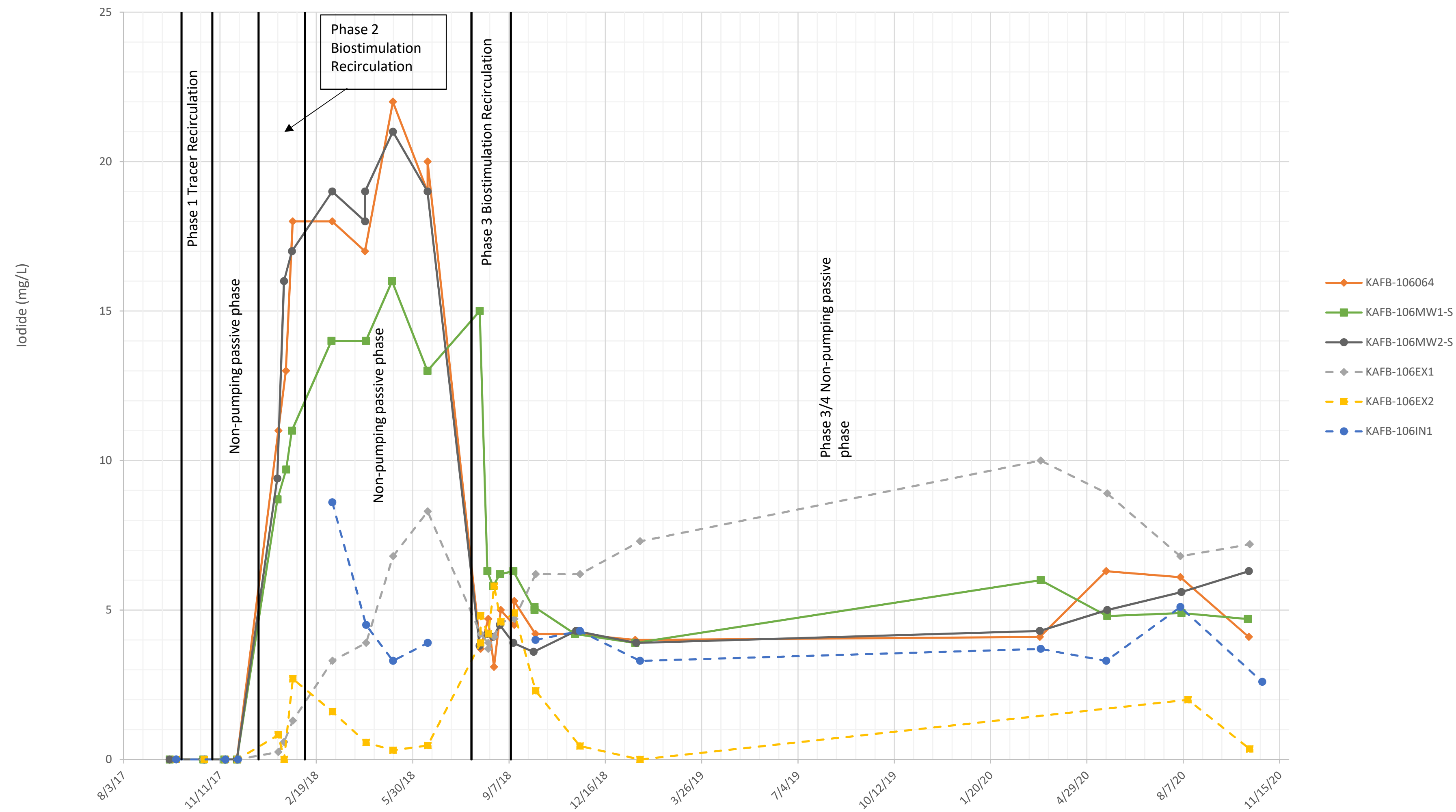
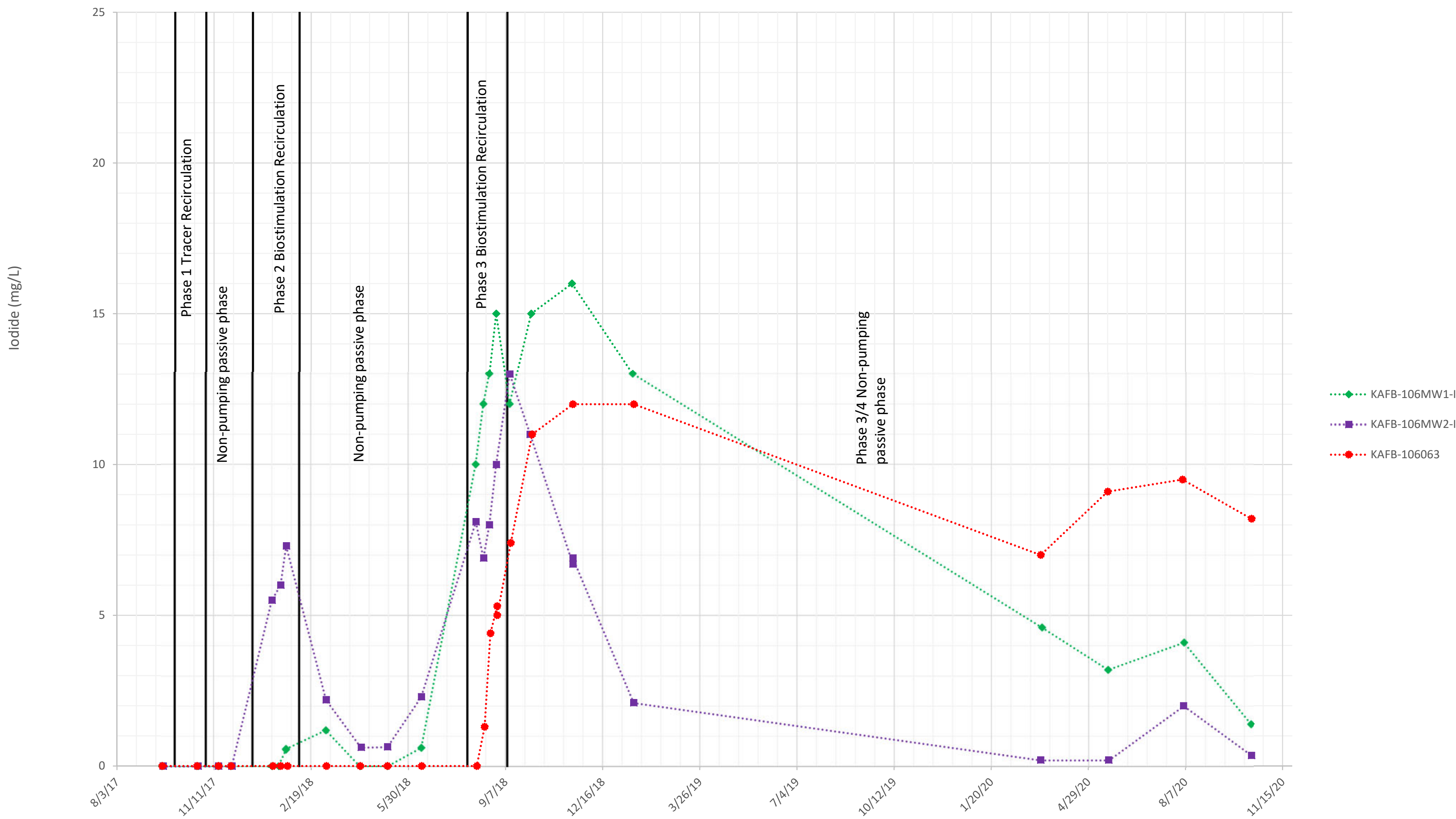
NEW MEXICO

FIGURE 12

WATER Δ²H – INTERMEDIATE WELLS



APTIM Aptim Federal Services, LLC	FIGURE 13
KIRTLAND AIR FORCE BASE NEW MEXICO	IODIDE CONCENTRATIONS - SHALLOW WELLS



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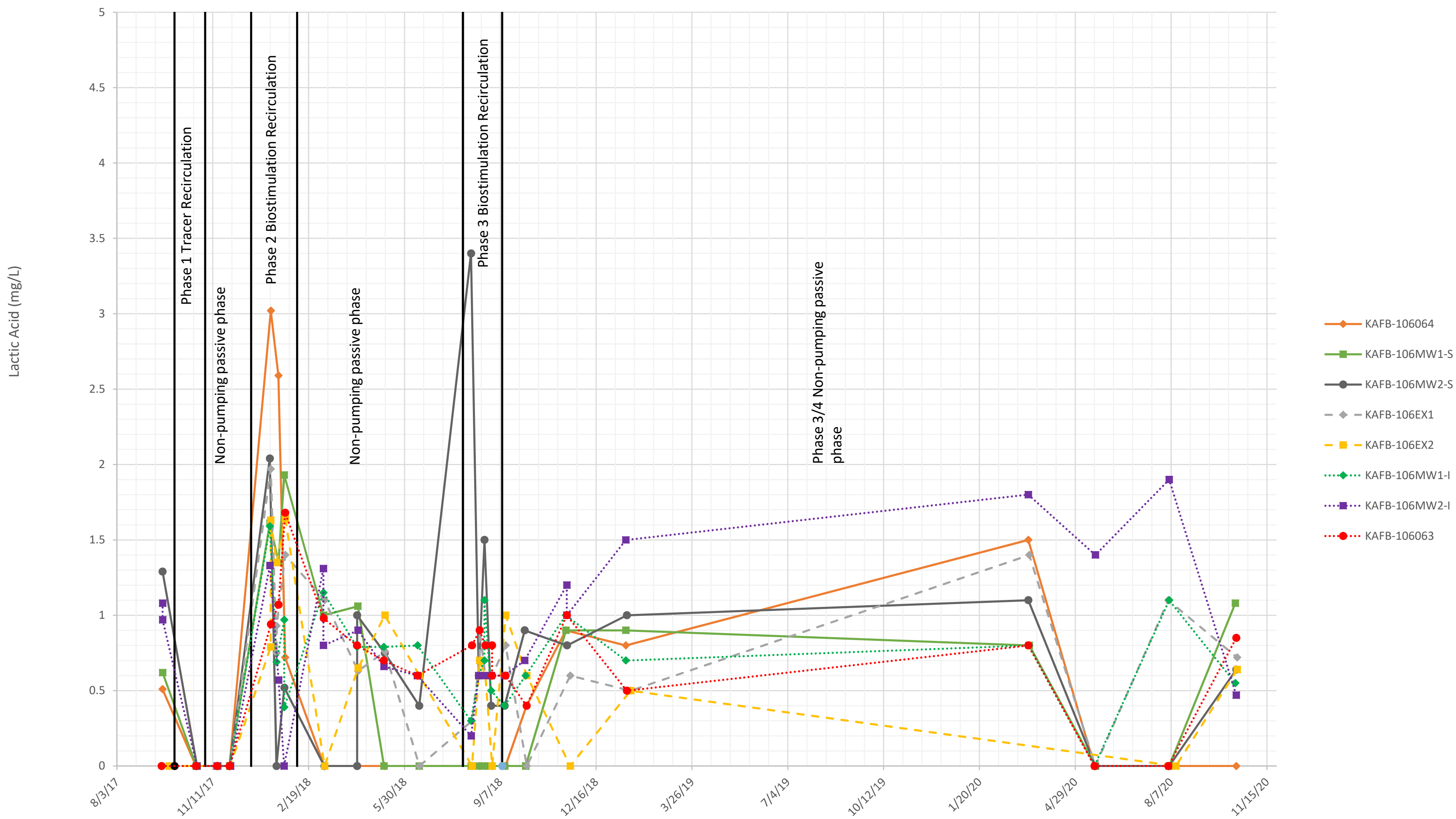
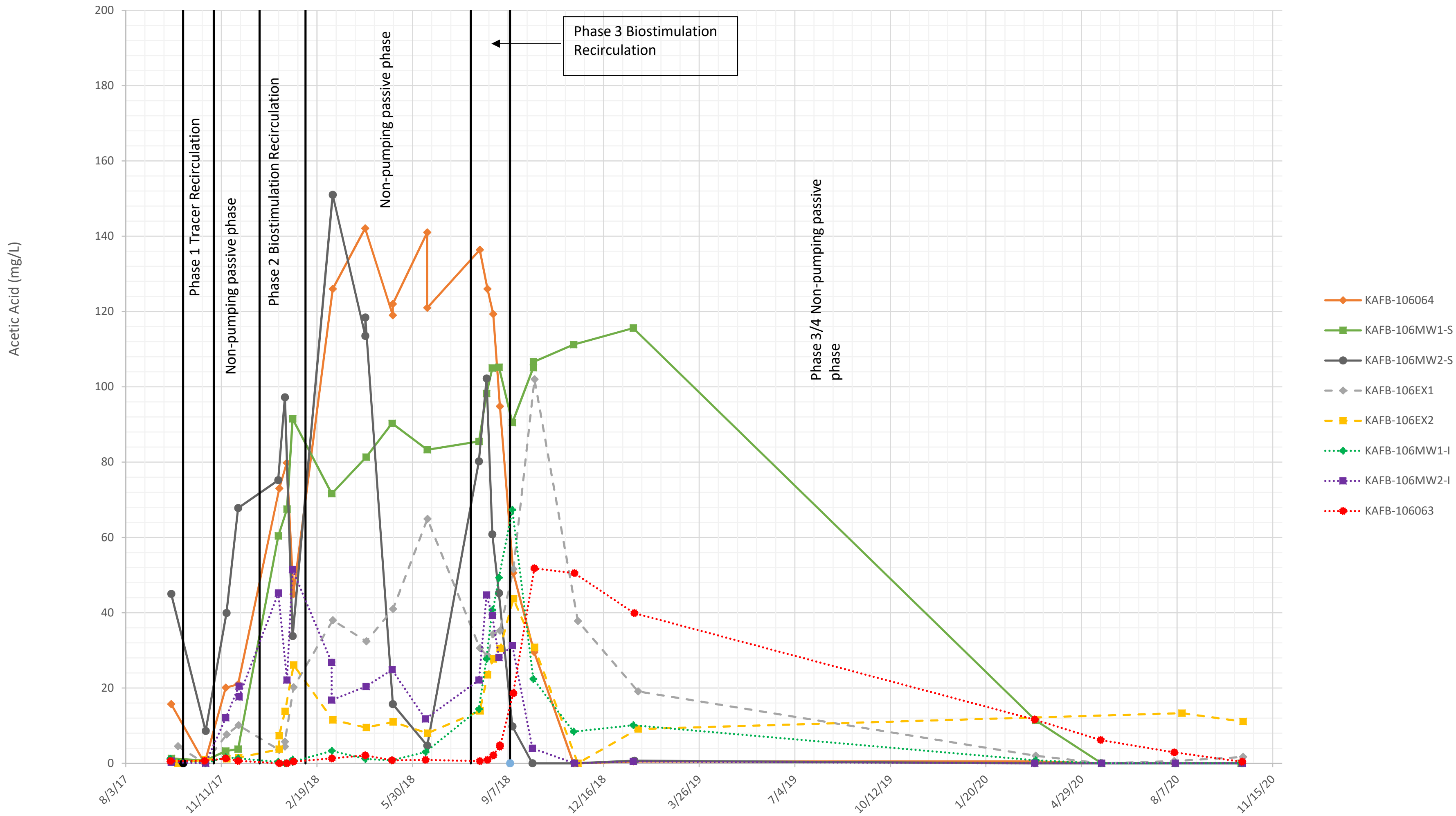
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 14

IODIDE CONCENTRATIONS - INTERMEDIATE WELLS



APTIM Aptim Federal Services, LLC	FIGURE 15
KIRTLAND AIR FORCE BASE NEW MEXICO	LACTIC ACID CONCENTRATIONS - ALL WELLS (EXCEPT 106IN1)



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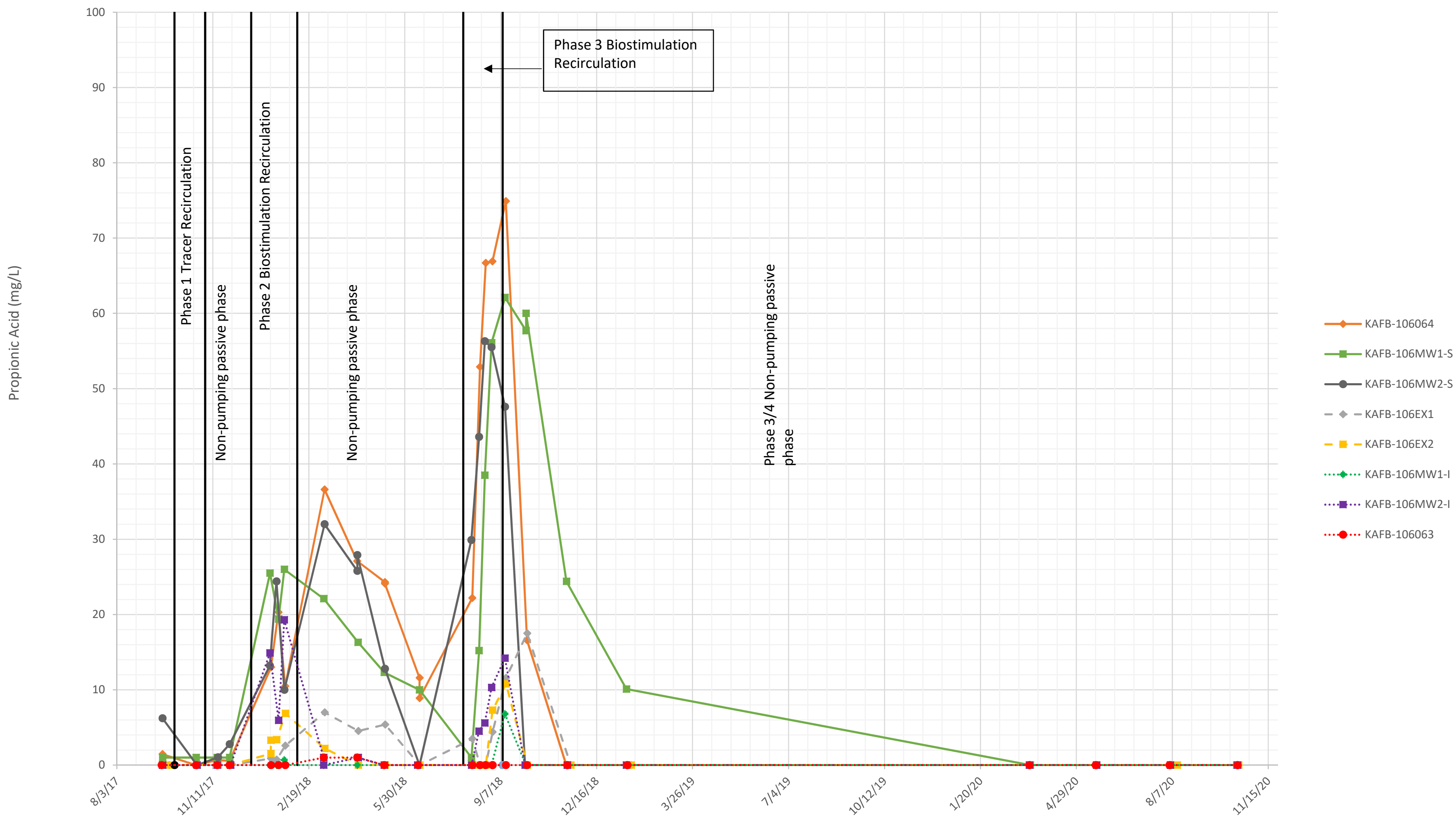
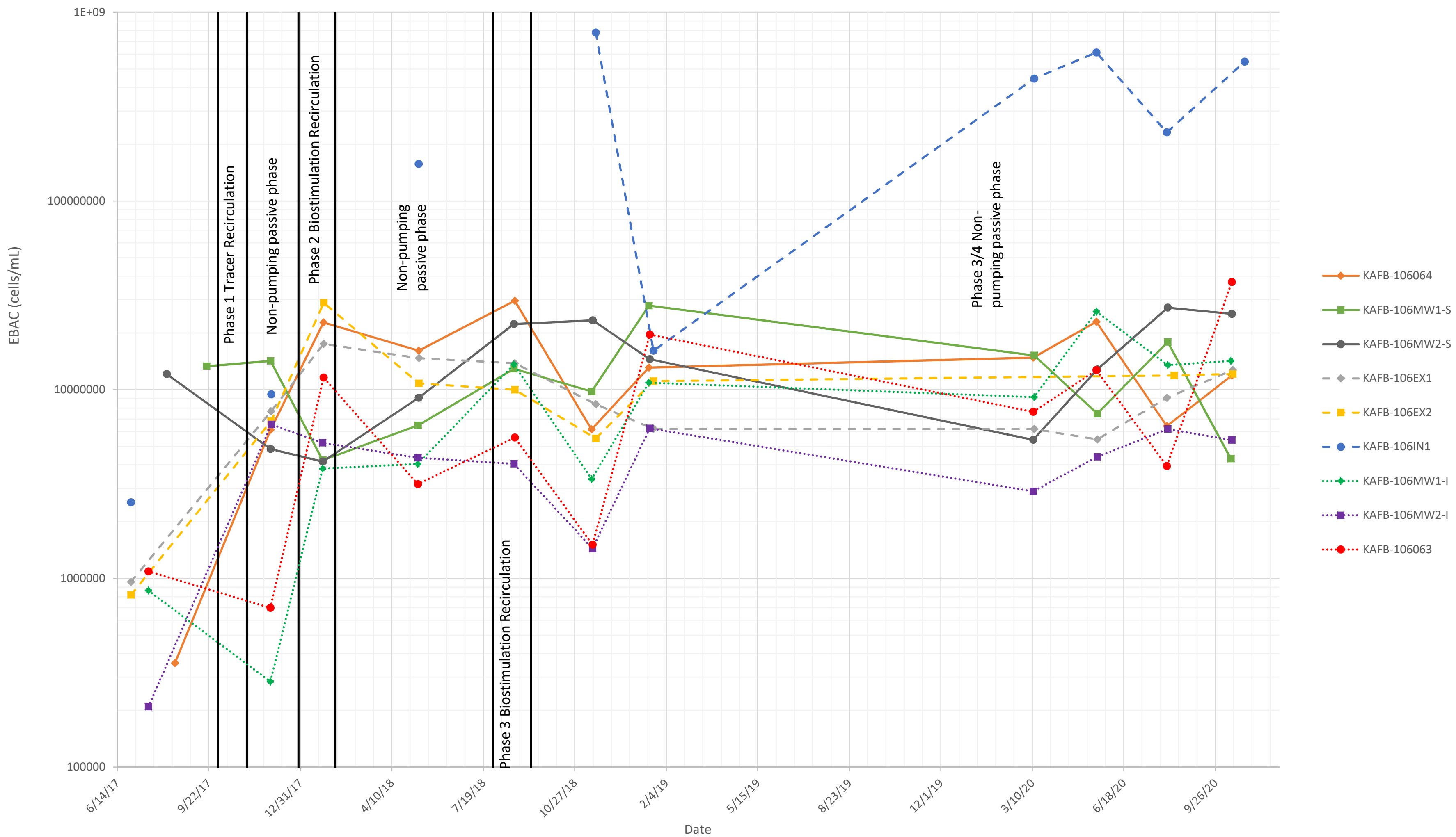
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 16

ACETIC ACID CONCENTRATIONS - ALL WELLS (EXCEPT 106IN1)



APTIM Aptim Federal Services, LLC	FIGURE 17
KIRTLAND AIR FORCE BASE NEW MEXICO	PROPIONIC ACID CONCENTRATIONS - ALL WELLS (EXCEPT 106IN1)



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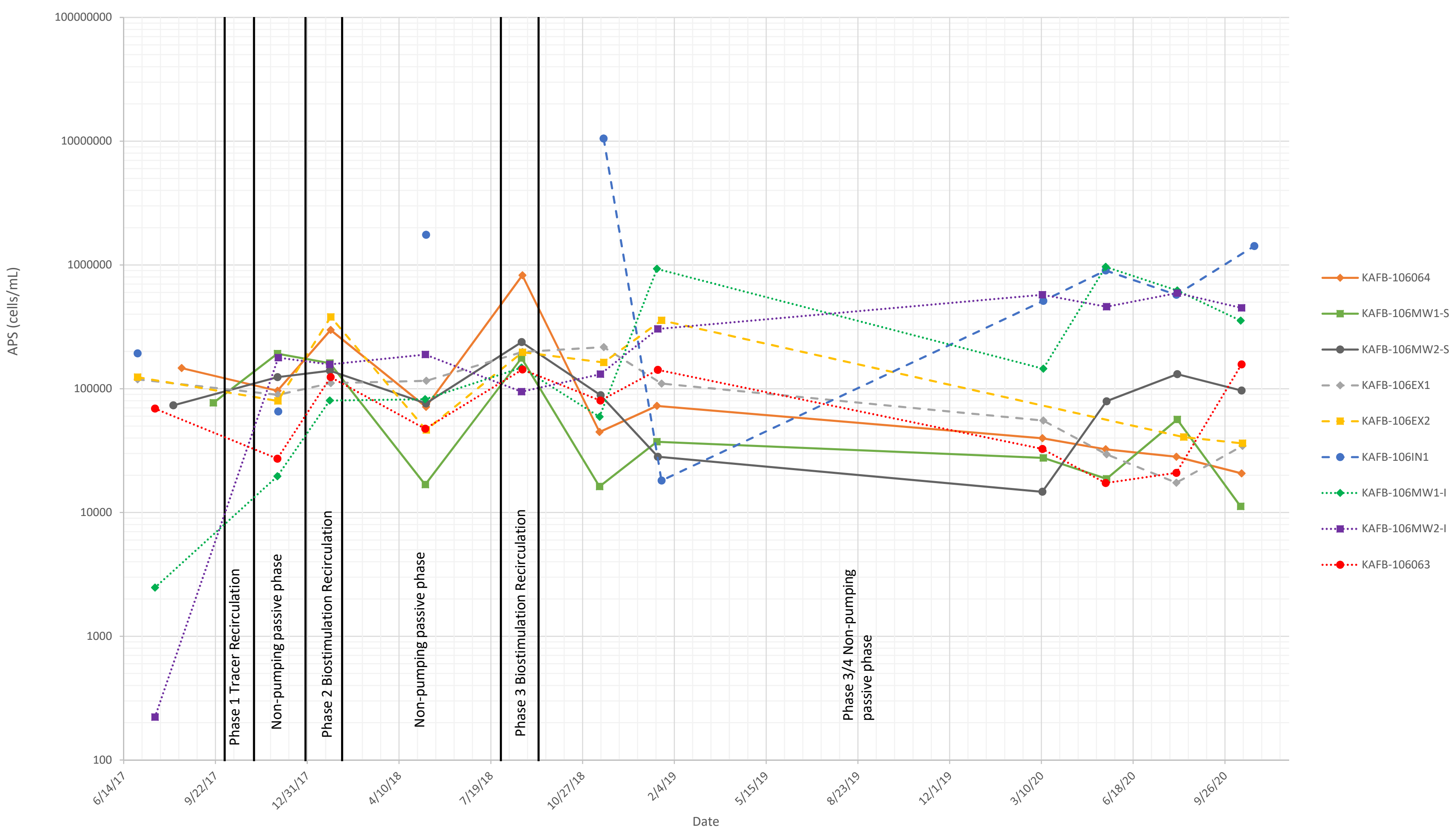
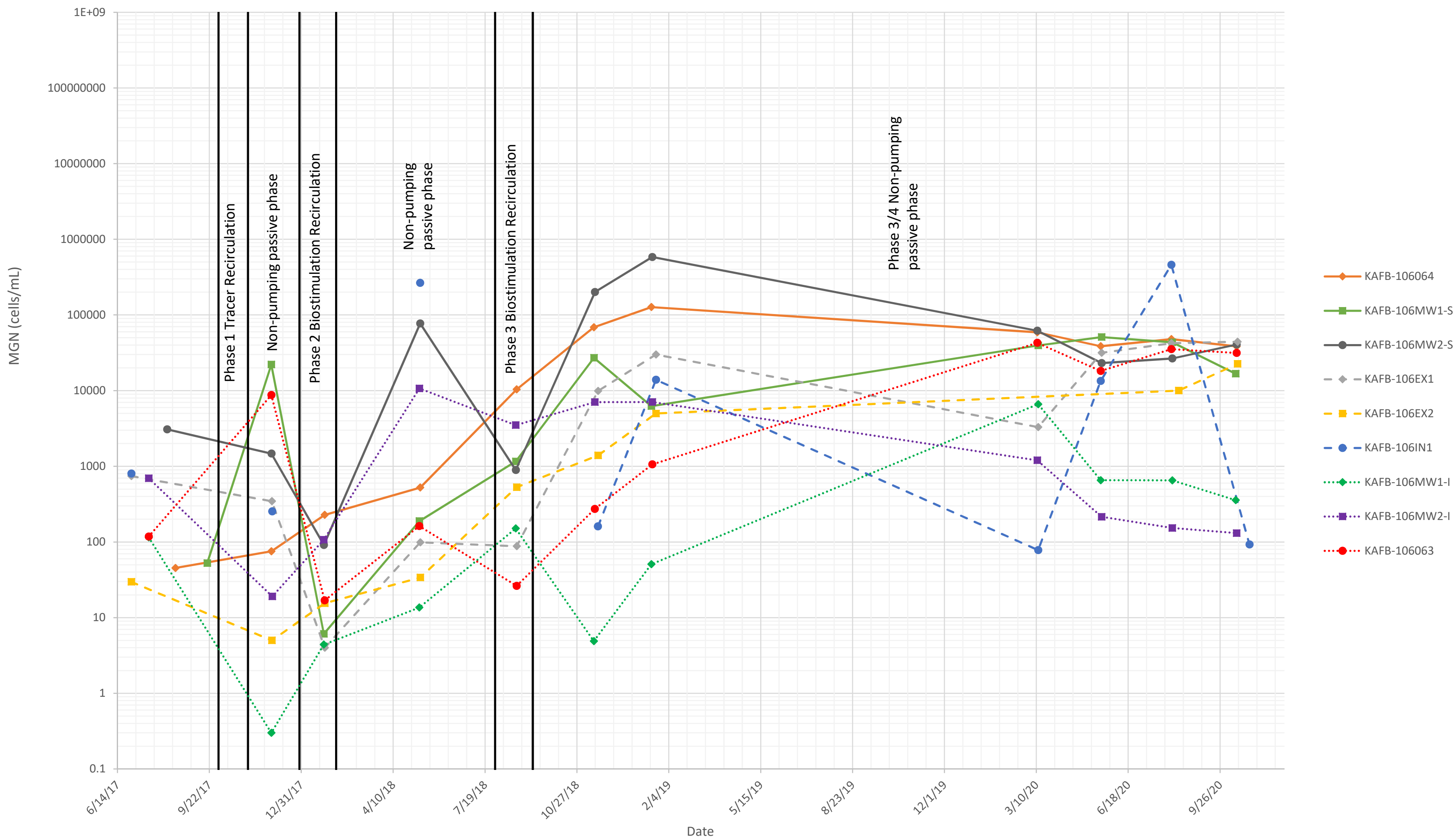
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 18

EBAC CONCENTRATIONS - ALL WELLS



APTIM Aptim Federal Services, LLC	FIGURE 19
KIRTLAND AIR FORCE BASE NEW MEXICO	APS CONCENTRATIONS - ALL WELLS



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KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 20

MGN CONCENTRATIONS - ALL WELLS

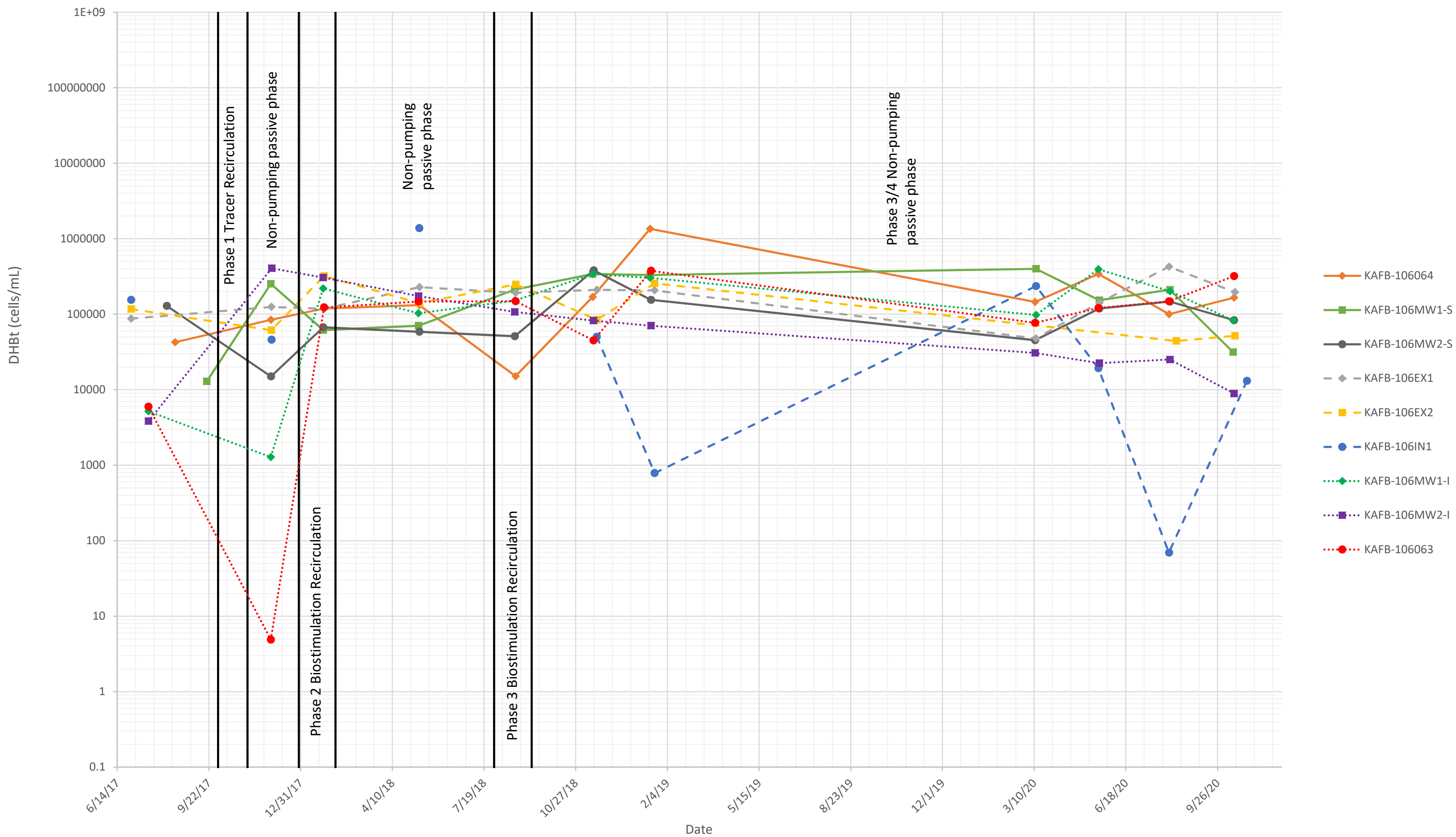

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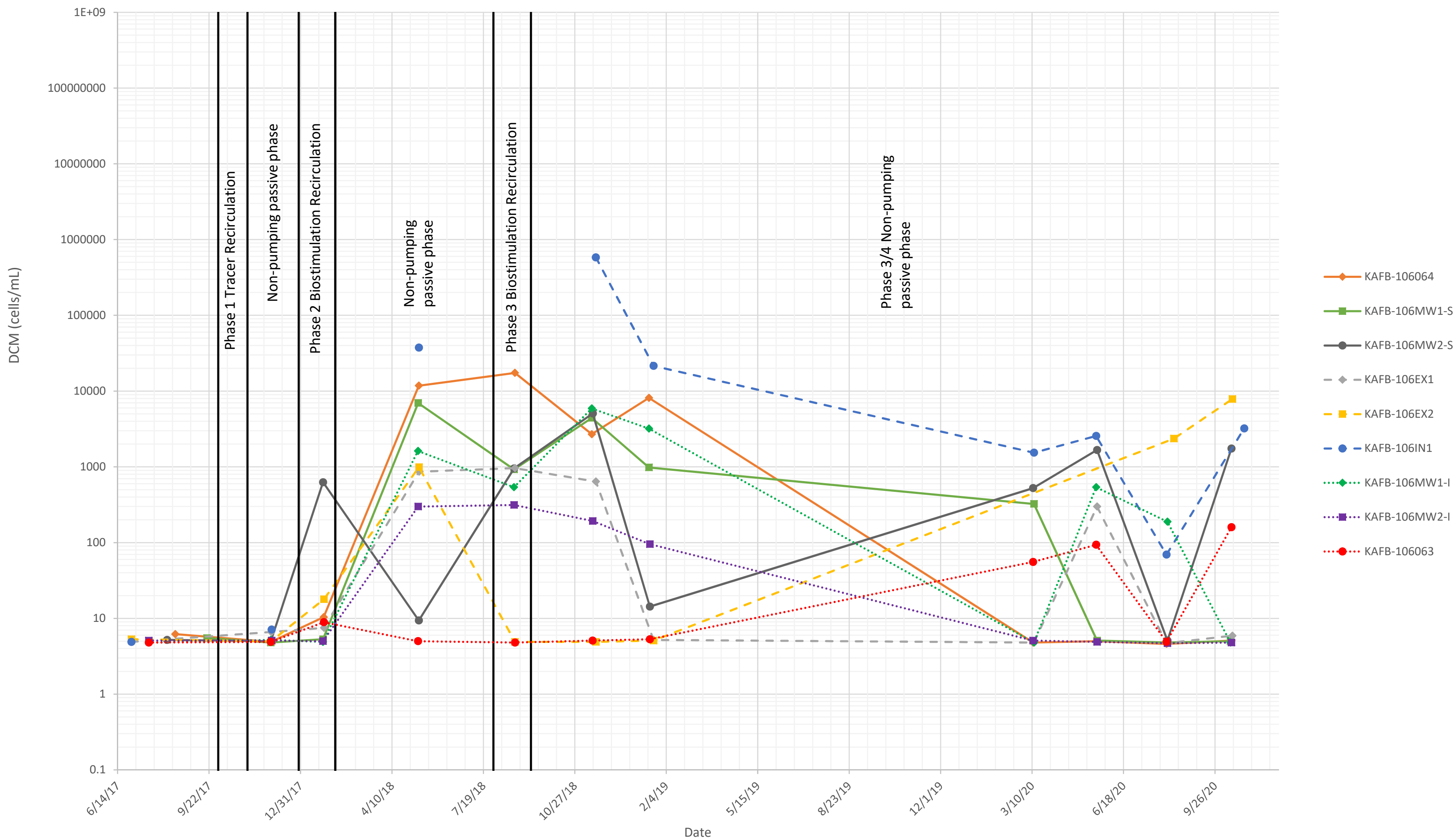
FIGURE 21

DHBT CONCENTRATIONS - ALL WELLS



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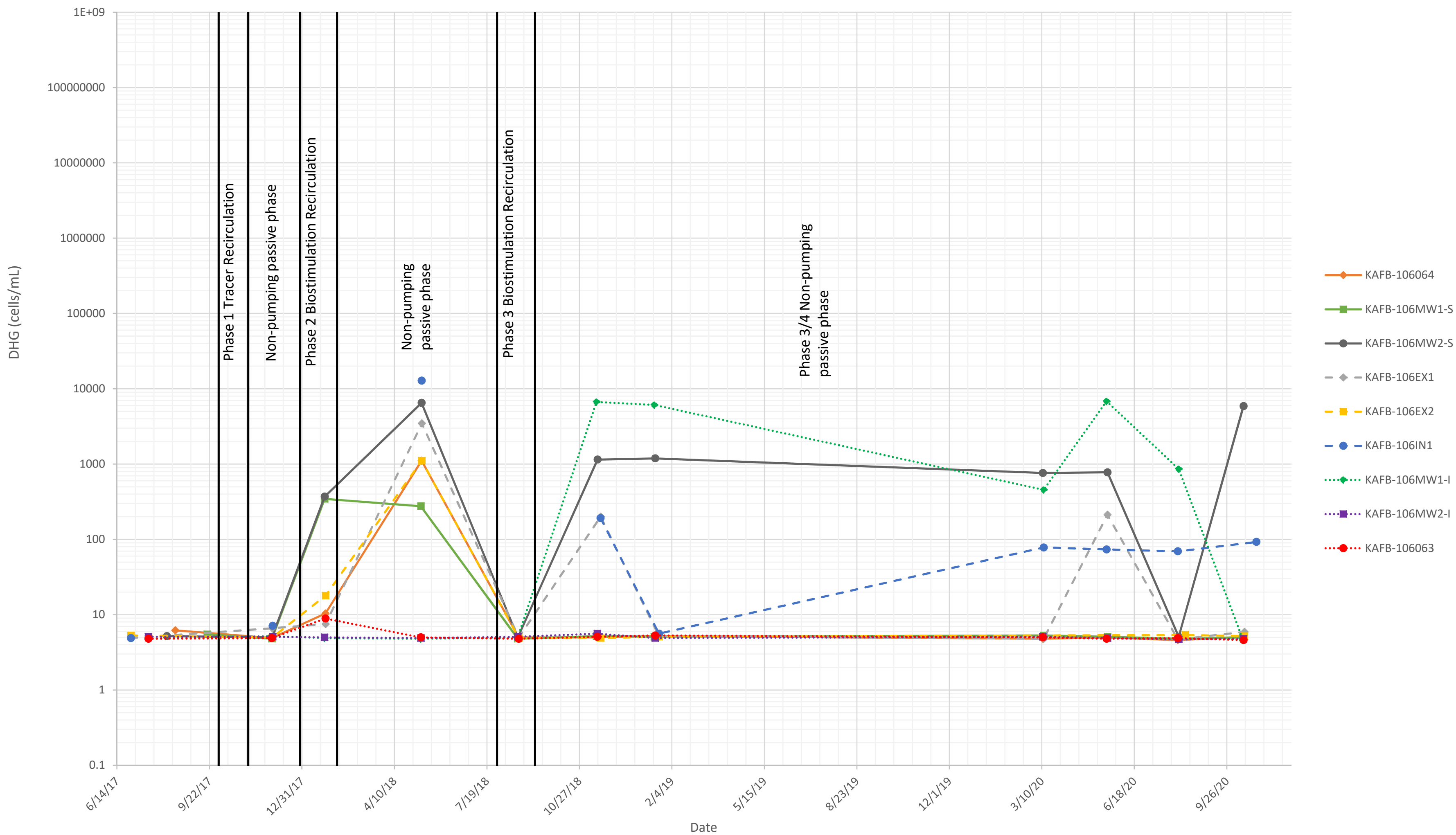
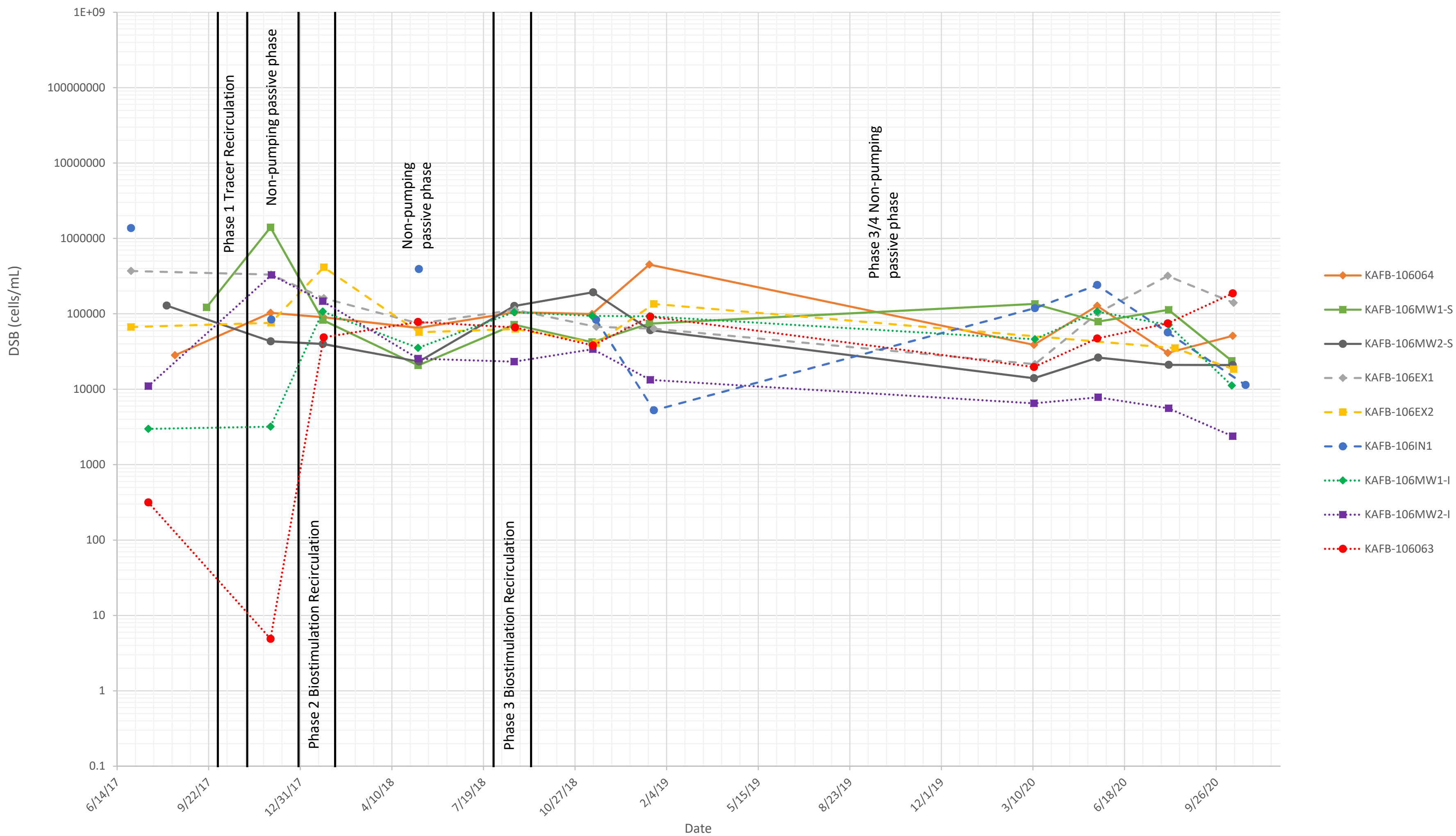
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 22

DCM CONCENTRATIONS - ALL WELLS



APTIM Aptim Federal Services, LLC	FIGURE 23
KIRTLAND AIR FORCE BASE NEW MEXICO	DHG CONCENTRATIONS - ALL WELLS



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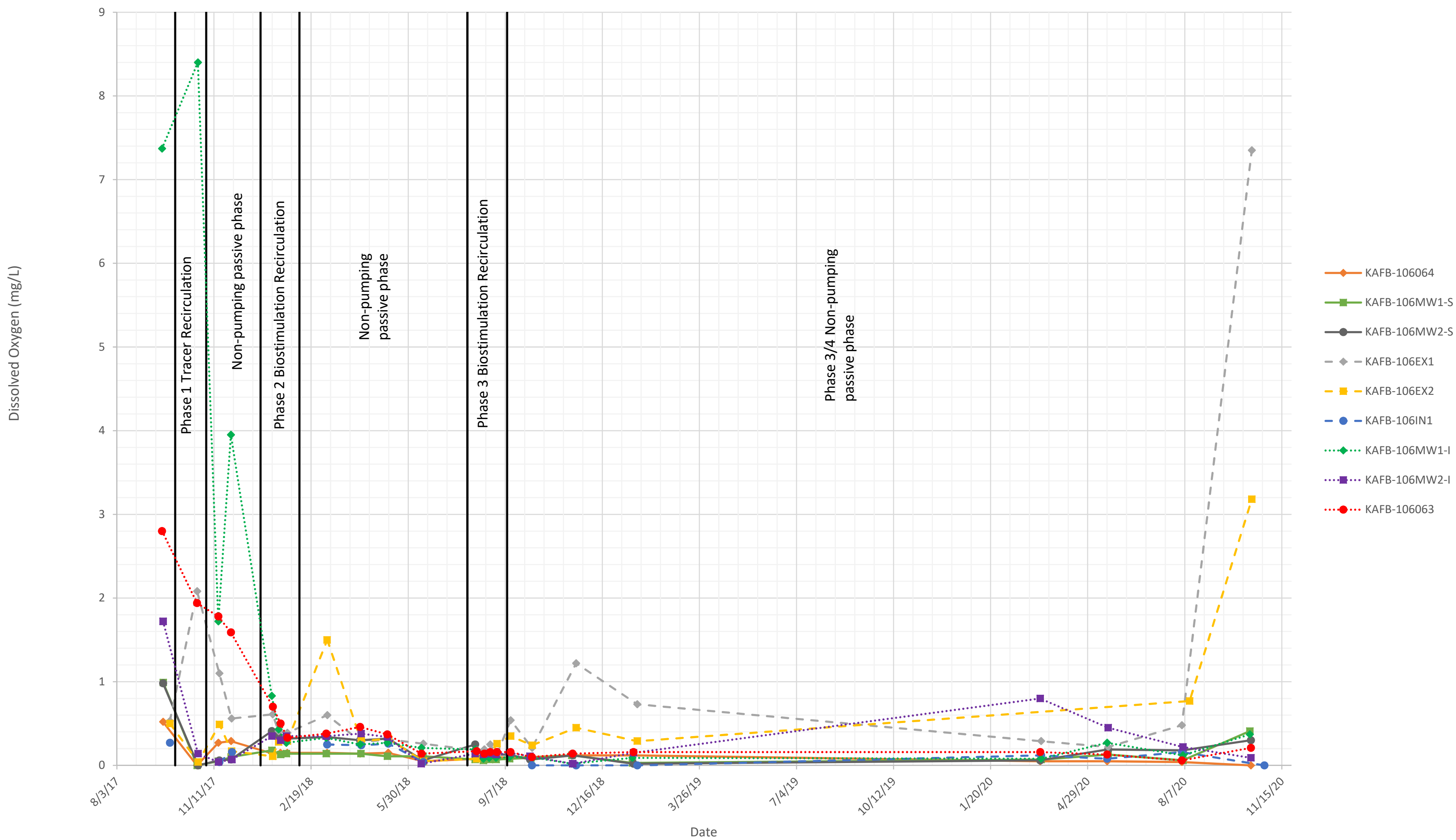
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 24

DSB CONCENTRATIONS - ALL WELLS



APTIM Aptim Federal Services, LLC	FIGURE 25
KIRTLAND AIR FORCE BASE NEW MEXICO	DISSOLVED OXYGEN - ALL WELLS

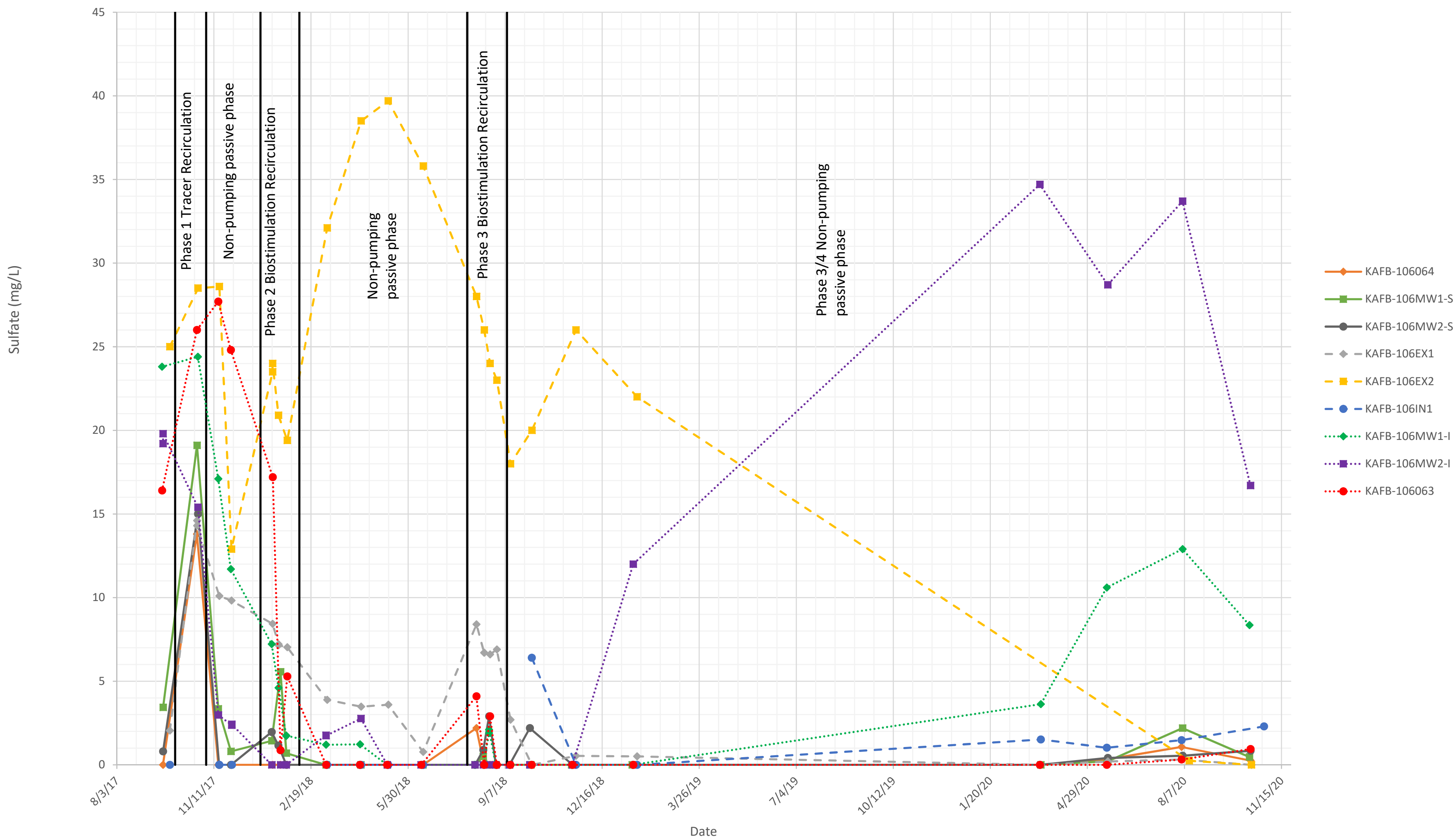


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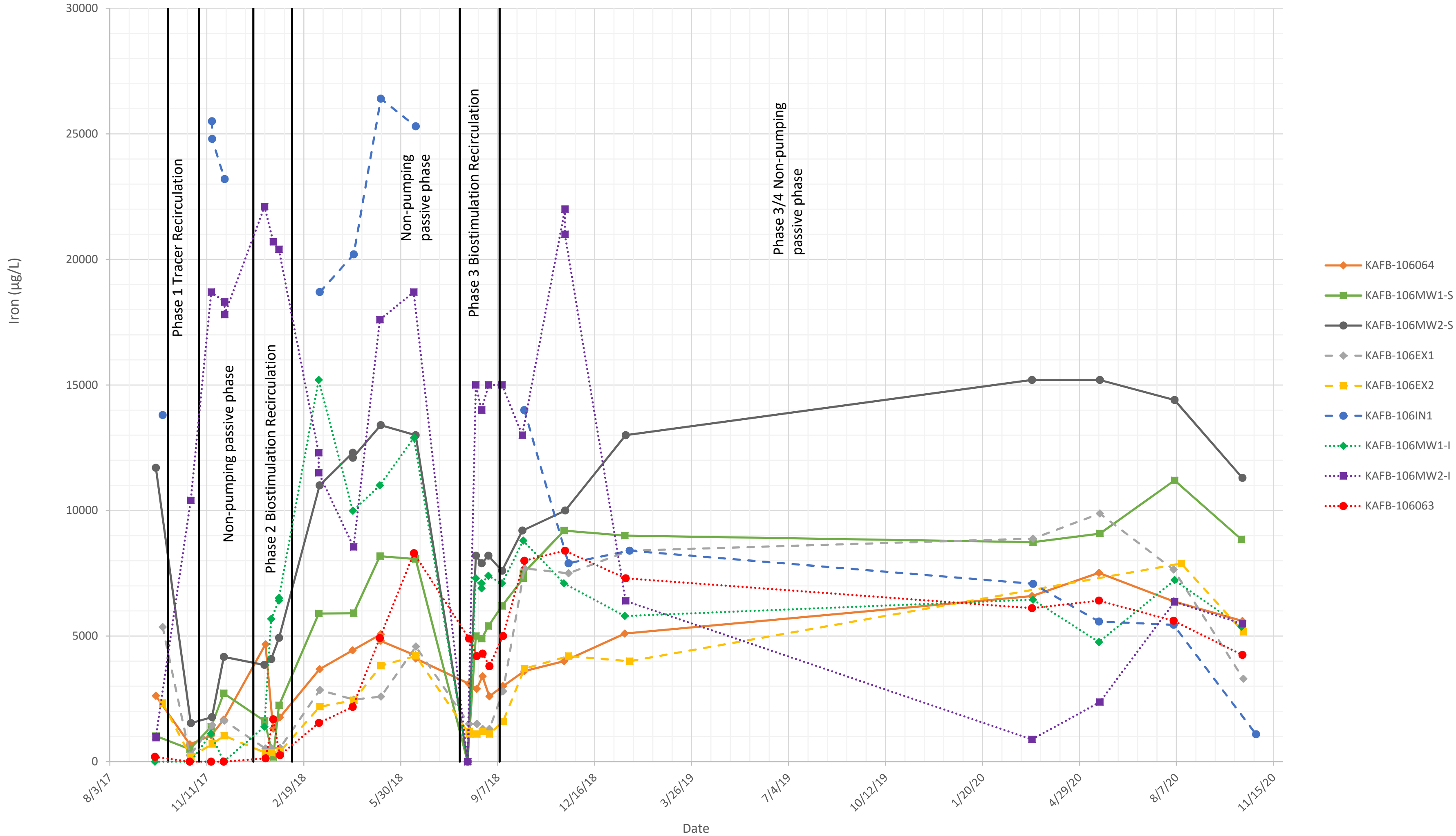
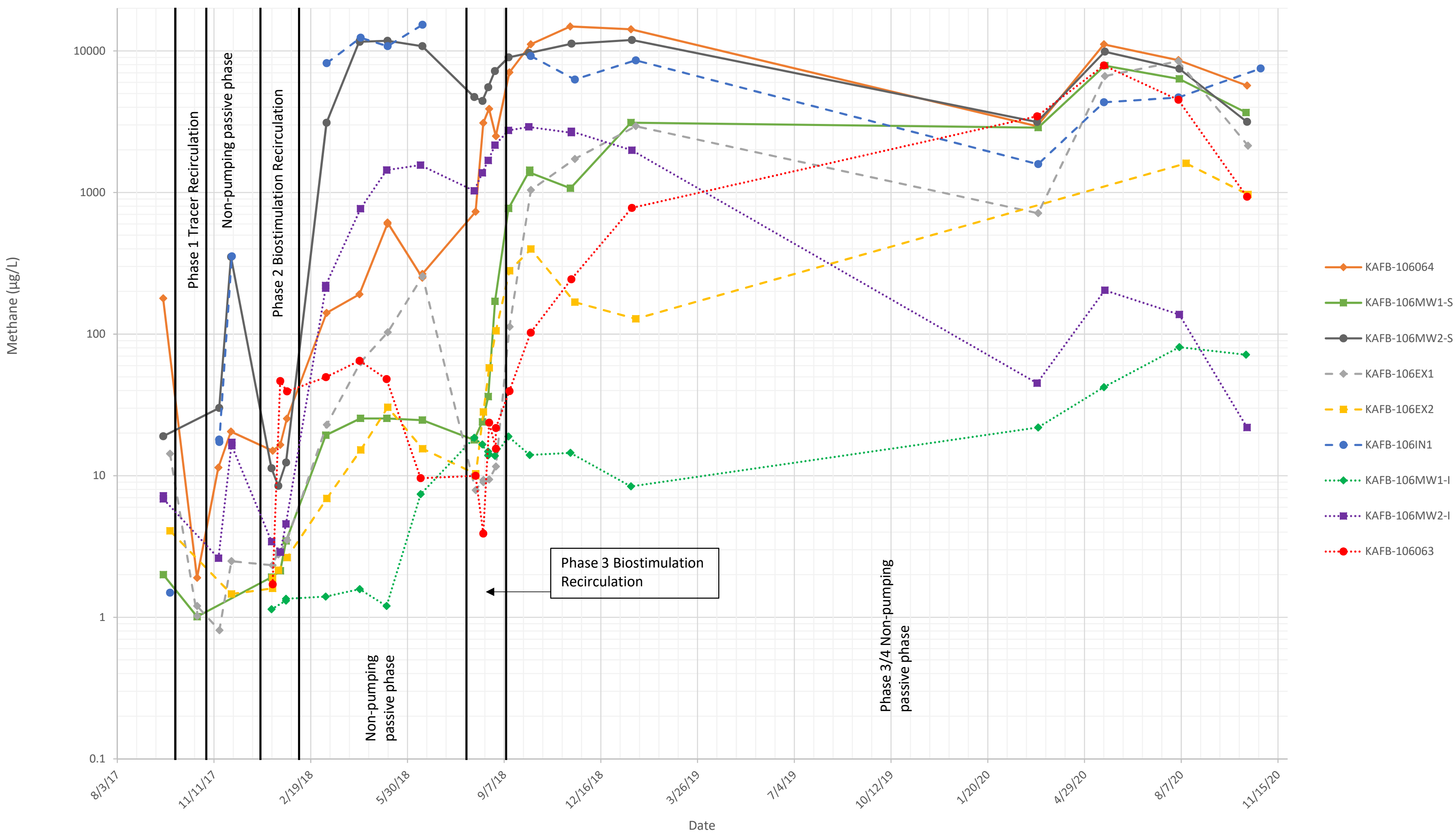
FIGURE 26

KIRTLAND AIR FORCE BASE
NEW MEXICO

SULFATE CONCENTRATIONS - ALL WELLS



APTIM Aptim Federal Services, LLC	FIGURE 27
KIRTLAND AIR FORCE BASE NEW MEXICO	IRON (DISSOLVED) CONCENTRATIONS - ALL WELLS



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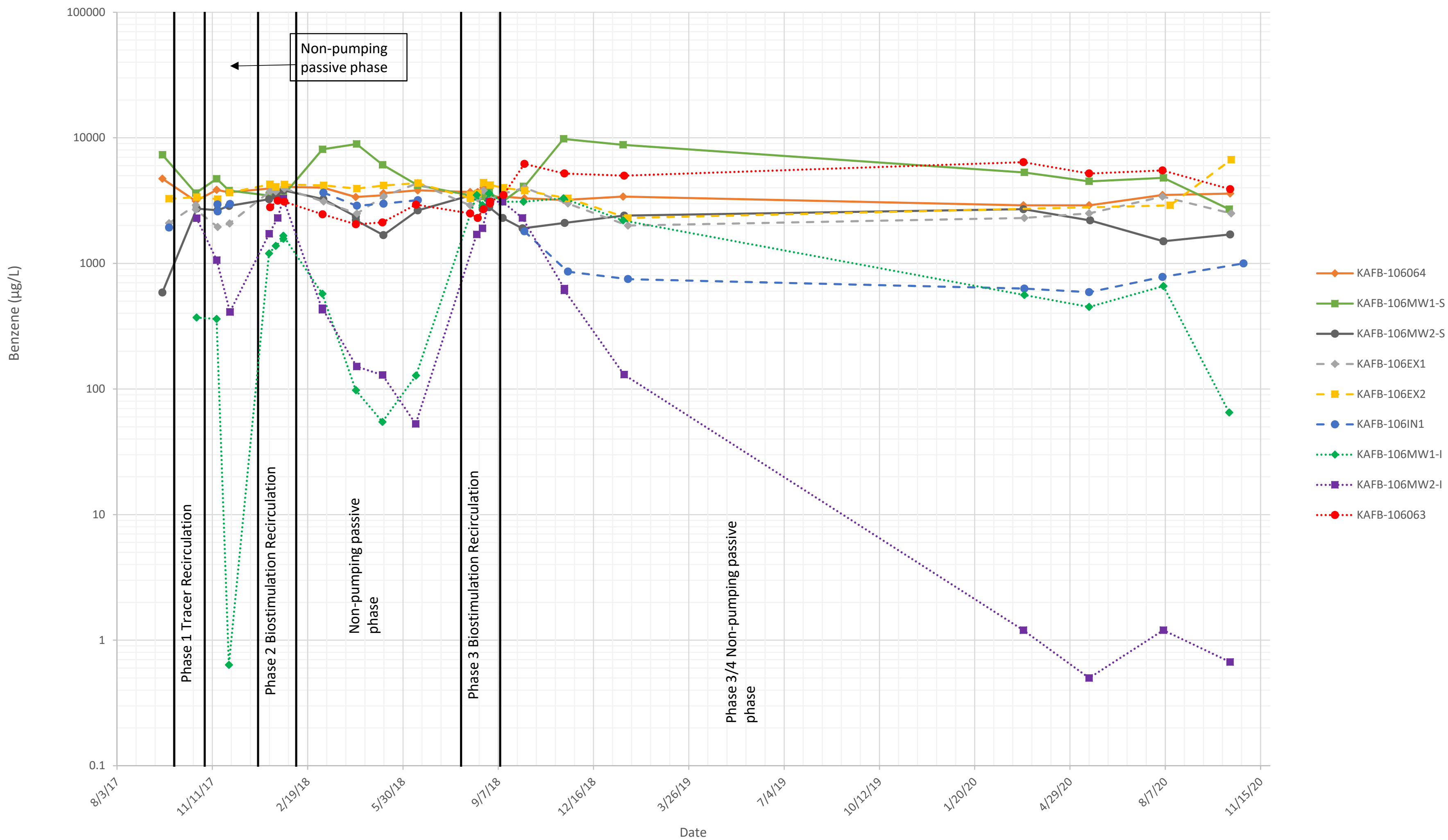
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 28

METHANE CONCENTRATIONS - ALL WELLS



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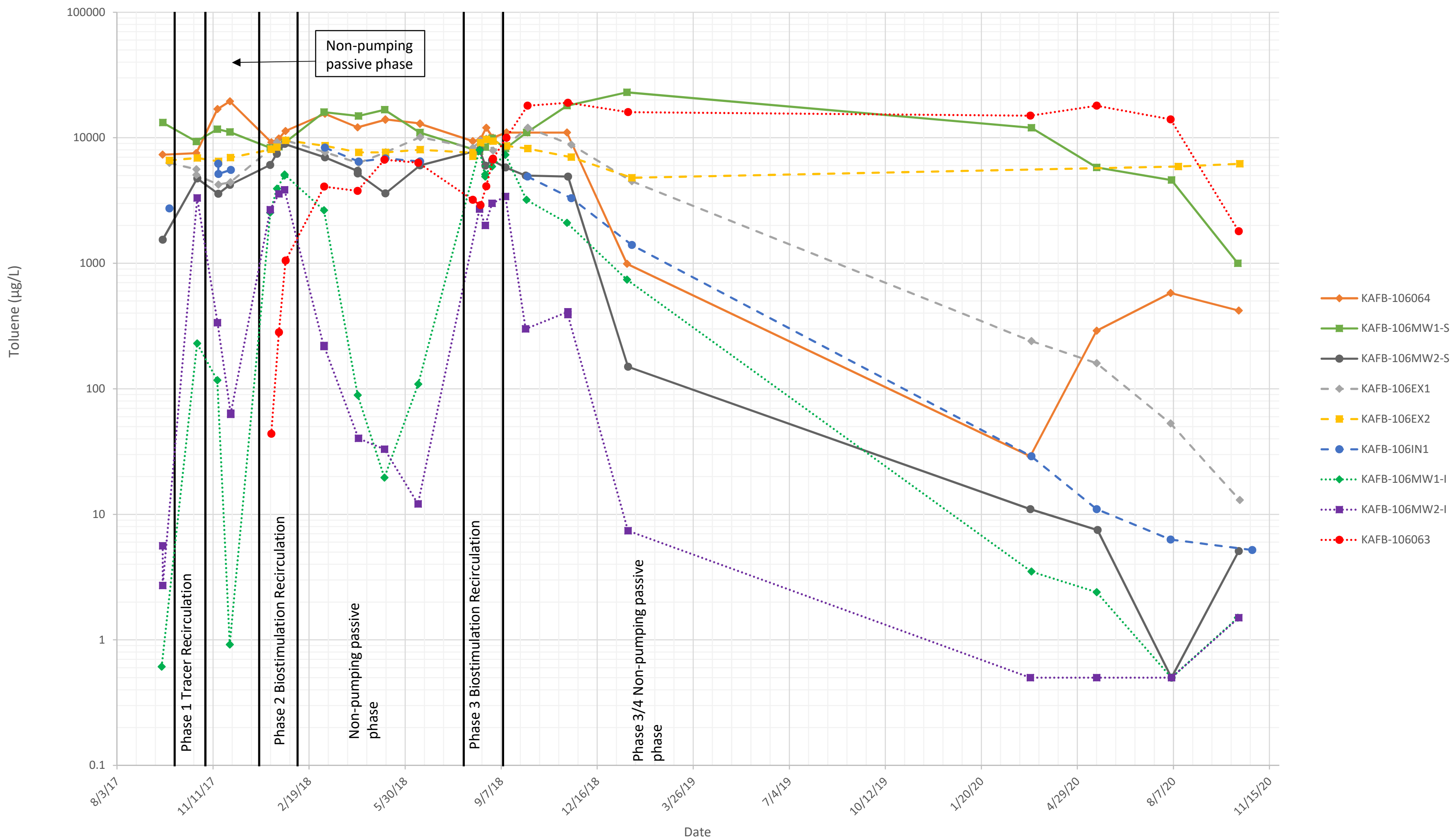
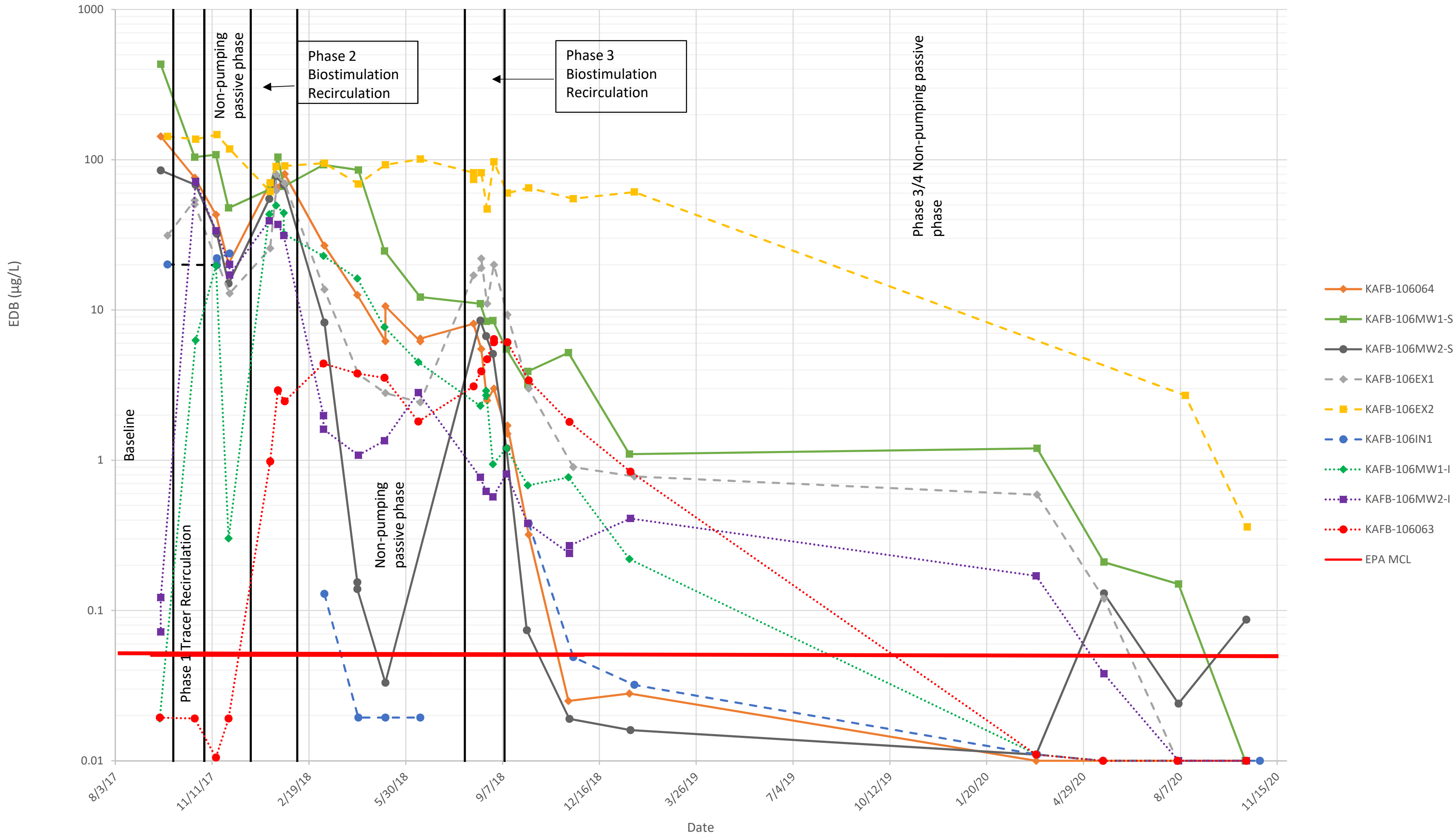
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 29

BENZENE CONCENTRATIONS - ALL WELLS



APTIM Aptim Federal Services, LLC	FIGURE 30
KIRTLAND AIR FORCE BASE NEW MEXICO	TOLUENE CONCENTRATIONS - ALL WELLS



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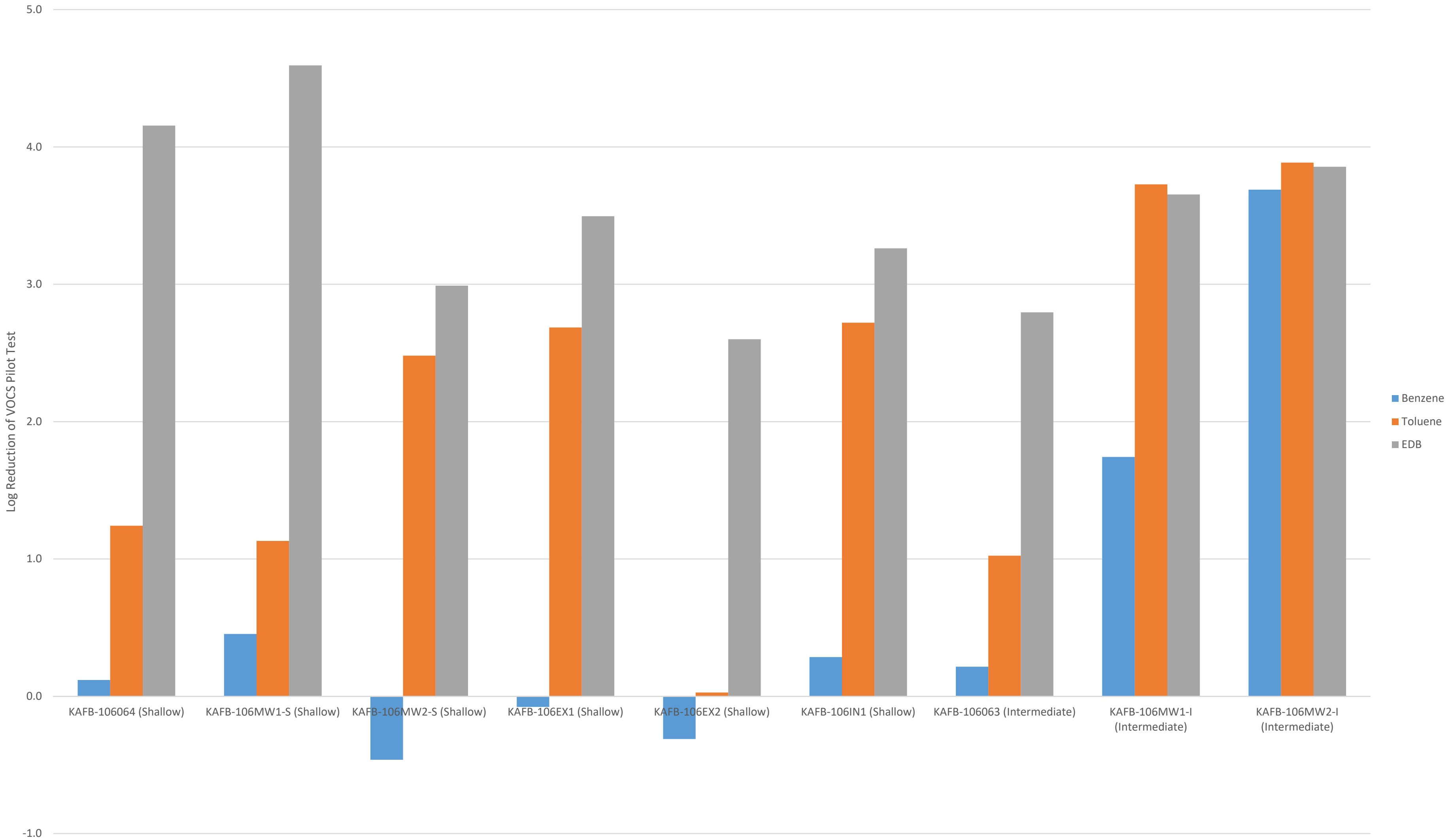
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 31

EDB CONCENTRATIONS - ALL WELLS



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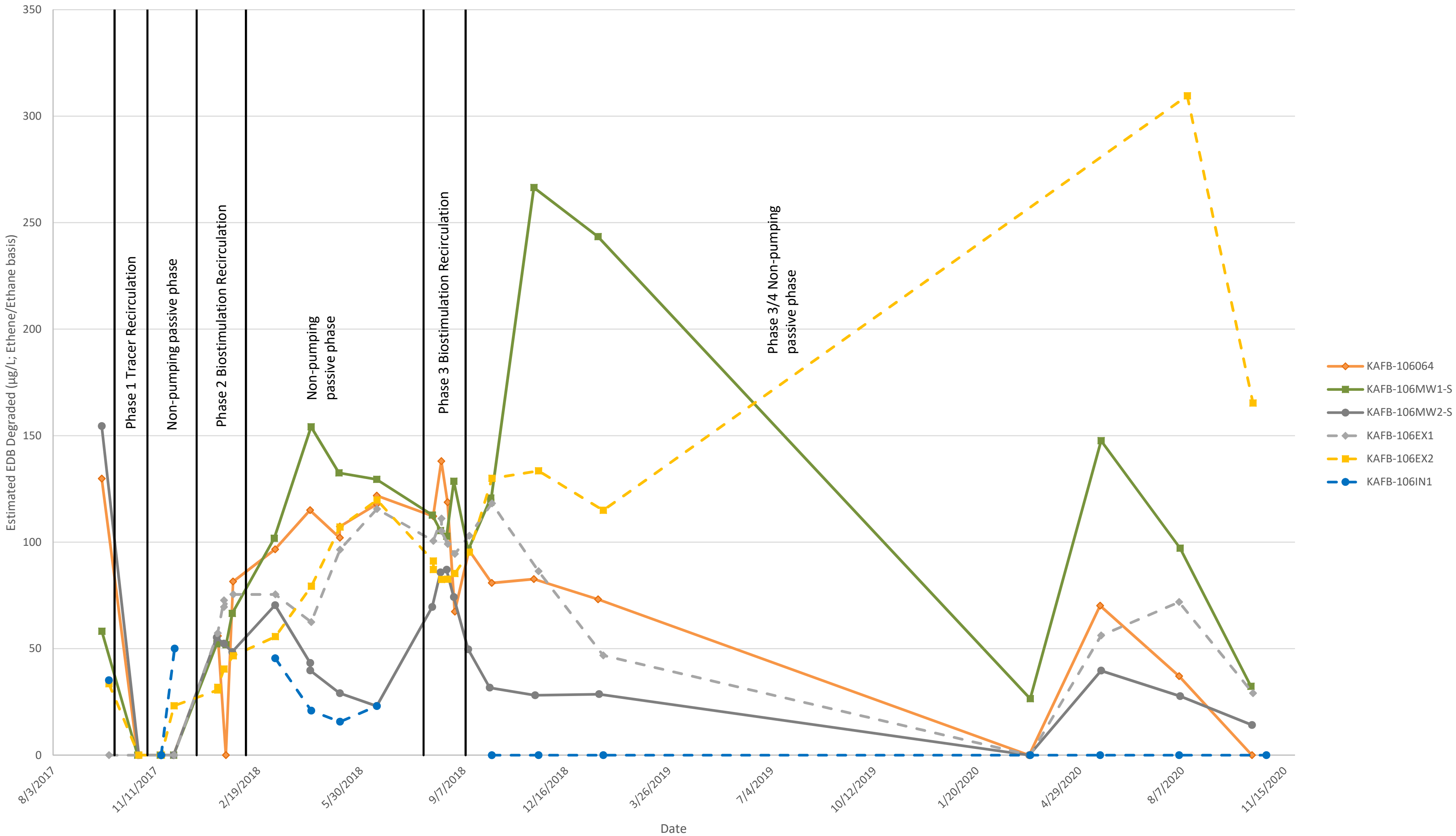
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 32

VOC REDUCTION - ALL WELLS



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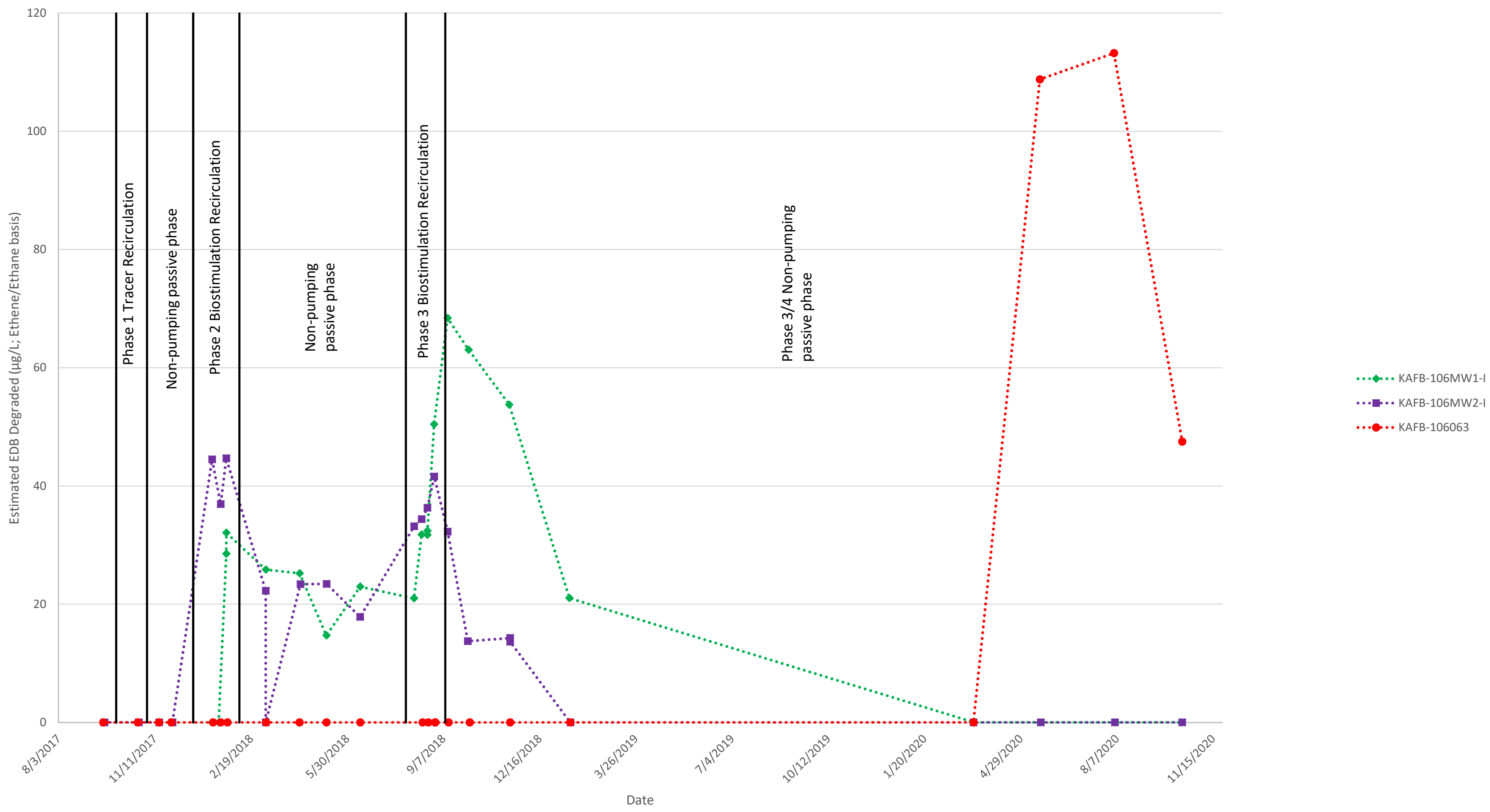
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 33

ETHENE/ETHANE BASED ESTIMATE OF EDB DEGRADED - SHALLOW WELLS



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KIRTLAND AIR FORCE BASE
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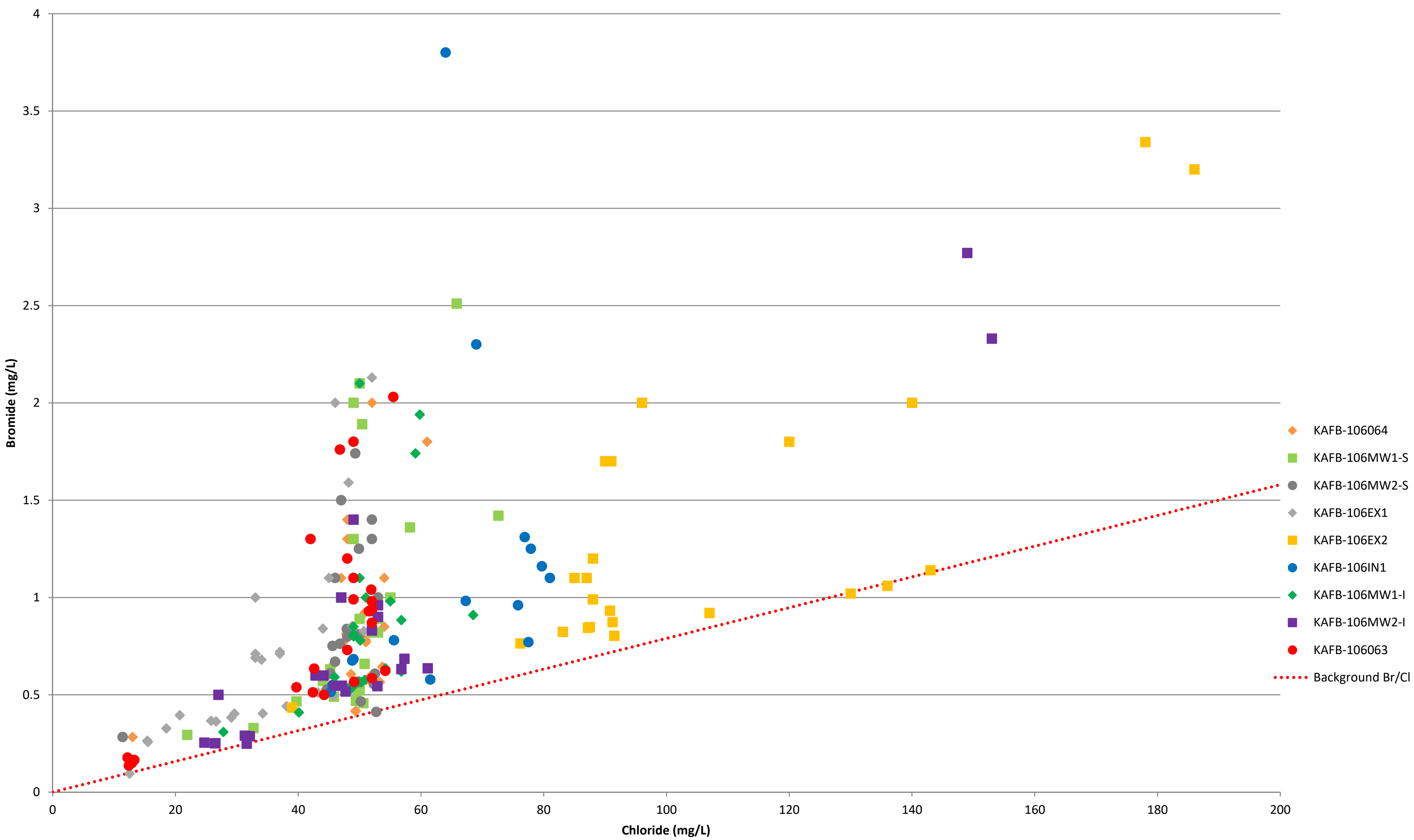
FIGURE 34

ETHENE/ETHANE BASED ESTIMATE OF EDB DEGRADED - INTERMEDIATE WELLS



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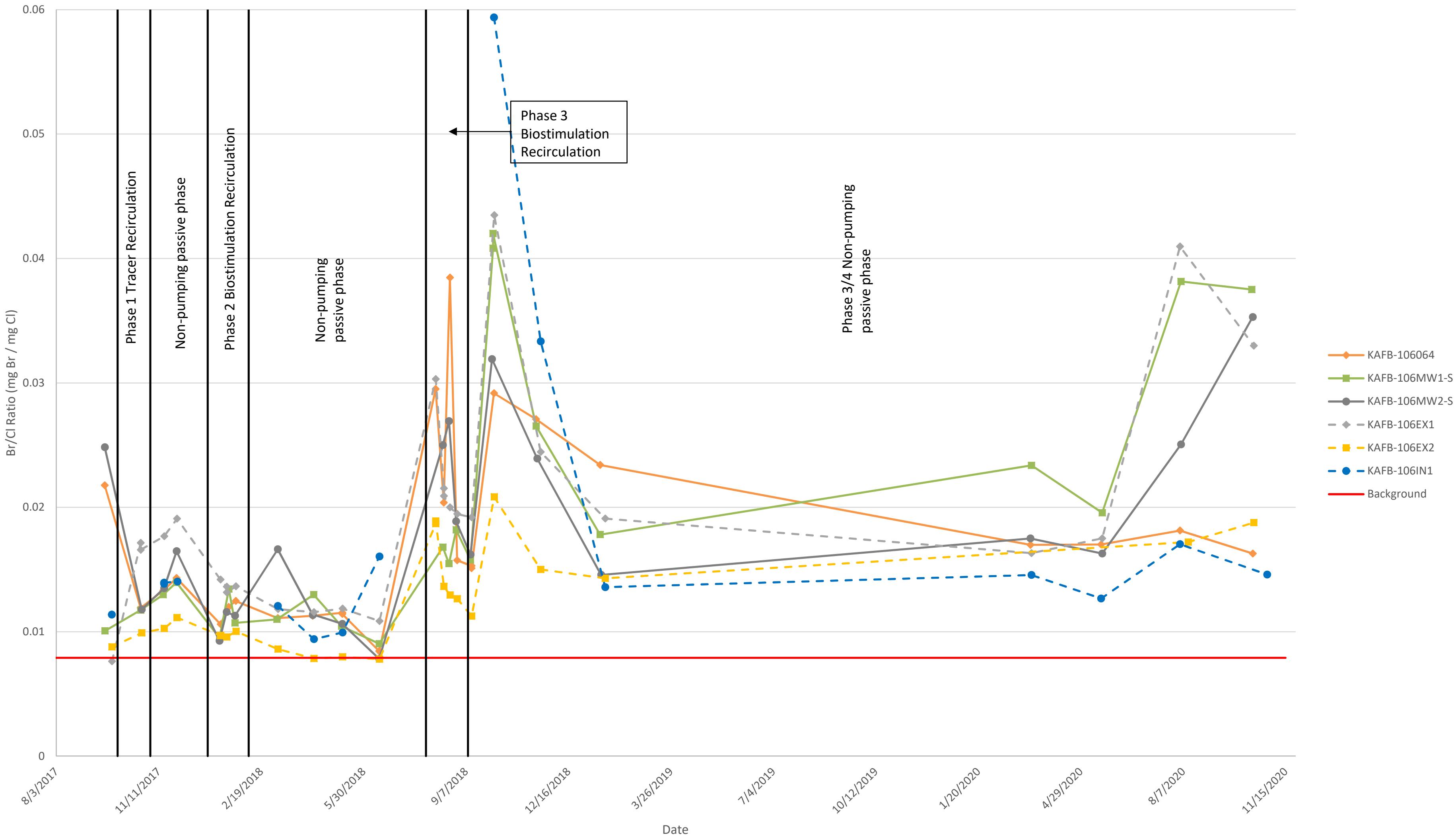
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 35

BROMIDE VS. CHLORIDE - ALL WELLS



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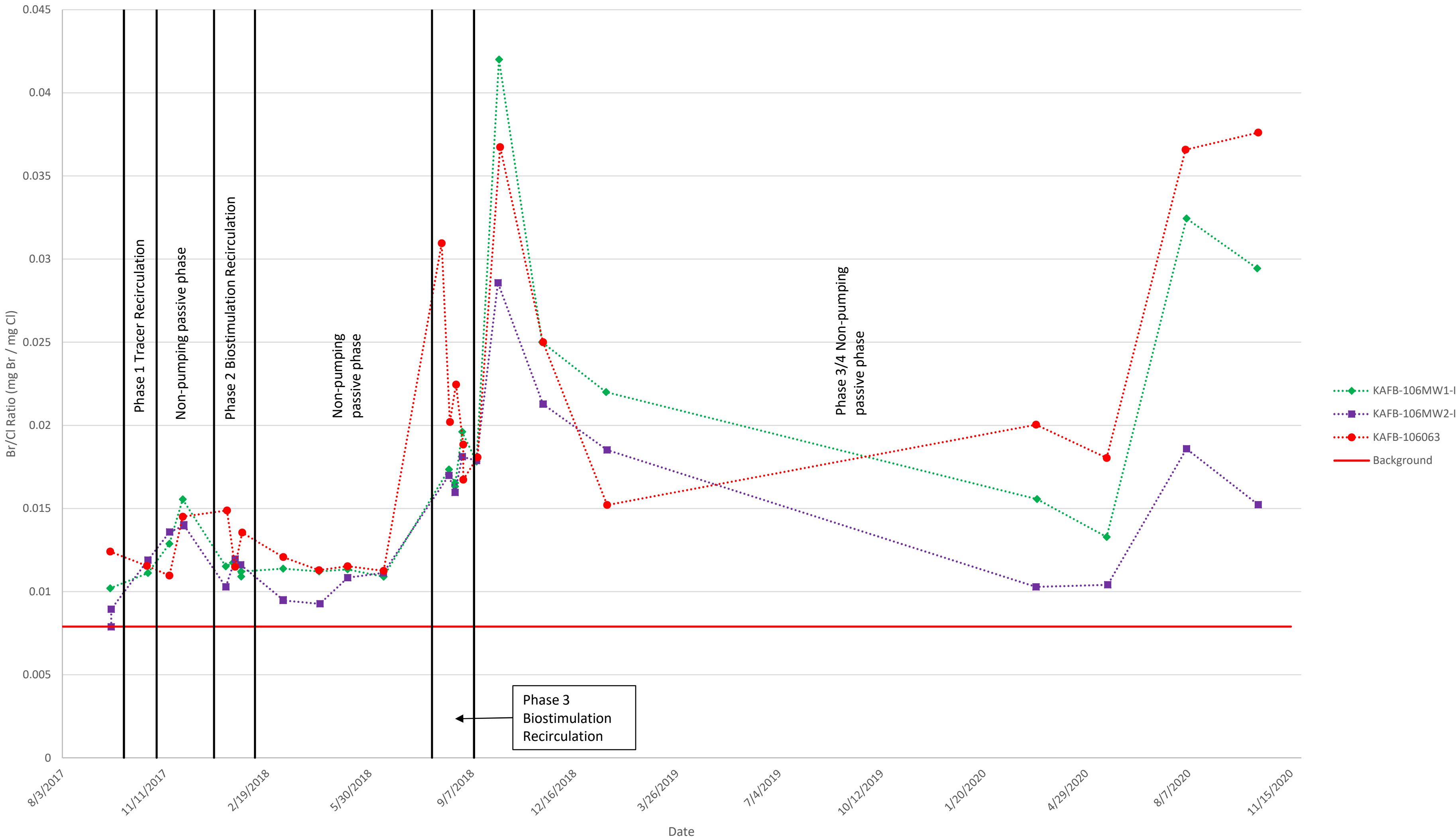
KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 36

BR/CL RATIO - SHALLOW WELLS

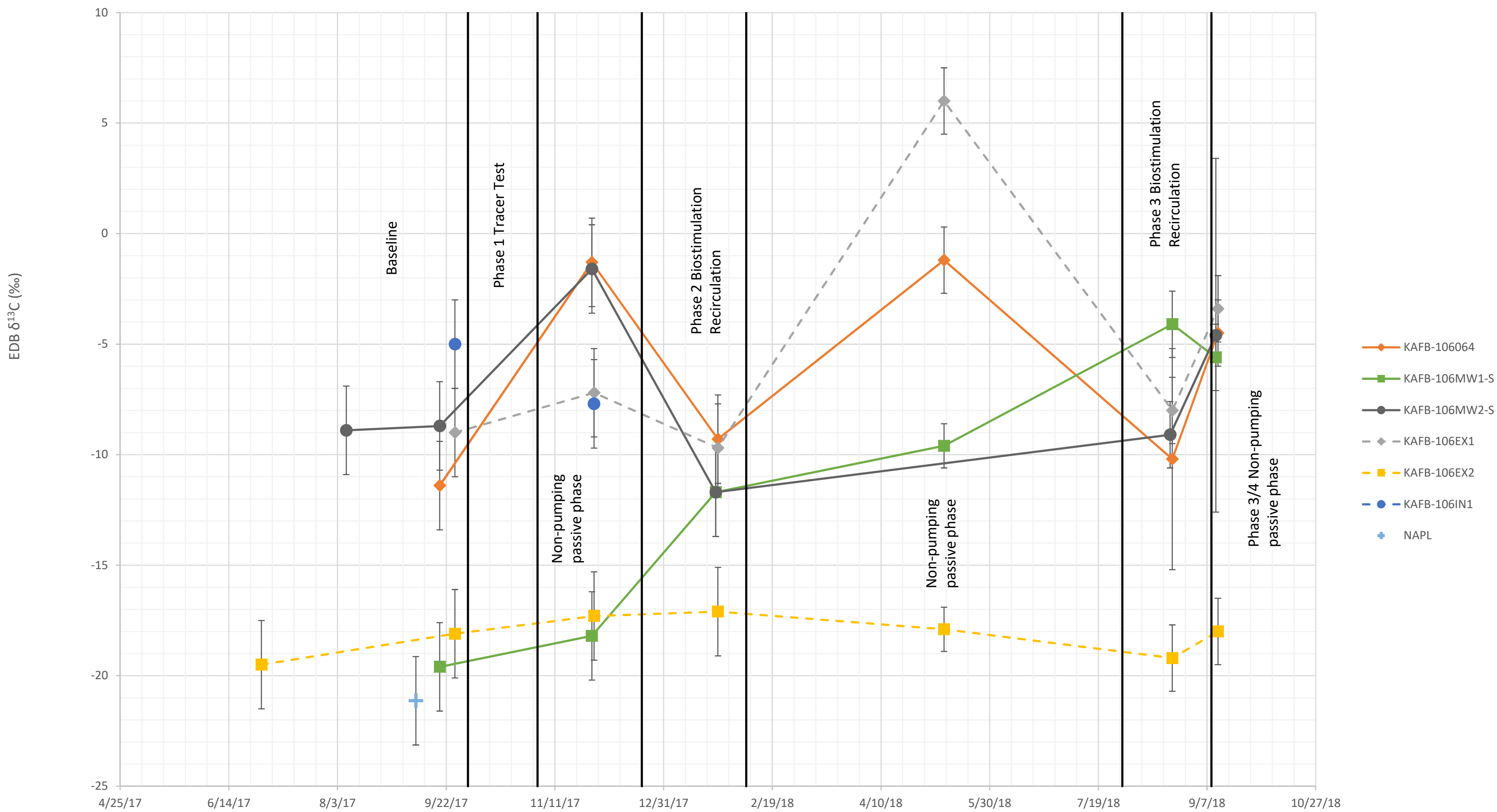


APTIM Aptim Federal Services, LLC

KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 37

BR/CL RATIO - INTERMEDIATE WELLS



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KIRTLAND AIR FORCE BASE
NEW MEXICO

FIGURE 38

EDB Δ13C - SHALLOW WELLS

TABLES

Table 1
Well Completion and Survey Data

Well ID	Well Type	Date Completed	Survey Date	Easting[a]	Northing[a]	Ground Elevation[b]	Top of Well Vault/Protective Casing Elevation[b]	Top of PVC Elevation[b]	Water Level (feet bgs)[c]	Screened Interval (feet bgs)[d]	Well Depth[d] (feet bgs)	Pump Intake (feet bgs)[d]	Casing Diameter (inches)	Casing Type
Newly Installed Wells														
KAFB-106EX1	Extraction	3/12/2017	9/28/2017	1542416.04	1473778.98	5349.35	5349.35	5345.82	477.00	487 - 502	507	491	6.00	SDR 17 PVC/SS Screen
KAFB-106EX2	Extraction	2/26/2017	9/28/2017	1542255.24	1473822.85	5346.84	5346.84	5343.50	477.00	487 - 502	507	491	6.00	SDR 17 PVC/SS Screen
KAFB-106IN1	Injection	3/20/2017	9/28/2017	1542327.02	1473797.07	5348.37	5348.37	5345.07	477.00	477 - 497	502	492	6.00	SDR 17 PVC/SS Screen
KAFB-106MW1-S	GWMW	1/12/2017	9/28/2017	1542355.49	1473838.55	5347.45	5347.53	5347.03	478.00	463 - 498	500.5	488	4.00	Schedule 80 PVC/Screen
KAFB-106MW1-I	GWMW							5347.07	478.00	513 - 523	528	518	3.00	Schedule 80 PVC/Screen
KAFB-106MW2-S	GWMW	2/16/2017	9/28/2017	1542305.04	1473785.32	5347.97	5348.06	5347.55	478.00	463 - 498	500.5	488	4.00	Schedule 80 PVC/Screen
KAFB-106MW2-I	GWMW							5347.57	478.00	513 - 523	528	518	3.00	Schedule 80 PVC/Screen
Existing Wells														
KAFB-106064	GWMW	4/8/2011	4/15/2011	1542358.76	1473788.79	5347.90	5351.10	5350.50	491.00	488 - 508	513	495	5.00	Schedule 80 PVC/Screen
KAFB-106063	GWMW	4/8/2011	4/15/2011	1542371.25	1473763.99	5348.50	5351.90	5351.20	491.40	508 - 523	528	511	5.00	Schedule 80 PVC/Screen

Notes:

[a]Horizontal Coordinate System: NM_NAD83_ST_PL_Central_FIPS_3002_Feet. Measuring point is from the top of protective casing (GWMWs), or vault top (extraction and injection wells).

[b]Elevation above mean sea level. Ground elevation at GWMWs were measured at the northside of the concrete well pad. Ground Elevation at the extraction and injection wells was measured at the top of the well vault.

[c]Average water level measured during well completion, prior to well development.

[d]Screened interval, well depth, and pump intake for existing wells KAFB-106064 and KAFB-106063 is measured from top of casing (approximately 3 feet above ground surface).

bgs - Below ground surface.

GWMW - Groundwater Monitoring Well.

ID - Identification.

KAFB - Kirtland Air Force Base.

NAD83 - North American Datum of 1983.

PVC - Polyvinyl chloride.

SS - Stainless steel.

Table 2
Timeline of Pilot Test Activities

Month	Year	Phase	Event
January - March	2017	N/A	Drilling and construction of two nested groundwater monitoring wells, two extraction wells, and one injection well.
March - May			Surface completion on wells and well development.
March - May			Installation of system pipeline and utilities.
April			Recirculation system delivered to site.
May			Extraction and Injection well down-hole assembly installation; Geotech bladder pump installation.
May			Recirculation system shakedown testing with Calcon.
May - August			Troubleshoot Geotech bladder pump issues.
June - August			Baseline samples collected from all wells except KAFB-106MW1-S due to pump failure.
September			Installation of QED bladder pumps. NAPL detected in KAFB-106MW1-S.
			Recollect baseline samples with new pumps.
			Start system in preparation for Phase 1 on September 26, 2017.
October - November		1	Phase 1 Recirculation (Tracer Test). Fluorescein and deuterated water were injected over a 24 hour period on October 2 through October 3.
November - December			Phase 1 Passive period.
December		2	Start system in preparation for Phase 2 on December 11, 2017.
			Begin injecting amendments on December 22, 2017. Notice that chemical feed pump is leaking; crystallization is observed within check ball housing; turn off system on 12/23/17 to troubleshoot.
			Remix amendment tank to include lower ratios of DAP and lactate. Resume injecting on 12/29/17.
February	2018		Finishing injecting amendments and groundwater for Phase 2 on 2/7/18. Total additions for Phase 2: 150 kg DAP, 290 gallons WilClear Plus®, and 71 kg KI.
February - July			Phase 2 Passive period.
July - August			Data from Phase 2 indicates biostimulation has effectively reduced concentrations of EDB within the pilot test area. Suggested that bioaugmentation be deferred for Phase 3 and additional biostimulation be performed. NMED concurs and approves the Phase 3 Notification Letter in a letter dated August 7, 2018.
July - September		3	Start system for Phase 3 on July 30, 2018. Total additions for Phase 3: 143 kg DAP and 340 gallons WilClear plus. No tracer was used.
September			Phase 3 Passive period began on September 9, 2018.
September			During the first Phase 3 Passive sampling event (9/12/18), the Grundfos pump installed in the injection well failed to lift water after 40 minutes. Excessive drawdown was observed at injection well with transducer, and the pump was shutoff. Tripping out the transducer indicates fine sand, silt, and grey biological growth on the transducer. KAFB-106IN1 is not sampled.
October - November			Samples from the injection well are collected by bailing the sound tube using a stainless steel bailer.
November		4	Phase 4, long-term rebound monitoring began on November 19, 2018.
January	2019		Collect first Phase 4 sample on January 16, 17, and 21, 2019. System continues to remain off.
March - October	2020		Conduct first groundwater sampling event since January 2019 on March 11 and 12, 2020. Sample on a quarterly frequency.

Notes:

DAP - Diammonium phosphate.
IN - Injection well.
KAFB - Kirtland Air Force Base.
kg - Kilograms.
KI - Potassium iodide.
MW - Monitoring well.
NAPL - Non-aqueous phase liquid.
NMED - New Mexico Environment Department.

Table 3
Field Water Quality Measurements

Location Name	Sample No.	Date	Time	Gallons Removed	Depth to Groundwater (feet below TOC)[a]	Depth to NAPL (feet below TOC)[a]	Temperature (°C)	pH (S.U.)	Specific Conductivity (mS/cm²)	DO (mg/L)	ORP (mV)	Turbidity (NTU)
KAFB-106063	106063-BL-071817	7/18/2017	1057	2.5	NM	NM	20.2	7.19	0.379	0.04	-123.8	NR
	106063-BL-091817	9/18/2017	1309	2.5	480.24	NA	21.0	7.22	0.543	2.80	-13.5	0.72
	106063-P1R-100417	10/4/2017	1510	4	480.58	NA	21.0	7.23	0.512	1.27	-24.0	1.98
	106063-P1R-100617	10/6/2017	952	4	480.58	NA	18.3	7.20	0.495	1.03	82.8	2.01
	106063-P1R-100917	10/9/2017	1052	4	480.55	NA	18.6	7.30	0.493	1.06	66.1	1.48
	106063-P1R-101217	10/12/2017	0959	4	480.21	NA	18.5	7.12	0.474	1.18	108.1	1.57
	106063-P1R-101617	10/16/2017	1126	4	480.42	NA	18.3	7.12	0.464	1.41	138.0	1.63
	106063-P1R-102017	10/20/2017	1027	4	480.39	NA	17.8	7.17	0.440	1.65	157.7	1.19
	106063-P1R-102417	10/24/2017	0928	4	480.64	NA	16.7	7.31	0.417	1.94	156.3	1.10
	106063-P1R-110117	11/1/2017	0955	4	480.25	NA	17.6	7.18	0.440	2.83	207.9	1.56
	106063-P1P-111517	11/15/2017	0950	4	480.08	NA	17.4	7.15	0.436	1.78	181.6	2.09
	106063-P1P-112817	11/28/2017	1010	4	479.72	NA	16.3	7.26	0.425	1.59	152.8	2.43
	106063-P2R-011018	1/10/2018	1440	5	478.62	NA	15.3	7.14	0.658	0.70	-99.6	3.50
	106063-P2R-011818	1/18/2018	1150	5	478.99	NA	15.0	7.23	0.681	0.50	-130.2	3.42
	106063-P2R-012518	1/25/2018	1140	5	478.83	NA	16.0	7.19	0.696	0.33	-155.2	4.61
	106063-P2P-030618	3/6/2018	1440	4	478.68	NA	17.0	7.11	0.723	0.38	-166.7	3.41
	106063-P2P-041018	4/10/2018	1040	5	478.53	NA	17.7	6.99	0.772	0.46	-175.5	6.51
	106063-P2P-050818	5/8/2018	1100	5	478.22	NA	20.4	6.94	0.817	0.37	-188.3	4.17
	106063-P2P-061218	6/12/2018	1515	5	478.71	NA	24.4	6.94	0.869	0.14	-133.6	6.14
	106063-P3R-080818	8/8/2018	0955	5	478.99	NA	19.2	6.91	0.856	0.17	-175.3	1.59
	106063-P3R-081618	8/16/2018	0945	5	479.08	NA	19.1	6.89	0.866	0.14	-158.6	2.15
	106063-P3R-082218	8/22/2018	1000	5	479.25	NA	18.7	6.92	0.885	0.16	-128.2	3.69
	106063-P3R-082918	8/29/2018	0955	5	479.11	NA	18.8	6.81	0.894	0.16	-120.6	7.49
	106063-P3P-091218	9/12/2018	0935	5	479.07	NA	18.4	7.12	0.915	0.16	-109.3	1.65
	106063-P3P-100418	10/4/2018	1020	5	479.00	NA	18.9	6.88	0.839	0.10	-133.6	4.24
	106063-P3P-111518	11/15/2018	0915	5	479.00	NA	16.8	6.88	0.913	0.14	-111.3	1.81
	106063-P4P-011719	1/17/2019	0950	5	479.03	NA	16.7	6.78	0.980	0.16	-113.1	1.25
	106063-LTM-031120	3/11/2020	1420	6.2	474.18	NA	17.6	6.92	1.079	0.16	-84.6	1.46
	106063-LTM-051920	5/19/2020	1018	8.0	473.91	NA	18.9	6.90	1.051	0.13	-168.6	1.98
	106063-LTM-080420	8/4/2020	1405	8.1	474.95	NA	20.0	6.85	1.053	0.06	-134.3	9.32
	106063-LTM-101420	10/14/2020	0958	7.7	475.70	NA	18.3	6.87	0.868	0.21	-129.9	9.38

Table 3
Field Water Quality Measurements

Location Name	Sample No.	Date	Time	Gallons Removed	Depth to Groundwater (feet below TOC)[a]	Depth to NAPL (feet below TOC)[a]	Temperature (°C)	pH (S.U.)	Specific Conductivity (mS/cm²)	DO (mg/L)	ORP (mV)	Turbidity (NTU)
KAFB-106064	106064-BL-081617	8/16/2017	1033	4	NM	NM	19.1	7.00	0.413	0.71	-132.7	7.89
	106064-BL-091917	9/19/2017	1042	4.5	479.45	NA	19.6	6.90	0.607	0.52	-180.5	10.0
	106064-P1R-100417	10/4/2017	1510	4	480.58	NA	19.7	7.04	0.750	0.22	-138.7	5.03
	106064-P1R-100617	10/6/2017	0925	3.5	480.58	NA	18.2	7.20	0.758	0.09	-152.2	4.12
	106064-P1R-100917	10/9/2017	1450	3.5	479.43	NA	18.3	7.11	0.751	0.11	-157.8	1.34
	106064-P1R-101217	10/12/2017	1348	2.5	479.43	NA	19.7	7.12	0.756	0.00	-241.6	0.64
	106064-P1R-101617	10/16/2017	1423	2.6	479.43	NA	18.9	7.13	0.728	0.00	-236.0	0.97
	106064-P1R-102017	10/20/2017	1420	2.9	479.50	NA	19.0	7.13	0.721	0.00	-238.2	0.75
	106064-P1R-102417	10/24/2017	1120	4	479.61	NA	18.0	7.09	0.707	0.00	-257.5	0.91
	106064-P1R-110117	11/1/2017	1340	4.4	479.60	NA	18.7	7.02	0.719	0.00	-229.6	1.58
	106064-P1P-111517	11/15/2017	1151	4.5	479.28	NA	17.7	6.92	0.749	0.27	-185.3	4.59
	106064-P1P-112817	11/28/2017	1210	4.5	479.88	NA	17.0	6.96	0.741	0.29	-176.3	4.01
	106064-P2R-011018	1/10/2018	1338	4.5	477.60	NA	16.3	6.90	0.873	0.14	-143.4	2.90
	106064-P2R-011818	1/18/2018	1015	3.2	478.06	NA	16.3	6.74	0.886	0.15	-150.9	3.92
	106064-P2R-012518	1/25/2018	0930	3.5	477.85	NA	15.4	6.70	0.964	0.15	-143.2	4.23
	106064-P2P-030718	3/7/2018	0935	3.5	477.82	NA	16.3	6.80	1.024	0.15	-155.4	2.17
	106064-P2P-041018	4/10/2018	0910	4	477.70	NA	17.4	6.72	1.057	0.14	-180.0	1.88
	106064-P2P-050918	5/9/2018	0904	4	477.40	NA	18.8	6.75	1.068	0.15	-455.5	4.53
	106064-P2P-061418	6/14/2018	1005	5	477.90	NA	20.3	6.76	1.055	0.05	-131.8	11.8
	106064-P3R-080818	8/8/2018	0910	4	478.02	NA	18.9	6.68	1.030	0.08	-103.9	6.51
	106064-P3R-081618	8/16/2018	0925	5	478.12	NA	19.3	6.74	1.011	0.09	-118.0	5.18
	106064-P3R-082218	8/22/2018	0930	5	478.15	NA	18.6	6.64	1.023	0.09	-112.9	6.25
	106064-P3R-082918	8/29/2018	0922	5	478.15	NA	19.0	6.64	1.015	0.10	-114.2	7.21
	106064-P3P-091218	9/12/2018	0900	5	478.20	NA	18.9	6.72	1.031	0.09	-124.9	5.15
	106064-P3P-100418	10/4/2018	0920	5	478.00	NA	18.6	6.63	1.039	0.10	-126.5	7.84
	106064-P3P-111418	11/14/2018	0952	5	478.25	NA	17.0	6.86	1.049	0.12	-172.0	2.50
	106064-P4P-011619	1/16/2019	0952	5	478.15	NA	16.5	6.71	1.085	0.12	-126.5	3.09
	106064-LTM-031120	3/11/2020	1025	5.7	473.35	NA	17.3	6.82	1.108	0.05	-116.4	1.27
	106064-LTM-051920	5/19/2020	0957	6.1	473.08	NA	18.3	6.81	1.215	0.05	-193.6	4.84
	106064-LTM-080420	8/4/2020	0924	5.0	473.90	NA	19.3	6.66	1.264	0.04	-148.3	7.64
	106064-LTM-101420	10/14/2020	0905	4.8	474.93	NA	17.6	6.72	1.189	0.00	-100.9	9.30
KAFB-106MW1-S	106MW1S-BL-091917	9/19/2017	1510	3	476.32	476.08	20.8	7.19	0.738	0.99	-145.2	15.1
	106MW1S-P1R-100417	10/4/2017	1200	5.5	476.56	476.30	19.4	7.17	0.704	0.54	-140.9	5.95
	106MW1S-P1R-100617	10/6/2017	1453	5	476.31	NM	19.9	8.40*	0.736	0.34	-139.6	2.43
	106MW1S-P1R-100917	10/9/2017	1218	5	476.19	476.01	18.3	7.20	0.729	0.23	-138.3	2.28
	106MW1S-P1R-101217	10/12/2017	1120	5	476.31	476.10	18.8	7.29	0.736	0.10	-163.7	2.01
	106MW1S-P1R-101617	10/16/2017	1213	3.6	476.54	476.29	18.7	7.31	0.744	0.04	-173.6	1.31
	106MW1S-P1R-102017	10/20/2017	1141	4.1	475.91	475.90	18.6	7.32	0.761	0.03	-172.9	1.04

Table 3
Field Water Quality Measurements

Location Name	Sample No.	Date	Time	Gallons Removed	Depth to Groundwater (feet below TOC)[a]	Depth to NAPL (feet below TOC)[a]	Temperature (°C)	pH (S.U.)	Specific Conductivity (mS/cm²)	DO (mg/L)	ORP (mV)	Turbidity (NTU)
KAFB-106MW1-S	106MW1S-P1R-102417	10/24/2017	1316	4	476.29	476.13	18.9	7.29	0.750	0.00	-192.2	1.11
	106MW1S-P1R-110117	11/1/2017	1125	4.7	475.65	NA	18.2	7.21	0.747	0.02	-169.1	1.22
	106MW1S-P1P-111517	11/15/2017	1133	6	475.80	NA	17.9	7.28	0.753	0.05	-207.0	5.42
	106MW1S-P1P-112817	11/28/2017	1125	4.5	475.46	NA	17.4	7.16	0.773	0.10	-187.8	3.31
	106MW1S-P2R-010918	1/9/2018	1307	4.5	474.55	NA	17.6	7.04	0.856	0.18	-153.5	3.28
	106MW1S-P2R-011818	1/18/2018	1400	4.5	474.50	NA	17.1	7.02	0.890	0.13	-180.0	4.12
	106MW1S-P2R-012418	1/24/2018	1316	3.5	474.60	NA	15.7	6.93	0.914	0.14	-159.2	4.42
	106MW1S-P2P-030618	3/6/2018	1300	4.5	474.35	NA	16.6	7.08	0.995	0.14	-166.0	2.49
	106MW1S-P2P-041118	4/11/2018	0920	4	474.00	NA	17.9	7.00	1.034	0.14	-174.9	2.29
	106MW1S-P2P-050818	5/8/2018	1429	6	473.96	NA	20.8	6.88	1.070	0.11	-585.7	2.09
	106MW1S-P2P-061418	6/14/2018	0810	6	474.53	NA	19.3	7.11	0.998	0.11	-121.5	8.58
	106MW1S-P3R-080718	8/7/2018	1315	6	474.64	NA	20.4	6.86	1.029	0.07	-104.8	4.99
	106MW1S-P3R-081518	8/15/2018	1125	6	474.63	NA	19.7	6.93	1.004	0.06	-124.9	7.18
	106MW1S-P3R-082118	8/21/2018	1125	6	474.80	NA	20.1	6.81	1.016	0.07	-108.1	5.84
	106MW1S-P3R-082818	8/28/2018	1135	6	474.66	NA	19.5	6.81	1.026	0.07	-103.0	5.89
	106MW1S-P3P-091118	9/11/2018	1130	6	474.75	NA	19.2	6.82	1.034	0.08	-114.9	5.14
	106MW1S-P3P-100318	10/3/2018	1020	6	474.78	NA	18.5	6.69	1.068	0.09	-110.0	5.07
	106MW1S-P3P-111418	11/14/2018	1207	6	474.60	NA	16.5	6.87	1.089	0.12	-119.5	5.56
	106MW1S-P4P-011619	1/16/2019	1314	6	473.60	NA	17.3	6.97	1.124	0.03	-126.2	1.43
	106MW1S-LTM-031220	3/12/2020	1100	9.6	469.80	NA	17.8	6.99	1.159	0.07	-89.1	1.99
	106MW1S-LTM-052020	5/20/2020	1000	7.0	469.70	NA	18.5	6.89	1.189	0.13	-121.2	2.35
	106MW1S-LTM-080520	8/5/2020	1055	12.2	470.70	NA	19.5	6.76	1.072	0.06	-138.6	3.72
	106MW1S-LTM-101320	10/13/2020	1209	6.9	471.60	NA	19.2	6.80	0.927	0.41	-122.3	6.23

Table 3
Field Water Quality Measurements

Location Name	Sample No.	Date	Time	Gallons Removed	Depth to Groundwater (feet below TOC)[a]	Depth to NAPL (feet below TOC)[a]	Temperature (°C)	pH (S.U.)	Specific Conductivity (mS/cm^2)	DO (mg/L)	ORP (mV)	Turbidity (NTU)
KAFB-106MW1-I	106MW1I-BL-071817	7/18/2017	1245	2	475.94	NA	19.3	7.55	0.445	9.59	220.1	1.06
	106MW1I-BL-091817	9/18/2017	1140	2	476.12	NA	19.2	7.48	0.460	7.37	194.5	3.02
	106MW1I-P1R-100417	10/4/2017	0920	3	NM	NM	18.5	7.52	0.464	7.79	145.2	0.85
	106MW1I-P1R-100617	10/6/2017	1055	3	NM	NM	18.7	7.16	0.464	7.69	117.7	0.61
	106MW1I-P1R-100917	10/9/2017	0955	8.7 L	NM	NM	18.2	7.13	0.466	7.81	140.0	0.62
	106MW1I-P1R-101217	10/12/2017	0915	2.9	NM	NM	17.9	7.60	0.410	8.33	230.4	0.73
	106MW1I-P1R-101617	10/16/2017	1018	2.5	NM	NM	18.0	7.62	0.406	8.58	180.5	0.82
	106MW1I-P1R-102017	10/20/2017	0955	3.1	NM	NM	18.1	7.60	0.414	8.51	147.3	0.91
	106MW1I-P1R-102517	10/25/2017	0946	4	NM	NM	17.5	7.47	0.490	8.40	41.0	1.79
	106MW1I-P1R-110117	11/1/2017	0930	3.8	NM	NM	17.6	7.26	0.611	7.18	26.8	2.53
	106MW1I-P1P-111517	11/15/2017	0916	4	NM	NM	17.5	7.23	0.553	1.72	-124.9	4.11
	106MW1I-P1P-112817	11/28/2017	0930	5	NM	NM	17.4	7.24	0.488	3.95	36.9	2.09
	106MW1I-P2R-010918	1/9/2018	1114	4	NM	NM	17.0	7.12	0.782	0.83	-153.1	4.76
	106MW1I-P2R-011618	1/16/2018	1030	7	NM	NM	15.3	7.12	0.810	0.43	-158.0	2.81
	106MW1I-P2R-012418	1/24/2018	1052	7.5	NM	NM	16.5	6.94	0.839	0.27	-155.7	3.50
	106MW1I-P2P-030618	3/6/2018	1025	8	NM	NM	16.6	7.22	0.838	0.33	-200.3	4.17
	106MW1I-P2P-041018	4/10/2018	1405	7	NM	NM	18.7	7.22	0.796	0.25	-206.0	2.31
	106MW1I-P2P-050818	5/8/2018	1018	7	NM	NM	19.2	7.10	0.785	0.27	-203.4	2.09
	106MW1I-P2P-061218	6/12/2018	1455	6	NM	NM	21.1	7.11	0.822	0.21	-159.1	4.51
	106MW1I-P3R-080718	8/7/2018	1027	6	NM	NM	19.4	7.06	0.820	0.19	-129.5	2.95
	106MW1I-P3R-081518	8/15/2018	0935	5	NM	NM	18.9	7.10	0.894	0.08	-147.8	3.95
	106MW1I-P3R-082118	8/21/2018	0925	5	NM	NM	19.0	7.02	0.943	0.09	-148.0	5.03
	106MW1I-P3R-082818	8/28/2018	0920	5	NM	NM	18.8	7.00	0.981	0.09	-145.4	5.08
	106MW1I-P3P-091118	9/11/2018	0932	5	NM	NM	18.6	7.08	1.030	0.10	-150.1	7.15
	106MW1I-P3P-100318	10/3/2018	0855	5	NM	NM	18.2	6.92	0.944	0.10	-142.2	4.13
	106MW1I-P3P-111418	11/14/2018	1027	5	NM	NM	17.1	6.87	0.971	0.02*	-123.6	4.74
	106MW1I-P4P-011619	1/16/2019	1119	5	NM	NM	17.0	7.20	0.827	0.09	-138.2	1.11
	106MW1I-LTM-031220	3/12/2020	1528	11.5	NM	NM	17.9	7.03	0.852	0.08	-122.8	1.48
	106MW1I-LTM-051920	5/19/2020	1433	7.5	NM	NM	23.1	6.89	0.824	0.27	-206.1	2.22
	106MW1I-LTM-080520	8/5/2020	1520	12.2	NM	NM	19.6	6.82	0.831	0.12	-152.7	2.52
	106MW1I-LTM-101320	10/13/2020	0940	6.6	NM	NM	18.2	6.81	0.803	0.37	-141.6	3.40

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Field Water Quality Measurements

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KAFB-106MW2-S	106MW2S-BL-080717	8/7/2017	1234	3	NM	NM	19.6	7.10	0.875	1.01	-93.2	14.8
	106MW2S-BL-091917	9/19/2017	1225	3	NM	NM	19.7	6.94	0.765	0.98	-167.8	7.17
	106MW2S-P1R-100417	10/4/2017	0948	4	NM	NM	18.7	7.21	0.760	0.75	-188.9	2.45
	106MW2S-P1R-100617	10/6/2017	1142	4	NM	NM	19.0	7.26	0.803	0.50	-196.9	4.6
	106MW2S-P1R-100917	10/9/2017	1446	4	NM	NM	18.3	7.39	0.789	0.52	-191.4	2.41
	106MW2S-P1R-101217	10/12/2017	1412	4	NM	NM	19.2	7.24	0.761	0.35	-200.4	2.26
	106MW2S-P1R-101617	10/16/2017	1445	4	NM	NM	19.3	7.28	0.753	0.28	-207.2	2.91
	106MW2S-P1R-102017	10/20/2017	1429	4	NM	NM	18.9	7.32	0.728	0.25	-218.0	4.42
	106MW2S-P1R-102517	10/25/2017	1323	4	NM	NM	18.9	7.31	0.708	0.00	-214.1	1.19
	106MW2S-P1R-110117	11/1/2017	1413	4	NM	NM	18.7	7.15	0.759	0.24	-214.8	1.90
	106MW2S-P1P-111617	11/16/2017	0921	4.5	NM	NM	17.5	7.30	0.786	0.06	-198.3	12.3
	106MW2S-P1P-112817	11/28/2017	1302	3.5	NM	NM	18.0	7.21	0.863	0.07	-204.3	3.85
	106MW2S-P2R-010918	1/9/2018	1045	3.5	NM	NM	17.3	6.85	0.852	0.41	-196.2	3.52
	106MW2S-P2R-011618	1/16/2018	0945	4	NM	NM	13.7	6.91	0.870	0.35	-172.1	3.10
	106MW2S-P2R-012418	1/24/2018	1345	4	NM	NM	16.3	6.74	0.970	0.32	-174.1	2.97
	106MW2S-P2P-030718	3/7/2018	0940	4	NM	NM	15.9	6.78	1.039	0.34	-183.1	3.35
	106MW2S-P2P-041018	4/10/2018	1305	4	NM	NM	19.4	6.91	1.168	0.30	-231.1	5.39
	106MW2S-P2P-050918	5/9/2018	0915	4	NM	NM	19.0	7.02	1.132	0.32	-226.5	7.19
	106MW2S-P2P-061418	6/14/2018	0905	4	NM	NM	18.9	7.00	1.094	0.06	-150.2	4.97
	106MW2S-P3R-080718	8/7/2018	1020	5	NM	NM	19.1	6.74	1.097	0.25	-108.6	8.79
	106MW2S-P2R-081518	8/15/2018	1130	5	NM	NM	19.7	6.73	1.021	0.11	-153.8	2.89
	106MW2S-P3R-082118	8/21/2018	1140	5	NM	NM	20.1	6.70	1.017	0.12	-151.1	2.88
	106MW2S-P3R-082818	8/28/2018	0945	5	NM	NM	18.6	6.73	1.057	0.13	-150.0	5.15
	106MW2S-P3P-091118	9/11/2018	1200	5	NM	NM	19.4	7.10	0.992	0.13	-158.7	2.77
	106MW2S-P3P-100218	10/2/2018	1040	5	NM	NM	19.0	6.74	0.999	0.07	-165.2	7.59
	106MW2S-P3P-111518	11/15/2018	1423	5	NM	NM	17.9	6.85	1.052	0.12	-132.0	9.91
	106MW2S-P4P-011719	1/17/2019	1307	5	NM	NM	17.6	6.89	1.129	0.02	-151.0	9.40
	106MW2S-LTM-031120	3/11/2020	1542	10.5	NM	NM	17.5	6.91	1.093	0.06	-130.7	3.69
	106MW2S-LTM-052020	5/20/2020	1105	12	470.15	NA	19.0	6.77	1.029	0.19	-164.4	3.24
	106MW2S-LTM-080520	8/5/2020	1055	9.1	470.82	NM	19.8	6.81	0.799	0.18	-118.8	2.51
	106MW2S-LTM-101420	10/14/2020	1400	6.1	NM	NM	18.8	6.84	0.885	0.30	-154.0	8.73

Table 3
Field Water Quality Measurements

Location Name	Sample No.	Date	Time	Gallons Removed	Depth to Groundwater (feet below TOC)[a]	Depth to NAPL (feet below TOC)[a]	Temperature (°C)	pH (S.U.)	Specific Conductivity (mS/cm²)	DO (mg/L)	ORP (mV)	Turbidity (NTU)
KAFB-106MW2-I	106MW2I-BL-072417	7/24/2017	1124	2.5	NM	NM	19.3	7.23	0.431	6.70	199.2	2.84
	106MW2I-BL-091917	9/19/2017	1337	2.5	NM	NM	19.7	7.26	0.454	1.72	-118.1	3.16
	106M21I-P1R-100417	10/4/2017	1142	4	NM	NM	18.6	7.26	0.518	2.38	-154.2	3.08
	106M21I-P1R-100617	10/6/2017	1412	4	NM	NM	19.4	7.24	0.530	2.24	-156.7	4.85
	106M21I-P1R-100917	10/9/2017	1216	4	NM	NM	18.3	7.32	0.559	2.28	-140.5	6.20
	106MW2I-P1R-101217	10/12/2017	1130	4	NM	NM	18.4	7.21	0.558	2.23	-137.2	5.71
	106MW2I-P1R-101617	10/16/2017	1251	4	NM	NM	18.8	7.22	0.701	1.50	-160.3	3.81
	106MW2I-P1R-102017	10/20/2017	1153	4	NM	NM	18.6	7.30	0.732	0.52	-218.3	4.84
	106MW2I-P1R-102517	10/25/2017	1117	4	NM	NM	18.1	7.38	0.685	0.14	-228.9	6.55
	106MW2I-P1R-110117	11/1/2017	1126	4	NM	NM	18.3	7.31	0.767	0.28	-271.0	5.64
	106MW2I-P1P-111517	11/15/2017	1438	4	NM	NM	18.2	7.50	0.749	0.04	-265.4	2.48
	106MW2I-P1P-112917	11/29/2017	0929	4	NM	NM	17.4	7.45	0.695	0.07	-259.1	2.07
	106MW2I-P2R-010918	1/9/2018	1353	4	NM	NM	17.5	7.07	0.874	0.35	-226.8	3.17
	106MW2I-P2R-011818	1/18/2018	1355	4	NM	NM	17.3	7.15	0.870	0.30	-234.1	5.19
	106MW2I-P2R-012418	1/24/2018	0940	4	NM	NM	15.6	7.01	0.872	0.35	-230.7	3.50
	106MW2I-P2P-030618	3/6/2018	1013	4	NM	NM	16.5	7.09	0.585	0.35	-211.3	3.68
	106MW2I-P2P-041118	4/11/2018	1020	5	NM	NM	18.8	6.96	0.620	0.38	-198.7	4.67
	106MW2I-P2P-050818	5/8/2018	1400	5	NM	NM	20.5	6.96	0.800	0.34	-214.8	3.34
	106MW2I-P2P-061218	6/12/2018	1020	5	NM	NM	19.9	7.07	0.830	0.02	-154.8	4.34
	106MW2I-P3R-080718	8/7/2018	1410	5	NM	NM	21.7	6.93	0.919	0.14	-137.8	7.98
	106MW2I-P3R-081518	8/15/2018	0945	5	NM	NM	19.3	6.88	0.912	0.13	-139.2	3.54
	106MW2I-P3R-082118	8/21/2018	0950	5	NM	NM	19.2	6.86	0.904	0.14	-141.6	1.39
	106MW2I-P3R-082818	8/28/2018	1140	5	NM	NM	19.7	7.45	0.938	0.13	-132.5	3.47
	106MW2I-P3P-091118	9/11/2018	1015	5	NM	NM	19.1	7.06	0.976	0.15	-130.1	1.40
	106MW2I-P3P-100218	10/2/2018	0900	5	NM	NM	18.1	6.73	0.869	0.11	-137.2	4.98
	106MW2I-P3P-111518	11/15/2018	0942	5	NM	NM	17.1	6.86	0.861	0.02*	-140.1	4.13
	106MW2I-P4P-011719	1/17/2019	1025	5	NM	NM	16.8	7.20	0.575	0.15	-146.4	0.32
	106MW2I-LTM-031120	3/11/2020	1110	10	NM	NM	17.4	7.21	0.457	0.80	-50.2	2.75
	106MW2I-LTM-052020	5/20/2020	1350	9.6	NM	NM	19.7	6.98	0.603	0.45	-114.4	3.60
	106MW2I-LTM-080520	8/5/2020	1435	7.9	NM	NM	19.5	6.89	0.790	0.22	-94.4	1.98
	106MW2I-LTM-101420	10/14/2020	1423	8.6	NM	NM	19.1	6.94	1.057	0.09	-92.1	7.53

Table 3
Field Water Quality Measurements

Location Name	Sample No.	Date	Time	Gallons Removed	Depth to Groundwater (feet below TOC)[a]	Depth to NAPL (feet below TOC)[a]	Temperature (°C)	pH (S.U.)	Specific Conductivity (mS/cm²)	DO (mg/L)	ORP (mV)	Turbidity (NTU)
KAFB-106EX1	106EX1-BL-062917	6/29/2017	0953	3.5	482.37	NM	20.2	7.29	0.570	0.36	-116.0	2.79
	106EX1-BL-092617	9/26/2017	1218	3.5	481.75	NM	20.3	7.02	0.650	0.53	-162.8	14.8
	106EX1-P1R-100417	10/4/2017	1553	3.5	482.65	NM	20.6	7.04	0.551	2.70	-53.2	1.61
	106EX1-P1R-100617	10/6/2017	1526	3.5	482.31	NM	20.7	7.04	0.541	2.19	-74.9	1.61
	106EX1-P1R-100917	10/9/2017	1524	3.5	480.21	NM	20.0	7.12	0.547	2.29	-69.1	2.72
	106EX1-P1R-101217	10/12/2017	1503	3.5	482.50	NM	20.7	7.07	0.497	2.21	-26.0	0.93
	106EX1-P1R-101617	10/16/2017	1514	3.5	484.20	NM	20.4	7.16	0.479	2.26	-50.0	1.34
	106EX1-P1R-102017	10/20/2017	1505	3.5	480.50	NM	20.5	7.10	0.473	2.05	-70.0	1.27
	106EX1-P1R-102417	10/24/2017	1404	5	482.40	NM	20.3	7.10	0.490	2.08	-69.9	2.96
	106EX1-P1R-110117	11/1/2017	1445	5	483.36	NM	20.2	6.93	0.555	1.72	-104.3	2.22
	106EX1-P1P-111617	11/16/2017	1316	16	482.24	NM	20.3	7.08	0.534	1.1	-129.9	5.49
	106EX1-P1P-112917	11/29/2017	1243	15	480.50	NM	19.6	7.05	0.575	0.56	-122.7	4.91
	106EX1-P2R-011018	1/10/2018	1028	2.5	481.41	NM	19.3	6.95	0.600	0.61	-101.5	4.05
	106EX1-P2R-011618	1/16/2018	1150	5	480.43	NM	18.3	6.96	0.604	0.41	-115.4	3.65
	106EX1-P2R-012518	1/25/2018	1305	5	480.64	NM	19.5	6.88	0.637	0.39	-122.6	3.28
	106EX1-P2P-030718	3/7/2018	1440	5	481.40	NM	20.0	6.82	0.707	0.60	-153.9	4.75
	106EX1-P2P-041118	4/11/2018	1450	5	480.50	NM	20.6	6.82	0.756	0.28	-175.3	12.7
	106EX1-P2P-050918	5/9/2018	1435	6	482.01	NM	20.6	6.84	0.818	0.31	-139.8	6.01
	106EX1-P2P-061418	6/14/2018	1428	10	478.89	NM	20.7	6.88	0.861	0.26	-90.0	9.16
	106EX1-P3R-080818	8/8/2018	1155	6	480.50	NM	20.6	6.92	0.720	0.18	-75.9	5.27
	106EX1-P3R-081618	8/16/2018	1110	7	480.50	NM	20.7	6.89	0.753	0.19	-79.2	1.95
	106EX1-P3R-082218	8/22/2018	1105	6	480.50	NM	20.5	7.01	0.757	0.25	-85.0	2.47
	106EX1-P3R-082918	8/29/2018	1115	7	480.65	NM	20.7	6.89	0.758	0.13	-96.1	9.11
	106EX1-P3P-091218	9/12/2018	1255	6	476.49	NM	21.2	6.93	0.815	0.54	-117.0	9.01
	106EX1-P3P-100418	10/4/2018	1440	8	475.35	NM	21.0	6.82	0.996	0.21	-116.8	9.59
	106EX1-P3P-111918	11/19/2018	1345	8	480.32	NM	20.1	6.93	0.911	1.22	-83.2	NR
	106EX1-P4P-012119	1/21/2019	1208	8	478.20	NM	19.4	7.08	0.959	0.73	-110.0	4.80
	106EX1-LTM-031220	3/12/2020	1035	4.5	468.26	467.85	17.1	6.89	1.107	0.29	-74.6	4.23
	106EX1-LTM-052020	5/20/2020	1445	5.5	467.98	467.45	20.1	6.89	1.118	0.22	-124.1	NR
	106EX1-LTM-080420	8/4/2020	1455	5.7	468.44	468.41	22.7	6.85	0.670	0.48	-85.7	4.52
	106EX1-LTM-101520	10/15/2020	1230	1.5	469.54	NA	23.9	6.86	0.931	7.35	-63.4	54.2

Table 3
Field Water Quality Measurements

Location Name	Sample No.	Date	Time	Gallons Removed	Depth to Groundwater (feet below TOC)[a]	Depth to NAPL (feet below TOC)[a]	Temperature (°C)	pH (S.U.)	Specific Conductivity (mS/cm[2])	DO (mg/L)	ORP (mV)	Turbidity (NTU)
KAFB-106EX2	106EX2-BL-062917	6/29/2017	1050	3.5	478.34	NM	20.4	7.40	0.883	0.57	-113.0	3.61
	106EX2-BL-092617	9/26/2017	1257	3.5	476.75	NM	20.4	7.04	0.873	0.50	-157.8	2.27
	106EX2-P1R-100417	10/4/2017	1616	3.5	480.19	NM	20.6	7.12	0.918	0.89	-72.8	1.70
	106EX2-P1R-100617	10/6/2017	1551	3.5	479.60	NM	20.7	7.08	0.929	0.81	-65.3	1.27
	106EX2-P1R-100917	10/9/2017	1554	3.5	482.40	NM	20.2	7.14	0.936	0.61	-70.8	1.59
	106EX2-P1R-101217	10/12/2017	1531	3.5	480.40	NM	20.6	7.09	0.824	0.15	-43.9	0.83
	106EX2-P1R-101617	10/16/2017	1548	3.5	480.50	NM	20.5	7.12	0.843	0.02	-60.4	0.87
	106EX2-P1R-102017	10/20/2017	1540	3.5	478.10	NM	20.8	7.10	0.879	0.00	-75.9	0.78
	106EX2-P1R-102517	10/25/2017	1410	5	483.00	NM	20.4	7.07	0.834	0.04	-87.7	1.46
	106EX2-P1R-110117	11/1/2017	1521	5	484.85	NM	20.4	6.96	0.908	0.23	-112.7	3.34
	106EX2-P1P-111617	11/16/2017	1355	12	481.65	NM	20.3	7.04	0.945	0.49	-112.1	2.78
	106EX2-P1P-112917	11/29/2017	1326	12	480.40	NM	20.1	6.99	0.999	0.17	-103.7	3.17
	106EX2-P2R-011018	1/10/2018	1105	2	486.17	NM	19.9	7.02	0.937	0.11	-107.8	3.15
	106EX2-P2R-011618	1/16/2018	1250	6	486.40	NM	19.6	6.99	0.918	0.28	-118.8	3.61
	106EX2-P2R-012518	1/25/2018	1345	4.5	486.60	NM	20.1	6.90	0.946	0.29	-123.1	3.10
	106EX2-P2P-030718	3/7/2018	1515	7	485.50	NM	19.9	6.80	1.050	1.50	-127.3	3.22
	106EX2-P2P-041118	4/11/2018	1531	5	486.00	NM	20.6	6.74	1.142	0.29	-152.2	14.0
	106EX2-P2P-050918	5/9/2018	1355	7	484.98	NM	20.6	6.72	1.174	0.32	-142.2	5.81
	106EX2-P2P-061418	6/14/2018	1526	10	484.30	NM	21.1	6.85	1.131	0.05	-102.2	8.88
	106EX2-P3R-080818	8/8/2018	1235	5	487.00	NM	21.0	6.92	1.017	0.08	-81.6	6.92
	106EX2-P3R-081618	8/16/2018	1235	7	487.50	NM	21.0	6.88	1.032	0.13	-118.1	1.57
	106EX2-P3R-082218	8/22/2018	1205	7	487.50	NM	21.0	6.97	1.053	0.13	-117.0	2.09
	106EX2-P3R-082918	8/29/2018	1215	8	487.50	NM	21.2	6.87	1.044	0.26	-121.4	8.95
	106EX2-P3P-091218	9/12/2018	1355	8	478.54	NM	22.0	6.93	1.061	0.35	-155.4	4.35
	106EX2-P3P-100418	10/4/2018	1525	8	474.98	NM	21.6	6.83	1.089	0.24	-112.7	7.98
	106EX2-P3P-111918	11/19/2018	1440	8	474.61	NM	20.1	6.91	1.047	0.45	-93.3	3.22
	106EX2-P4P-012119	1/21/2019	1305	8	479.02	NM	19.4	6.99	1.154	0.29	-126.7	2.28
	106EX2-LTM-081220	8/12/2020	1050	1.8	466.38	466.30	23.8	6.87	1.061	0.77	-82.1	5.64
	106EX2-LTM-101520	10/15/2020	1210	1.3	467.20	NA	22.6	6.88	1.316	3.18	-10.0	26.3

Table 3
Field Water Quality Measurements

Location Name	Sample No.	Date	Time	Gallons Removed	Depth to Groundwater (feet below TOC)[a]	Depth to NAPL (feet below TOC)[a]	Temperature (°C)	pH (S.U.)	Specific Conductivity (mS/cm^2)	DO (mg/L)	ORP (mV)	Turbidity (NTU)
KAFB-106IN1	106IN1-BL-062917	6/29/2017	0815	NR	476.10	NM	19.4	7.20	0.738	0.79	-110.6	17.8
	106IN1-BL-092617	9/26/2017	1105	90	477.22	NM	21.1	7.00	0.736	0.27	-179.7	2.78
	106IN1-P1P-111617	11/16/2017	1100	117	477.15	NM	22.4	6.94	0.937	0.04	-225.1	19.2
	106IN1-P1P-112917	11/29/2017	1055	110	477.35	NM	22.1	6.86	0.934	0.16	-180.9	15.9
	106IN1-P2P-030718	3/7/2018	1343	268	479.90	NM	23.5	6.34	1.750	0.25	-225.4	63.8
	106IN1-P2P-041118	4/11/2018	1355	185	477.63	NM	24.8	6.50	1.744	0.24	-261.6	50.3
	106IN1-P2P-050918	5/9/2018	1235	150	478.96	NM	24.7	6.63	0.846	0.26	-257.2	36.3
	106IN1-P2P-061418	6/14/2018	1310	220	477.59	NM	24.8	6.76	1.701	0.04	-219.5	36.1
	106IN1-P3P-100418[b]	10/4/2018	NA	NA	475.35	NM	NM	NM	NM	NM	NM	NM
	106IN1-P3P-111918[b]	11/19/2018	NA	NA	474.51	NM	NM	NM	NM	NM	NM	NM
	106IN1-P4P-012119[b]	1/21/2019	NA	NA	473.60	NM	NM	NM	NM	NM	NM	NM
	106IN1-LTM-031220	3/12/2020	1540	6.4	468.29	NA	17.5	7.03	3.707	0.12	-132.1	93.8
	106IN1-LTM-051920	5/19/2020	1435	5.2	467.55	NA	20.4	7.01	3.950	0.08	-215.5	72.0
	106IN1-LTM-080420	8/4/2020	1000	4.0	477.90	NA	19.7	7.10	3.940	0.16	-195.8	62.3
	106IN1-LTM-102820	10/28/2020	1218	7.4	470.90	NA	17.2	7.10	3.162	0.00	-136.6	99.8

Notes:

[a] Depth to Groundwater and non-aqueous phase liquid (NAPL) measurements were collected prior to purging (static) and during purging activities. The level included in this table represents the level collected just before sampling. Groundwater and NAPL measurements could not be obtained from nested intermediate wells (KAFB-106MW1-I and KAFB-106MW2-I) with the dedicated bladder pump downhole since the diameter of the well was too small. Additionally, groundwater and NAPL measurements could not be obtained from KAFB-106MW2-S due to an obstruction in the well casing. Groundwater level measurements from the extraction and injection wells were obtained from the downhole transducers during sampling activities.

* DO probe produced erroneous readings.

[b] Sample was collected from sound tube using a stainless steel bailer.

°C - degrees Celcius.

DO - Dissolved oxygen.

KAFB - Kirtland Air Force Base.

mg/L - Milligram per liter.

mS/cm^2 - Millisiemens per square centimeter.

mV - Millivolts.

NA - Not applicable. For NAPL measurements, this indicates there is no measurable product in the well.

NM - Not measured due to tubing obstruction or diameter of the well.

No. - Number.

NR - Not recorded.

NTU - Nephelometric Turbidity Unit.

S.U. - Standard Unit.

TOC - Top of casing.

Baseline (Phase 1)

Recirculation

Passive

Table 4
Groundwater Sampling Frequency, Locations, and Analytes

Phase	Analyte	Locations[a]	Frequency
Phase 1	Water Isotopes (δ2H) (IRMS) and Dye Tracer (Fluorescein) (Fluorimetric)	6 MWs, 2 EWs, 1 IW	1 event (baseline)
		6 MWs, 2 EWs	8 events (recirculation, collected on Days 2, 4, 7, 10, 14, 18, 23, and 30)
		6 MWs, 2 EWs, 1 IW	2 events (passive, collected during Weeks 2 and 4)
	Microbial Community (QuantArray-Chlor)	6 MWs, 2 EWs, 1 IW	1 event (baseline)
		6 MWs, 2 EWs, 1 IW	1 event (passive, collected during Week 4)
	CSIA (Kuder et at, 2012)	3 MWs[c], 2EWs, 1 IW	1 event (baseline)
		3 MWs[c], 2EWs, 1 IW	1 event (passive, collected during Week 4)
	All Other Analytes[b]	6 MWs, 2 EWs, 1 IW	1 event (baseline)
		6 MWs, 2 EWs	8 events (recirculation, collected on Days 2, 4, 7, 10, 14, 18, 23, and 30)
		6 MWs, 2 EWs, 1 IW	2 events (passive, collected during Weeks 2 and 4)
Phase 2	Microbial Community (QuantArray-Chlor)	6 MWs, 2 EWs	1 event (recirculation, collected during Week 4)
		6 MWs, 2 EWs, 1 IW	1 event (passive, collected at end of Month 3)
	CSIA (Kuder et at, 2012)	3 MWs[c], 2EWs, 1 IW	1 event (recirculation, collected during Week 4)
		3 MWs[c], 2EWs, 1 IW	1 event (passive, collected at end of Month 3)
	All Other Analytes[b]	6 MWs, 2 EWs	3 events (recirculation, collected during Weeks 2, 3, and 4)
		6 MWs, 2 EWs, 1 IW	4 events (passive, collected at end of Months 1, 2, 3, and 4)[d]
Phase 3	Microbial Community (QuantArray-Chlor)	6 MWs, 2 EWs	1 event (recirculation, collected during Week 4)
		6 MWs, 2 EWs, 1 IW	1 event (passive, collected at end of Month 3)
	CSIA (Kuder et at, 2012)	3 MWs[c], 2EWs, 1 IW	1 event (recirculation, collected during Week 4)
		3 MWs[c], 2EWs, 1 IW	1 event (passive, collected at end of Month 3)
	All Other Analytes[b]	6 MWs, 2 EWs	4 events (recirculation, collected during Weeks 2, 3, 4, and 5)[e]
		6 MWs, 2 EWs, 1 IW	3 events (passive, collected at end of Months 1, 2, and 3)
Phase 4	Microbial Community (QuantArray-Chlor)	6 MWs, 2 EWs, 1 IW	1 event (passive, collected at the end of Month 2)
	CSIA (Kuder et at, 2012)	3 MWs[c], 2EWs, 1 IW	1 event (passive, collected at the end of Month 2)
	All Other Analytes[b]	6 MWs, 2 EWs, 1 IW	1 event (passive, collected at the end of Month 2)
Phase 4[f]	Microbial Community (QuantArray-Chlor)	6 MWs, 2 EWs, 1 IW	4 events (passive, quarterly beginning in 2020)
	All Other Analytes[g]	6 MWs, 2 EWs, 1 IW	4 events (passive, quarterly beginning in 2020)

Notes:

Kuder, T., Wilson J.T., Philip, P., He, Y.T., 2012. Carbon Isotope Fractionation in Reactions of 1,2 Dibromoethane with FeS and Hydrogen Sulfide. Environ. Sci. Technol. 46, 7495-7502.

Table 4
Groundwater Sampling Frequency, Locations, and Analytes

[a] 4 MWs = KAFB-106064, KAFB-106063, KAFB-106MW1-S, KAFB-106MW1-I, KAFB-106MW2-S, KAFB-106MW2-I

2 EWs = KAFB-106EX1 and KAFB-106EX2

1 IW = KAFB-106IN1

[b] EDB (EPA Method 8011), VOCs (EPA Method 8260B), reduced gases (RSK-175), anions (E353.2, SM4500PE, and SW9056A), VFAs (E300M), dissolved iron and manganese (EPA Method 6010C), and alkalinity (SM2320B).

[c] Includes shallow monitoring wells KAFB-106064, KAFB-106MW1-S, and KAFB-106MW2-S.

[d] An additional sampling event was conducted at the end of the passive phase (Month 4).

[e] An additional sampling event was conducted at the end of recirculation (Week 5).

[f] Quarterly Phase 4 sampling was initiated in March 2020 and continued through October 2020. Extraction well KAFB-106EX2 was not sampled during first and second quarter 2020 due to the presence of NAPL in the well.

[g] EDB (EPA Method 8011), VOCs (EPA Method 8260C), reduced gases (RSK-175; EPA 3810), anions (EPA Method 300.0, EPA Method 365.3, and SM4500PE), VFAs (EPA Method 300M), dissolved iron and manganese (EPA Method 6020A), total lead (EPA Method 6020A), and alkalinity (SM2320B).

CSIA - Compound-Specific Isotope Analysis.

EDB - Ethylene dibromide.

EPA- U.S. Environmental Protection Agency.

EW - Extraction well.

IRMS - Isotope Ratio Mass Spectrometry.

IW - Injection well.

KAFB - Kirtland Air Force Base.

Microbial Community - Microorganism population.

MW - Monitoring well.

NAPL - Non-aqueous phase liquid.

VFA - Volatile Fatty Acid.

VOCs - Volatile organic compound.

Table 5
Manual Extraction Well Water Level Measurements

Well ID	Phase	Date[a]	Depth to Water (feet below TOC)	Drawdown (feet)[b]	Flow Rate (gpm)
KAFB-106EX1	1	6/29/2017	476.20	NA	NA
		10/17/2017	482.58	-6.38	10
		10/23/2017	483.25	-7.05	10
		10/31/2017	483.40	-7.20	10
	2	11/29/2017 (Static)	475.97	NA	NA
		12/13/2017	481.28	-5.31	10
		12/15/2017	481.61	-5.64	10
		12/20/2017	481.64	-5.67	10
		12/22/2017	481.58	-5.61	10
		12/27/2017	481.77	-5.80	10
		1/2/2018	481.71	-5.74	10
		1/4/2018	481.80	-5.83	10
		1/8/2018	481.90	-5.93	10
		1/10/2018	481.41	-5.44	10
		1/12/2018	482.12	-6.15	10
		1/15/2018	480.47	-4.50	10
		1/17/2018	480.90	-4.93	10
		1/19/2018	480.62	-4.65	10
		1/22/2018	480.61	-4.64	10
		1/30/2018	480.52	-4.55	10
	3	6/14/2018 (Static)	474.78	NA	NA
		7/30/2018	479.46	-4.68	10
		8/6/2018	480.11	-5.33	10
		8/13/2018	480.06	-5.28	10
		8/21/2018	480.33	-5.55	10
KAFB-106EX2	1	6/29/2017	476.70	NA	NA
		10/17/2017	483.69	-6.99	10
		10/23/2017	484.36	-7.66	10
		10/31/2017	484.85	-8.15	10
	2	11/29/2017 (Static)	475.93	NA	NA
		12/13/2017	484.53	-8.60	10
		12/15/2017	485.02	-9.09	10
		12/20/2017	485.34	-9.41	10
		12/22/2017	485.40	-9.47	10
		12/27/2017	485.94	-10.01	10
		12/29/2017	486.05	-10.12	10
		1/2/2018	486.14	-10.21	10
		1/4/2018	486.24	-10.31	10
		1/8/2018	486.68	-10.75	9
		1/10/2018	486.17	-10.24	9
		1/12/2018	486.73	-10.80	8
		1/15/2018	486.41	-10.48	8

Table 5
Manual Extraction Well Water Level Measurements

Well ID	Phase	Date[a]	Depth to Water (feet below TOC)	Drawdown (feet)[b]	Flow Rate (gpm)
KAFB-106EX2	2	1/17/2018	486.73	-10.80	8
		1/19/2018	486.61	-10.68	8
		1/22/2018	486.43	-10.50	7
		1/24/2018	486.65	-10.72	7
		1/26/2018	486.65	-10.72	7
		1/30/2018	486.89	-10.96	7
	3	6/14/2018 (Static)	474.34	NA	NA
		7/30/2018	487.07	-12.73	7
		7/31/2018	487.25	-12.91	7
		8/1/2018	487.35	-13.01	7
		8/2/2018	487.34	-13.00	7
		8/6/2018	487.32	-12.98	6
		8/7/2018	487.37	-13.03	6
		8/8/2018	487.50	-13.16	6
		8/9/2018	487.54	-13.20	6
		8/10/2018	487.66	-13.32	6
		8/13/2018	487.51	-13.17	6
		8/14/2018	487.54	-13.20	6
		8/16/2018	487.51	-13.17	5
		8/20/2018	487.52	-13.18	5
		8/21/2018	487.52	-13.18	5
		8/23/2018	487.55	-13.21	5
		8/30/2018	487.36	-13.02	4
		9/4/2018	487.42	-13.08	4

Notes:

[a] Only dates in which water levels were measured during active recirculation are included.

[b]Drawdown is determined by subtracting the static water level measured during the previous passive Phase from the water level measured during the active recirculation (pumping) Phase.

gpm - Gallons per minute.

ID - Identification.

KAFB - Kirtland Air Force Base.

TOC - Top of casing.

Table 6
Amendment Batching Summary

Batch #	Date	Phase	DAP (kg)	KI (kg)	Wilclear Plus® Lactate (gallons)	Potable Water (gallons)	Notes
1	12/22/2017	2	127	33	135	315	Stopped injecting on 12/23/17 due to crystallization issues in chemical feed pump. Removed 150 gallons of batch 1 mixture from tank, and added 150 gallons of water on 12/28. Resumed injection of amendments on 12/29/17 at 0806. Diluted the remaining stored 150 gallons of mixture with 75 gallons of water, and added the 225 gallons to the tank on 1/2/18.
	1/4/2018		0	12	50	200	Mounding increases, decide to add less DAP. Removed 200 gallons of amendment mixture from tank and store in tote to accommodate this batch without DAP. Brought tank level up to ~450 gallons. Start injecting new mixture on 1/5/18 at 0820.
	1/11/2018		0	6	25	100	Also added 100 gallons of diluted mixture that was previously removed from tank on 1/4 (prior to mixing batch 2). Brought tank level up to ~450 gallons. Used same ratio as 1/4/18 mix.
	1/15/2018		0	6	25	100	Also added 100 gallons of diluted mixture that was previously removed from tank on 1/4/18 (prior to mixing batch 2). Brought tank level up to ~510 gallons. Used same ratio as 1/4/18 mix.
2	1/23/2018		23	14	55	220	Brought tank level up from 175 to 450 gallons. Finish Phase 2 injection on 2/3/18 at 1130. Inject remaining 11 gallons of amendment and flush injection well for 1 hour at 17 gpm on 2/7/18. System off at 1725.
3	7/30/2018	3	38	0	90	360	Brought tank level up to 450 gallons. Start injection on 7/30/18 at 1504.
4	8/6/2018		29	0	70	280	Brought tank level up to 500 gallons. Resume injection on 8/6/18 at 1539.
5	8/14/2018		26	0	62	248	Level was at 190 gallons, needed 310 gallons to bring level up to 500. Resume injection on 8/14/18 at 1453.
6	8/23/2018		28	0	66	264	Resume injection on 8/23/18 at 1431.
7	8/30/2018		22	0	52	208	Resume injection on 8/30/18 at 1301. Finish Phase 3 injection on 9/9/18 at 1525. Flush injection well for approximately 1 hour.
		TOTAL	293	71	630	2,295	

Notes:

- Number.

DAP - Diammonium phosphate.

kg - Kilogram.

KI - Potassium iodide.

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation		
	Sample ID	106063-BL-071817			106063-BL-091817			106063-P1R-100417		
	Sample Date	7/18/2017			9/18/2017			10/4/2017		
	Sample Pupose	REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	4.8	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	ND	U	4.8	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	4.8	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	4.8	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	5950		4.8	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	1120		4.8	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	4.8	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	316		4.8	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	ND	U	4.8	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.8	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	261		4.8	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	9.5		4.8	NS	--	--	NS	--	--
	Methanogens (MGN)	118		4.8	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	11300		4.8	NS	--	--	NS	--	--
	PMMO	136		4.8	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	639		4.8	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	69100		4.8	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	113		4.8	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	19200		4.8	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	9950		4.8	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	1090000		4.8	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	ND	U	4.8	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	0.5	J	4.8	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	UJ	0.0188	ND	UJ	0.0194	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	ND	U	1	0.63	J	1	NS	--	--
	BUTYRIC ACID	ND	U	1	ND	U	1	NS	--	--
	FORMIC ACID	ND	U	1	ND	U	1	NS	--	--
	LACTIC ACID	ND	U	1	ND	U	1	NS	--	--
	PROPIONIC ACID	ND	U	1	ND	U	1	NS	--	--
	PYRUVIC ACID	ND	U	1	ND	U	1	NS	--	--
	VALERIC ACID	ND	U	1	ND	U	1	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	NS	--	--
	ETHANE	ND	U	4	ND	U	4	NS	--	--
	ETHYLENE	ND	U	5	ND	U	5	NS	--	--
	METHANE	ND	U	2	ND	U	2	NS	--	--
	PROPANE	ND	U	6	ND	U	6	NS	--	--

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation		
	Sample ID	106063-BL-071817			106063-BL-091817			106063-P1R-100417		
	Sample Date	7/18/2017			9/18/2017			10/4/2017		
	Sample Pupose	REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	206		1	311		1	NS	--	--
	BROMIDE	0.178		0.125	0.165		0.125	NS	--	--
	CHLORIDE	15.7		0.33	13.3		0.33	NS	--	--
	IODIDE	ND	U	0.2	ND	U	0.75	NS	--	--
	NITRATE	NA	--	--	NA	--	--	NS	--	--
	NITRITE	NA	--	--	NA	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	NS	--	--
	O-PHOSPHATE (AS P)	ND	U	0.02	ND	U	0.02	NS	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NS	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NS	--	--
	SULFATE	16.2		1	16.4		1	NS	--	--
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	0.054		0.06	0.193		0.06	NS	--	--
	MANGANESE	0.308		0.006	0.438		0.006	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-96.01		-99	-95.56		-99	-94.59		-99
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	1	ND	U	1	NS	--	--
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	ND	U	1	ND	U	1	NS	--	--
	1,2-DIBROMOETHANE	ND	U	1	ND	U	1	NS	--	--
	1,2-DICHLOROETHANE	ND	U	1	1.86	J	1	NS	--	--
	1,3,5-TRIMETHYLBENZENE	ND	U	1	ND	U	1	NS	--	--
	2-BUTANONE	ND	U	10	ND	U	10	NS	--	--
	2-CHLOROTOLUENE	ND	U	1	ND	U	1	NS	--	--
	2-HEXANONE	ND	U	5	ND	U	5	NS	--	--
	4-METHYL-2-PENTANONE	ND	U	5	ND	U	5	NS	--	--
	ACETONE	31.8		10	16.1	J	10	NS	--	--
	BENZENE	ND	U	1	ND	U	1	NS	--	--
	CARBON DISULFIDE	ND	U	1	ND	U	1	NS	--	--
	CHLOROMETHANE	ND	U	1	ND	U	1	NS	--	--
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	ND	U	2	ND	U	2	NS	--	--
	ETHYLBENZENE	ND	U	1	ND	U	1	NS	--	--
	ISOPROPYLBENZENE	ND	U	1	ND	U	1	NS	--	--
	M,P-XYLENES	NA	--	--	NA	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	ND	U	1	0.561	J	1	NS	--	--
	METHYLENE CHLORIDE	ND	U	2	ND	U	2	NS	--	--
	NAPHTHALENE	ND	U	1	ND	U	1	NS	--	--
	N-BUTYLBENZENE	ND	U	1	ND	U	1	NS	--	--
	N-PROPYLBENZENE	ND	U	1	ND	U	1	NS	--	--
	O-XYLENE	NA	--	--	NA	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	ND	U	1	ND	U	1	NS	--	--
	SEC-BUTYLBENZENE	ND	U	1	ND	U	1	NS	--	--
	TERT-BUTYLBENZENE	ND	U	1	ND	U	1	NS	--	--
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NS	--	--
	TOLUENE	ND	U	1	ND	U	1	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--
	TRICHLOROETHENE	ND	U	1	ND	U	1	NS	--	--
	TRICHLOROFLUOROMETHANE	ND	U	2	ND	U	2	NS	--	--
	VINYL CHLORIDE	NA	--	--	NA	--	--	NS	--	--
	XYLENES	ND	U	3	ND	U	3	NS	--	--

Refer to notes at the end of the table.

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 1 Recirculation						Phase 1 Recirculation					
	Sample ID	106063-P1R-100617			106063-P1R-100917			106063-P1R-101217			106063-P1R-101617		
	Sample Date	10/6/2017			10/9/2017			10/12/2017			10/16/2017		
	Sample Pupose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BUTYRIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	FORMIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	LACTIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPIONIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PYRUVIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VALERIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 7
Analytical Data Table for KAFB-106063

Chemical Class and Analytical Method[a]	Parameter	106063-P1R-100617 Result	Val Qual	LOQ	106063-P1R-100917 Result	Val Qual	LOQ	106063-P1R-101217 Result	Val Qual	LOQ	106063-P1R-101617 Result	Val Qual	LOQ
	Phase Designation	Phase 1 Recirculation						Phase 1 Recirculation					
	Sample ID	106063-P1R-100617			106063-P1R-100917			106063-P1R-101217			106063-P1R-101617		
	Sample Date	10/6/2017			10/9/2017			10/12/2017			10/16/2017		
	Sample Pupose	REG			REG			REG			REG		
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	IODIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	MANGANESE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-96.02		-99	-95.95		-99	-95.92		-99	-96.05		-99
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ACETONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 1 Recirculation									Phase 1 Passive		
	Sample ID	106063-P1R-102017			106063-P1R-102417			106063-P1R-110117			106063-P1P-111517		
	Sample Date	10/20/2017			10/24/2017			11/1/2017			11/15/2017		
	Sample Pupose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	ND	U	0.0191	NS	--	--	0.0105	J	0.019
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	0.65	J	1	NS	--	--	1.29		1
	BUTYRIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	FORMIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	LACTIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	PROPIONIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	PYRUVIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	VALERIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	ND	U	10	NS	--	--	ND	U	10
	ETHANE	NS	--	--	ND	U	4	NS	--	--	ND	U	4
	ETHYLENE	NS	--	--	ND	U	5	NS	--	--	ND	U	5
	METHANE	NS	--	--	ND	U	2	NS	--	--	ND	U	2
	PROPANE	NS	--	--	ND	U	6	NS	--	--	ND	U	6

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 1 Recirculation									Phase 1 Passive		
	Sample ID	106063-P1R-102017			106063-P1R-102417			106063-P1R-110117			106063-P1P-111517		
	Sample Date	10/20/2017			10/24/2017			11/1/2017			11/15/2017		
	Sample Pupose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	NS	--	--	213		1	NS	--	--	154		1
	BROMIDE	NS	--	--	0.149	J-	0.125	NS	--	--	0.136	J	0.125
	CHLORIDE	NS	--	--	12.9		0.33	NS	--	--	12.4		0.33
	IODIDE	NS	--	--	ND	U	0.75	NS	--	--	ND	U	0.75
	NITRATE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	NITRITE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	ND	U	0.375	NS	--	--	ND	U	0.375
	O-PHOSPHATE (AS P)	NS	--	--	ND	U	0.02	NS	--	--	0.0281	J	0.02
	ORTHOPHOSPHATE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	PHOSPHORUS	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	SULFATE	NS	--	--	26		1	NS	--	--	27.7		1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	ND	U	0.06	NS	--	--	ND	U	0.06
	MANGANESE	NS	--	--	0.0331		0.006	NS	--	--	0.0393		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-95.37		-99	-97.16		-99	-94.1		-99	-95.56		-99
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	1,2-DIBROMOETHANE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	1,2-DICHLOROETHANE	NS	--	--	0.881	J	1	NS	--	--	ND	U	1
	1,3,5-TRIMETHYLBENZENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	2-BUTANONE	NS	--	--	ND	U	10	NS	--	--	ND	U	10
	2-CHLOROTOLUENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	2-HEXANONE	NS	--	--	ND	U	5	NS	--	--	ND	U	5
	4-METHYL-2-PENTANONE	NS	--	--	ND	U	5	NS	--	--	ND	U	5
	ACETONE	NS	--	--	ND	U	10	NS	--	--	8.05	J	10
	BENZENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	CARBON DISULFIDE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	CHLOROMETHANE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	ND	U	2	NS	--	--	ND	U	2
	ETHYLBENZENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	ISOPROPYLBENZENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	METHYLENE CHLORIDE	NS	--	--	ND	U	2	NS	--	--	ND	U	2
	NAPHTHALENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	N-BUTYLBENZENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	N-PROPYLBENZENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	SEC-BUTYLBENZENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	TERT-BUTYLBENZENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	TOLUENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	TRICHLOROETHENE	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	TRICHLOROFLUOROMETHANE	NS	--	--	ND	U	2	NS	--	--	ND	U	2
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	XYLENES	NS	--	--	ND	U	3	NS	--	--	ND	U	3

Refer to notes at the end of the table.

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation								
	Sample ID	**106063-P1P-112817**			**106063-P2R-011018**			**106063-P2R-011818**			**106063-P2R-012518**		
	Sample Date	**11/28/2017**			**1/10/2018**			**1/18/2018**			**1/25/2018**		
	Sample Pupose	**REG**			**REG**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	8.9
	1,2 DCA Reductase (DCAR)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	8.9
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.9
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	ND	U	8.9
	Chloroform Reductase (CFR)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	8.9
	Dehalobacter DCM (DCM)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	8.9
	Dehalobacter spp. (DHBt)	ND	U	4.9	NS	--	--	NS	--	--	123000		8.9
	Dehalobium chlorocoercia (DECO)	245		4.9	NS	--	--	NS	--	--	20600		8.9
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.9
	Dehalogenimonas spp. (DHG)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	8.9
	Desulfitobacterium spp. (DSB)	ND	U	4.9	NS	--	--	NS	--	--	48700		8.9
	Desulfuromonas spp. (DSM)	ND	U	4.9	NS	--	--	NS	--	--	126		8.9
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	8.9
	Epoxyalkane Transferase (EtnE)	1970		4.9	NS	--	--	NS	--	--	106		8.9
	Ethene Monooxygenase (EtnC)	230		4.9	NS	--	--	NS	--	--	ND	U	8.9
	Methanogens (MGN)	8730		4.9	NS	--	--	NS	--	--	16.9		8.9
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	ND	U	8.9
	Phenol Hydroxylase (PHE)	53000		4.9	NS	--	--	NS	--	--	20100		8.9
	PMMO	30.2		4.9	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	788		4.9	NS	--	--	NS	--	--	ND	U	8.9
	Sulfate Reducing Bacteria (APS)	27200		4.9	NS	--	--	NS	--	--	124000		8.9
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.9
	Toluene Dioxygenase (TOD)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	8.9
	Toluene Monooxygenase (RMO)	6230		4.9	NS	--	--	NS	--	--	9740		8.9
	Toluene Monooxygenase 2 (RDEG)	115000		4.9	NS	--	--	NS	--	--	14400		8.9
	Total Eubacteria (EBAC)	698000		4.9	NS	--	--	NS	--	--	11600000		8.9
	trans-1,2-DCE Reductase (TDR)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	8.9
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	8.9
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.9
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	U	0.0191	0.981		0.0948	2.92		0.188	2.47	J+	0.194
VFAs (mg/L) EPA Method 300m	ACETIC ACID	0.64	J	1	ND	U	1	ND	U	1	0.45	J	1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	ND	U	1	0.94	J	1	1.07		1	1.68		1
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	ND	U	4	ND	U	4	ND	U	4
	ETHYLENE	ND	U	5	ND	U	5	ND	U	5	1.83	J	5
	METHANE	ND	U	2	1.71	J	2	46.6		2	39.4	J+	2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	ND	U	6

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation								
	Sample ID	106063-P1P-112817			106063-P2R-011018			106063-P2R-011818			106063-P2R-012518		
	Sample Date	11/28/2017			1/10/2018			1/18/2018			1/25/2018		
	Sample Pupose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
General Chemistry (mg/L)	ALKALINITY	178		1	284		1	358		1	327		1
SM2320b, EPA Method 300,	BROMIDE	0.177	J	0.125	0.634		0.125	0.623		0.25	0.538		0.125
EPA Method 353.2, SM4500	CHLORIDE	12.2		0.33	42.6		0.33	54.2		0.66	39.7		0.33
PE[c]	IODIDE	ND	U	0.75	ND	U	0.75	ND	U	0.75	ND	U	0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	0.0116	J	0.02	0.0172	J	0.02	0.0154	J	0.02	ND	U	0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	24.8		1	17.2	J+	1	0.873	J+	2	5.29		1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	ND	U	0.06	0.129		0.06	1.68		0.06	0.254	J-	0.06
EPA Method 6010	MANGANESE	0.0782		0.006	0.234		0.006	3.56		0.006	0.574	J-	0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-95.76		-99	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	1	ND	U	25	ND	U	12.5	ND	U	25
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	ND	U	1	157		25	154		12.5	256		25
	1,2-DIBROMOETHANE	ND	U	1	ND	U	25	ND	U	12.5	ND	U	25
	1,2-DICHLOROETHANE	0.605	J	1	ND	U	25	ND	U	12.5	ND	U	25
	1,3,5-TRIMETHYLBENZENE	ND	U	1	68.9		25	76.8		12.5	120		25
	2-BUTANONE	ND	U	10	ND	U	250	ND	U	125	ND	U	250
	2-CHLOROTOLUENE	ND	U	1	ND	U	25	ND	U	12.5	ND	U	25
	2-HEXANONE	ND	U	5	ND	U	125	ND	U	62.5	ND	U	125
	4-METHYL-2-PENTANONE	ND	U	5	ND	U	125	46.2	J	62.5	ND	U	125
	ACETONE	7.26	J	10	ND	U	250	67.6	J	125	ND	U	250
	BENZENE	ND	U	1	2800		25	3160		12.5	3100		25
	CARBON DISULFIDE	ND	U	1	ND	U	25	ND	U	12.5	ND	U	25
	CHLOROMETHANE	ND	U	1	20.2		25	ND	U	12.5	ND	U	25
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	2	ND	U	50	ND	U	25	ND	U	50
	ETHYLBENZENE	ND	U	1	65.5		25	192		12.5	541		25
	ISOPROPYLBENZENE	ND	U	1	43	J	25	57		12.5	82.3		25
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	1	ND	U	25	ND	U	12.5	ND	U	25
	METHYLENE CHLORIDE	ND	U	2	ND	U	50	ND	U	25	ND	U	50
	NAPHTHALENE	ND	U	1	45		25	72.7		12.5	83.7		25
	N-BUTYLBENZENE	ND	U	1	ND	U	25	8.31	J	12.5	ND	U	25
	N-PROPYLBENZENE	ND	U	1	31.1	J	25	53.7		12.5	89.9		25
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	1	ND	U	25	12.5	J	12.5	ND	U	25
	SEC-BUTYLBENZENE	ND	U	1	ND	U	25	10.9	J	12.5	15.9	J	25
	TERT-BUTYLBENZENE	ND	U	1	ND	U	25	ND	U	12.5	ND	U	25
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	ND	U	1	43.8	J	25	282		12.5	1050		25
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	1	ND	U	25	ND	U	12.5	ND	U	25
	TRICHLOROFLUOROMETHANE	ND	U	2	ND	U	50	ND	U	25	ND	U	50
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	ND	U	3	715		75	935		37.5	1380		75

Refer to notes at the end of the table.

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 2 Passive											
	Sample ID	**106063-P2P-030618**			**106063-P2P-041018**			**106063-P2P-050818**			**106063-P2P-061218**		
	Sample Date	**3/6/2018**			**4/10/2018**			**5/8/2018**			**6/12/2018**		
	Sample Pupose	**REG**			**REG**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	147000		5	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	5210		5	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	78100		5	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	141		5	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	235		5	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	162		5	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	4390		5	NS	--	--
	PMMO	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	333		5	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	47500		5	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	3460		5	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	2120		5	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	3160000		5	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	4.4	J+	1.91	3.78	J	1.89	3.54		0.189	1.81		0.0949
VFAs (mg/L) EPA Method 300m	ACETIC ACID	1.3		1	2.1		1	0.8	J	1	0.9	J	1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	0.98	J	1	0.8	J	1	0.7	J	1	0.6	J	1
	PROPIONIC ACID	1		1	1		1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	ND	U	4	ND	U	4	ND	U	4
	ETHYLENE	3.04	J	5	4.12		5	6.2		5	7.7		5
	METHANE	49.6		2	64.79		2	48.11		2	9.6		2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	ND	U	6

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 2 Passive											
	Sample ID	106063-P2P-030618			106063-P2P-041018			106063-P2P-050818			106063-P2P-061218		
	Sample Date	3/6/2018			4/10/2018			5/8/2018			6/12/2018		
	Sample Pupose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	352		1	296		1	372		1	400		1
	BROMIDE	0.512		0.25	0.499	J-	0.25	0.566		0.25	0.585		0.25
	CHLORIDE	42.4		0.66	44.2		0.66	49.1		0.66	52		0.66
	IODIDE	ND	U	0.75	ND	U	0.75	ND	U	0.75	ND	U	0.75
	NITRATE	NA	--	--	ND	U	0.2	ND	U	0.2	ND	U	0.2
	NITRITE	NA	--	--	ND	U	0.2	ND	U	0.2	ND	U	0.2
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	NA	--	--	NA	--	--	NA	--	--
	O-PHOSPHATE (AS P)	ND	U	0.02	ND	U	0.02	ND	U	0.02	0.0238		0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	2	ND	U	2	ND	U	2	ND	U	2
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	1.54		0.06	2.18	J-	0.06	4.92		0.06	8.3		0.06
	MANGANESE	1.71		0.006	2.22	J+	0.006	3.19		0.006	4.23		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	25	ND	U	50	ND	U	25
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	ND	U	25	190		25	257		50	264		25
	1,2-DIBROMOETHANE	ND	U	25	ND	U	25	ND	U	50	ND	U	25
	1,2-DICHLOROETHANE	ND	U	25	ND	U	25	ND	U	50	ND	U	25
	1,3,5-TRIMETHYLBENZENE	95.9		25	96.2		25	118		50	131		25
	2-BUTANONE	ND	U	250	ND	U	250	ND	U	500	ND	U	250
	2-CHLOROTOLUENE	ND	U	25	ND	U	25	ND	U	50	ND	U	25
	2-HEXANONE	ND	U	125	ND	U	125	ND	U	250	ND	U	125
	4-METHYL-2-PENTANONE	ND	U	125	ND	U	125	ND	U	250	69.6	J	125
	ACETONE	ND	U	250	ND	U	250	ND	U	500	ND	U	250
	BENZENE	2460		25	2050		25	2120		50	2940		25
	CARBON DISULFIDE	ND	U	25	ND	U	25	ND	U	50	ND	U	25
	CHLOROMETHANE	ND	U	25	ND	U	25	ND	U	50	ND	U	25
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	50	ND	U	50	ND	U	100	ND	U	50
	ETHYLBENZENE	866		25	784		25	1080		50	1500		25
	ISOPROPYLBENZENE	91.9		25	106		25	135		50	169		25
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	25	ND	U	50	ND	U	25
	METHYLENE CHLORIDE	ND	U	50	ND	U	50	ND	U	100	ND	U	50
	NAPHTHALENE	69.6		25	80.4		25	126		50	127		25
	N-BUTYLBENZENE	ND	U	25	ND	U	25	ND	U	50	17	J	25
	N-PROPYLBENZENE	85.8		25	75.7		25	103		50	132		25
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	102		25	105		25	142		50	140		25
	SEC-BUTYLBENZENE	14.8	J	25	13.1	J	25	ND	U	50	23.5	J	25
	TERT-BUTYLBENZENE	ND	U	25	ND	U	25	ND	U	50	ND	U	25
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	4080		25	3770		25	6680		50	6320		25
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	25	ND	U	25	ND	U	50	ND	U	25
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	50	ND	U	100	ND	U	50
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	1580		75	1290		75	1760		150	1850		75

Refer to notes at the end of the table.

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 3 Recirculation						Phase 3 Recirculation					
	Sample ID	106063-P3R-080818			106063-P3R-081618			106063-P3R-082218			106063-P3R-082918		
	Sample Date	8/8/2018			8/16/2018			8/22/2018			8/29/2018		
	Sample Pupose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	149000		4.8	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	5180		4.8	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	2.2		0.5	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	66100		4.8	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	49.8		4.8	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	26.3		4.8	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	374		4.8	NS	--	--
	PMMO	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	1490		4.8	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	143000		4.8	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	1670		4.8	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	634		4.8	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	5580000		4.8	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	4.8	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	3.1		0.031	3.9		0.03	4.7		0.03	6.4		0.03
VFAs (mg/L) EPA Method 300m	ACETIC ACID	0.6	J	1	0.9	J	1	2.1		1	4.8		1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	0.8	J	1	0.9	J	1	0.8	J	1	0.8	J	1
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	ND	U	10	ND	U	10	ND	U	10
	ETHANE	NS	--	--	ND	U	4	ND	U	4	ND	U	4
	ETHYLENE	NS	--	--	8.2		5	9.6		5	6.4		5
	METHANE	NS	--	--	3.9		2	23.7		2	15.5		2
	PROPANE	NS	--	--	ND	U	6	ND	U	6	ND	U	6

Table 7
Analytical Data Table for KAFB-106063

Phase Designation		Phase 3 Recirculation						Phase 3 Recirculation					
Sample ID		106063-P3R-080818			106063-P3R-081618			106063-P3R-082218			106063-P3R-082918		
Sample Date		8/8/2018			8/16/2018			8/22/2018			8/29/2018		
Sample Pupose		REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	370		5	380		5	380		5	400		5
	BROMIDE	1.3		1	0.99		0.5	1.1		0.5	0.98		0.5
	CHLORIDE	42		1	49		0.5	49		0.5	52		0.5
	IODIDE	ND	U	0.75	1.3		0.75	4.4		0.75	5.3		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	R	0.05	ND	U	0.05	ND		0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	R	0.15	ND	U	0.15	ND		0.15	ND	U	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	4.1		2	ND	U	1	2.9		1	ND	U	1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	4.9		0.05	4.2		0.05	4.3		0.05	3.8		0.05
	MANGANESE	4.2		0.003	4.5		0.003	4.8		0.003	4.9		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	0.5	ND	U	0.5	ND	U	10	ND	U	0.5
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	210		20	270		100	290		20	310		50
	1,2-DIBROMOETHANE	5.3	J+	1	ND	U	1	ND	U	20	8.4	J+	1
	1,2-DICHLOROETHANE	3		1	2.7		1	ND	U	20	3		1
	1,3,5-TRIMETHYLBENZENE	120	J+	0.5	120		0.5	130		10	130	J+	0.5
	2-BUTANONE	3.9	J+	10	3.5	J	10	ND	U	200	6.2	J+	10
	2-CHLOROTOLUENE	ND	U	0.5	38		0.5	ND	U	10	ND	U	0.5
	2-HEXANONE	22	J+	5	22		5	ND	U	100	38	J+	5
	4-METHYL-2-PENTANONE	52	J+	5	52		5	68	J	100	63	J+	5
	ACETONE	24	J+	10	19		10	ND	U	200	34	J+	10
	BENZENE	2500		20	2300		100	2700		20	3000		50
	CARBON DISULFIDE	ND	U	2	ND	U	2	ND	U	40	ND	U	2
	CHLOROMETHANE	ND	U	1	ND	U	1	ND	U	20	ND	U	1
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	1	ND	U	1	ND	U	20	ND	U	1
	ETHYLBENZENE	1100		20	1300		100	1400		20	1500		50
	ISOPROPYLBENZENE	160	J+	1	140		1	160		20	160	J+	1
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	0.45	J+	0.5	0.48	J	0.5	ND	U	10	0.48	J+	0.5
	METHYLENE CHLORIDE	ND	U	5	ND	U	5	ND	U	100	ND	U	5
	NAPHTHALENE	100	J+	5	100		5	120		100	140	J+	5
	N-BUTYLBENZENE	16	J+	1	17		1	19	J	20	20	J+	1
	N-PROPYLBENZENE	100	J+	1	100		1	110		20	110	J+	1
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	150	J+	1	150		1	130		20	160	J+	1
	SEC-BUTYLBENZENE	17	J+	1	17		1	19	J	20	18	J+	1
	TERT-BUTYLBENZENE	1.3	J+	1	ND	U	1	ND	U	20	1.5	J+	1
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	3200		20	2900		100	4100		50	6700		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	1	ND	U	1	ND	U	20	ND	U	1
	TRICHLOROFLUOROMETHANE	ND	U	1	ND	U	1	ND	U	20	ND	U	1
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	1600		10	2100		50	2600		10	3100		25

Refer to notes at the end of the table.

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 3 Recirculation			Phase 3 Passive								
	Sample ID	106063-P3R-082918-FD			106063-P3P-091218			106063-P3P-100418			106063-P3P-111518		
	Sample Date	8/29/2018			9/12/2018			10/4/2018			11/15/2018		
	Sample Pupose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	0.3	J	0.5
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	44900		5.1
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	1430		5.1
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	13.9		0.5
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	38200		5.1
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	28.8		5.1
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	273		5.1
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	0.5	J	5.1
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	2200		5.1
	PMMO	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	642		5.1
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	80200		5.1
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	2.6		0.5
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	592		5.1
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	694		5.1
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	1510000		5.1
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	ND	U	5.1
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	7.3		0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	6.1		0.029	6.1		0.029	3.4		0.015	1.8		0.0059
VFAs (mg/L) EPA Method 300m	ACETIC ACID	4.4		1	18.6		10	51.8		10	50.5		10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	0.7	J	10	0.6	J	1
	LACTIC ACID	0.6	J	1	0.6	J	1	0.4	J	1	1	J	1
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	ND	U	4	ND	U	4	ND	U	4
	ETHYLENE	8.7		5	11		5	17.5		5	17.5		5
	METHANE	21.7		2	39.6		2	102.3		2	244		2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	0.9	J	6

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 3 Recirculation			Phase 3 Passive								
	Sample ID	106063-P3R-082918-FD			106063-P3P-091218			106063-P3P-100418			106063-P3P-111518		
	Sample Date	8/29/2018			9/12/2018			10/4/2018			11/15/2018		
	Sample Pupose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L)	ALKALINITY	390		5	400		5	410		5	420		5
SM2320b, EPA Method 300,	BROMIDE	0.87		0.5	0.94		0.5	1.8		0.5	1.2		0.5
EPA Method 353.2, SM4500	CHLORIDE	52		0.5	52		0.5	49		0.5	48		0.5
PE[c]	IODIDE	5		0.75	7.4		0.75	11		0.75	12		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.05	ND	U	0.05	ND	U	0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	U	0.15	ND	U	0.15	ND	U	0.15	ND	UJ	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	3.8		0.05	5		0.05	8		0.05	8.4		0.05
EPA Method 6010	MANGANESE	4.9		0.003	5.5		0.003	6.6		0.003	6.3		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	50	ND	U	25	ND	U	50
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	330		100	410		100	600		50	510		100
	1,2-DIBROMOETHANE	ND	U	100	ND	U	100	ND	U	50	ND	U	100
	1,2-DICHLOROETHANE	ND	U	100	ND	U	100	ND	U	50	ND	U	100
	1,3,5-TRIMETHYLBENZENE	140		50	150		50	210		25	190		50
	2-BUTANONE	ND	U	1000	ND	U	1000	ND	U	500	ND	U	1000
	2-CHLOROTOLUENE	ND	U	50	ND	U	50	ND	U	25	ND	U	50
	2-HEXANONE	ND	U	500	ND	U	500	100	J	250	ND	U	500
	4-METHYL-2-PENTANONE	ND	U	500	ND	U	500	ND	U	250	ND	U	500
	ACETONE	ND	U	1000	ND	U	1000	ND	U	500	ND	U	1000
	BENZENE	3100		100	3500		100	6200		50	5200		100
	CARBON DISULFIDE	ND	U	200	ND	U	200	ND	U	100	ND	U	200
	CHLOROMETHANE	ND	U	100	ND	U	100	ND	U	50	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	50	ND	U	100
	ETHYLBENZENE	1600		100	1600		100	2200		50	2100		100
	ISOPROPYLBENZENE	160		100	170		100	220		50	200		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	50	ND	U	25	ND	U	50
	METHYLENE CHLORIDE	270	J	500	ND	U	500	ND	U	250	ND	U	500
	NAPHTHALENE	ND	U	500	ND	U	500	200	J	250	ND	U	500
	N-BUTYLBENZENE	ND	U	100	ND	U	100	28	J	50	ND	U	100
	N-PROPYLBENZENE	120		100	120		100	150		50	140		100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	140		100	120		100	110		50	73	J	100
	SEC-BUTYLBENZENE	ND	U	100	ND	U	100	27	J	50	ND	U	100
	TERT-BUTYLBENZENE	ND	U	100	ND	U	100	ND	U	50	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	6800		100	10000		100	18000		100	19000		200
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	100	ND	U	100	ND	U	50	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	50	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	3200		50	3800		50	5900		25	6000		50

Refer to notes at the end of the table.

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 4 Passive											
	Sample ID	**106063-P4P-011719**			**106063-LTM-031120**			**106063-LTM-051920**			**106063-LTM-051920-FD**		
	Sample Date	**1/17/2019**			**3/11/2020**			**5/19/2020**			**5/19/2020**		
	Sample Pupose	**REG**			**REG**			**REG**			**FD**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	1,2 DCA Reductase (DCAR)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	ND	U	0.5	ND	U	0.5	NS	--	--
	cer A Reductase	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Chloroform Reductase (CFR)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	5.3	55.6		5	93.7		4.8	NS	--	--
	Dehalobacter spp. (DHBt)	376000		5.3	76900		5	121000		4.8	NS	--	--
	Dehalobium chlorocoercia (DECO)	3370		5.3	1880		5	1420		4.8	NS	--	--
	Dehalococcoides (DHC)	0.6		0.5	2.2		0.5	0.7		0.5	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Desulfitobacterium spp. (DSB)	91800		5.3	19700		5	47200		4.8	NS	--	--
	Desulfuromonas spp. (DSM)	20		5.3	ND	U	5	ND	U	4.8	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Epoxyalkane Transferase (EtnE)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Methanogens (MGN)	1060		5.3	42800		5	18200		4.8	NS	--	--
	PCE Reductase (PCE-1)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Phenol Hydroxylase (PHE)	1360		5.3	162		5	623		4.8	NS	--	--
	PMMO	NA	--	--	NA	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	1960		5.3	2840		5	558		4.8	NS	--	--
	Sulfate Reducing Bacteria (APS)	142000		5.3	32600		5	17300		4.8	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	ND	U	0.5	ND	U	0.5	NS	--	--
	Toluene Dioxygenase (TOD)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Toluene Monooxygenase (RMO)	8780		5.3	1020		5	3640		4.8	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	3180		5.3	388		5	1410		4.8	NS	--	--
	Total Eubacteria (EBAC)	19600000		5.3	7630000		5	12700000		4.8	NS	--	--
	trans-1,2-DCE Reductase (TDR)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	5.3	ND	U	5	ND	U	4.8	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	0.2	J	0.5	ND	U	0.5	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.84		0.0031	ND	U	0.011	ND	U	0.01	ND	U	0.01
VFAs (mg/L) EPA Method 300m	ACETIC ACID	39.9		10	11.6		10	5.7	J	10	6.2	J	10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	FORMIC ACID	0.3	J	1	0.5	J	10	0.5	J	10	0.2	J	10
	LACTIC ACID	0.5	J	1	0.8	J	10	ND	U	10	ND	U	10
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	10		10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	ND	U	4	1.5	J	4	1.4	J	4
	ETHYLENE	16.2		5	0.9	J	5	14.7		5	14.8		5
	METHANE	777.8		2	3452.3		2	7891.9		2	7565.4		2
	PROPANE	ND	U	6	ND	U	6	0.9	J	6	1	J	6

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 4 Passive											
	Sample ID	106063-P4P-011719			106063-LTM-031120			106063-LTM-051920			106063-LTM-051920-FD		
	Sample Date	1/17/2019			3/11/2020			5/19/2020			5/19/2020		
	Sample Pupose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	430		5	576		5	566		5	569		5
	BROMIDE	0.73		0.5	1.04		0.1	0.929		0.1	0.923		0.1
	CHLORIDE	48		0.5	51.9		0.5	51.5		0.5	50.9		0.5
	IODIDE	12	J+	1.5	7		0.2	7	J-	0.2	7	J-	0.2
	NITRATE	NA	--	--	0.0608	J	0.1	0.0668	J-	0.1	0.0656	J-	0.1
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	UJ	0.05	ND	U	0.1	ND	UJ	0.1	ND	UJ	0.1
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	UJ	0.15	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	0.01	J	0.025	ND	UJ	0.025	ND	UJ	0.025
	SULFATE	ND	U	1	ND	U	0.5	ND	U	0.5	ND	U	0.5
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	ND	U	0.001	ND	U	0.001	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	7.3		0.05	6.11		0.05	6.41		0.05	6.75		0.05
	MANGANESE	5.5		0.003	5.72		0.125	6.07		0.125	6.62		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	500	ND	U	5	ND	U	10	ND	U	10
	1,2,4-TRICHLOROBENZENE	NA	--	--	ND	U	5	ND	U	10	ND	U	10
	1,2,4-TRIMETHYLBENZENE	520	J	1000	NA	--	--	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	1000	ND	U	5	ND	U	5	ND	U	5
	1,2-DICHLOROETHANE	NA	--	--	ND	U	5	ND	U	5	ND	U	5
	1,3,5-TRIMETHYLBENZENE	ND	U	500	180		5	160		10	140		10
	2-BUTANONE	ND	U	10000	ND	U	10	ND	U	10	ND	U	10
	2-CHLOROTOLUENE	ND	U	500	ND	U	5	ND	U	10	ND	U	10
	2-HEXANONE	ND	U	5000	ND	U	10	ND	U	20	ND	U	20
	4-METHYL-2-PENTANONE	ND	U	5000	ND	U	10	84		20	83		20
	ACETONE	ND	U	10000	ND	U	10	ND	U	10	ND	U	10
	BENZENE	5000		1000	6400		50	5200		50	5100		50
	CARBON DISULFIDE	ND	U	2000	ND	U	10	ND	U	10	ND	U	10
	CHLOROMETHANE	ND	U	1000	ND	U	5	ND	U	5	ND	U	5
	CIS-1,2-DICHLOROETHENE	NA	--	--	ND	U	5	ND	U	5	ND	U	5
	DICHLORODIFLUOROMETHANE	NA	--	--	ND	U	5	ND	U	10	ND	U	10
	ETHYLBENZENE	NA	--	--	1600		5	1700		10	1600		10
	ISOPROPYLBENZENE	ND	U	1000	200		5	200		10	180		10
	M,P-XYLENES	NA	--	--	2900		10	3400		10	3000		10
	METHYL TERT-BUTYL ETHER	ND	U	500	ND	U	5	ND	U	5	ND	U	5
	METHYLENE CHLORIDE	ND	U	5000	ND	U	10	ND	U	10	ND	U	10
	NAPHTHALENE	ND	U	5000	140		5	150		10	120		10
	N-BUTYLBENZENE	ND	U	1000	ND	U	5	25		10	20		10
	N-PROPYLBENZENE	ND	U	1000	150		5	150		10	130		10
	O-XYLENE	NA	--	--	1500		5	1600		10	1400		10
	P-ISOPROPYLTOLUENE	ND	U	1000	ND	U	5	ND	U	10	ND	U	10
	SEC-BUTYLBENZENE	ND	U	1000	25		5	25		10	21		10
	TERT-BUTYLBENZENE	ND	U	1000	ND	U	5	ND	U	10	ND	U	10
	TETRACHLOROETHENE	NA	--	--	ND	U	5	ND	U	10	ND	U	10
	TOLUENE	16000		1000	15000		50	18000		50	17000		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	ND	U	5	ND	U	5	ND	U	5
	TRICHLOROETHENE	ND	U	1000	ND	U	5	ND	U	5	ND	U	5
	TRICHLOROFLUOROMETHANE	ND	U	1000	ND	U	5	ND	U	10	ND	U	10
	VINYL CHLORIDE	NA	--	--	ND	U	5	ND	U	5	ND	U	5
	XYLENES	5200		500	4400		5	4900		10	4500		10

Refer to notes at the end of the table.

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 4 Passive					
	Sample ID	106063-LTM-080420			106063-LTM-101420		
	Sample Date	8/4/2020			10/14/2020		
	Sample Pupose	REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	4.9	4.6		4.6
	1,2 DCA Reductase (DCAR)	ND	U	4.9	4.6		4.6
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	0.5		0.5
	cer A Reductase	ND	U	4.9	4.6		4.6
	Chloroform Reductase (CFR)	ND	U	4.9	4.6		4.6
	Dehalobacter DCM (DCM)	ND	U	4.9	160		4.6
	Dehalobacter spp. (DHBt)	148000		4.9	320000		4.6
	Dehalobium chlorocoercia (DECO)	1250		4.9	3750		4.6
	Dehalococcoides (DHC)	0.5	J	0.5	2.5		0.5
	Dehalogenimonas spp. (DHG)	ND	U	4.9	4.6		4.6
	Desulfitobacterium spp. (DSB)	74700		4.9	187000		4.6
	Desulfuromonas spp. (DSM)	ND	U	4.9	4.7		4.6
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	4.6		4.6
	Epoxyalkane Transferase (EtnE)	ND	U	4.9	4.6		4.6
	Ethene Monooxygenase (EtnC)	ND	U	4.9	4.6		4.6
	Methanogens (MGN)	35300		4.9	31500		4.6
	PCE Reductase (PCE-1)	ND	U	4.9	4.6		4.6
	Phenol Hydroxylase (PHE)	144		4.9	7740		4.6
	PMMO	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	781		4.9	24.7		4.6
	Sulfate Reducing Bacteria (APS)	20900		4.9	157000		4.6
	tceA Reductase (TCE)	ND	U	0.5	0.5		0.5
	Toluene Dioxygenase (TOD)	ND	U	4.9	4.6		4.6
	Toluene Monooxygenase (RMO)	1020		4.9	6860		4.6
	Toluene Monooxygenase 2 (RDEG)	1210		4.9	14800		4.6
	Total Eubacteria (EBAC)	3940000		4.9	37200000		4.6
	trans-1,2-DCE Reductase (TDR)	ND	U	4.9	4.6		4.6
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.9	4.6		4.6
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	0.2		0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	U	0.01	ND	U	0.01
VFAs (mg/L) EPA Method 300m	ACETIC ACID	2.9	J	10	0.4		10
	BUTYRIC ACID	ND	U	10	ND	U	10
	FORMIC ACID	2.1	J	10	1.8	J	10
	LACTIC ACID	ND	U	10	0.9	J	10
	PROPIONIC ACID	ND	U	10	ND	U	10
	PYRUVIC ACID	ND	U	10	ND	U	10
	VALERIC ACID	ND	U	10	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10
	ETHANE	2.1	J	4	0.7	J	4
	ETHYLENE	14.9		5	6.4		5
	METHANE	4513.7		2	933.4		20
	PROPANE	1.3	J	6	ND	U	6

Table 7
Analytical Data Table for KAFB-106063

	Phase Designation	Phase 4 Passive					
	Sample ID	106063-LTM-080420			106063-LTM-101420		
	Sample Date	8/4/2020			10/14/2020		
	Sample Pupose	REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	572		5	479		5
	BROMIDE	2.03		0.1	1.76		0.1
	CHLORIDE	55.5		0.5	46.8		0.5
	IODIDE	9.5		2	8.2		
	NITRATE	0.0597	J	0.1	0.497		0.1
	NITRITE	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--
	PHOSPHORUS	ND	U	0.025	ND	U	0.025
	SULFATE	0.321	J	0.5	0.946		0.5
Metals (mg/L) EPA Method 6010	LEAD	ND	U	0.001	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	5.61		0.05	4.25		0.05
	MANGANESE	6.18		0.125	3.79		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	10	ND	U	10
	1,2,4-TRICHLOROBENZENE	ND	U	10	ND	U	10
	1,2,4-TRIMETHYLBENZENE	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	5	ND	U	5
	1,2-DICHLOROETHANE	ND	U	5	ND	U	5
	1,3,5-TRIMETHYLBENZENE	150		10	110		5
	2-BUTANONE	ND	U	10	ND	U	10
	2-CHLOROTOLUENE	ND	U	10	ND	U	10
	2-HEXANONE	ND	U	20	ND	U	20
	4-METHYL-2-PENTANONE	90		20	50		20
	ACETONE	ND	U	10	ND	U	10
	BENZENE	5500		50	3900		50
	CARBON DISULFIDE	ND	U	10	ND	U	20
	CHLOROMETHANE	ND	U	5	ND	U	5
	CIS-1,2-DICHLOROETHENE	ND	U	5	ND	U	5
	DICHLORODIFLUOROMETHANE	ND	U	10	ND	U	5
	ETHYLBENZENE	1600		10	1100		10
	ISOPROPYLBENZENE	210		10	210		5
	M,P-XYLENES	3100		10	2300		10
	METHYL TERT-BUTYL ETHER	ND	U	5	ND	U	5
	METHYLENE CHLORIDE	ND	U	10	ND	U	10
	NAPHTHALENE	160		10	110		5
	N-BUTYLBENZENE	21		10	44		10
	N-PROPYLBENZENE	140		10	93		10
	O-XYLENE	1400		10	1100		10
	P-ISOPROPYLTOLUENE	ND	U	10	ND	U	5
	SEC-BUTYLBENZENE	22		10	15		10
	TERT-BUTYLBENZENE	ND	U	10	ND	U	5
	TETRACHLOROETHENE	ND	U	10	ND	U	10
	TOLUENE	14000		50	1800		5
	TRANS-1,2-DICHLOROETHENE	ND	U	5	ND	U	5
	TRICHLOROETHENE	ND	U	5	ND	U	5
	TRICHLOROFLUOROMETHANE	ND	U	10	ND	U	5
	VINYL CHLORIDE	ND	U	5	ND	U	5
	XYLENES	4500		10	3400		10

Refer to notes at the end of the table.

Table 7
Analytical Data Table for KAFB-106063

Notes:

Sampling frequency for each analytical method is outlined in Table 4.

a. EPA analytical methods listed are for the most recent sampling event.

b. Samples were collected using Geotech Bladder Pumps.

c. Samples were recollected (except for QuantArray-Chlor analysis) using replacement QED Bladder Pumps.

-- = Not applicable.

δ2H - Delta Deuterium.

0/00 - Per mil.

cells/mL = Cells per milliliter.

EPA = Environmental Protection Agency.

FD = Field duplicate.

ID = Identification.

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base.

LOQ = Limit of Quantitation

μg/L = Microgram per liter.

mg/L = Milligram per liter.

NA = Not analyzed.

ND = Not detected.

NS = Not sampled.

REG = Regular/parent sample.

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

UJ = Analyte was not detected. The reported value is estimated.

VAL QUAL = Validation qualifier.

VFA - Volatile fatty acid.

VOC = Volatile organic compound.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation			Phase 1 Recirculation		
	Sample ID	106064-BL-081617			106064-BL-091917			106064-P1R-100417			106064-P1R-100417-FD		
	Sample Date	8/16/2017			9/19/2017			10/4/2017			10/4/2017		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.6	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	42500		6.2	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	6400		6.2	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.6	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	28200		6.2	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	4890		6.2	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	45.3		6.2	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	19200		6.2	NS	--	--	NS	--	--	NS	--	--
	PMMO	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	32.3		6.2	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	147000		6.2	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.6	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	8.3		6.2	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	11500		6.2	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	11400		6.2	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	356000		6.2	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	6.2	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.6	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	6.27		0.385	143	J+	9.67	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	ND	U	1	15.7		1	NS	--	--	NS	--	--
	BUTYRIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	FORMIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	LACTIC ACID	ND	U	1	0.51	J	1	NS	--	--	NS	--	--
	PROPIONIC ACID	ND	U	1	1.46		1	NS	--	--	NS	--	--
	PYRUVIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	VALERIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	NS	--	--	NS	--	--
	ETHANE	ND	U	4	1.65	J	4	NS	--	--	NS	--	--
	ETHYLENE	1.09	J	5	17.8		5	NS	--	--	NS	--	--
	METHANE	26		2	179		2	NS	--	--	NS	--	--
	PROPANE	ND	U	6	2.14	J	6	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	200		1	354		1	NS	--	--	NS	--	--
	BROMIDE	0.159		0.125	0.283		0.125	NS	--	--	NS	--	--
	CHLORIDE	11.5		0.33	13		0.33	NS	--	--	NS	--	--
	IODIDE	ND	U	0.2	ND	U	0.75	NS	--	--	NS	--	--
	NITRATE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	NITRITE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	0.0109		0.02	ND	U	0.02	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	SULFATE	11.7		1	ND	U	1	NS	--	--	NS	--	--

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation			Phase 1 Recirculation		
	Sample ID	106064-BL-081617			106064-BL-091917			106064-P1R-100417			106064-P1R-100417-FD		
	Sample Date	8/16/2017			9/19/2017			10/4/2017			10/4/2017		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	0.315	J	0.06	2.62		0.06	NS	--	--	NS	--	--
EPA Method 6010	MANGANESE	1.21	J-	0.006	2.13		0.006	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-95.99		-99	-94.52		-99	-93.39		-99	-94.11		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NA	--	--	-11.4 ±2‰	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	1.25	ND	U	50	NS	--	--	NS	--	--
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	12.7		1.25	141		50	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	9.65		1.25	148		50	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	2.22	J	1.25	ND	U	50	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	ND	U	1.25	37.5	J	50	NS	--	--	NS	--	--
	2-BUTANONE	ND	U	12.5	ND	U	500	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	ND	U	1.25	ND	U	50	NS	--	--	NS	--	--
	2-HEXANONE	ND	U	6.25	ND	U	250	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	5.28	J	6.25	ND	U	250	NS	--	--	NS	--	--
	ACETONE	13.7	J+	12.5	ND	U	500	NS	--	--	NS	--	--
	BENZENE	301		1.25	4730		50	NS	--	--	NS	--	--
	CARBON DISULFIDE	ND	U	1.25	ND	U	50	NS	--	--	NS	--	--
	CHLOROMETHANE	ND	U	1.25	ND	U	50	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	ND	U	2.5	ND	U	100	NS	--	--	NS	--	--
	ETHYLBENZENE	41.9		1.25	577		50	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	6.16		1.25	51.5	J	50	NS	--	--	NS	--	--
	M,P-XYLENES	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	0.717	J	1.25	ND	U	50	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	ND	U	2.5	ND	U	100	NS	--	--	NS	--	--
	NAPHTHALENE	4.96		1.25	56.2	J	50	NS	--	--	NS	--	--
	N-BUTYLBENZENE	0.795	J	1.25	ND	U	50	NS	--	--	NS	--	--
	N-PROPYLBENZENE	5.85		1.25	37.8	J	50	NS	--	--	NS	--	--
	O-XYLENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	5.06		1.25	31.8	J	50	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	1.61	J	1.25	ND	U	50	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	ND	U	1.25	ND	U	50	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TOLUENE	92.6		1.25	7330		50	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	ND	U	1.25	ND	U	50	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	ND	U	2.5	ND	U	100	NS	--	--	NS	--	--
	VINYL CHLORIDE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	XYLENES	66		3.75	2010		150	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 1 Recirculation			Phase 1 Recirculation						Phase 1 Recirculation		
	Sample ID	106064-P1R-100617			106064-P1R-100917			106064-P1R-101217			106064-P1R-101617		
	Sample Date	10/6/2017			10/9/2017			10/12/2017			10/16/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BUTYRIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	FORMIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	LACTIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPIONIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PYRUVIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VALERIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	144.5		0.01	33.529		0.01	9.946		0.01	2.504		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	IODIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 1 Recirculation			Phase 1 Recirculation						Phase 1 Recirculation		
	Sample ID	106064-P1R-100617			106064-P1R-100917			106064-P1R-101217			106064-P1R-101617		
	Sample Date	10/6/2017			10/9/2017			10/12/2017			10/16/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EPA Method 6010	MANGANESE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	123.55		-99	-56.22		-99	-80.18		-99	-91.39		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ACETONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 1 Recirculation									Phase 1 Passive		
	Sample ID	106064-P1R-102017			106064-P1R-102417			106064-P1R-110117			106064-P1P-111517		
	Sample Date	10/20/2017			10/24/2017			11/1/2017			11/15/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	76		1.9	NS	--	--	43.1		3.83
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	5.7	U	1	NS	--	--	20.1		1
	BUTYRIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	FORMIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	LACTIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	PROPIONIC ACID	NS	--	--	ND	U	1	NS	--	--	0.68	J	1
	PYRUVIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	VALERIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	3.289		0.01	4.128		0.01	6.553		0.01	5.942		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	ND	U	10	NS	--	--	ND	U	10
	ETHANE	NS	--	--	ND	U	4	NS	--	--	ND	U	4
	ETHYLENE	NS	--	--	3.18	J	5	NS	--	--	3.46	J	5
	METHANE	NS	--	--	1.9	J	2	NS	--	--	11.4		2
	PROPANE	NS	--	--	ND	U	6	NS	--	--	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	NS	--	--	317		1	NS	--	--	300		1
	BROMIDE	NS	--	--	0.53		0.125	NS	--	--	0.596		0.25
	CHLORIDE	NS	--	--	44.5		0.33	NS	--	--	44.8		0.66
	IODIDE	NS	--	--	ND	U	0.75	NS	--	--	ND	U	0.75
	NITRATE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	NITRITE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	ND	U	0.375	NS	--	--	ND	U	0.375
	O-PHOSPHATE (AS P)	NS	--	--	ND	U	0.02	NS	--	--	0.019	J	0.02
	ORTHOPHOSPHATE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	PHOSPHORUS	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	SULFATE	NS	--	--	13.8		1	NS	--	--	ND	U	2

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 1 Recirculation									Phase 1 Passive		
	Sample ID	106064-P1R-102017			106064-P1R-102417			106064-P1R-110117			106064-P1P-111517		
	Sample Date	10/20/2017			10/24/2017			11/1/2017			11/15/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	0.689		0.06	NS	--	--	1.04		0.06
	MANGANESE	NS	--	--	2.11		0.006	NS	--	--	2.53		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-90.18		-99	-90.67		-99	-85.04		-99	-88.46		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	1,2,4-TRICHLOROBENZENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	350		50	NS	--	--	344		50
	1,2-DIBROMOETHANE	NS	--	--	76.7	J	50	NS	--	--	49.9	J	50
	1,2-DICHLOROETHANE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	1,3,5-TRIMETHYLBENZENE	NS	--	--	111		50	NS	--	--	122		50
	2-BUTANONE	NS	--	--	ND	U	500	NS	--	--	ND	U	500
	2-CHLOROTOLUENE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	2-HEXANONE	NS	--	--	170	J	250	NS	--	--	142	J	250
	4-METHYL-2-PENTANONE	NS	--	--	ND	U	250	NS	--	--	ND	U	250
	ACETONE	NS	--	--	ND	U	500	NS	--	--	ND	U	500
	BENZENE	NS	--	--	3140		50	NS	--	--	3850		50
	CARBON DISULFIDE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	CHLOROMETHANE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	CIS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	ND	U	100	NS	--	--	ND	U	100
	ETHYLBENZENE	NS	--	--	894		50	NS	--	--	1470		50
	ISOPROPYLBENZENE	NS	--	--	77.9	J	50	NS	--	--	149		50
	M,P-XYLENES	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	METHYLENE CHLORIDE	NS	--	--	ND	U	100	NS	--	--	ND	U	100
	NAPHTHALENE	NS	--	--	105		50	NS	--	--	139		50
	N-BUTYLBENZENE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	N-PROPYLBENZENE	NS	--	--	72.7	J	50	NS	--	--	103		50
	O-XYLENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	51.2	J	50	NS	--	--	101		50
	SEC-BUTYLBENZENE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	TERT-BUTYLBENZENE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	TETRACHLOROETHENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	TOLUENE	NS	--	--	7540		50	NS	--	--	16900		50
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	TRICHLOROETHENE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	TRICHLOROFLUOROMETHANE	NS	--	--	ND	U	100	NS	--	--	ND	U	100
	VINYL CHLORIDE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	XYLENES	NS	--	--	3350		150	NS	--	--	4270		150

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation						Phase 2 Recirculation		
	Sample ID	106064-P1P-112817			106064-P2R-011018			106064-P2R-011818			106064-P2R-012518		
	Sample Date	11/28/2017			1/10/2018			1/18/2018			1/25/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	1,2 DCA Reductase (DCAR)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	1
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	ND	U	10.4
	Chloroform Reductase (CFR)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	Dehalobacter DCM (DCM)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	Dehalobacter spp. (DHBt)	84200		4.9	NS	--	--	NS	--	--	119000		10.4
	Dehalobium chlorocoercia (DECO)	4520		4.9	NS	--	--	NS	--	--	23600		10.4
	Dehalococcoides (DHC)	0.6		0.5	NS	--	--	NS	--	--	ND	U	1
	Dehalogenimonas spp. (DHG)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	Desulfitobacterium spp. (DSB)	103000		4.9	NS	--	--	NS	--	--	89700		10.4
	Desulfuromonas spp. (DSM)	5		4.9	NS	--	--	NS	--	--	10.7		10.4
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	Epoxyalkane Transferase (EtnE)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	Ethene Monooxygenase (EtnC)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	Methanogens (MGN)	75.4		4.9	NS	--	--	NS	--	--	228		10.4
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	4.3	J	10.4
	Phenol Hydroxylase (PHE)	6760		4.9	NS	--	--	NS	--	--	17400		10.4
	PMMO	69.7		4.9	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	422		4.9	NS	--	--	NS	--	--	590		10.4
	Sulfate Reducing Bacteria (APS)	96100		4.9	NS	--	--	NS	--	--	298000		10.4
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	1
	Toluene Dioxygenase (TOD)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	Toluene Monooxygenase (RMO)	22100		4.9	NS	--	--	NS	--	--	17800		10.4
	Toluene Monooxygenase 2 (RDEG)	8480		4.9	NS	--	--	NS	--	--	8300		10.4
	Total Eubacteria (EBAC)	6130000		4.9	NS	--	--	NS	--	--	22700000		10.4
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	ND	U	10.4
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.9	NS	--	--	NS	--	--	ND	U	10.4
	Vinyl Chloride Reductase (VCR)	0.3	J	0.5	NS	--	--	NS	--	--	ND	U	1
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	20.3		1.91	69.9		1.9	65		1.88	80.3	J+	1.9
VFAs (mg/L) EPA Method 300m	ACETIC ACID	21		1	73		1	79.8		1	44.9		1
	BUTYRIC ACID	ND	U	1	ND	U	1	1.05		1	0.74	J	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	ND	U	1	3.02		1	2.59		1	0.72	J	1
	PROPIONIC ACID	0.57	J	1	13		1	20.3		1	10.5		1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	5.489		0.01	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	2.01	J	4	1.82	J	4	2.86		4
	ETHYLENE	5.07		5	6.46		5	ND	U	5	9.47		5
	METHANE	20.5		2	15		2	16.5		2	25.3		2
	PROPANE	ND	U	6	1.93	J	6	2.23	J	6	3.21	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	312		1	354		1	341		1	352		1
	BROMIDE	0.654		0.25	0.565		0.25	0.644		0.25	0.606		0.125
	CHLORIDE	45.7		0.66	53.3		0.66	53.7		0.66	48.6		0.66
	IODIDE	ND	U	0.75	11		0.75	13		0.75	18		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	ND	U	0.02	1.12		0.04	1.92		0.04	1.72		0.1
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	2	ND	U	2	ND	U	2	ND	U	2

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation						Phase 2 Recirculation		
	Sample ID	106064-P1P-112817			106064-P2R-011018			106064-P2R-011818			106064-P2R-012518		
	Sample Date	11/28/2017			1/10/2018			1/18/2018			1/25/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	1.67		0.06	4.67		0.06	1.31		0.06	1.76	J-	0.06
	MANGANESE	2.72		0.006	0.777		0.006	3.69		0.006	3.75	J-	0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-87.46		-99	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	-1.3 ±2‰	--	--	NS	--	--	NS	--	--	-9.3 ±2‰	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	125	ND	U	50	ND	U	50	ND	U	50
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	488		125	342		50	274		50	398		50
	1,2-DIBROMOETHANE	ND	U	125	63.6	J	50	59.5	J	50	62.8	J	50
	1,2-DICHLOROETHANE	ND	U	125	ND	U	50	ND	U	50	ND	U	50
	1,3,5-TRIMETHYLBENZENE	171	J	125	126		50	97.8	J	50	149		50
	2-BUTANONE	ND	U	1250	ND	U	500	ND	U	500	ND	U	500
	2-CHLOROTOLUENE	ND	U	125	ND	U	50	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	625	ND	U	250	ND	U	250	ND	U	250
	4-METHYL-2-PENTANONE	ND	U	625	ND	U	250	ND	U	250	ND	U	250
	ACETONE	ND	U	1250	447	J	500	418	J	500	265	J	500
	BENZENE	3680		125	3950		50	3700		50	4070		50
	CARBON DISULFIDE	ND	U	125	ND	U	50	ND	U	50	ND	U	50
	CHLOROMETHANE	ND	U	125	64.8		50	ND	U	50	ND	U	50
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	250	ND	U	100	ND	U	100	ND	U	100
	ETHYLBENZENE	2040		125	1010		50	956		50	1180		50
	ISOPROPYLBENZENE	192	J	125	97.4	J	50	89.1	J	50	96.8	J	50
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	125	ND	U	50	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	250	55.6	J	100	ND	U	100	ND	U	100
	NAPHTHALENE	132	J	125	106		50	125		50	100		50
	N-BUTYLBENZENE	ND	U	125	ND	U	50	ND	U	50	ND	U	50
	N-PROPYLBENZENE	147	J	125	93.3	J	50	93.3	J	50	103		50
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	148	J	125	98.8	J	50	81.5	J	50	ND	U	50
	SEC-BUTYLBENZENE	ND	U	125	ND	U	50	ND	U	50	ND	U	50
	TERT-BUTYLBENZENE	ND	U	125	ND	U	50	ND	U	50	ND	U	50
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	19500		125	9200		50	9850		50	11300		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	125	ND	U	50	ND	U	50	ND	U	50
	TRICHLOROFLUOROMETHANE	ND	U	250	ND	U	100	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	5730		375	3180		150	3020		150	3740		150

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 2 Passive						Phase 2 Passive					
	Sample ID	106064-P2P-030718			106064-P2P-041018			106064-P2P-050918			106064-P2P-050918-FD		
	Sample Date	3/7/2018			4/10/2018			5/9/2018			5/9/2018		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.9	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	11800		9.1	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	132000		9.1	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	23100		9.1	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	ND	U	0.9	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	1110		9.1	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	64900		9.1	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	132		9.1	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	85.4		9.1	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	524		9.1	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	8350		9.1	NS	--	--
	PMMO	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	608		9.1	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	71300		9.1	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	0.9	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	16500		9.1	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	8850		9.1	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	16100000		9.1	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	9.1	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	0.9	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	26.8	J+	1.9	12.6	J	1.9	6.2		0.189	10.6		0.382
VFAs (mg/L) EPA Method 300m	ACETIC ACID	126		10	142.1		10	119		10	122		10
	BUTYRIC ACID	1.8		1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	1.2		1	0.4	J	1	0.3	J	1
	LACTIC ACID	ND	U	1	ND	U	10	ND	U	1	ND	U	1
	PROPIONIC ACID	36.6		1	27.1		10	24.3		1	24.1		1
	PYRUVIC ACID	0.8	J	1	ND	U	1	0.5	J	1	ND	U	1
	VALERIC ACID	0.6	J	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	3.1	J	4	4.5		4	4.5		4	4.59		4
	ETHYLENE	11.5		5	12.93		5	11		5	11.7		5
	METHANE	141		2	191		20	601		2	614		2
	PROPANE	2.9	J	6	4.3	J	6	4.8	J	6	4.9	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	423		1	374		1	421		1	402		1
	BROMIDE	0.53	J	0.625	0.576		0.25	0.597		0.25	0.594		0.25
	CHLORIDE	47.8		1.65	51.1		0.66	51.8		0.66	52		0.66
	IODIDE	18		0.75	17	J-	0.75	22		1.5	22		1.5
	NITRATE	NA	--	--	ND	U	0.2	ND	U	0.2	ND	U	0.2
	NITRITE	NA	--	--	ND	U	0.2	ND	U	0.2	ND	U	0.2
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	NA	--	--	NA	--	--	NA	--	--
	O-PHOSPHATE (AS P)	1.66	J-	0.2	1.07		0.04	1.28		0.04	1.27		0.04
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	5	ND	U	2	ND	U	2	ND	U	2

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 2 Passive						Phase 2 Passive					
	Sample ID	106064-P2P-030718			106064-P2P-041018			106064-P2P-050918			106064-P2P-050918-FD		
	Sample Date	3/7/2018			4/10/2018			5/9/2018			5/9/2018		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	3.68		0.06	4.43	J-	0.06	5.07		0.06	4.81		0.06
	MANGANESE	4.47		0.006	5.4	J+	0.006	5.62		0.006	5.41		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	-1.2 ±1.5‰	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	354		100	446		50	404		100	409		100
	1,2-DIBROMOETHANE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	1,2-DICHLOROETHANE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	1,3,5-TRIMETHYLBENZENE	118	J	100	152		50	124	J	100	142	J	100
	2-BUTANONE	ND	U	1000	ND	U	500	ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	2-HEXANONE	ND	U	500	ND	U	250	ND	U	500	ND	U	500
	4-METHYL-2-PENTANONE	ND	U	500	ND	U	250	ND	U	500	ND	U	500
	ACETONE	ND	U	1000	435	J	500	ND	U	1000	ND	U	1000
	BENZENE	4010		100	3380		50	3490		100	3620		100
	CARBON DISULFIDE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	CHLOROMETHANE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	200	ND	U	100	ND	U	200	ND	U	200
	ETHYLBENZENE	1810		100	1960		50	1660		100	1670		100
	ISOPROPYLBENZENE	193	J	100	248		50	202		100	207		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	METHYLENE CHLORIDE	ND	U	200	ND	U	100	ND	U	200	ND	U	200
	NAPHTHALENE	93.6	J	100	143		50	137	J	100	137	J	100
	N-BUTYLBENZENE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	N-PROPYLBENZENE	95.8	J	100	140		50	124	J	100	117	J	100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	100	50.8	J	50	56.1	J	100	56.2	J	100
	SEC-BUTYLBENZENE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	TERT-BUTYLBENZENE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	15500		100	12100		50	13900		100	14000		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	200	ND	U	100	ND	U	200	ND	U	200
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	5320		300	5290		150	5130		300	5220		300

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 2 Passive						Phase 3 Recirculation					
	Sample ID	106064-P2P-061418			106064-P2P-061418-FD			106064-P3R-080818			106064-P3R-081618		
	Sample Date	6/14/2018			6/14/2018			8/8/2018			8/16/2018		
	Sample Purpose	REG			FD			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	6.19		0.384	6.45		0.384	8.1		0.03	5.5		0.03
VFAs (mg/L) EPA Method 300m	ACETIC ACID	141	J	10	121	J	10	136.4		10	126		10
	BUTYRIC ACID	ND	UJ	10	ND	UJ	10	ND	U	1	ND	U	1
	FORMIC ACID	ND	UJ	10	ND	UJ	10	5.9	J	10	0.7	J	10
	LACTIC ACID	ND	UJ	10	ND	UJ	10	ND	U	1	ND	U	1
	PROPIONIC ACID	11.6	J	10	8.9	J	10	22.2		10	52.9		10
	PYRUVIC ACID	ND	UJ	10	ND	UJ	10	ND	U	1	ND	U	1
	VALERIC ACID	ND	UJ	10	ND	UJ	10	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	UJ	10	ND	UJ	10	ND	U	10	ND	U	10
	ETHANE	5.3	J	4	5.3	J	4	4.4		4	5.1		4
	ETHYLENE	12.6	J	5	13.2	J	5	12.6		5	15.8		5
	METHANE	250	J	2	266	J	2	731.3		2	3096.4		2
	PROPANE	6	J	6	6.5	J	6	5.8	J	6	5.7	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	483	J-	1	473	J-	1	390		5	390		5
	BROMIDE	0.416	J	0.625	0.417	J	0.625	1.8		1	1.1		0.5
	CHLORIDE	49.3		1.65	49.4		1.65	61		1	54		0.5
	IODIDE	19		1.5	20		1.5	3.7		0.75	4.7		0.75
	NITRATE	ND	U	0.5	ND	U	0.5	NA	--	--	NA	--	--
	NITRITE	ND	U	0.5	ND	U	0.5	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	NA	--	--	NA	--	--	ND	R	0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	1.45		0.04	6.73		0.2	NS	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	0.39	J-	0.15	2.5		0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	5	ND	U	5	2.2		2	ND	U	1

Table 8
Analytical Data Table for KAFB-106064

Phase Designation		Phase 2 Passive						Phase 3 Recirculation					
Sample ID		106064-P2P-061418			106064-P2P-061418-FD			106064-P3R-080818			106064-P3R-081618		
Sample Date		6/14/2018			6/14/2018			8/8/2018			8/16/2018		
Sample Purpose		REG			FD			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	4.23		0.06	4.11		0.06	3.1		0.05	2.9		0.05
	MANGANESE	5.85		0.006	5.47		0.006	5.8		0.003	6		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	100	ND	U	100	ND	U	0.5	ND	U	0.5
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	367		100	352		100	350		20	370		100
	1,2-DIBROMOETHANE	ND	U	100	ND	U	100	8.5	J+	1	ND	U	1
	1,2-DICHLOROETHANE	ND	U	100	ND	U	100	ND	U	1	ND	U	1
	1,3,5-TRIMETHYLBENZENE	122	J	100	123	J	100	110	J+	0.5	110		0.5
	2-BUTANONE	ND	U	1000	ND	U	1000	50	J+	10	63		10
	2-CHLOROTOLUENE	ND	U	100	ND	U	100	ND	U	0.5	ND	U	0.5
	2-HEXANONE	ND	U	500	ND	U	500	69	J+	5	80		5
	4-METHYL-2-PENTANONE	ND	U	500	ND	U	500	69	J+	5	63		5
	ACETONE	657	J	1000	657	J	1000	160	J+	10	200		10
	BENZENE	3820		100	3820		100	3700		20	3700		100
	CARBON DISULFIDE	ND	U	100	ND	U	100	ND	U	2	ND	U	2
	CHLOROMETHANE	ND	U	100	ND	U	100	ND	U	1	ND	U	1
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	200	ND	U	200	ND	U	1	ND	U	1
	ETHYLBENZENE	1370		100	1390		100	1100		20	1100		100
	ISOPROPYLBENZENE	149	J	100	158	J	100	110	J+	1	98		1
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	100	ND	U	100	ND	U	0.5	ND	U	0.5
	METHYLENE CHLORIDE	ND	U	200	ND	U	200	ND	U	5	ND	U	5
	NAPHTHALENE	110	J	100	113	J	100	130	J+	5	130		5
	N-BUTYLBENZENE	ND	U	100	ND	U	100	18	J+	1	18		1
	N-PROPYLBENZENE	104	J	100	112	J	100	85	J+	1	86		1
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	100	56.6	J	100	85	J+	1	83		1
	SEC-BUTYLBENZENE	ND	U	100	ND	U	100	16	J+	1	16		1
	TERT-BUTYLBENZENE	ND	U	100	ND	U	100	1.3	J+	1	1.2		1
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	13000		100	12900		100	9400	J-	100	9700		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	100	ND	U	100	ND	U	1	ND	U	1
	TRICHLOROFLUOROMETHANE	ND	U	200	ND	U	200	ND	U	1	ND	U	1
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	4450		300	4410		300	3400		10	3400		50

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 3 Recirculation						Phase 3 Passive					
	Sample ID	106064-P3R-082218			106064-P3R-082918			106064-P3P-091218			106064-P3P-091218-FD		
	Sample Date	8/22/2018			8/29/2018			9/12/2018			9/12/2018		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	17400		5	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	15100		5	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	52000		5	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	0.3	J	0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	105000		5	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	124		5	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	10400		5	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	18900		5	NS	--	--	NS	--	--	NS	--	--
	PMMO	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	825000		5	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	44400		5	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	11900		5	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	29600000		5	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	2.5		0.0003	3		0.015	1.5		0.0058	1.7		0.015
VFAs (mg/L) EPA Method 300m	ACETIC ACID	119.3		10	94.8		10	50.6		10	50.1		10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND		1
	FORMIC ACID	0.7	J	10	1.4		1	ND	U	1	ND		1
	LACTIC ACID	ND	U	1	ND	U	1	ND	U	1	ND		1
	PROPIONIC ACID	66.7		10	66.9		10	74.9		10	76.1		10
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND		1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND		1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND		10
	ETHANE	4.8		4	2.5	J	4	4.2		4	4.2		4
	ETHYLENE	13.2		5	7.7		5	10.4		5	10.4		5
	METHANE	3897.9		2	2501.3		2	7053.1		2	7090.1		2
	PROPANE	5.9	J	6	3.2	J	6	5.7	J	6	5.7		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	420		5	420		5	450		5	460		5
	BROMIDE	2		0.5	0.85		0.5	0.78	J+	0.5	0.77		0.5
	CHLORIDE	52		0.5	54		0.5	51		0.5	51		0.5
	IODIDE	3.1		0.75	5		0.75	4.5		0.75	5.3		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND		0.05	ND	U	0.05	ND	UJ	0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	3.5		0.15	4.3		0.15	3.9		0.15	3.9		0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND		1	ND	U	1	ND	U	1	ND	U	1

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 3 Recirculation						Phase 3 Passive					
	Sample ID	106064-P3R-082218			106064-P3R-082918			106064-P3P-091218			106064-P3P-091218-FD		
	Sample Date	8/22/2018			8/29/2018			9/12/2018			9/12/2018		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	3.4		0.05	2.6		0.05	3		0.05	3		0.05
EPA Method 6010	MANGANESE	7.2		0.003	6		0.003	6.5		0.003	6.6		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	-10.2 ±1.5‰	--	--	NS	--	--	-4.5 ±5‰	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	0.5	ND	U	50	ND	U	50
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	360	J+	100	320		100	350		100	360		100
	1,2-DIBROMOETHANE	ND	U	100	4.7	J+	1	ND	U	100	ND	U	100
	1,2-DICHLOROETHANE	ND	U	100	3.2		1	ND	U	100	ND	U	100
	1,3,5-TRIMETHYLBENZENE	110	J+	50	110	J+	0.5	120		50	120		50
	2-BUTANONE	ND	U	1000	74	J+	10	ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	ND	U	50	ND	U	0.5	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	500	78	J+	5	ND	U	500	ND	U	500
	4-METHYL-2-PENTANONE	ND	U	500	66	J+	5	ND	U	500	ND	U	500
	ACETONE	ND	U	1000	280	J+	10	ND	U	1000	ND	U	1000
	BENZENE	4000	J+	100	3500		100	3300		100	3400		100
	CARBON DISULFIDE	ND	U	200	ND	U	2	ND	U	200	ND	U	200
	CHLOROMETHANE	ND	U	100	ND	U	1	ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	1	ND	U	100	ND	U	100
	ETHYLBENZENE	1000		100	1000		100	1100		100	1200		100
	ISOPROPYLBENZENE	110	J+	100	94	J+	1	100		100	100		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	0.5	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	500	ND	U	5	ND	U	500	ND	U	500
	NAPHTHALENE	ND	U	500	130	J+	5	ND	U	500	ND	U	500
	N-BUTYLBENZENE	ND	U	100	19	J+	1	ND	U	100	ND	U	100
	N-PROPYLBENZENE	88	J+	100	87	J+	1	94	J	100	92	J	100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	86	J+	100	77	J+	1	64	J	100	62	J	100
	SEC-BUTYLBENZENE	ND	U	100	16	J+	1	ND	U	100	ND	U	100
	TERT-BUTYLBENZENE	ND	U	100	ND	U	1	ND	U	100	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	12000	J+	100	10000		100	11000		100	11000		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	100	ND	U	1	ND	U	100	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	1	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	3400	J+	50	3300		50	3500		50	3700		50

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 3 Passive						Phase 4 Passive					
	Sample ID	**106064-P3P-100418**			**106064-P3P-111418**			**106064-P4P-011619**			**106064-P4P-011619-FD**		
	Sample Date	**10/4/2018**			**11/14/2018**			**1/16/2019**			**1/16/2019**		
	Sample Purpose	**REG**			**REG**			**REG**			**FD**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	1,2 DCA Reductase (DCAR)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	ND	U	0.5	NS	--	--	ND	U	0.5
	cer A Reductase	NS	--	--	121		5	NS	--	--	ND	U	5.2
	Chloroform Reductase (CFR)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	Dehalobacter DCM (DCM)	NS	--	--	2700		5	NS	--	--	8140		5.2
	Dehalobacter spp. (DHBt)	NS	--	--	169000		5	NS	--	--	1350000		5.2
	Dehalobium chlorocoercia (DECO)	NS	--	--	4820		5	NS	--	--	22300		5.2
	Dehalococcoides (DHC)	NS	--	--	ND	U	0.5	NS	--	--	0.2	J	0.5
	Dehalogenimonas spp. (DHG)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	Desulfitobacterium spp. (DSB)	NS	--	--	99400		5	NS	--	--	450000		5.2
	Desulfuromonas spp. (DSM)	NS	--	--	36.6		5	NS	--	--	19.6		5.2
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	Epoxyalkane Transferase (EtnE)	NS	--	--	ND	U	5	NS	--	--	94.8		5.2
	Ethene Monooxygenase (EtnC)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	Methanogens (MGN)	NS	--	--	68700		5	NS	--	--	127000		5.2
	PCE Reductase (PCE-1)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	Phenol Hydroxylase (PHE)	NS	--	--	13300		5	NS	--	--	15700		5.2
	PMMO	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	1080		5	NS	--	--	ND	U	5.2
	Sulfate Reducing Bacteria (APS)	NS	--	--	44700		5	NS	--	--	72700		5.2
	tceA Reductase (TCE)	NS	--	--	ND	U	0.5	NS	--	--	ND	U	0.5
	Toluene Dioxygenase (TOD)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	Toluene Monooxygenase (RMO)	NS	--	--	6670		5	NS	--	--	18800		5.2
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	5350		5	NS	--	--	11100		5.2
	Total Eubacteria (EBAC)	NS	--	--	6160000		5	NS	--	--	13100000		5.2
	trans-1,2-DCE Reductase (TDR)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	ND	U	5	NS	--	--	ND	U	5.2
	Vinyl Chloride Reductase (VCR)	NS	--	--	ND	U	0.5	NS	--	--	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.32	J+	0.0015	0.025	J	0.00029	0.028		0.0003	0.026		0.0003
VFAs (mg/L) EPA Method 300m	ACETIC ACID	29.5		10	ND	U	1	0.5	J	1	0.3	J	1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	0.4	J	1	0.9	J	1	0.8	J	1	0.8	J	1
	PROPIONIC ACID	16.6		10	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	3.9	J	4	4.3		4	4.5		4	4.5		4
	ETHYLENE	8.4		5	8.3		5	6.7		5	6.6		5
	METHANE	11125.4		2	14886.8		2	14220.9		20	15034.6		20
	PROPANE	5.1	J	6	5.1	J	6	5.5	J	6	5.3	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	480		5	510		5	510		5	510		5
	BROMIDE	1.4		0.5	1.3		0.5	1.1		0.5	0.77		0.5
	CHLORIDE	48		0.5	48		0.5	47		0.5	48		0.5
	IODIDE	4.2		0.75	4.2	J+	0.75	4		0.75	NA	--	--
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.05	ND	U	0.05	ND	UJ	0.05	ND	UJ	0.05
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	2.9		0.15	0.92	J	0.75	0.14	J	0.15	0.12	J	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	1	ND	U	1	ND	U	1	ND	U	1

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 3 Passive						Phase 4 Passive					
	Sample ID	106064-P3P-100418			106064-P3P-111418			106064-P4P-011619			106064-P4P-011619-FD		
	Sample Date	10/4/2018			11/14/2018			1/16/2019			1/16/2019		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	3.6		0.05	4		0.05	5.1		0.05	5		0.05
EPA Method 6010	MANGANESE	7.7		0.003	6.8		0.003	7.1		0.003	6.4		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	25	ND	U	50	ND	U	50
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	350		50	380		50	470		100	420		100
	1,2-DIBROMOETHANE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	1,2-DICHLOROETHANE	ND	U	50	ND	U	50	NA	--	--	NA	--	--
	1,3,5-TRIMETHYLBENZENE	120		25	140		25	160		50	140		50
	2-BUTANONE	ND	U	500	ND	U	500	ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	250	ND	U	250	ND	U	500	ND	U	500
	4-METHYL-2-PENTANONE	ND	U	250	ND	U	250	ND	U	500	ND	U	500
	ACETONE	ND	U	500	ND	U	500	ND	U	1000	ND	U	1000
	BENZENE	3300		50	3200		50	3400		100	3200		100
	CARBON DISULFIDE	ND	U	100	ND	U	100	ND	U	200	ND	U	200
	CHLOROMETHANE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	50	ND	U	50	NA	--	--	NA	--	--
	ETHYLBENZENE	110		50	1800		50	NA	--	--	NA	--	--
	ISOPROPYLBENZENE	100		50	190		50	230		100	210		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	250	ND	U	250	ND	U	500	ND	U	500
	NAPHTHALENE	140	J	250	140	J	250	ND	U	500	ND	U	500
	N-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	N-PROPYLBENZENE	95		50	120		50	160		100	130		100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	68		50	52		50	ND	U	100	ND	U	100
	SEC-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	TERT-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	11000		100	11000		100	990		100	930		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	3600		25	5500		25	5000		50	4500		50

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 4 Passive											
	Sample ID	**106064-LTM-031120**			**106064-LTM-031120-FD**			**106064-LTM-051920**			**106064-LTM-080420**		
	Sample Date	**3/11/2020**			**3/11/2020**			**5/19/2020**			**8/4/2020**		
	Sample Purpose	**REG**			**FD**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	1,2 DCA Reductase (DCAR)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	BAV1 Vinyl Chloride Reductase (BVC)	0.5	J	0.5	NS	--	--	ND	U	0.5	ND	U	0.5
	cer A Reductase	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Chloroform Reductase (CFR)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Dehalobacter DCM (DCM)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Dehalobacter spp. (DHBt)	145000		4.8	NS	--	--	342000		5	100000		4.6
	Dehalobium chlorocoercia (DECO)	10500		4.8	NS	--	--	3340		5	1310		4.6
	Dehalococcoides (DHC)	27		0.5	NS	--	--	2.1		0.5	1.6		0.5
	Dehalogenimonas spp. (DHG)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Desulfitobacterium spp. (DSB)	38700		4.8	NS	--	--	128000		5	30300		4.6
	Desulfuromonas spp. (DSM)	ND	U	4.8	NS	--	--	ND	U	5	0.3	J	4.6
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Epoxyalkane Transferase (EtnE)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Ethene Monooxygenase (EtnC)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Methanogens (MGN)	59100		4.8	NS	--	--	38600		5	48000		4.6
	PCE Reductase (PCE-1)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Phenol Hydroxylase (PHE)	8890		4.8	NS	--	--	631		5	449		4.6
	PMMO	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	2800		4.8	NS	--	--	24.6		5	776		4.6
	Sulfate Reducing Bacteria (APS)	39800		4.8	NS	--	--	32400		5	28200		4.6
	tceA Reductase (TCE)	1		0.5	NS	--	--	0.6		0.5	ND	U	0.5
	Toluene Dioxygenase (TOD)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Toluene Monooxygenase (RMO)	12800		4.8	NS	--	--	1160		5	ND	U	4.6
	Toluene Monooxygenase 2 (RDEG)	12100		4.8	NS	--	--	2020		5	1170		4.6
	Total Eubacteria (EBAC)	14800000		4.8	NS	--	--	22900000		5	6410000		4.6
	trans-1,2-DCE Reductase (TDR)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.8	NS	--	--	ND	U	5	ND	U	4.6
	Vinyl Chloride Reductase (VCR)	6.3		0.5	NS	--	--	ND	U	0.5	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.011
VFAs (mg/L) EPA Method 300m	ACETIC ACID	0.5	J	10	ND	U	1	ND	U	10	ND	U	10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	FORMIC ACID	0.9	J	10	0.5	J	10	0.3	J	10	3.3	J	10
	LACTIC ACID	1.5	J	10	1.4	J	10	ND	U	10	ND	U	10
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	1.5	J	4	1.7	J	4	8.2		4	4.1		4
	ETHYLENE	ND	U	5	ND	U	5	2.8		5	1.7	J	5
	METHANE	2626.3		2	2942.2		2	11127.7		2	8613.5		2
	PROPANE	ND	U	6	ND	U	6	4.5	J	6	2.9	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	599		5	607		5	673		5	707		5
	BROMIDE	0.832		0.1	0.837		0.1	0.813		0.1	0.921		0.1
	CHLORIDE	49		0.5	48.1		0.5	47.8		0.5	50.8		0.5
	IODIDE	4.1		0.2	3.8		0.2	6.3		0.2	6.1		2
	NITRATE	0.0572	J	0.1	0.0758	J	0.1	0.0718	J-	0.1	0.0842	J	0.1
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1	ND	U	0.1	ND	UJ	0.1	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	0.011	J	0.025	0.017	J	0.025	0.029	J-	0.025	0.092		0.025
	SULFATE	ND	U	0.5	ND	U	0.5	0.326	J	0.5	1.07		0.5

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 4 Passive											
	Sample ID	106064-LTM-031120			106064-LTM-031120-FD			106064-LTM-051920			106064-LTM-080420		
	Sample Date	3/11/2020			3/11/2020			5/19/2020			8/4/2020		
	Sample Purpose	REG			FD			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001
Dissolved Metals (mg/L)	IRON	6.59		0.05	6.51		0.05	7.52		0.05	6.39		0.05
EPA Method 6010	MANGANESE	6.4		0.125	6.17		0.125	7.07		0.125	7.26		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	2.5	ND	U	2.5	ND	U	5	ND	U	10
EPA Method 8260	1,2,4-TRICHLOROBENZENE	ND	U	2.5	ND	U	2.5	ND	U	5	ND	U	10
	1,2,4-TRIMETHYLBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	5
	1,2-DICHLOROETHANE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	5
	1,3,5-TRIMETHYLBENZENE	110		2.5	110		2.5	120		5	130		10
	2-BUTANONE	ND	U	5	ND	U	5	ND	U	5	ND	U	10
	2-CHLOROTOLUENE	ND	U	2.5	ND	U	2.5	ND	U	5	ND	U	10
	2-HEXANONE	ND	U	5	ND	U	5	ND	U	10	ND	U	20
	4-METHYL-2-PENTANONE	ND	U	5	ND	U	5	ND	U	10	ND	U	20
	ACETONE	ND	U	5	ND	U	5	ND	U	5	61		10
	BENZENE	2800		25	2900		25	2900		12	3500		50
	CARBON DISULFIDE	ND	U	5	ND	U	5	ND	U	5	ND	U	10
	CHLOROMETHANE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	5
	CIS-1,2-DICHLOROETHENE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	5
	DICHLORODIFLUOROMETHANE	ND	U	2.5	ND	U	2.5	ND	U	5	ND	U	10
	ETHYLBENZENE	1300		25	1300		25	1300		25	1200		10
	ISOPROPYLBENZENE	160		2.5	160		2.5	160		5	170		10
	M,P-XYLENES	2600		50	2700		50	2700		25	2400		10
	METHYL TERT-BUTYL ETHER	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	5
	METHYLENE CHLORIDE	ND	U	5	ND	U	5	ND	U	5	ND	U	10
	NAPHTHALENE	89		2.5	100		2.5	120		5	130		10
	N-BUTYLBENZENE	14		2.5	15		2.5	16		5	18		10
	N-PROPYLBENZENE	100		2.5	100		2.5	110		5	110		10
	O-XYLENE	1200		25	1200		25	1200		25	1100		10
	P-ISOPROPYLTOLUENE	ND	U	2.5	ND	U	2.5	30		5	54		10
	SEC-BUTYLBENZENE	15		2.5	17		2.5	17		5	19		10
	TERT-BUTYLBENZENE	ND	U	2.5	ND	U	2.5	ND	U	5	ND	U	10
	TETRACHLOROETHENE	ND	U	2.5	ND	U	2.5	ND	U	5	ND	U	10
	TOLUENE	29		2.5	25		2.5	290		2.5	580		5
	TRANS-1,2-DICHLOROETHENE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	5
	TRICHLOROETHENE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	5
	TRICHLOROFLUOROMETHANE	ND	U	2.5	ND	U	2.5	ND	U	5	ND	U	10
	VINYL CHLORIDE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	5
	XYLENES	3800		25	3900		25	4000		25	3600		10

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 4 Passive		
	Sample ID	106064-LTM-101420		
	Sample Date	10/14/2020		
	Sample Purpose	REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	5.1
	1,2 DCA Reductase (DCAR)	ND	U	5.1
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5
	cer A Reductase	ND	U	5.1
	Chloroform Reductase (CFR)	ND	U	5.1
	Dehalobacter DCM (DCM)	ND	U	5.1
	Dehalobacter spp. (DHBt)	166000		5.1
	Dehalobium chlorocoercia (DECO)	1460		5.1
	Dehalococcoides (DHC)	5.4		0.5
	Dehalogenimonas spp. (DHG)	ND	U	5.1
	Desulfitobacterium spp. (DSB)	51100		5.1
	Desulfuromonas spp. (DSM)	ND	U	5.1
	Dichloromethane Dehalogenase (DCMA)	ND	U	5.1
	Epoxyalkane Transferase (EtnE)	ND	U	5.1
	Ethene Monooxygenase (EtnC)	ND	U	5.1
	Methanogens (MGN)	38400		5.1
	PCE Reductase (PCE-1)	ND	U	5.1
	Phenol Hydroxylase (PHE)	427		5.1
	PMMO	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	66.4		5.1
	Sulfate Reducing Bacteria (APS)	20700		5.1
	tceA Reductase (TCE)	ND	U	0.5
	Toluene Dioxygenase (TOD)	ND	U	5.1
	Toluene Monooxygenase (RMO)	749		5.1
	Toluene Monooxygenase 2 (RDEG)	384		5.1
	Total Eubacteria (EBAC)	11900000		5.1
	trans-1,2-DCE Reductase (TDR)	ND	U	5.1
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	5.1
	Vinyl Chloride Reductase (VCR)	0.1		0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	U	0.01
VFAs (mg/L) EPA Method 300m	ACETIC ACID	ND	U	10
	BUTYRIC ACID	ND	U	10
	FORMIC ACID	1.2	J	10
	LACTIC ACID	ND	U	10
	PROPIONIC ACID	ND	U	10
	PYRUVIC ACID	ND	U	10
	VALERIC ACID	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10
	ETHANE	3.2		4
	ETHYLENE	5		5
	METHANE	5693.7		2
	PROPANE	2.3		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	637		5
	BROMIDE	0.77		0.1
	CHLORIDE	47.3		0.5
	IODIDE	4.1		
	NITRATE	0.047	J	0.1
	NITRITE	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--
	ORTHOPHOSPHATE	NA	--	--
	PHOSPHORUS	0.073		0.025
	SULFATE	0.258	J	0.5

Table 8
Analytical Data Table for KAFB-106064

	Phase Designation	Phase 4 Passive		
	Sample ID	106064-LTM-101420		
	Sample Date	10/14/2020		
	Sample Purpose	REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	5.6		0.05
	MANGANESE	6.77		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	10
	1,2,4-TRICHLOROBENZENE	ND	U	10
	1,2,4-TRIMETHYLBENZENE	NA	--	--
	1,2-DIBROMOETHANE	ND	U	5
	1,2-DICHLOROETHANE	ND	U	5
	1,3,5-TRIMETHYLBENZENE	150		10
	2-BUTANONE	ND	U	10
	2-CHLOROTOLUENE	ND	U	10
	2-HEXANONE	ND	U	20
	4-METHYL-2-PENTANONE	ND	U	20
	ACETONE	ND	U	10
	BENZENE	3600		50
	CARBON DISULFIDE	ND	U	20
	CHLOROMETHANE	ND	U	5
	CIS-1,2-DICHLOROETHENE	ND	U	5
	DICHLORODIFLUOROMETHANE	ND	U	5
	ETHYLBENZENE	1300		10
	ISOPROPYLBENZENE	190		5
	M,P-XYLENES	3100		10
	METHYL TERT-BUTYL ETHER	ND	U	5
	METHYLENE CHLORIDE	ND	U	10
	NAPHTHALENE	120		5
	N-BUTYLBENZENE	48		10
	N-PROPYLBENZENE	110		10
	O-XYLENE	1400		10
	P-ISOPROPYLTOLUENE	83		10
	SEC-BUTYLBENZENE	19		5
	TERT-BUTYLBENZENE	ND	U	10
	TETRACHLOROETHENE	ND	U	5
	TOLUENE	420		5
	TRANS-1,2-DICHLOROETHENE	ND	U	5
	TRICHLOROETHENE	ND	U	5
	TRICHLOROFLUOROMETHANE	ND	U	5
	VINYL CHLORIDE	ND	U	5
	XYLENES	4500		5

Refer to notes at the end of the table.

Table 8
Analytical Data Table for KAFB-106064

Notes:

Sampling frequency for each analytical method is outlined in Table 4.

a. EPA analytical methods listed are for the most recent sampling event.

b. Samples were collected using Geotech Bladder Pumps.

c. Samples were recollected (except for QuantArray-Chlor analysis) using replacement QED Bladder Pumps.

-- = Not applicable.

δ2H - Delta Deuterium.

0/00 - Per mil.

cells/mL = Cells per milliliter.

EPA = Environmental Protection Agency.

FD = Field duplicate.

ID = Identification.

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base.

LOQ = Limit of Quantitation

μg/L = Microgram per liter.

mg/L = Milligram per liter.

NA = Not analyzed.

ND = Not detected.

NS = Not sampled.

REG = Regular/parent sample.

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

UJ = Analyte was not detected. The reported value is estimated.

VAL QUAL = Validation qualifier.

VFA - Volatile fatty acid.

VOC = Volatile organic compound.

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106EX1-BL-062917			106EX1-BL-092617			106EX1-P1R-100417			106EX1-P1R-100617		
	Sample Date	6/29/2017			9/26/2017			10/4/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community	1,1 DCA Reductase (DCA)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
(cells/mL)	1,2 DCA Reductase (DCAR)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	87400		4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	18700		4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	370000		4.9	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	6.3		4.9	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	2480		4.9	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	742		4.9	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	143000		4.9	NS	--	--	NS	--	--	NS	--	--
	PMMO	88.3		4.9	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	3850		4.9	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	119000		4.9	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	51.4		4.9	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	404000		4.9	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	114000		4.9	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	959000		4.9	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5									
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	28.5		1.89	31.3	J+	1.94	NS	--	--	NS	--	--
VFAs (mg/L)	ACETIC ACID	ND	U	1	4.51		1	NS	--	--	NS	--	--
EPA Method 300m	BUTYRIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	FORMIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	LACTIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	PROPIONIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	PYRUVIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	VALERIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	NS	--	--	NS	--	--
RSKSOP-175	ETHANE	0.67	J	4	ND	U	4	NS	--	--	NS	--	--
	ETHYLENE	1.13	J	5	3.08	J	5	NS	--	--	NS	--	--
	METHANE	2.61		2	14.3		2	NS	--	--	NS	--	--
	PROPANE	ND	U	6	ND	U	6	NS	--	--	NS	--	--
General Chemistry (mg/L)	ALKALINITY	246		1	313		1	NS	--	--	NS	--	--
SM2320b, EPA Method 300,	BROMIDE	0.373	J-	0.125	0.0952	J	0.25	NS	--	--	NS	--	--
EPA Method 353.2, SM4500	CHLORIDE	12.3		0.33	12.5		0.66	NS	--	--	NS	--	--
Pe[c]	IODIDE	ND	U	0.2	ND	U	0.75	NS	--	--	NS	--	--
	NITRATE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	NITRITE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	0.0958		0.02	0.219	J+	0.02	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	SULFATE	7.48		1	2.05	J	2	NS	--	--	NS	--	--

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106EX1-BL-062917			106EX1-BL-092617			106EX1-P1R-100417			106EX1-P1R-100617		
	Sample Date	6/29/2017			9/26/2017			10/4/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	1.33		0.06	5.36		0.06	NS	--	--	NS	--	--
	MANGANESE	1.89		0.006	3.07		0.006	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-94.24		-99	-94.04		-99	-94.57		-99	-95.56		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NA	--	--	-9.0 ±2‰	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	167		25	215		50	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	32.3	J	25	40.1	J	50	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	55.2		25	69.6	J	50	NS	--	--	NS	--	--
	2-BUTANONE	215	J	250	287	J	500	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	2-HEXANONE	153	J	125	239	J	250	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	62.8	J	125	ND	U	250	NS	--	--	NS	--	--
	ACETONE	673		250	951	J	500	NS	--	--	NS	--	--
	BENZENE	1100		25	2090		50	NS	--	--	NS	--	--
	CARBON DISULFIDE	ND	U	25	27.2	J	50	NS	--	--	NS	--	--
	CHLOROMETHANE	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	ND	U	50	ND	U	100	NS	--	--	NS	--	--
	ETHYLBENZENE	526		25	797		50	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	36	J+	25	58	J	50	NS	--	--	NS	--	--
	M,P-XYLENES	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	ND	U	50	ND	U	100	NS	--	--	NS	--	--
	NAPHTHALENE	68.9	J+	25	114		50	NS	--	--	NS	--	--
	N-BUTYLBENZENE	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	N-PROPYLBENZENE	46.6	J	25	61.7	J	50	NS	--	--	NS	--	--
	O-XYLENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TOLUENE	4380		25	6300		50	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	ND	U	25	ND	U	50	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	100	NS	--	--	NS	--	--
	VINYL CHLORIDE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	XYLENES	1690		75	2590		150	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 1 Recirculation						Phase 1 Recirculation					
	Sample ID	106EX1-P1R-100917			106EX1-P1R-101217			106EX1-P1R-101617			106EX1-P1R-101617-FD		
	Sample Date	10/9/2017			10/12/2017			10/16/2017			10/16/2017		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)												
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BUTYRIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	FORMIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	LACTIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPIONIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PYRUVIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VALERIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	0.009		0.01	0.735		0.01	0.773		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	IODIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 1 Recirculation						Phase 1 Recirculation					
	Sample ID	106EX1-P1R-100917			106EX1-P1R-101217			106EX1-P1R-101617			106EX1-P1R-101617-FD		
	Sample Date	10/9/2017			10/12/2017			10/16/2017			10/16/2017		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	MANGANESE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-95.92		-99	-95		-99	-92.41		-99	-92.76		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ACETONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 1 Recirculation						Phase 1 Recirculation					
	Sample ID	106EX1-P1R-102017			106EX1-P1R-102417			106EX1-P1R-102417-FD			106EX1-P1R-110117		
	Sample Date	10/20/2017			10/24/2017			10/24/2017			11/1/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)												
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	53.6		1.92	50.4		1.9	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	ND	U	1	ND	U	1	NS	--	--
	BUTYRIC ACID	NS	--	--	ND	U	1	ND	U	1	NS	--	--
	FORMIC ACID	NS	--	--	ND	U	1	ND	U	1	NS	--	--
	LACTIC ACID	NS	--	--	ND	U	1	ND	U	1	NS	--	--
	PROPIONIC ACID	NS	--	--	ND	U	1	ND	U	1	NS	--	--
	PYRUVIC ACID	NS	--	--	ND	U	1	ND	U	1	NS	--	--
	VALERIC ACID	NS	--	--	ND	U	1	ND	U	1	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	1.847		0.01	2.625		0.01				3.733		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	ND	U	10	ND	U	10	NS	--	--
	ETHANE	NS	--	--	ND	U	4	ND	U	4	NS	--	--
	ETHYLENE	NS	--	--	3.07	J	5	3.53	J	5	NS	--	--
	METHANE	NS	--	--	1.02	J	2	1.2	J	2	NS	--	--
	PROPANE	NS	--	--	ND	U	6	ND	U	6	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	NS	--	--	267		1	268		1	NS	--	--
	BROMIDE	NS	--	--	0.264		0.125	0.257		0.125	NS	--	--
	CHLORIDE	NS	--	--	15.4		0.33	15.5		0.33	NS	--	--
	IODIDE	NS	--	--	ND	U	0.75	ND	U	0.75	NS	--	--
	NITRATE	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	NITRITE	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	ND	U	0.375	ND	U	0.375	NS	--	--
	O-PHOSPHATE (AS P)	NS	--	--	ND	U	0.02	ND	U	0.02	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	SULFATE	NS	--	--	14.6		1	14.3		1	NS	--	--

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 1 Recirculation						Phase 1 Recirculation					
	Sample ID	106EX1-P1R-102017			106EX1-P1R-102417			106EX1-P1R-102417-FD			106EX1-P1R-110117		
	Sample Date	10/20/2017			10/24/2017			10/24/2017			11/1/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	NS	--	--	0.248		0.06	0.25		0.06	NS	--	--
EPA Method 6010	MANGANESE	NS	--	--	1.57		0.006	1.59		0.006	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-92.35		-99	-93.32		-99	-94.31		-99	-89.6		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	NS	--	--	ND	U	25	ND	U	25	NS	--	--
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	255		25	220		25	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	57.6		25	67.8		25	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	ND	U	25	ND	U	25	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	92.3		25	81.2		25	NS	--	--
	2-BUTANONE	NS	--	--	ND	U	250	148	J	250	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	ND	U	25	ND	U	25	NS	--	--
	2-HEXANONE	NS	--	--	103	J	125	106	J	125	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	ND	U	125	68.6	J	125	NS	--	--
	ACETONE	NS	--	--	719		250	853		250	NS	--	--
	BENZENE	NS	--	--	2910		25	2680		25	NS	--	--
	CARBON DISULFIDE	NS	--	--	ND	U	25	ND	U	25	NS	--	--
	CHLOROMETHANE	NS	--	--	ND	U	25	ND	U	25	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	ND	U	50	ND	U	50	NS	--	--
	ETHYLBENZENE	NS	--	--	688		25	620		25	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	61.4		25	53		25	NS	--	--
	M,P-XYLENES	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	ND	U	25	ND	U	25	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	ND	U	50	ND	U	50	NS	--	--
	NAPHTHALENE	NS	--	--	72.4		25	68.6		25	NS	--	--
	N-BUTYLBENZENE	NS	--	--	14.6	J	25	12.9	J	25	NS	--	--
	N-PROPYLBENZENE	NS	--	--	63.9		25	58.1		25	NS	--	--
	O-XYLENE	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	ND	U	25	13.5	J	25	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	ND	U	25	13.5	J	25	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	ND	U	25	ND	U	25	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	TOLUENE	NS	--	--	5610		25	5060		25	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	ND	U	25	ND	U	25	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	ND	U	50	ND	U	50	NS	--	--
	VINYL CHLORIDE	NS	--	--	NA	--	--	NA	--	--	NS	--	--
	XYLENES	NS	--	--	2470		75	2240		75	NS	--	--

Refer to notes at the end of the table.

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 1 Passive						Phase 2 Recirculation					
	Sample ID	106EX1-P1P-111617			106EX1-P1P-112917			106EX1-P2R-011018			106EX1-P2R-011618		
	Sample Date	11/16/2017			11/29/2017			1/10/2018			1/16/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community	1,1 DCA Reductase (DCA)	NS	--	--	ND	U	6.6	NS	--	--	NS	--	--
(cells/mL)	1,2 DCA Reductase (DCAR)	NS	--	--	ND	U	6.6	NS	--	--	NS	--	--
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	ND	U	0.7	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NA	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	ND	U	6.6	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	ND	U	6.6	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	125000		6.6	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	7140		6.6	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	ND	U	0.7	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	ND	U	6.6	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	331000		6.6	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	ND	U	6.6	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	ND	U	6.6	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	138		6.6	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	ND	U	6.6	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	346		6.6	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NA	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	22700		6.6	NS	--	--	NS	--	--
	PMMO	NS	--	--	2.7	J	6.6	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	1630		6.6	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	89300		6.6	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	ND	U	0.7	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	22200		6.6	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	373000		6.6	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	227000		6.6	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	7680000		6.6	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NA	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	157		6.6	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)				ND	U	0.7	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	21		3.81	12.9		1.87	25.7		1.88	62.2		1.91
VFAs (mg/L)	ACETIC ACID	7.65		1	10.1		1	3.53		1	4.45		1
EPA Method 300m	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	ND	U	1	ND	U	1	1.97		1	0.75	J	1
	PROPIONIC ACID	ND	U	1	ND	U	1	0.88	J	1	0.32	J	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	3.947		0.01	5.251		0.01	NS	--	--	NS	--	--
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
RSKSOP-175	ETHANE	ND	U	4	ND	U	4	1.74	J	4	2.66	J	4
	ETHYLENE	2.77	J	5	5.17		5	6.91		5	8.34		5
	METHANE	0.81	J	2	2.49		2	2.33		2	2.92		2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	2.68	J	6
General Chemistry (mg/L)	ALKALINITY	246		1	264		1	281	J-	1	280		1
SM2320b, EPA Method 300,	BROMIDE	0.327		0.125	0.395		0.125	0.366	J-	0.125	0.403		0.125
EPA Method 353.2, SM4500	CHLORIDE	18.5		0.33	20.7		0.33	25.8		0.33	29.6		0.33
Pe[c]	IODIDE	ND	U	0.75	ND	U	0.75	0.25	J	0.75	0.58	J	0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	0.0153	J	0.02	ND	U	0.02	0.0136	J	0.02	ND	U	0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	10.1		1	9.82		1	8.43	J+	1	7.21		1

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	**Phase 1 Passive**						**Phase 2 Recirculation**					
	Sample ID	**106EX1-P1P-111617**			**106EX1-P1P-112917**			**106EX1-P2R-011018**			**106EX1-P2R-011618**		
	Sample Date	**11/16/2017**			**11/29/2017**			**1/10/2018**			**1/16/2018**		
	Sample Purpose	**REG**			**REG**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	1.45		0.06	1.63		0.06	0.521		0.06	0.535		0.06
	MANGANESE	1.94		0.006	2.27		0.006	2.33		0.006	2.49		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-91.2		-99	-88.51		-99	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	-7.2±2‰	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	25	ND	U	50	ND	U	50
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	169		50	161		25	257		50	325		50
	1,2-DIBROMOETHANE	ND	U	50	21.9	J	25	51.7	J	50	51	J	50
	1,2-DICHLOROETHANE	ND	U	50	ND	U	25	ND	U	50	ND	U	50
	1,3,5-TRIMETHYLBENZENE	60.2	J	50	59.1		25	92.9	J	50	114		50
	2-BUTANONE	ND	U	500	ND	U	250	ND	U	500	ND	U	500
	2-CHLOROTOLUENE	ND	U	50	ND	U	25	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	250	120	J	125	125	J	250	ND	U	250
	4-METHYL-2-PENTANONE	ND	U	250	75.5	J	125	ND	U	250	ND	U	250
	ACETONE	407	J-	500	375	J	250	493	J	500	356	J	500
	BENZENE	1950		50	2080		25	3750		50	3940		50
	CARBON DISULFIDE	ND	U	50	ND	U	25	ND	U	50	ND	U	50
	CHLOROMETHANE	ND	U	50	ND	U	25	47.9		50	ND	U	50
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	ETHYLBENZENE	437		50	477		25	815		50	919		50
	ISOPROPYLBENZENE	40.2	J	50	49	J	25	63.4	J	50	71.2	J	50
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	25	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	100	ND	U	50	57.4	J	100	ND	U	100
	NAPHTHALENE	64.5	J	50	63.1		25	80.9		50	98.7	J	50
	N-BUTYLBENZENE	ND	U	50	ND	U	25	ND	U	50	ND	U	50
	N-PROPYLBENZENE	45.1	J	50	49.6	J	25	70.2	J	50	84.6	J	50
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	50	19.3	J	25	29	J	50	36.9	J	50
	SEC-BUTYLBENZENE	ND	U	50	ND	U	25	ND	U	50	ND	U	50
	TERT-BUTYLBENZENE	ND	U	50	ND	U	25	ND	U	50	ND	U	50
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	4230		50	4420		25	8190		50	9220		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	ND	U	25	ND	U	50	ND	U	50
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	50	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	1490		150	1690		75	2760		150	2860		150

Refer to notes at the end of the table.

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 2 Recirculation						Phase 2 Passive					
	Sample ID	**106EX1-P2R-011618-FD**			**106EX1-P2R-012518**			**106EX1-P2P-030718**			**106EX1-P2P-041118**		
	Sample Date	**1/16/2018**			**1/25/2018**			**3/7/2018**			**4/11/2018**		
	Sample Purpose	**FD**			**REG**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	ND	U	0.7	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	118000		7.5	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	15700		7.5	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	ND	U	0.7	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	161000		7.5	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	14.7		7.5	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	121		7.5	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	4	J	7.5	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	0.4	J	7.5	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	100000		7.5	NS	--	--	NS	--	--
	PMMO	NS	--	--	NA	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	639		7.5	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	111000		7.5	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	ND	U	0.7	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	115000		7.5	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	35500		7.5	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	17500000		7.5	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	ND	U	7.5	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	210		7.5	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	ND	U	0.7	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	80		1.91	69.7	J+	1.91	13.7	J+	1.91	3.74	J	1.92
VFAs (mg/L) EPA Method 300m	ACETIC ACID	5.75		1	20.2		1	38		1	32.4		1
	BUTYRIC ACID	ND	U	1	ND	U	1	0.6	J	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	0.93	J	1	1.4		1	1.1		1	0.63	J	1
	PROPIONIC ACID	0.73	J	1	2.58		1	7		1	4.54		1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	2.71	J	4	2.36	J	4	2.4	J	4	2.17	J	4
	ETHYLENE	7.83		5	9.04		5	9		5	7.28		5
	METHANE	2.78		2	3.51		2	22.9		2	63.2		2
	PROPANE	2.61	J	6	3.04	J	6	3.4	J	6	3.42	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	294		1	291		1	331		1	337		1
	BROMIDE	0.383	J	0.25	0.363		0.125	0.404	J	0.25	0.441		0.125
	CHLORIDE	29.1		0.66	26.6		0.33	34.2		0.66	38.1		0.33
	IODIDE	0.59	J	0.75	1.3		0.75	3.3		0.75	3.9		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	ND	U	0.1
	NITRITE	NA	--	--	NA	--	--	NA	--	--	ND	U	0.1
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	NA	--	--
	O-PHOSPHATE (AS P)	ND	U	0.02	0.0354	J	0.02	0.0116	J	0.02	0.0256		0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	7.15		2	7.03		1	3.89	J	2	3.48		1

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 2 Recirculation						Phase 2 Passive					
	Sample ID	106EX1-P2R-011618-FD			106EX1-P2R-012518			106EX1-P2P-030718			106EX1-P2P-041118		
	Sample Date	1/16/2018			1/25/2018			3/7/2018			4/11/2018		
	Sample Purpose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	0.518		0.06	0.548	J-	0.06	2.85		0.06	2.47	J-	0.06
	MANGANESE	2.46		0.006	2.39	J-	0.006	3.19		0.006	3.45	J+	0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	-9.7 ±2‰	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	300		50	345		50	270		50	281		50
	1,2-DIBROMOETHANE	45.8	J	50	45.4	J	50	ND	U	50	ND	U	50
	1,2-DICHLOROETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	1,3,5-TRIMETHYLBENZENE	104		50	118		50	94.4	J	50	98.3	J	50
	2-BUTANONE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	2-CHLOROTOLUENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	250	ND	U	250	ND	U	250	ND	U	250
	4-METHYL-2-PENTANONE	ND	U	250	ND	U	250	ND	U	250	ND	U	250
	ACETONE	356	J	500	ND	U	500	ND	U	500	ND	U	500
	BENZENE	3740		50	3950		50	3110		50	2490		50
	CARBON DISULFIDE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	CHLOROMETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	ETHYLBENZENE	842		50	963		50	811		50	786		50
	ISOPROPYLBENZENE	59.9	J	50	76.1	J	50	99.9	J	50	122		50
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	NAPHTHALENE	86.5	J	50	102		50	69.6	J	50	96.3	J	50
	N-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	N-PROPYLBENZENE	74.5	J	50	87	J	50	67.3	J	50	75.8	J	50
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	30.9	J	50	ND	U	50	ND	U	50	44.9	J	50
	SEC-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	TERT-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	8610		50	9550		50	7660		50	6280		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2640		150	3190		150	2430		150	2180		150

Refer to notes at the end of the table.

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 2 Passive						Phase 3 Recirculation					
	Sample ID	106EX1-P2P-050918			106EX1-P2P-061418			106EX1-P3R-080818			106EX1-P3R-081618		
	Sample Date	5/9/2018			6/14/2018			8/8/2018			8/16/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.8	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	864		7.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	228000		7.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	46800		7.9	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.8	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	3470		7.9	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	74400		7.9	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	3800		7.9	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	222		7.9	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	98.9		7.9	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	119000		7.9	NS	--	--	NS	--	--	NS	--	--
	PMMO	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	300		7.9	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	116000		7.9	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.8	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	138000		7.9	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	62700		7.9	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	14700000		7.9	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	7.9	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.8	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	2.8		0.0939	2.43		0.192	17		0.31	19		0.3
VFAs (mg/L) EPA Method 300m	ACETIC ACID	41		1	64.9	J	10	30.6		10	28.5		10
	BUTYRIC ACID	ND	U	1	ND	UJ	10	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	UJ	10	ND	U	1	ND	U	1
	LACTIC ACID	0.76	J	1	ND	UJ	10	0.3	J	1	0.7	J	1
	PROPIONIC ACID	5.38		1	ND	UJ	10	3.5	J	10	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	UJ	10	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	UJ	10	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	UJ	10	ND	U	10	ND	U	10
	ETHANE	3.18	J	4	4.3	J	4	3.3	J	4	3.8	J	4
	ETHYLENE	11.4		5	13.2	J	5	11.9		5	13		5
	METHANE	103		2	256	J	2	7.9		2	9.3		2
	PROPANE	4.9	J	6	5.6	J	6	7.1		6	5.5	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	349		1	408	J-	1	310		5	320		5
	BROMIDE	0.512		0.125	0.496	J	0.25	1		1	0.71		0.5
	CHLORIDE	43.2		0.33	45.7		0.66	33		1	33		0.5
	IODIDE	6.8		0.75	8.3		0.75	4.2		0.75	3.9		0.75
	NITRATE	ND	U	0.1	ND	U	0.2	NA	--	--	NA	--	--
	NITRITE	ND	U	0.1	ND	U	0.2	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	NA	--	--	NA	--	--	ND	R	0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	0.0364	J	0.02	0.0185		0.02	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	ND	R	0.15	ND	U	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	3.6		1	0.774	J	2	8.4		2	6.7		1

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 2 Passive						Phase 3 Recirculation					
	Sample ID	106EX1-P2P-050918			106EX1-P2P-061418			106EX1-P3R-080818			106EX1-P3R-081618		
	Sample Date	5/9/2018			6/14/2018			8/8/2018			8/16/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	2.59		0.06	4.58		0.06	1.5		0.05	1.5		0.05
EPA Method 6010	MANGANESE	3.97		0.006	5.03		0.006	4		0.003	4.2		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	6.0 ±1.5‰	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	50	ND	U	0.5	ND	U	10
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	296		50	334		50	250		20	320		20
	1,2-DIBROMOETHANE	ND	U	50	ND	U	50	19	J+	1	19	J	20
	1,2-DICHLOROETHANE	ND	U	50	ND	U	50	ND	U	1	ND	U	20
	1,3,5-TRIMETHYLBENZENE	104		50	114		50	100	J+	0.5	110		10
	2-BUTANONE	ND	U	500	ND	U	500	67	J+	10	81	J	200
	2-CHLOROTOLUENE	ND	U	50	ND	U	50	ND	U	0.5	ND	U	10
	2-HEXANONE	ND	U	250	ND	U	250	83	J+	5	88	J	100
	4-METHYL-2-PENTANONE	ND	U	250	ND	U	250	67	J+	5	66	J	100
	ACETONE	ND	U	500	408	J	500	230	J+	10	280		200
	BENZENE	3410		50	4360		50	2900		20	3500		20
	CARBON DISULFIDE	ND	U	50	ND	U	50	ND	U	2	ND	U	40
	CHLOROMETHANE	ND	U	50	ND	U	50	ND	U	1	ND	U	20
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	1	ND	U	20
	ETHYLBENZENE	866		50	1090		50	760		20	890		20
	ISOPROPYLBENZENE	125		50	167		50	74	J+	1	79		20
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	50	ND	U	0.5	ND	U	10
	METHYLENE CHLORIDE	ND	U	100	55.4	J	100	ND	U	5	ND	U	100
	NAPHTHALENE	113		50	114		50	120	J+	5	130		100
	N-BUTYLBENZENE	ND	U	50	ND	U	50	14	J+	1	14	J	20
	N-PROPYLBENZENE	83.6	J	50	92.6	J	50	71	J+	1	76		20
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	54.8	J	50	ND	U	50	51	J+	1	49		20
	SEC-BUTYLBENZENE	ND	U	50	ND	U	50	14	J+	1	15	J	20
	TERT-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	1	ND	U	20
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	7660		50	10100		50	8300	J-	100	9500		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	ND	U	50	ND	U	1	ND	U	20
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	1	ND	U	20
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2680		150	3480		150	2400		10	2900		10

Refer to notes at the end of the table.

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 3 Recirculation									Phase 3 Passive		
	Sample ID	106EX1-P3R-081618-FD			106EX1-P3R-082218			106EX1-P3R-082918			106EX1-P3P-091218		
	Sample Date	8/16/2018			8/22/2018			8/29/2018			9/12/2018		
	Sample Purpose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	ND	U	0.5	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	963		5	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	192000		5	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	11100		5	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	1.4		0.5	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	113000		5	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	367		5	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	87.9		5	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	67000		5	NS	--	--	NS	--	--
	PMMO	NS	--	--	NA	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	183		5	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	198000		5	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	ND	U	0.5	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	278000		5	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	22000		5	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	13800000		5	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	ND	U	5	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	ND	U	0.5	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	22		0.061	11		0.0003	20		0.059	9.3		0.03
VFAs (mg/L) EPA Method 300m	ACETIC ACID	28.6		10	34.3		10	35.2		10	51.6		10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	0.9	J	1	0.6	J	1	0.6	J	1	0.8	J	1
	PROPIONIC ACID	ND	U	1	ND	U	1	4.4		1	11.6		1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	3.6	J	4	3.5	J	4	3.4	J	4	3.8	J	4
	ETHYLENE	12.3		5	11.5		5	10.9		5	11.8		5
	METHANE	9		2	9.4		2	11.6		2	112.7		2
	PROPANE	4.8	J	6	4.8	J	6	4.5	J	6	4.7	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	330		5	340		5	340		5	360		5
	BROMIDE	0.69		0.5	0.68		0.5	0.72		0.5	0.71		0.5
	CHLORIDE	33		0.5	34		0.5	37		0.5	37		0.5
	IODIDE	3.7		0.75	4.1		0.75	4.6		0.75	4.7		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.05	ND		0.05	ND	U	0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	U	0.15	ND		0.15	ND	U	0.15	ND	U	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	6.7		1	6.6		1	6.9		1	2.7		1

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 3 Recirculation									Phase 3 Passive		
	Sample ID	106EX1-P3R-081618-FD			106EX1-P3R-082218			106EX1-P3R-082918			106EX1-P3P-091218		
	Sample Date	8/16/2018			8/22/2018			8/29/2018			9/12/2018		
	Sample Purpose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	1.5		0.05	1.3		0.05	1.3		0.05	2.8		0.05
EPA Method 6010	MANGANESE	4.2		0.003	3.8		0.003	4.1		0.003	4.6		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	8.0 ±1.5‰	--	--	NS	--	--	-3.4 ±1.5‰	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	10	ND	U	50	ND	U	0.5	ND	U	50
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	300		20	340		100	260		100	300		100
	1,2-DIBROMOETHANE	20		20	ND	U	100	19	J+	1	ND	U	100
	1,2-DICHLOROETHANE	ND	U	20	ND	U	100	2.8		1	ND	U	100
	1,3,5-TRIMETHYLBENZENE	100		10	120		50	99	J+	0.5	110		50
	2-BUTANONE	73	J	200	ND	U	1000	72	J+	10	ND	U	1000
	2-CHLOROTOLUENE	ND	U	10	ND	U	50	ND	U	0.5	ND	U	50
	2-HEXANONE	92	J	100	ND	U	500	75	J+	5	ND	U	500
	4-METHYL-2-PENTANONE	70	J	100	ND	U	500	61	J+	5	ND	U	500
	ACETONE	280		200	ND	U	1000	250	J+	10	ND	U	1000
	BENZENE	3300		20	3800		100	3200		100	3600		100
	CARBON DISULFIDE	ND	U	40	ND	U	200	ND	U	2	ND	U	200
	CHLOROMETHANE	ND	U	20	ND	U	100	ND	U	1	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	20	ND	U	100	ND	U	1	ND	U	100
	ETHYLBENZENE	830		20	1000		100	790		100	970		100
	ISOPROPYLBENZENE	71		20	88	J	100	77	J+	1	110		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	10	ND	U	50	ND	U	0.5	ND	U	50
	METHYLENE CHLORIDE	ND	U	100	ND	U	500	ND	U	5	ND	U	500
	NAPHTHALENE	120		100	ND	U	500	120	J+	5	ND	U	500
	N-BUTYLBENZENE	12	J	20	ND	U	100	15	J+	1	ND	U	100
	N-PROPYLBENZENE	68		20	87	J	100	73	J+	1	85	J	100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	44		20	53	J	100	59	J+	1	64	J	100
	SEC-BUTYLBENZENE	14	J	20	ND	U	100	13	J+	1	ND	U	100
	TERT-BUTYLBENZENE	ND	U	20	ND	U	100	1	J+	1	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	9300		100	9800		100	7900		100	8700		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	20	ND	U	100	ND	U	1	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	20	ND	U	100	ND	U	1	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2700		10	3200		50	2500		50	3000		50

Refer to notes at the end of the table.

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 3 Passive						Phase 4 Passive					
	Sample ID	106EX1-P3P-100418			106EX1-P3P-111918			106EX1-P4P-012119			106EX1-LTM-031220		
	Sample Date	10/4/2018			11/19/2018			1/21/2019			3/12/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	ND	U	5.9	ND	U	5.2	ND	U	4.8
	1,2 DCA Reductase (DCAR)	NS	--	--	ND	U	5.9	ND	U	5.2	ND	U	4.8
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	ND	U	0.6	ND	U	0.5	ND	U	0.5
	cer A Reductase	NS	--	--	ND	U	5.9	ND	U	5.2	ND	U	4.8
	Chloroform Reductase (CFR)	NS	--	--	44.2		5.9	ND	U	5.2	ND	U	4.8
	Dehalobacter DCM (DCM)	NS	--	--	640		5.9	ND	U	5.2	ND	U	4.8
	Dehalobacter spp. (DHBt)	NS	--	--	211000		5.9	207000		5.2	47700		4.8
	Dehalobium chlorocoercia (DECO)	NS	--	--	5700		5.9	4970		5.2	1400		4.8
	Dehalococcoides (DHC)	NS	--	--	ND	U	0.6	0.3	J	0.5	1.5		0.5
	Dehalogenimonas spp. (DHG)	NS	--	--	200		5.9	ND	U	5.2	ND	U	4.8
	Desulfitobacterium spp. (DSB)	NS	--	--	67400		5.9	63300		5.2	21500		4.8
	Desulfuromonas spp. (DSM)	NS	--	--	ND	U	5.9	ND	U	5.2	7		4.8
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	ND	U	5.9	ND	U	5.2	ND	U	4.8
	Epoxyalkane Transferase (EtnE)	NS	--	--	ND	U	5.9	ND	U	5.2	ND	U	4.8
	Ethene Monooxygenase (EtnC)	NS	--	--	ND	U	5.9	ND	U	5.2	ND	U	4.8
	Methanogens (MGN)	NS	--	--	9890		5.9	30000		5.2	3290		4.8
	PCE Reductase (PCE-1)	NS	--	--	ND	U	5.9	ND	U	5.2	ND	U	4.8
	Phenol Hydroxylase (PHE)	NS	--	--	14600		5.9	12700		5.2	16400		4.8
	PMMO	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	ND	U	5.9	95.3		5.2	157		4.8
	Sulfate Reducing Bacteria (APS)	NS	--	--	217000		5.9	110000		5.2	55300		4.8
	tceA Reductase (TCE)	NS	--	--	ND	U	0.6	ND	U	0.5	ND	U	0.5
	Toluene Dioxygenase (TOD)	NS	--	--	ND	U	5.9	ND	U	5.2	ND	U	4.8
	Toluene Monooxygenase (RMO)	NS	--	--	30700		5.9	34000		5.2	21800		4.8
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	19800		5.9	8210		5.2	8110		4.8
	Total Eubacteria (EBAC)	NS	--	--	8370000		5.9	6200000		5.2	6190000		4.8
	trans-1,2-DCE Reductase (TDR)	NS	--	--	ND	U	5.9	ND	U	5.2	ND	U	4.8
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	ND	U	5.9	ND	U	5.2	98		4.8
	Vinyl Chloride Reductase (VCR)	NS	--	--	ND	U	0.6	ND	U	0.5	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	3		0.015	0.9		0.0059	0.78		0.003	0.59		0.021
VFAs (mg/L) EPA Method 300m	ACETIC ACID	102		10	37.8		10	19.1		10	2	J	10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	0.8	J	10
	LACTIC ACID	ND	U	1	0.6	J	1	0.5	J	1	1.4	J	10
	PROPIONIC ACID	17.5		10	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	4.4		4	3.6	J	4	1.9	J	4	ND	U	4
	ETHYLENE	13.5		5	9.5		5	5.2		5	1.1	J	5
	METHANE	1040.2		2	1724		2	2940.2		2	714.3		2
	PROPANE	11.2		6	5.7	J	6	ND	U	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	440		5	420		5	420		5	580		5
	BROMIDE	2		0.5	1.1		0.5	0.84		0.5	0.827		0.1
	CHLORIDE	46		0.5	45		0.5	44		0.5	50.7		0.5
	IODIDE	6.2		0.75	6.2		0.75	7.3	J+	1.5	10		0.2
	NITRATE	NA	--	--	NA	--	--	NA	--	--	0.0551	J	0.1
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.05	ND	U	0.05	ND	UJ	0.05	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	U	0.15	ND	UJ	0.15	ND	UJ	0.15	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	ND	U	0.025
	SULFATE	ND	U	1	0.54	J	1	0.51	J	1	ND	U	0.5

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 3 Passive						Phase 4 Passive					
	Sample ID	106EX1-P3P-100418			106EX1-P3P-111918			106EX1-P4P-012119			106EX1-LTM-031220		
	Sample Date	10/4/2018			11/19/2018			1/21/2019			3/12/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	ND	U	0.001
Dissolved Metals (mg/L)	IRON	7.7		0.05	7.5		0.05	8.4		0.05	8.88		0.05
EPA Method 6010	MANGANESE	6.8		0.003	5.7		0.003	4.8		0.003	4.55		0.05
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	25	ND	U	10	ND	U	2.5
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	ND	U	2.5
	1,2,4-TRIMETHYLBENZENE	530		100	280		50	250		20	NA	--	--
	1,2-DIBROMOETHANE	ND	U	100	ND	U	50	ND	U	20	ND	U	2.5
	1,2-DICHLOROETHANE	ND	U	100	ND	U	50	NA	--	--	ND	U	2.5
	1,3,5-TRIMETHYLBENZENE	180		50	100		25	78		10	82		2.5
	2-BUTANONE	ND	U	1000	ND	U	500	ND	U	200	ND	U	5
	2-CHLOROTOLUENE	ND	U	50	ND	U	25	ND	U	10	ND	U	2.5
	2-HEXANONE	ND	U	500	ND	U	250	ND	U	100	ND	U	5
	4-METHYL-2-PENTANONE	ND	U	500	ND	U	250	47	J	100	ND	U	5
	ACETONE	ND	U	1000	ND	U	500	ND	U	200	ND	U	5
	BENZENE	4000		100	3000		50	2000		20	2300		25
	CARBON DISULFIDE	ND	U	200	ND	U	100	ND	U	40	ND	U	5
	CHLOROMETHANE	ND	U	100	ND	U	50	ND	U	20	ND	U	2.5
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	ND	U	2.5
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	50	NA	--	--	ND	U	2.5
	ETHYLBENZENE	1300		100	950		50	NA	--	--	560		2.5
	ISOPROPYLBENZENE	190		100	180		50	150		20	83		2.5
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	1100		5
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	25	ND	U	10	ND	U	2.5
	METHYLENE CHLORIDE	ND	U	500	ND	U	250	ND	U	100	ND	U	5
	NAPHTHALENE	690		500	ND	U	250	90	J	100	64		2.5
	N-BUTYLBENZENE	ND	U	100	ND	U	50	13	J	20	13		2.5
	N-PROPYLBENZENE	150		100	84		50	63		20	45		2.5
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	640		2.5
	P-ISOPROPYLTOLUENE	110		100	56		50	56		20	ND	U	2.5
	SEC-BUTYLBENZENE	ND	U	100	ND	U	50	13	J	20	15		2.5
	TERT-BUTYLBENZENE	ND	U	100	ND	U	50	ND	U	20	ND	U	2.5
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	ND	U	2.5
	TOLUENE	12000		100	8800		50	4500		50	240		2.5
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	ND	U	2.5
	TRICHLOROETHENE	ND	U	100	ND	U	50	ND	U	20	ND	U	2.5
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	50	ND	U	20	ND	U	2.5
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	ND	U	2.5
	XYLENES	4100		50	3000		25	2100		10	1700		2.5

Refer to notes at the end of the table.

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 4 Passive								
	Sample ID	106EX1-LTM-052020			106EX1-LTM-080420			106EX1-LTM-101520		
	Sample Date	5/20/2020			8/4/2020			10/15/2020		
	Sample Purpose	REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community	1,1 DCA Reductase (DCA)	ND	U	4.9	ND	U	4.7	5.9		5.9
(cells/mL)	1,2 DCA Reductase (DCAR)	ND	U	4.9	ND	U	4.7	5.9		5.9
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	ND	U	0.5	0.6		0.6
	cer A Reductase	ND	U	4.9	ND	U	4.7	5.9		5.9
	Chloroform Reductase (CFR)	ND	U	4.9	ND	U	4.7	5.9		5.9
	Dehalobacter DCM (DCM)	299		4.9	ND	U	4.7	5.9		5.9
	Dehalobacter spp. (DHBt)	142000		4.9	426000		4.7	196000		5.9
	Dehalobium chlorocoercia (DECO)	1710		4.9	1880		4.7	541		5.9
	Dehalococcoides (DHC)	1.2		0.5	0.4	J	0.5	4.8		0.6
	Dehalogenimonas spp. (DHG)	212		4.9	ND	U	4.7	5.9		5.9
	Desulfitobacterium spp. (DSB)	103000		4.9	319000		4.7	140000		5.9
	Desulfuromonas spp. (DSM)	ND	U	4.9	ND	U	4.7	5.9		5.9
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	ND	U	4.7	5.9		5.9
	Epoxyalkane Transferase (EtnE)	ND	U	4.9	ND	U	4.7	5.9		5.9
	Ethene Monooxygenase (EtnC)	ND	U	4.9	ND	U	4.7	5.9		5.9
	Methanogens (MGN)	31600		4.9	42400		4.7	44300		5.9
	PCE Reductase (PCE-1)	ND	U	4.9	ND	U	4.7	5.9		5.9
	Phenol Hydroxylase (PHE)	6630		4.9	4340		4.7	16600		5.9
	PMMO	NA	--	--	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	4.9	ND	U	4.7	5.9		5.9
	Sulfate Reducing Bacteria (APS)	29500		4.9	17400		4.7	34500		5.9
	tceA Reductase (TCE)	ND	U	0.5	ND	U	0.5	0.6		0.6
	Toluene Dioxygenase (TOD)	ND	U	4.9	ND	U	4.7	5.9		5.9
	Toluene Monooxygenase (RMO)	5060		4.9	12400		4.7	18200		5.9
	Toluene Monooxygenase 2 (RDEG)	2970		4.9	5740		4.7	5920		5.9
	Total Eubacteria (EBAC)	5450000		4.9	9050000		4.7	12700000		5.9
	trans-1,2-DCE Reductase (TDR)	ND	U	4.9	ND	U	4.7	5.9		5.9
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.9	203		4.7	164		5.9
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	ND	U	0.5	0.6		0.6
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.12		0.01	ND	U	0.011	ND	U	0.01
VFAs (mg/L)	ACETIC ACID	ND	U	10	0.6	J	10	1.7		10
EPA Method 300m	BUTYRIC ACID	ND	U	10	ND	U	10	ND	U	10
	FORMIC ACID	0.4	J	10	3.3	J	10	2.4	J	10
	LACTIC ACID	ND	U	10	1.1	J	10	0.7	J	10
	PROPIONIC ACID	ND	U	10	ND	U	10	ND	U	10
	PYRUVIC ACID	ND	U	10	ND	U	10	ND	U	10
	VALERIC ACID	ND	U	10	ND	U	10	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	ND	U	10
RSKSOP-175	ETHANE	2	J	4	2.9	J	4	0.8	J	4
	ETHYLENE	6.5		5	8		5	3.6	J	5
	METHANE	6636.4		2	8461.1		2	2141.2		2
	PROPANE	2.9	J	6	4.3	J	6	0.8	J	6
General Chemistry (mg/L)	ALKALINITY	584		5	604		5	584		5
SM2320b, EPA Method 300,	BROMIDE	0.854		0.1	2.13		0.1	1.59		0.1
EPA Method 353.2, SM4500	CHLORIDE	48.8		0.5	52		0.5	48.2		0.5
Pe[c]	IODIDE	8.9		0.2	6.8		2	7.2		
	NITRATE	0.0727	J	0.1	0.0741	J	0.1	ND	U	0.1
	NITRITE	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1	ND	U	0.1	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	ND	U	0.025	ND	U	0.025	ND	U	0.025
	SULFATE	0.202	J	0.5	0.321	J	0.5	ND	U	0.5

Table 9
Analytical Data Table for KAFB-106EX1

	Phase Designation	Phase 4 Passive								
	Sample ID	106EX1-LTM-052020			106EX1-LTM-080420			106EX1-LTM-101520		
	Sample Date	5/20/2020			8/4/2020			10/15/2020		
	Sample Purpose	REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	0.000687	J	0.001	0.00069	J	0.001	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	9.88		0.05	7.65		0.05	3.3		0.05
	MANGANESE	4.86		0.05	5.17		0.125	4.57		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	5	ND	U	10	ND	U	5
	1,2,4-TRICHLOROBENZENE	ND	U	5	ND	U	10	ND	U	5
	1,2,4-TRIMETHYLBENZENE	NA	--	--	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	2.5	ND	U	5	ND	U	2.5
	1,2-DICHLOROETHANE	ND	U	2.5	ND	U	5	ND	U	2.5
	1,3,5-TRIMETHYLBENZENE	79		5	77		10	46		5
	2-BUTANONE	ND	U	5	ND	U	10	ND	U	5
	2-CHLOROTOLUENE	ND	U	5	ND	U	10	ND	U	2.5
	2-HEXANONE	ND	U	10	ND	U	20	ND	U	10
	4-METHYL-2-PENTANONE	ND	U	10	ND	U	10	ND	U	10
	ACETONE	14		5	58		10	ND	U	5
	BENZENE	2500		12	3400		50	2500		25
	CARBON DISULFIDE	ND	U	5	ND	U	10	ND	U	10
	CHLOROMETHANE	ND	U	2.5	ND	U	5	ND	U	2.5
	CIS-1,2-DICHLOROETHENE	ND	U	2.5	ND	U	5	ND	U	2.5
	DICHLORODIFLUOROMETHANE	ND	U	5	ND	U	10	ND	U	2.5
	ETHYLBENZENE	630		5	640		10	140		5
	ISOPROPYLBENZENE	100		5	100		10	23		2.5
	M,P-XYLENES	1300		5	1300		10	400		5
	METHYL TERT-BUTYL ETHER	ND	U	2.5	ND	U	5	ND	U	2.5
	METHYLENE CHLORIDE	9.8	J	5	ND	U	10	ND	U	5
	NAPHTHALENE	97		5	100		10	41		2.5
	N-BUTYLBENZENE	10		5	ND	U	10	ND	U	5
	N-PROPYLBENZENE	48		5	44		10	ND	U	5
	O-XYLENE	700		5	740		10	460		5
	P-ISOPROPYLTOLUENE	45		5	ND	U	10	ND	U	5
	SEC-BUTYLBENZENE	11		5	11		10	ND	U	2.5
	TERT-BUTYLBENZENE	ND	U	5	ND	U	10	ND	U	5
	TETRACHLOROETHENE	ND	U	5	ND	U	10	ND	U	2.5
	TOLUENE	160		2.5	53		5	13		2.5
	TRANS-1,2-DICHLOROETHENE	ND	U	2.5	ND	U	5	ND	U	2.5
	TRICHLOROETHENE	ND	U	2.5	ND	U	5	ND	U	2.5
	TRICHLOROFLUOROMETHANE	ND	U	5	ND	U	10	ND	U	2.5
	VINYL CHLORIDE	ND	U	2.5	ND	U	5	ND	U	2.5
	XYLENES	2000		5	2000		10	870		2.5

Refer to notes at the end of the table.

Table 9
Analytical Data Table for KAFB-106EX1

Notes:

Sampling frequency for each analytical method is outlined in Table 4.

a. EPA analytical methods listed are for the most recent sampling event.

b. Samples were collected using Geotech Bladder Pumps.

c. Samples were recollected (except for QuantArray-Chlor analysis) using replacement QED Bladder Pumps.

-- = Not applicable.

δ2H - Delta Deuterium.

0/00 - Per mil.

cells/mL = Cells per milliliter.

EPA = Environmental Protection Agency.

FD = Field duplicate.

ID = Identification.

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base.

LOQ = Limit of Quantitation

μg/L = Microgram per liter.

mg/L = Milligram per liter.

NA = Not analyzed.

ND = Not detected.

NS = Not sampled.

REG = Regular/parent sample.

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

UJ = Analyte was not detected. The reported value is estimated.

VAL QUAL = Validation qualifier.

VFA - Volatile fatty acid.

VOC = Volatile organic compound.

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106EX2-BL-062917			106EX2-BL-092617			106EX2-P1R-100417			106EX2-P1R-100617		
	Sample Date	6/29/2017			9/26/2017			10/4/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community	1,1 DCA Reductase (DCA)	ND	U	5.3	NS	--	--	NS	--	--	NS	--	--
(cells/mL)	1,2 DCA Reductase (DCAR)	ND	U	5.3	NS	--	--	NS	--	--	NS	--	--
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	1600		5.3	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	5.3	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	117000		5.3	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	29900		5.3	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	5.3	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	66900		5.3	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	ND	U	5.3	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	5.3	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	ND	U	5.3	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	5.3	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	29.7		5.3	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	38900		5.3	NS	--	--	NS	--	--	NS	--	--
	PMMO	108		5.3	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	229		5.3	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	124000		5.3	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	36.8		5.3	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	45100		5.3	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	14500		5.3	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	818000		5.3	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	190		5.3	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	143		9.53	143	J+	7.59	NS	--	--	NS	--	--
VFAs (mg/L)	ACETIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
EPA Method 300m	BUTYRIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	FORMIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	LACTIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	PROPIONIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	PYRUVIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	VALERIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	NS	--	--	NS	--	--
RSKSOP-175	ETHANE	1.34	J	4	2.63	J	4	NS	--	--	NS	--	--
	ETHYLENE	0.98	J	5	2.54	J	5	NS	--	--	NS	--	--
	METHANE	1.48	J	2	4.08		2	NS	--	--	NS	--	--
	PROPANE	1.82	J	6	ND	U	6	NS	--	--	NS	--	--
General Chemistry (mg/L)	ALKALINITY	279		1	309		1	NS	--	--	NS	--	--
SM2320b, EPA Method 300,	BROMIDE	0.998	J-	0.125	0.803		0.25	NS	--	--	NS	--	--
EPA Method 353.2, SM4500	CHLORIDE	91.3		0.66	91.5		0.66	NS	--	--	NS	--	--
Pe[c]	IODIDE	ND	U	0.2	ND	U	0.75	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	0.621		0.375	ND	U	0.375	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	0.0275		0.02	0.196	J+	0.02	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	26.8		2	25		2	NS	--	--	NS	--	--
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106EX2-BL-062917			106EX2-BL-092617			106EX2-P1R-100417			106EX2-P1R-100617		
	Sample Date	6/29/2017			9/26/2017			10/4/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Dissolved Metals (mg/L)	IRON	0.99		0.06	2.33		0.06	NS	--	--	NS	--	--
EPA Method 6010	MANGANESE	2.63		0.006	3.1		0.006	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-93.16		-99	-91.73		-99	-92.4		-99	-93.58		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	-19.5 ±2‰	--	--	-18.1 ±2‰	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	50	NS	--	--	NS	--	--
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	190		50	178		50	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	154		50	146		50	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	ND	U	50	ND	U	50	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	65	J	50	69.8	J	50	NS	--	--	NS	--	--
	2-BUTANONE	ND	U	500	ND	U	500	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	ND	U	50	ND	U	50	NS	--	--	NS	--	--
	2-HEXANONE	277	J	250	281	J	250	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	ND	U	250	ND	U	250	NS	--	--	NS	--	--
	ACETONE	1340		500	1040		500	NS	--	--	NS	--	--
	BENZENE	3700		50	3270		50	NS	--	--	NS	--	--
	CARBON DISULFIDE	ND	U	50	27.6	J	50	NS	--	--	NS	--	--
	CHLOROMETHANE	ND	U	50	ND	U	50	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	100	NS	--	--	NS	--	--
	ETHYLBENZENE	697		50	692		50	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	45.8	J+	50	52.5	J	50	NS	--	--	NS	--	--
	M,P-XYLENES	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	50	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	ND	U	100	ND	U	100	NS	--	--	NS	--	--
	NAPHTHALENE	73.4	J+	50	66.4	J	50	NS	--	--	NS	--	--
	N-BUTYLBENZENE	ND	U	50	ND	U	50	NS	--	--	NS	--	--
	N-PROPYLBENZENE	59.4	J	50	57.7	J	50	NS	--	--	NS	--	--
	O-XYLENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	ND	U	50	ND	U	50	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	ND	U	50	ND	U	50	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	ND	U	50	ND	U	50	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TOLUENE	8290		50	6600		50	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	ND	U	50	ND	U	50	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	100	NS	--	--	NS	--	--
	VINYL CHLORIDE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	XYLENES	2620		150	2350		150	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 10
Analytical Data Table for KAFB-106EX2

Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
	Phase Designation	Phase 1 Recirculation											
	Sample ID	106EX2-P1R-100917			106EX2-P1R-101217			106EX2-P1R-101617			106EX2-P1R-102017		
	Sample Date	10/9/2017			10/12/2017			10/16/2017			10/20/2017		
	Sample Purpose	REG			REG			REG			REG		
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BUTYRIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	FORMIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	LACTIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPIONIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PYRUVIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VALERIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	0.275		0.01	3.242		0.01	5.394		0.01	6.778		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	IODIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106EX2-P1R-100917			106EX2-P1R-101217			106EX2-P1R-101617			106EX2-P1R-102017		
	Sample Date	10/9/2017			10/12/2017			10/16/2017			10/20/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Dissolved Metals (mg/L)	IRON	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EPA Method 6010	MANGANESE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-92.76		-99	-91.11		-99	-87.24		-99	-85.66		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ACETONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 1 Recirculation									Phase 1 Passive		
	Sample ID	106EX2-P1R-102517			106EX2-P1R-110117			106EX2-P1R-110117-FD			106EX2-P1P-111617		
	Sample Date	10/25/2017			11/1/2017			11/1/2017			11/16/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	137		9.48	NS	--	--	NS	--	--	147		3.8
VFAs (mg/L) EPA Method 300m	ACETIC ACID	0.98	J	1	NS	--	--	NS	--	--	1.18		1
	BUTYRIC ACID	ND	U	1	NS	--	--	NS	--	--	ND	U	1
	FORMIC ACID	ND	U	1	NS	--	--	NS	--	--	ND	U	1
	LACTIC ACID	ND	U	1	NS	--	--	NS	--	--	ND	U	1
	PROPIONIC ACID	ND	U	1	NS	--	--	NS	--	--	ND	U	1
	PYRUVIC ACID	ND	U	1	NS	--	--	NS	--	--	ND	U	1
	VALERIC ACID	ND	U	1	NS	--	--	NS	--	--	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	10.117		0.01	8.221		0.01	8.337		0.01	6.291		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	NS	--	--	NS	--	--	ND	U	10
	ETHANE	ND	U	4	NS	--	--	NS	--	--	ND	U	4
	ETHYLENE	ND	U	5	NS	--	--	NS	--	--	ND	U	5
	METHANE	ND	U	2	NS	--	--	NS	--	--	ND	U	2
	PROPANE	ND	U	6	NS	--	--	NS	--	--	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	280		1	NS	--	--	NS	--	--	346		1
	BROMIDE	0.823		0.25	NS	--	--	NS	--	--	0.932		0.25
	CHLORIDE	83.1		0.66	NS	--	--	NS	--	--	90.8		0.66
	IODIDE	ND	U	0.75	NS	--	--	NS	--	--	ND	U	0.75
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	NS	--	--	NS	--	--	ND	U	0.375
	O-PHOSPHATE (AS P)	0.116		0.02	NS	--	--	NS	--	--	0.0116	J	0.02
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	28.5		2	NS	--	--	NS	--	--	28.6		2
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 1 Recirculation									Phase 1 Passive		
	Sample ID	106EX2-P1R-102517			106EX2-P1R-110117			106EX2-P1R-110117-FD			106EX2-P1P-111617		
	Sample Date	10/25/2017			11/1/2017			11/1/2017			11/16/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Dissolved Metals (mg/L)	IRON	0.19		0.06	NS	--	--	NS	--	--	0.701		0.06
EPA Method 6010	MANGANESE	2.05		0.006	NS	--	--	NS	--	--	2.5		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-85.6		-99	-84		-99	-83		-99	-86.66		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	214		50	NS	--	--	NS	--	--	186		50
	1,2-DIBROMOETHANE	139		50	NS	--	--	NS	--	--	134		50
	1,2-DICHLOROETHANE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	1,3,5-TRIMETHYLBENZENE	79.3	J	50	NS	--	--	NS	--	--	64.8	J	50
	2-BUTANONE	ND	U	500	NS	--	--	NS	--	--	ND	U	500
	2-CHLOROTOLUENE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	2-HEXANONE	254	J	250	NS	--	--	NS	--	--	243	J	250
	4-METHYL-2-PENTANONE	158	J	250	NS	--	--	NS	--	--	157	J	250
	ACETONE	996	J	500	NS	--	--	NS	--	--	1020	J-	500
	BENZENE	3370		50	NS	--	--	NS	--	--	3250		50
	CARBON DISULFIDE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	CHLOROMETHANE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	CIS-1,2-DICHLOROETHENE	NA	--	--	NS	--	--	NS	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	NS	--	--	NS	--	--	ND	U	100
	ETHYLBENZENE	597		50	NS	--	--	NS	--	--	594		50
	ISOPROPYLBENZENE	51.4	J	50	NS	--	--	NS	--	--	47.3	J	50
	M,P-XYLENES	NA	--	--	NS	--	--	NS	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	METHYLENE CHLORIDE	ND	U	100	NS	--	--	NS	--	--	ND	U	100
	NAPHTHALENE	98.2	J	50	NS	--	--	NS	--	--	94.1	J	50
	N-BUTYLBENZENE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	N-PROPYLBENZENE	56.5	J	50	NS	--	--	NS	--	--	50.2	J	50
	O-XYLENE	NA	--	--	NS	--	--	NS	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	SEC-BUTYLBENZENE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	TERT-BUTYLBENZENE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	TETRACHLOROETHENE	NA	--	--	NS	--	--	NS	--	--	NA	--	--
	TOLUENE	6890		50	NS	--	--	NS	--	--	6480		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NS	--	--	NS	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	NS	--	--	NS	--	--	ND	U	50
	TRICHLOROFLUOROMETHANE	ND	U	100	NS	--	--	NS	--	--	ND	U	100
	VINYL CHLORIDE	NA	--	--	NS	--	--	NS	--	--	NA	--	--
	XYLENES	2310		150	NS	--	--	NS	--	--	2120		150

Refer to notes at the end of the table.

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation								
	Sample ID	106EX2-P1P-112917			106EX2-P2R-011018			106EX2-P2R-011018-FD			106EX2-P2R-011618		
	Sample Date	11/29/2017			1/10/2018			1/10/2018			1/16/2018		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community	1,1 DCA Reductase (DCA)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
(cells/mL)	1,2 DCA Reductase (DCAR)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	0.7		0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	61500		5	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	7710		5	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	4.4		0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	75900		5	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	5.1		5	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	19200		5	NS	--	--	NS	--	--	NS	--	--
	PMMO	24.1		5	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	79600		5	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	5		0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	ND	U	5	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	94800		5	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	50500		5	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	6810000		5	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	93.3		5	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	7.1		0.5	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	118		4.8	61.4		9.59	70.2		9.49	90.1		3.78
VFAs (mg/L)	ACETIC ACID	1.5		1	3.74		1	7.32		1	13.8		1
EPA Method 300m	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	ND	U	1	0.79	J	1	1.63		1	1.35		1
	PROPIONIC ACID	ND	U	1	1.52		1	3.3		1	3.37		1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	5.154		0.01	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
RSKSOP-175	ETHANE	1.76	J	4	1.56	J	4	1.65	J	4	2.25	J	4
	ETHYLENE	1.81	J	5	3.1	J	5	3.2	J	5	3.92	J	5
	METHANE	1.46	J	2	1.6	J	2	1.89	J	2	2.15		2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	ND	U	6
General Chemistry (mg/L)	ALKALINITY	329		1	350		1	354		1	354		1
SM2320b, EPA Method 300,	BROMIDE	0.434	J	0.25	0.848		0.25	0.844		0.25	0.873		0.25
EPA Method 353.2, SM4500	CHLORIDE	39		0.66	87.5		0.66	87.2		0.66	91.2		0.66
Pe[c]	IODIDE	ND	U	0.75	0.82	J	0.75	0.83	J	0.75	ND	U	0.75
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	ND	U	0.02	0.0172	J	0.02	0.0136	J	0.02	ND	U	0.02
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	12.9		2	23.5	J+	2	24	J+	2	20.9		2
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation								
	Sample ID	106EX2-P1P-112917			106EX2-P2R-011018			106EX2-P2R-011018-FD			106EX2-P2R-011618		
	Sample Date	11/29/2017			1/10/2018			1/10/2018			1/16/2018		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Dissolved Metals (mg/L)	IRON	1.03		0.06	0.352		0.06	0.356		0.06	0.358		0.06
EPA Method 6010	MANGANESE	2.93		0.006	2.87		0.006	2.87		0.006	3.01		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-86.95		-99	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	-17.3 ±2‰	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	50	ND	U	50	ND	U	50
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	180		25	256		50	273		50	272		50
	1,2-DIBROMOETHANE	133		25	118		50	112		50	117		50
	1,2-DICHLOROETHANE	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	1,3,5-TRIMETHYLBENZENE	67.4		25	89.8	J	50	93	J	50	96.6	J	50
	2-BUTANONE	236	J	250	ND	U	500	ND	U	500	ND	U	500
	2-CHLOROTOLUENE	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	2-HEXANONE	278		125	231	J	250	197	J	250	162	J	250
	4-METHYL-2-PENTANONE	165	J	125	ND	U	250	ND	U	250	ND	U	250
	ACETONE	1080		250	954	J	500	829	J	500	668	J	500
	BENZENE	3660		25	4260		50	4240		50	4070		50
	CARBON DISULFIDE	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	CHLOROMETHANE	ND	U	25	50.5		50	61.6		50	ND	U	50
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	50	ND	U	100	ND	U	100	ND	U	100
	ETHYLBENZENE	689		25	882		50	871		50	855		50
	ISOPROPYLBENZENE	56.9		25	66.3	J	50	66.9	J	50	66.4	J	50
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	50	58	J	100	50.4	J	100	ND	U	100
	NAPHTHALENE	89.2		25	101		50	91.5		50	95.3	J	50
	N-BUTYLBENZENE	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	N-PROPYLBENZENE	58.6		25	69.2	J	50	67.8	J	50	65.6	J	50
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	14.6	J	25	28.6	J	50	27.6	J	50	25.9	J	50
	SEC-BUTYLBENZENE	12.5	J	25	ND	U	50	ND	U	50	ND	U	50
	TERT-BUTYLBENZENE	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	6940		25	8070		50	8110		50	8410		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	100	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2330		75	2870		150	2880		150	2680		150

Refer to notes at the end of the table.

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 2 Recirculation			Phase 2 Passive								
	Sample ID	106EX2-P2R-012518			106EX2-P2P-030718			106EX2-P2P-041118			106EX2-P2P-050918		
	Sample Date	1/25/2018			3/7/2018			4/11/2018			5/9/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	1,2 DCA Reductase (DCAR)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	1.8	NS	--	--	NS	--	--	ND	U	0.9
	cer A Reductase	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	Chloroform Reductase (CFR)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	Dehalobacter DCM (DCM)	ND	U	17.9	NS	--	--	NS	--	--	990		9.1
	Dehalobacter spp. (DHBt)	321000		17.9	NS	--	--	NS	--	--	140000		9.1
	Dehalobium chlorocoercia (DECO)	33700		17.9	NS	--	--	NS	--	--	18300		9.1
	Dehalococcoides (DHC)	ND	U	1.8	NS	--	--	NS	--	--	ND	U	0.9
	Dehalogenimonas spp. (DHG)	ND	U	17.9	NS	--	--	NS	--	--	1110		9.1
	Desulfitobacterium spp. (DSB)	414000		17.9	NS	--	--	NS	--	--	57000		9.1
	Desulfuromonas spp. (DSM)	67.9		17.9	NS	--	--	NS	--	--	19900		9.1
	Dichloromethane Dehalogenase (DCMA)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	Epoxyalkane Transferase (EtnE)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	Ethene Monooxygenase (EtnC)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	Methanogens (MGN)	15.5	J	17.9	NS	--	--	NS	--	--	33.9		9.1
	PCE Reductase (PCE-1)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	Phenol Hydroxylase (PHE)	74600		17.9	NS	--	--	NS	--	--	33600		9.1
	PMMO	NA	--	--	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	Sulfate Reducing Bacteria (APS)	380000		17.9	NS	--	--	NS	--	--	46400		9.1
	tceA Reductase (TCE)	ND	U	1.8	NS	--	--	NS	--	--	ND	U	0.9
	Toluene Dioxygenase (TOD)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	Toluene Monooxygenase (RMO)	83200		17.9	NS	--	--	NS	--	--	25000		9.1
	Toluene Monooxygenase 2 (RDEG)	79800		17.9	NS	--	--	NS	--	--	18800		9.1
	Total Eubacteria (EBAC)	28900000		17.9	NS	--	--	NS	--	--	10800000		9.1
	trans-1,2-DCE Reductase (TDR)	ND	U	17.9	NS	--	--	NS	--	--	ND	U	9.1
	Trichlorobenzene Dioxygenase (TCBO)	934		17.9	NS	--	--	NS	--	--	ND	U	9.1
	Vinyl Chloride Reductase (VCR)	ND	U	1.8							ND	U	0.9
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	90.9	J+	9.62	94.8	J+	9.52	69	J	9.59	92.5		3.85
VFAs (mg/L) EPA Method 300m	ACETIC ACID	26.1		1	11.5		1	9.5		1	11		1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	1.64		1	ND	U	1	0.65		1	1	J	1
	PROPIONIC ACID	6.86		1	2.2		1	1		1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	2.41	J	4	3.2	J	4	5.1		4	6.8		4
	ETHYLENE	4.7	J	5	5.3		5	7.05		5	9.6		5
	METHANE	2.64		2	6.9		2	15.2		2	30.4		2
	PROPANE	2.42	J	6	3.1	J	6	5.9	J	6	8.6		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	363		1	377		1	380		1	373		1
	BROMIDE	0.764		0.125	0.92	J	0.625	1.02		0.25	1.14		0.25
	CHLORIDE	76.2		0.66	107		1.65	130		0.66	143		0.66
	IODIDE	2.7		0.75	1.6		0.75	0.57	J	0.75	0.31	J	0.75
	NITRATE	NS	--	--	NS	--	--	ND	U	0.2	ND	U	0.2
	NITRITE	NS	--	--	NS	--	--	ND	U	0.2	ND	U	0.2
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	ND	U	0.02	0.0131	J	0.02	0.0202		0.02	0.0382	J	0.02
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	19.4		2	32.1		5	38.5		2	39.7		2
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 2 Recirculation			Phase 2 Passive								
	Sample ID	106EX2-P2R-012518			106EX2-P2P-030718			106EX2-P2P-041118			106EX2-P2P-050918		
	Sample Date	1/25/2018			3/7/2018			4/11/2018			5/9/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Dissolved Metals (mg/L)	IRON	0.403	J-	0.06	2.19		0.06	2.44	J-	0.06	3.82		0.06
EPA Method 6010	MANGANESE	2.96	J-	0.006	4.11		0.006	4.86	J+	0.006	5.02		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	-17.1 ±2‰	--	--	NS	--	--	NS	--	--	-17.9 ±1‰	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	301		50	251		50	306		50	301		50
	1,2-DIBROMOETHANE	122		50	116		50	96.9	J	50	94.8	J	50
	1,2-DICHLOROETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	1,3,5-TRIMETHYLBENZENE	110		50	84.2	J	50	109		50	103		50
	2-BUTANONE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	2-CHLOROTOLUENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	2-HEXANONE	191	J	250	200	J+	250	254	J	250	245	J	250
	4-METHYL-2-PENTANONE	ND	U	250	136	J	250	177	J	250	146	J	250
	ACETONE	643	J	500	788	J	500	877	J	500	498	J	500
	BENZENE	4250		50	4180		50	3940		50	4170		50
	CARBON DISULFIDE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	CHLOROMETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	ETHYLBENZENE	994		50	923		50	954		50	898		50
	ISOPROPYLBENZENE	74.4	J	50	91.7	J	50	109		50	104		50
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	NAPHTHALENE	101		50	82.5	J	50	126		50	130		50
	N-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	N-PROPYLBENZENE	86.8	J	50	73.3	J	50	90.5	J	50	86.4	J	50
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	50	ND	U	50	39.9	J	50	45.1	J	50
	SEC-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	TERT-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	9530		50	8630		50	7640		50	7640		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	3020		150	2850		150	2910		150	2950		150

Refer to notes at the end of the table.

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 2 Passive			Phase 3 Recirculation								
	Sample ID	106EX2-P2P-061418			106EX2-P3R-080818			106EX2-P3R-080818-FD			106EX2-P3R-081618		
	Sample Date	6/14/2018			8/8/2018			8/8/2018			8/16/2018		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	101		3.83	82		0.3	74		0.31	82		0.31
VFAs (mg/L) EPA Method 300m	ACETIC ACID	8	J	1	13.9		1	14		1	23.5		10
	BUTYRIC ACID	ND	UJ	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	UJ	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	0.6	J	1	ND	U	1	ND	U	1	0.7	J	1
	PROPIONIC ACID	ND	UJ	1	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	UJ	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	UJ	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	UJ	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	6.9	J	4	4.9		4	4.8		4	4.7		4
	ETHYLENE	11.4	J	5	9		5	8.5		5	7.9		5
	METHANE	15.5	J	2	10.3		2	10		2	28.2		2
	PROPANE	9.4	J	6	5.3	J	6	5.4	J	6	5.3	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	419	J-	1	380		5	370		5	380		5
	BROMIDE	1.06	J	0.625	1.7		1	1.7		1	1.2		0.5
	CHLORIDE	136		1.65	91		1	90		1	88		0.5
	IODIDE	0.47	J	0.75	3.9		0.75	4.8		0.75	4.2		0.75
	NITRATE	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	NITRITE	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	ND	R	0.05	ND	R	0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	0.0185		0.02	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	ND	R	0.15	ND	R	0.15	ND	U	0.15
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	35.8		5	28		2	28		2	26		1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 2 Passive			Phase 3 Recirculation								
	Sample ID	**106EX2-P2P-061418**			**106EX2-P3R-080818**			**106EX2-P3R-080818-FD**			**106EX2-P3R-081618**		
	Sample Date	**6/14/2018**			**8/8/2018**			**8/8/2018**			**8/16/2018**		
	Sample Purpose	**REG**			**REG**			**FD**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Dissolved Metals (mg/L)	IRON	4.21		0.06	1.1		0.05	1.2		0.05	1.1		0.05
EPA Method 6010	MANGANESE	5.24		0.006	4.4		0.003	4.7		0.003	4.8		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (μg/L)	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	0.5	ND	U	0.5	ND	U	10
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	367		25	230		20	230		20	260		20
	1,2-DIBROMOETHANE	91		25	78	J+	1	85	J+	1	85		20
	1,2-DICHLOROETHANE	ND	U	25	ND	U	1	ND	U	1	ND	U	20
	1,3,5-TRIMETHYLBENZENE	124		25	86	J+	0.5	88	J+	0.5	89		10
	2-BUTANONE	180	J	250	130	J+	10	130	J+	10	110	J	200
	2-CHLOROTOLUENE	ND	U	25	ND	U	0.5	ND	U	0.5	ND	U	10
	2-HEXANONE	259		125	160	J+	5	160	J+	5	150	J	100
	4-METHYL-2-PENTANONE	129	J	125	98	J+	5	99	J+	5	90	J	100
	ACETONE	561		250	480	J+	10	490	J+	10	430		200
	BENZENE	4360		25	3300		20	3500		20	3600		20
	CARBON DISULFIDE	ND	U	25	ND	U	2	ND	U	2	ND	U	40
	CHLOROMETHANE	ND	U	25	ND	U	1	ND	U	1	ND	U	20
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	50	ND	U	1	ND	U	1	ND	U	20
	ETHYLBENZENE	1070		25	770		20	770		20	870		20
	ISOPROPYLBENZENE	118		25	70	J+	1	71	J+	1	74		20
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	0.5	ND	U	0.5	ND	U	10
	METHYLENE CHLORIDE	28.4	J	50	ND	U	5	ND	U	5	ND	U	100
	NAPHTHALENE	138		25	120	J+	5	130	J+	5	120		100
	N-BUTYLBENZENE	18.9	J	25	12	J+	1	13	J+	1	12	J	20
	N-PROPYLBENZENE	113		25	69	J+	1	71	J+	1	75		20
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	25	32	J+	1	33	J+	1	30		20
	SEC-BUTYLBENZENE	21.9	J	25	13	J+	1	13	J+	1	13	J	20
	TERT-BUTYLBENZENE	ND	U	25	1.2	J+	1	1.1	J+	1	ND	U	20
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	8030		25	7600	J-	100	7100	J-	100	9100		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	25	ND	U	1	ND	U	1	ND	U	20
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	1	ND	U	1	ND	U	20
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	3670		75	2400		10	2400		10	2800		10

Refer to notes at the end of the table.

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 3 Recirculation						Phase 3 Passive					
	Sample ID	106EX2-P3R-082218			106EX2-P3R-082918			106EX2-P3P-091218			106EX2-P3P-100418		
	Sample Date	8/22/2018			8/29/2018			9/12/2018			10/4/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	248000		4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	13000		4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	62800		4.9	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	529		4.9	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	10900		4.9	NS	--	--	NS	--	--	NS	--	--
	PMMO	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	2040		4.9	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	197000		4.9	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	32100		4.9	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	6480		4.9	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	9990000		4.9	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	47		0.0003	97		0.3	60		0.29	65		0.15
VFAs (mg/L) EPA Method 300m	ACETIC ACID	27.7		10	30.5		10	43.7		10	30.8		10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	0.6	J	1	ND	U	1	1		1	0.6	J	1
	PROPIONIC ACID	ND	U	1	7.3		1	10.8		1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	4.5		4	4.5		4	4.7		4	6.7		4
	ETHYLENE	8.1		5	8.5		5	9.8		5	13.1		5
	METHANE	57.7		2	105.5		2	279.7		2	398.5		2
	PROPANE	5.1	J	6	5.1	J	6	5.5	J	6	7.8		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	400		5	400		5	410		5	400		5
	BROMIDE	1.1		0.5	1.1		0.5	0.99		0.5	2		0.5
	CHLORIDE	85		0.5	87		0.5	88		0.5	96		0.5
	IODIDE	5.8		0.75	4.6		0.75	4.9		0.75	2.3		0.75
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND		0.05	ND	U	0.05	0.11		0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	ND		0.15	ND	U	0.15	ND	U	0.15	ND	U	0.15
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	24		1	23		1	18		1	20		1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 3 Recirculation						Phase 3 Passive					
	Sample ID	106EX2-P3R-082218			106EX2-P3R-082918			106EX2-P3P-091218			106EX2-P3P-100418		
	Sample Date	8/22/2018			8/29/2018			9/12/2018			10/4/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Dissolved Metals (mg/L)	IRON	1.2		0.05	1.1		0.05	1.6		0.05	3.7		0.05
EPA Method 6010	MANGANESE	4.9		0.003	5.2		0.003	5.6		0.003	5.8		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	-19.2 ±1.5‰	--	--	NS	--	--	-18.0 ±1.5‰	--	--	NS	--	--
VOCs (μg/L)	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	0.5	ND	U	50	ND	U	50
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	310		100	290		100	260		100	340		100
	1,2-DIBROMOETHANE	ND	U	100	78	J+	1	73	J	100	ND	U	100
	1,2-DICHLOROETHANE	ND	U	100	3.5		1	ND	U	100	ND	U	100
	1,3,5-TRIMETHYLBENZENE	110		50	92	J+	0.5	94	J	50	110		50
	2-BUTANONE	ND	U	1000	130	J+	10	ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	ND	U	50	ND	U	0.5	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	500	140	J+	5	ND	U	500	200	J	500
	4-METHYL-2-PENTANONE	ND	U	500	94	J+	5	ND	U	500	ND	U	500
	ACETONE	ND	U	1000	490	J+	10	ND	U	1000	ND	U	1000
	BENZENE	4400		100	4200		100	4000		100	3800		100
	CARBON DISULFIDE	ND	U	200	ND	U	2	ND	U	200	ND	U	200
	CHLOROMETHANE	ND	U	100	ND	U	1	ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	1	ND	U	100	ND	U	100
	ETHYLBENZENE	1000		100	1000		100	940		100	960		100
	ISOPROPYLBENZENE	94	J	100	78	J+	1	85	J	100	120		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	0.5	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	500	ND	U	5	ND	U	500	ND	U	500
	NAPHTHALENE	ND	U	500	130	J+	5	ND	U	500	280	J	500
	N-BUTYLBENZENE	ND	U	100	14	J+	1	ND	U	100	ND	U	100
	N-PROPYLBENZENE	93	J	100	78	J+	1	84	J	100	97	J	100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	100	38	J+	1	ND	U	100	57	J	100
	SEC-BUTYLBENZENE	ND	U	100	13	J+	1	ND	U	100	ND	U	100
	TERT-BUTYLBENZENE	ND	U	100	1	J+	1	ND	U	100	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	9700		100	9400		100	8600		100	8200		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	100	ND	U	1	ND	U	100	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	1	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	3300		50	3300		50	3000		50	3000		50

Refer to notes at the end of the table.

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 3 Passive			Phase 4 Passive								
	Sample ID	**106EX2-P3P-111918**			**106EX2-P4P-012119**			**106EX2-LTM-081220**			**106EX2-LTM-101520**		
	Sample Date	**11/19/2018**			**1/21/2019**			**8/12/2020**			**10/15/2020**		
	Sample Purpose	**REG**			**REG**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	1,2 DCA Reductase (DCAR)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	ND	U	0.5	ND	U	0.5	0.5		0.5
	cer A Reductase	117		4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	Chloroform Reductase (CFR)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	Dehalobacter DCM (DCM)	ND	U	4.9	ND	U	5.1	2360		5.4	7860		5.2
	Dehalobacter spp. (DHBt)	84700		4.9	256000		5.1	44200		5.4	51700		5.2
	Dehalobium chlorocoercia (DECO)	3390		4.9	11000		5.1	1690		5.4	6130		5.2
	Dehalococcoides (DHC)	ND	U	0.5	0.8		0.5	0.3	J	0.5	0.6		0.5
	Dehalogenimonas spp. (DHG)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	Desulfitobacterium spp. (DSB)	40800		4.9	135000		5.1	35000		5.4	18400		5.2
	Desulfuromonas spp. (DSM)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.3		5.2
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	Epoxyalkane Transferase (EtnE)	ND	U	4.9	111		5.1	ND	U	5.4	5.2		5.2
	Ethene Monooxygenase (EtnC)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	Methanogens (MGN)	1390		4.9	4980		5.1	10000		5.4	22600		5.2
	PCE Reductase (PCE-1)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	Phenol Hydroxylase (PHE)	3150		4.9	12400		5.1	8900		5.4	11200		5.2
	PMMO	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	Sulfate Reducing Bacteria (APS)	163000		4.9	357000		5.1	40700		5.4	36200		5.2
	tceA Reductase (TCE)	ND	U	0.5	ND	U	0.5	ND	U	0.5	0.5		0.5
	Toluene Dioxygenase (TOD)	ND	U	4.9	ND	U	5.1	ND	U	5.4	499		5.2
	Toluene Monooxygenase (RMO)	5160		4.9	14900		5.1	12300		5.4	27600		5.2
	Toluene Monooxygenase 2 (RDEG)	5880		4.9	6660		5.1	5140		5.4	7870		5.2
	Total Eubacteria (EBAC)	5520000		4.9	11100000		5.1	11900000		5.4	12100000		5.2
	trans-1,2-DCE Reductase (TDR)	ND	U	4.9	ND	U	5.1	ND	U	5.4	5.2		5.2
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.9	ND	U	5.1	142		5.4	838		5.2
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	ND	U	0.5	ND	U	0.5	0.5		0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	55		0.29	62		0.3	2.7		0.1	0.36		0.011
VFAs (mg/L) EPA Method 300m	ACETIC ACID	ND	U	1	9.1		1				11.1		10
	BUTYRIC ACID	ND	U	1	ND	U	1				ND	U	10
	FORMIC ACID	ND	U	1	ND	U	1				2.2	J	10
	LACTIC ACID	ND	U	1	0.5	J	1				0.6	J	10
	PROPIONIC ACID	ND	U	1	ND	U	1				ND	U	10
	PYRUVIC ACID	ND	U	1	ND	U	1				ND	U	10
	VALERIC ACID	ND	U	1	ND	U	1				ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	7.8		4	7.2		4	10.5		4	4.7		4
	ETHYLENE	12.6		5	10.4		5	36.3		5	20.2		5
	METHANE	168.3		2	128.3		2	1607.8		2	968.3		2
	PROPANE	9.7		6	9.6		6	13.7		6	5.9	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	360		5	360		5	474		5	465		5
	BROMIDE	1.8		0.5	2		1	3.2		0.1	3.34		0.1
	CHLORIDE	120		5	140		1	186		5	178		5
	IODIDE	0.45	J	0.75	ND	U	0.75	ND	U	2	0.35		
	NITRATE	NS	--	--	NS	--	--	ND	U	0.1	ND	U	0.1
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.05	ND	UJ	0.05	ND	U	0.1	ND	U	0.1
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	ND	UJ	0.75	ND	UJ	0.15	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	ND	U	0.025	ND	U	0.025
	SULFATE	26		1	22		2	0.246	J	0.5	ND	U	0.5
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	ND	U	0.001	ND	U	0.001

Table 10
Analytical Data Table for KAFB-106EX2

	Phase Designation	Phase 3 Passive			Phase 4 Passive								
	Sample ID	106EX2-P3P-111918			106EX2-P4P-012119			106EX2-LTM-081220			106EX2-LTM-101520		
	Sample Date	11/19/2018			1/21/2019			8/12/2020			10/15/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Dissolved Metals (mg/L)	IRON	4.2		0.05	4		0.05	7.89		0.05	5.17		0.05
EPA Method 6010	MANGANESE	5.9		0.003	5.2		0.003	7.18		0.125	5.33		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	13	ND	U	10	ND	U	10	ND	U	5
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	ND	U	10	ND	U	10
	1,2,4-TRIMETHYLBENZENE	250		25	250		20	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	47		25	31		20	ND	U	5	ND	U	5
	1,2-DICHLOROETHANE	ND	U	25	NA	--	--	ND	U	5	ND	U	5
	1,3,5-TRIMETHYLBENZENE	83		13	84		10	160		10	150		5
	2-BUTANONE	ND	U	250	ND	U	200	ND	U	10	ND	U	10
	2-CHLOROTOLUENE	ND	U	13	ND	U	10	ND	U	10	ND	U	10
	2-HEXANONE	170	J	130	120	J	100	ND	U	20	ND	U	20
	4-METHYL-2-PENTANONE	110	J	130	73	J	100	ND	U	20	ND	U	20
	ACETONE	190	J	250	190	J	200	ND	U	10	ND	U	10
	BENZENE	3300		25	2300		20	2900		50	6700		50
	CARBON DISULFIDE	ND	U	50	ND	U	40	ND	U	10	ND	U	20
	CHLOROMETHANE	ND	U	25	ND	U	20	ND	U	5	ND	U	5
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	ND	U	5	ND	U	5
	DICHLORODIFLUOROMETHANE	ND	U	25	NA	--	--	ND	U	10	ND	U	5
	ETHYLBENZENE	800		25	NA	--	--	1200		10	1100		10
	ISOPROPYLBENZENE	99		25	93		20	110		10	96		5
	M,P-XYLENES	NA	--	--	NA	--	--	3100		10	3600		10
	METHYL TERT-BUTYL ETHER	ND	U	13	ND	U	10	ND	U	5	ND	U	5
	METHYLENE CHLORIDE	ND	U	130	ND	U	100	ND	U	10	ND	U	10
	NAPHTHALENE	120	J	130	110		100	150		10	160		5
	N-BUTYLBENZENE	ND	U	25	12	J	20	21		10	ND	U	10
	N-PROPYLBENZENE	72		25	70		20	140		10	64		10
	O-XYLENE	NA	--	--	NA	--	--	1300		10	1500		10
	P-ISOPROPYLTOLUENE	44		25	38		20	ND	U	10	ND	U	10
	SEC-BUTYLBENZENE	14	J	25	13	J	20	24		10	17		5
	TERT-BUTYLBENZENE	ND	U	25	ND	U	20	ND	U	10	ND	U	5
	TETRACHLOROETHENE	NA	--	--	NA	--	--	ND	U	10	ND	U	10
	TOLUENE	7000		50	4800		50	5900		50	6200		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	ND	U	5	ND	U	5
	TRICHLOROETHENE	ND	U	25	ND	U	20	ND	U	5	ND	U	5
	TRICHLOROFLUOROMETHANE	ND	U	25	ND	U	20	ND	U	10	ND	U	10
	VINYL CHLORIDE	NA	--	--	NA	--	--	ND	U	5	ND	U	5
	XYLENES	2600		13	2200		10	4400		10	5200		10

Refer to notes at the end of the table.

Table 10
Analytical Data Table for KAFB-106EX2

Notes:

Sampling frequency for each analytical method is outlined in Table 4.

a. EPA analytical methods listed are for the most recent sampling event.

b. Samples were collected using Geotech Bladder Pumps.

c. Samples were recollected (except for QuantArray-Chlor analysis) using replacement QED Bladder Pumps.

-- = Not applicable.

δ2H - Delta Deuterium.

0/00 - Per mil.

cells/mL = Cells per milliliter.

EPA = Environmental Protection Agency.

FD = Field duplicate.

ID = Identification.

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base.

LOQ = Limit of Quantitation

µg/L = Microgram per liter.

mg/L = Milligram per liter.

NA = Not analyzed.

ND = Not detected.

NS = Not sampled.

REG = Regular/parent sample.

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

UJ = Analyte was not detected. The reported value is estimated.

VAL QUAL = Validation qualifier.

VFA - Volatile fatty acid.

VOC = Volatile organic compound.

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106IN1-BL-062917			106IN1-BL-092617			106IN1-P1R-100217-1			106IN1-P1R-100217-2		
	Sample Date	6/29/2017			9/26/2017			10/2/2017			10/2/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community	1,1 DCA Reductase (DCA)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
(cells/mL)	1,2 DCA Reductase (DCAR)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	155000		4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	25700		4.9	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	1370000		4.9	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	2	J	4.9	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	1530		4.9	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	4.9	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	801		4.9	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	204000		4.9	NS	--	--	NS	--	--	NS	--	--
	PMMO	2830		4.9	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	10000		4.9	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	193000		4.9	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	1370		4.9	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	393000		4.9	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	304000		4.9	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	2530000		4.9	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	484		4.9	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	47.4		1.88	20.1	J+	1.92	NS	--	--	NS	--	--
VFAs (mg/L)	ACETIC ACID	ND	U	1	1.17		1	NS	--	--	NS	--	--
EPA Method 300m	BUTYRIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	FORMIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	LACTIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	PROPIONIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	PYRUVIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	VALERIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	566.7		0.01	540.1		0.01
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	NS	--	--	NS	--	--
RSKSOP-175	ETHANE	1.27	J	4	0.94	J	4	NS	--	--	NS	--	--
	ETHYLENE	2.3	J	5	4.36	J	5	NS	--	--	NS	--	--
	METHANE	2.15		2	1.49	J	2	NS	--	--	NS	--	--
	PROPANE	2.01	J	6	1.52	J	6	NS	--	--	NS	--	--
General Chemistry (mg/L)	ALKALINITY	261		1	299		1	NS	--	--	NS	--	--
SM2320b, EPA Method 300,	BROMIDE	0.621	J-	0.125	0.515		0.25	NS	--	--	NS	--	--
EPA Method 353.2, SM4500	CHLORIDE	48.6		0.66	45.3		0.66	NS	--	--	NS	--	--
Pec	IODIDE	ND	U	0.2	ND	U	0.75	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	0.0425		0.02	0.209	J+	0.02	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	3.03	J	2	ND	U	2	NS	--	--	NS	--	--

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106IN1-BL-062917			106IN1-BL-092617			106IN1-P1R-100217-1			106IN1-P1R-100217-2		
	Sample Date	6/29/2017			9/26/2017			10/2/2017			10/2/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	4.81		0.06	13.8		0.06	NS	--	--	NS	--	--
	MANGANESE	3.27		0.006	3.31		0.006	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-92.97		-99	-93.85		-99	576.52		-99	608.76		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NA	--	--	-5.0 ±2‰	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	183		10	193		12.5	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	75		10	28.6		12.5	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	ND	U	10	6.76	J	12.5	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	63.6		10	62.8		12.5	NS	--	--	NS	--	--
	2-BUTANONE	1570		100	163	J	125	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	2-HEXANONE	220		50	136		62.5	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	82.4	J	50	98.3	J	62.5	NS	--	--	NS	--	--
	ACETONE	1780		100	667		125	NS	--	--	NS	--	--
	BENZENE	1930		10	1930		12.5	NS	--	--	NS	--	--
	CARBON DISULFIDE	ND	U	10	7.23	J	12.5	NS	--	--	NS	--	--
	CHLOROMETHANE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	ND	U	20	ND	U	25	NS	--	--	NS	--	--
	ETHYLBENZENE	396		10	696		12.5	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	31.3		10	49.5		12.5	NS	--	--	NS	--	--
	M,P-XYLENES	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	ND	U	20	ND	U	25	NS	--	--	NS	--	--
	NAPHTHALENE	46		10	80		12.5	NS	--	--	NS	--	--
	N-BUTYLBENZENE	8.21	J	10	8.26	J	12.5	NS	--	--	NS	--	--
	N-PROPYLBENZENE	29.3		10	45.5		12.5	NS	--	--	NS	--	--
	O-XYLENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	6.71	J	10	7.24	J	12.5	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	ND	U	10	8.72	J	12.5	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TOLUENE	3680		10	2730		12.5	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	ND	U	20	ND	U	25	NS	--	--	NS	--	--
	VINYL CHLORIDE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	XYLENES	1720		30	1640		37.5	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Phase 1 Recirculation			Phase 1 Passive								
	Sample ID	106IN1-P1R-100317-3			106IN1-P1P-111617			106IN1-P1P-111617-FD			106IN1-P1P-112917		
	Sample Date	10/3/2017			11/16/2017			11/16/2017			11/29/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.7
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	45900		7.1
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	7550		7.1
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	0.9		0.7
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	84000		7.1
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	254		7.1
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	6530		7.1
	PMMO	NS	--	--	NS	--	--	NS	--	--	0.3	J	7.1
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	65400		7.1
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	1.4		0.7
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	3500		7.1
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	57400		7.1
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	31700		7.1
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	9460000		7.1
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	ND	U	7.1
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	2.3		0.7
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	19.9		3.8	22.1		3.88	23.8		1.94
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	108		1	114		1	102		1
	BUTYRIC ACID	NS	--	--	9.2		1	10.1		1	4.78		1
	FORMIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	PROPIONIC ACID	NS	--	--	21.9		1	22.7		1	19.3		1
	PYRUVIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	NS	--	--	4.34		1	4.03		1	3.88		1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	592.2		0.01	3.338		0.01	NS	--	--	3.197		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	ND	U	10	ND	U	10	ND	U	10
	ETHANE	NS	--	--	ND	U	4	ND	U	4	1.54	J	4
	ETHYLENE	NS	--	--	4.04	J	5	4.03	J	5	6.02		5
	METHANE	NS	--	--	18		2	17.3		2	354		2
	PROPANE	NS	--	--	ND	U	6	ND	U	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	NS	--	--	314		1	289		1	298		1
	BROMIDE	NS	--	--	0.676		0.25	0.683		0.25	0.78		0.25
	CHLORIDE	NS	--	--	48.8		0.66	49		0.66	55.6		0.66
	IODIDE	NS	--	--	ND	U	0.75	ND	U	0.75	ND	U	0.75
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	NS	--	--	0.0245	J	0.02	0.0171	J	0.02	0.109		0.02
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	ND	U	2	ND	U	2	ND	U	2

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Phase 1 Recirculation			Phase 1 Passive								
	Sample ID	106IN1-P1R-100317-3			106IN1-P1P-111617			106IN1-P1P-111617-FD			106IN1-P1P-112917		
	Sample Date	10/3/2017			11/16/2017			11/16/2017			11/29/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	NS	--	--	25.5		0.06	24.8		0.06	23.2		0.06
EPA Method 6010	MANGANESE	NS	--	--	3.09		0.006	3.06		0.006	3.08		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	588.99		-99	-88.51		-99	-87.39		-99	-87.49		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	-7.7±2‰	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	NS	--	--	ND	U	50	ND	U	50	ND	U	25
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	194		50	170		50	172		25
	1,2-DIBROMOETHANE	NS	--	--	26.5	J	50	26.4	J	50	29.6	J	25
	1,2-DICHLOROETHANE	NS	--	--	ND	U	50	ND	U	50	ND	U	25
	1,3,5-TRIMETHYLBENZENE	NS	--	--	68.7	J	50	58.3	J	50	63.6		25
	2-BUTANONE	NS	--	--	ND	U	500	ND	U	500	127	J	250
	2-CHLOROTOLUENE	NS	--	--	ND	U	50	ND	U	50	ND	U	25
	2-HEXANONE	NS	--	--	ND	U	250	ND	U	250	139	J	125
	4-METHYL-2-PENTANONE	NS	--	--	ND	U	250	ND	U	250	102	J	125
	ACETONE	NS	--	--	466	J-	500	451	J-	500	469	J	250
	BENZENE	NS	--	--	2950		50	2590		50	2970		25
	CARBON DISULFIDE	NS	--	--	ND	U	50	ND	U	50	ND	U	25
	CHLOROMETHANE	NS	--	--	ND	U	50	ND	U	50	ND	U	25
	CIS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	ND	U	100	ND	U	100	ND	U	50
	ETHYLBENZENE	NS	--	--	576		50	483		50	601		25
	ISOPROPYLBENZENE	NS	--	--	57.5	J	50	49.6	J	50	70.2		25
	M,P-XYLENES	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	ND	U	50	ND	U	50	ND	U	25
	METHYLENE CHLORIDE	NS	--	--	ND	U	100	ND	U	100	ND	U	50
	NAPHTHALENE	NS	--	--	73.6	J	50	77	J	50	81.9		25
	N-BUTYLBENZENE	NS	--	--	ND	U	50	ND	U	50	ND	U	25
	N-PROPYLBENZENE	NS	--	--	45.6	J	50	39.3	J	50	53.4		25
	O-XYLENE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	ND	U	50	ND	U	50	33.7	J	25
	SEC-BUTYLBENZENE	NS	--	--	ND	U	50	ND	U	50	ND	U	25
	TERT-BUTYLBENZENE	NS	--	--	ND	U	50	ND	U	50	ND	U	25
	TETRACHLOROETHENE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	NS	--	--	6210		50	5140		50	5540		25
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	NS	--	--	ND	U	50	ND	U	50	ND	U	25
	TRICHLOROFLUOROMETHANE	NS	--	--	ND	U	100	ND	U	100	ND	U	50
	VINYL CHLORIDE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	NS	--	--	1790		150	1520		150	1930		75

Refer to notes at the end of the table.

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Phase 2 Recirculation											
	Sample ID	106IN1-P2R-010218-01			106IN1-P2R-010218-02			106IN1-P2R-011018-03			106IN1-P2R-012418		
	Sample Date	1/2/2018			1/2/2018			1/10/2018			1/24/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	ND	U	1	ND	U	1	26.3		1
	BUTYRIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	NS	--	--	140		20	144	J	10	154	J	1
	PROPIONIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	IODIDE	18		0.75	18		0.75	18		0.75	26		1.5
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	9.74		1
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Phase 2 Recirculation											
	Sample ID	106IN1-P2R-010218-01			106IN1-P2R-010218-02			106IN1-P2R-011018-03			106IN1-P2R-012418		
	Sample Date	1/2/2018			1/2/2018			1/10/2018			1/24/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	MANGANESE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ACETONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Phase 2 Passive											
	Sample ID	106IN1-P2P-030718			106IN1-P2P-041118			106IN1-P2P-050918			106IN1-P2P-061418		
	Sample Date	3/7/2018			4/11/2018			5/9/2018			6/14/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	6.3	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	37500		62.5	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	1380000		62.5	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	478000		62.5	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	ND	U	6.3	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	12800		62.5	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	392000		62.5	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	265000		62.5	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	82700		62.5	NS	--	--
	PMMO	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	1750000		62.5	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	6.3	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	78900		62.5	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	58000		62.5	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	157000000		62.5	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	62.5	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	6.3	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.129		0.0193	ND	U	0.0194	ND	U	0.019	ND	U	0.0192
VFAs (mg/L) EPA Method 300m	ACETIC ACID	312		10	55.1		20	20.7		3	11.4	J	10
	BUTYRIC ACID	34.7		1	ND	U	1	ND	U	3	ND	UJ	10
	FORMIC ACID	14.7		1	ND	U	1	ND	U	3	ND	UJ	10
	LACTIC ACID	ND	U	1	ND	U	1	2.48	J	3	ND	UJ	10
	PROPIONIC ACID	170		10	121		20	89.3		10	8.7	J	10
	PYRUVIC ACID	47		1	11.2	J	20	ND	U	3	ND	UJ	10
	VALERIC ACID	9.1		1	2.9		1	ND	U	3	ND	UJ	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	UJ	10
	ETHANE	1.9	J	4	0.66	J	4	0.65	J	4	1	J	4
	ETHYLENE	5		5	2.5		5	1.73	J	5	2.5	J	5
	METHANE	8200		20	12400		20	10800		20	15300	J	20
	PROPANE	2.4	J	6	0.92	J	6	0.97	J	6	1.1	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	578		1	668		1	787		1	762	J-	1
	BROMIDE	0.55	J	1.25	0.578	J	0.625	0.77		0.25	ND	U	1.25
	CHLORIDE	45.6		3.3	61.5		1.65	77.5		0.66	77.9		3.3
	IODIDE	8.6		0.75	4.5		0.75	3.3		0.75	3.9		0.75
	NITRATE	NS	--	--	ND	U	0.5	ND	U	0.2	ND	U	1
	NITRITE	NS	--	--	ND	U	0.5	ND	U	0.2	ND	U	1
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	NS	--	--	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	10.8		0.5	8.66		0.2	6.64		0.2	0.624		0.02
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	ND	U	10	ND	U	5	ND	U	2	ND	U	10

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Phase 2 Passive											
	Sample ID	106IN1-P2P-030718			106IN1-P2P-041118			106IN1-P2P-050918			106IN1-P2P-061418		
	Sample Date	3/7/2018			4/11/2018			5/9/2018			6/14/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	18.7		0.06	20.2	J-	0.06	26.4		0.06	25.3		0.06
EPA Method 6010	MANGANESE	6.4		0.006	5.37	J+	0.006	5.57		0.006	5.54		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	2.5	ND	U	50	ND	U	25
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	271		50	286		2.5	309		50	261		25
	1,2-DIBROMOETHANE	ND	U	50	ND	U	2.5	ND	U	50	ND	U	25
	1,2-DICHLOROETHANE	ND	U	50	2.57	J	2.5	ND	U	50	ND	U	25
	1,3,5-TRIMETHYLBENZENE	104		50	106		2.5	110		50	89.2		25
	2-BUTANONE	ND	U	500	128		25	ND	U	500	ND	U	250
	2-CHLOROTOLUENE	ND	U	50	ND	U	2.5	ND	U	50	ND	U	25
	2-HEXANONE	ND	U	250	145		12.5	ND	U	250	63.4	J	125
	4-METHYL-2-PENTANONE	147	J	250	181		12.5	157	J	250	172	J	125
	ACETONE	459	J	500	332		25	ND	U	500	132	J	250
	BENZENE	3660		50	2880		25	2990		50	3190		25
	CARBON DISULFIDE	ND	U	50	ND	U	2.5	ND	U	50	ND	U	25
	CHLOROMETHANE	ND	U	50	ND	U	2.5	ND	U	50	ND	U	25
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	5	ND	U	100	ND	U	50
	ETHYLBENZENE	1750		50	976		2.5	1270		50	999		25
	ISOPROPYLBENZENE	147		50	194		2.5	238		50	216		25
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	2.5	ND	U	50	ND	U	25
	METHYLENE CHLORIDE	ND	U	100	ND	U	5	ND	U	100	ND	U	50
	NAPHTHALENE	67.4	J	50	132		2.5	122		50	96.2		25
	N-BUTYLBENZENE	ND	U	50	ND	U	2.5	ND	U	50	14	J	25
	N-PROPYLBENZENE	122		50	132		2.5	118		50	89.1		25
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	50	107		2.5	105		50	84		25
	SEC-BUTYLBENZENE	ND	U	50	15.6		2.5	ND	U	50	15.9	J	25
	TERT-BUTYLBENZENE	ND	U	50	ND	U	2.5	ND	U	50	ND	U	25
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	8330		50	6460	J-	25	6840		50	6470		25
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	ND	U	2.5	ND	U	50	19.2	J	25
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	5	ND	U	100	ND	U	50
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2620		150	2590	J-	75	2750		150	2550		75

Refer to notes at the end of the table.

Table 11
Analytical Data Table for KAFB-106IN1

Phase Designation		Phase 3 Passive						Phase 4 Passive					
Sample ID		106IN1-P3P-100418[d]			106IN1-P3P-111918[d]			106IN1-P4P-012119[d]			106IN1-LTM-031220		
Sample Date		10/4/2018			11/19/2018			1/21/2019			3/12/2020		
Sample Purpose		REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	1,2 DCA Reductase (DCAR)	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	ND	U	19.2	ND	U	0.6	ND	U	7.8
	cer A Reductase	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	Chloroform Reductase (CFR)	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	Dehalobacter DCM (DCM)	NS	--	--	581000		192	21500		5.6	1540		78.1
	Dehalobacter spp. (DHBt)	NS	--	--	50200		192	786		5.6	236000		78.1
	Dehalobium chlorocoercia (DECO)	NS	--	--	1710000		192	10300		5.6	71400		78.1
	Dehalococcoides (DHC)	NS	--	--	ND	U	19.2	ND	U	0.6	14.2		7.8
	Dehalogenimonas spp. (DHG)	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	Desulfitobacterium spp. (DSB)	NS	--	--	83400		192	5250		5.6	119000		78.1
	Desulfuromonas spp. (DSM)	NS	--	--	731		192	ND	U	5.6	ND	U	78.1
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	Epoxyalkane Transferase (EtnE)	NS	--	--	ND	U	192	ND	U	5.6	2590		78.1
	Ethene Monooxygenase (EtnC)	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	Methanogens (MGN)	NS	--	--	161	J	192	13900		5.6	ND	U	78.1
	PCE Reductase (PCE-1)	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	Phenol Hydroxylase (PHE)	NS	--	--	638000		192	14400		5.6	23900		78.1
	PMMO	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	Sulfate Reducing Bacteria (APS)	NS	--	--	10500000		192	18100		5.6	513000		78.1
	tceA Reductase (TCE)	NS	--	--	ND	U	19.2	ND	U	0.6	2.2	J	7.8
	Toluene Dioxygenase (TOD)	NS	--	--	337		192	54.1		5.6	ND	U	78.1
	Toluene Monooxygenase (RMO)	NS	--	--	340000		192	17200		5.6	32400		78.1
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	652000		192	16900		5.6	41700		78.1
	Total Eubacteria (EBAC)	NS	--	--	780000000		192	16100000		5.6	445000000		78.1
	trans-1,2-DCE Reductase (TDR)	NS	--	--	ND	U	192	ND	U	5.6	ND	U	78.1
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	4660		192	70.6		5.6	ND	U	78.1
	Vinyl Chloride Reductase (VCR)	NS	--	--	ND	U	19.2	ND	U	0.6	ND	U	7.8
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.38		0.0016	0.049	J	0.00029	0.032		0.0003	ND	U	0.011
VFAs (mg/L) EPA Method 300m	ACETIC ACID	484.1		10	ND	U	1	ND	U	1	1	J	10
	BUTYRIC ACID	44.2		10	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	29		10	0.4	J	1	ND	U	1	0.7	J	10
	LACTIC ACID	ND	U	1	0.9	J	1	ND	U	1	1	J	10
	PROPIONIC ACID	304.6		10	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	85.1		10	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	8.3	J	10	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	ND	U	4	ND	U	4	ND	U	4
	ETHYLENE	1.1	J	5	ND	U	5	ND	U	5	ND	U	5
	METHANE	9209.1		2	6278.9		2	8581.4		2	1586.5		2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	1000		5	2100		5	1400		5	2260		5
	BROMIDE	3.8		1	2.3	J	5	1.1		0.5	1.16		0.1
	CHLORIDE	64		1	69		5	81		0.5	79.7		0.5
	IODIDE	4		1.5	4.3		1.5	3.3	J+	1.5	3.7		0.2
	NITRATE	NS	--	--	NS	--	--	NS	--	--	0.113		0.1
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1	ND	U	0.5	ND	UJ	0.05	ND	U	0.1
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	12		0.75	9.9	J-	0.75	4.1	J-	0.75	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	3.84		0.125
	SULFATE	6.4		2	ND	U	10	ND	U	1	1.52		0.5

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Phase 3 Passive						Phase 4 Passive					
	Sample ID	106IN1-P3P-100418[d]			106IN1-P3P-111918[d]			106IN1-P4P-012119[d]			106IN1-LTM-031220		
	Sample Date	10/4/2018			11/19/2018			1/21/2019			3/12/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	0.00462	J	0.001
Dissolved Metals (mg/L)	IRON	14		0.05	7.9		0.05	8.4		0.05	7.08		0.05
EPA Method 6010	MANGANESE	9.7		0.003	8		0.003	6.3		0.003	6.17		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	50	ND	U	5	ND	U	2.5
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	ND	U	2.5
	1,2,4-TRIMETHYLBENZENE	220		50	180		100	190		10	NA	--	--
	1,2-DIBROMOETHANE	ND	U	50	ND	U	100	ND	U	10	ND	U	2.5
	1,2-DICHLOROETHANE	ND	U	50	ND	U	100	NA	--	--	ND	U	2.5
	1,3,5-TRIMETHYLBENZENE	78		25	65	J	50	63		5	33		2.5
	2-BUTANONE	200	J	500	ND	U	1000	ND	U	100	ND	U	5
	2-CHLOROTOLUENE	ND	U	25	ND	U	50	ND	U	5	ND	U	2.5
	2-HEXANONE	ND	U	250	ND	U	500	39	J	50	ND	U	5
	4-METHYL-2-PENTANONE	110	J	250	ND	U	500	110		50	ND	U	5
	ACETONE	750		500	ND	U	1000	ND	U	100	ND	U	5
	BENZENE	1800		50	860		100	750		10	630		2.5
	CARBON DISULFIDE	ND	U	100	ND	U	200	ND	U	20	ND	U	5
	CHLOROMETHANE	ND	U	50	ND	U	100	ND	U	10	ND	U	2.5
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	ND	U	2.5
	DICHLORODIFLUOROMETHANE	ND	U	50	ND	U	100	NA	--	--	ND	U	2.5
	ETHYLBENZENE	760		50	670		100	NA	--	--	260		2.5
	ISOPROPYLBENZENE	100		50	95	J	100	83		10	57		2.5
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	420		5
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	50	4.5	J	5	ND	U	2.5
	METHYLENE CHLORIDE	ND	U	250	ND	U	500	ND	U	50	ND	U	5
	NAPHTHALENE	ND	U	250	ND	U	500	86		50	44		2.5
	N-BUTYLBENZENE	ND	U	50	ND	U	100	9.1	J	10	ND	U	2.5
	N-PROPYLBENZENE	78		50	70	J	100	61		10	38		2.5
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	230		2.5
	P-ISOPROPYLTOLUENE	51		50	ND	U	100	43		10	ND	U	2.5
	SEC-BUTYLBENZENE	ND	U	50	ND	U	100	8.8	J	10	ND	U	2.5
	TERT-BUTYLBENZENE	ND	U	50	ND	U	100	ND	U	10	ND	U	2.5
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	ND	U	2.5
	TOLUENE	4900		50	3300		100	1400		25	29		2.5
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	ND	U	2.5
	TRICHLOROETHENE	ND	U	50	ND	U	100	ND	U	10	ND	U	2.5
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	100	ND	U	10	ND	U	2.5
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	ND	U	2.5
	XYLENES	2100		25	1800		50	1400		5	650		2.5

Refer to notes at the end of the table.

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Phase 4 Passive											
	Sample ID	106IN1-LTM-051920			106IN1-LTM-080420			106IN1-LTM-080420-FD			106IN1-LTM-102820		
	Sample Date	5/19/2020			8/4/2020			8/4/2020			10/28/2020		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	1,2 DCA Reductase (DCAR)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	7.4	ND	U	6.9	NS	--	--	9.3		9.3
	cer A Reductase	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Chloroform Reductase (CFR)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Dehalobacter DCM (DCM)	2560		73.5	ND	U	69.4	NS	--	--	3220		92.6
	Dehalobacter spp. (DHBt)	19200		73.5	ND	U	69.4	NS	--	--	13100		92.6
	Dehalobium chlorocoercia (DECO)	38700		73.5	47500		69.4	NS	--	--	69200		92.6
	Dehalococcoides (DHC)	224		7.4	ND	U	6.9	NS	--	--	15.3		9.3
	Dehalogenimonas spp. (DHG)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Desulfitobacterium spp. (DSB)	241000		73.5	56800		69.4	NS	--	--	11400		92.6
	Desulfuromonas spp. (DSM)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Dichloromethane Dehalogenase (DCMA)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Epoxyalkane Transferase (EtnE)	1180		73.5	ND	U	69.4	NS	--	--	1510		92.6
	Ethene Monooxygenase (EtnC)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Methanogens (MGN)	13400		73.5	459000		69.4	NS	--	--	92.6		92.6
	PCE Reductase (PCE-1)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Phenol Hydroxylase (PHE)	33100		73.5	19900		69.4	NS	--	--	18700		92.6
	PMMO	NA	--	--	NA	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Sulfate Reducing Bacteria (APS)	903000		73.5	574000		69.4	NS	--	--	1420000		92.6
	tceA Reductase (TCE)	10.8		7.4	ND	U	6.9	NS	--	--	9.3		9.3
	Toluene Dioxygenase (TOD)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Toluene Monooxygenase (RMO)	27400		73.5	16400		69.4	NS	--	--	21300		92.6
	Toluene Monooxygenase 2 (RDEG)	38700		73.5	26300		69.4	NS	--	--	59900		92.6
	Total Eubacteria (EBAC)	612000000		73.5	231000000		69.4	NS	--	--	547000000		92.6
	trans-1,2-DCE Reductase (TDR)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	73.5	ND	U	69.4	NS	--	--	92.6		92.6
	Vinyl Chloride Reductase (VCR)	ND	U	7.4	ND	U	6.9	NS	--	--	9.3		9.3
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	U	0.01	ND	U	0.011	ND	U	0.01	ND	U	0.011
VFAs (mg/L) EPA Method 300m	ACETIC ACID	ND	U	10	ND	U	10	ND	U	10	6.1		10
	BUTYRIC ACID	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	FORMIC ACID	ND	U	10	4.1	J	10	4.6	J	10	4.2	J	10
	LACTIC ACID	ND	U	10	ND	U	10	ND	U	10	0.7	J	10
	PROPIONIC ACID	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	PYRUVIC ACID	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	VALERIC ACID	ND	U	10	ND	U	10	ND	U	10	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	ND	U	4	ND	U	4	ND	U	4
	ETHYLENE	ND	U	5	ND	U	5	ND	U	5	ND	U	5
	METHANE	4339.3		2	4693.6		2	3841.8		2	7519.3		2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	2270		5	2340		5	2290		5	2150		5
	BROMIDE	0.96		0.1	1.24		0.1	1.31		0.1	0.982		0.1
	CHLORIDE	75.8		0.5	75.6		0.5	76.9		0.5	67.3		0.5
	IODIDE	3.3		0.2	4.3		2	5.1		2	2.6		
	NITRATE	0.0667	J	0.1	0.0479	J	0.1	0.0565	J	0.1	0.052	J-	0.1
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1	ND	U	0.1	ND	U	0.1	ND	UJ	0.1
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	7.45		0.25	7.39		0.25	7.43		0.25	3.68	J-	0.25
	SULFATE	1.02		0.5	1.35		0.5	1.48		0.5	2.3		0.5

Table 11
Analytical Data Table for KAFB-106IN1

	Phase Designation	Phase 4 Passive											
	Sample ID	106IN1-LTM-051920			106IN1-LTM-080420			106IN1-LTM-080420-FD			106IN1-LTM-102820		
	Sample Date	5/19/2020			8/4/2020			8/4/2020			10/28/2020		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	0.00438	J	0.001	0.00446	J	0.001	0.0052		0.001	0.00587		0.001
Dissolved Metals (mg/L)	IRON	5.58		0.05	5.45		0.05	4.6		0.05	1.09		0.05
EPA Method 6010	MANGANESE	6.2		0.125	6.3		0.125	5.51		0.125	5.61		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	5	ND	U	5	ND	U	5	ND	U	1
EPA Method 8260	1,2,4-TRICHLOROBENZENE	ND	U	5	ND	U	5	ND	U	5	ND	U	1
	1,2,4-TRIMETHYLBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	0.5
	1,2-DICHLOROETHANE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	0.5
	1,3,5-TRIMETHYLBENZENE	32		5	35		5	37		5	52	J+	0.5
	2-BUTANONE	ND	U	5	ND	U	5	ND	U	5	3.5	J+	1
	2-CHLOROTOLUENE	ND	U	5	ND	U	5	ND	U	5	ND	U	1
	2-HEXANONE	ND	U	10	ND	U	10	ND	U	10	ND	U	2
	4-METHYL-2-PENTANONE	ND	U	10	ND	U	10	ND	U	10	ND	U	2
	ACETONE	ND	U	5	38		5	41		5	24	J+	1
	BENZENE	590		2.5	760		2.5	780		2.5	1000		12
	CARBON DISULFIDE	ND	U	5	ND	U	5	ND	U	5	ND	U	2
	CHLOROMETHANE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	0.5
	CIS-1,2-DICHLOROETHENE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	0.5
	DICHLORODIFLUOROMETHANE	ND	U	5	ND	U	5	ND	U	5	ND	U	0.5
	ETHYLBENZENE	250		5	290		5	300		5	370		25
	ISOPROPYLBENZENE	58		5	69		5	73		5	110	J+	0.5
	M,P-XYLENES	400		5	460		5	470		5	630		25
	METHYL TERT-BUTYL ETHER	ND	U	2.5	ND	U	2.5	ND	U	2.5	1.5	J+	0.5
	METHYLENE CHLORIDE	ND	U	5	ND	U	5	ND	U	5	ND	U	1
	NAPHTHALENE	68		5	57		5	57		5	68	J+	0.5
	N-BUTYLBENZENE	5.6		5	5.4		5	5.9		5	ND	U	1
	N-PROPYLBENZENE	38		5	44		5	47		5	72	J+	1
	O-XYLENE	220		5	240		5	250		5	310		12
	P-ISOPROPYLTOLUENE	35		5	33		5	36		5	56	J+	1
	SEC-BUTYLBENZENE	6		5	6.5		5	7		5	12	J+	1
	TERT-BUTYLBENZENE	ND	U	5	ND	U	5	ND	U	5	ND	U	0.5
	TETRACHLOROETHENE	ND	U	5	ND	U	5	ND	U	5	ND	U	1
	TOLUENE	11		2.5	6.1		2.5	6.3		2.5	5.2	J+	0.5
	TRANS-1,2-DICHLOROETHENE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	0.5
	TRICHLOROETHENE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	0.5
	TRICHLOROFLUOROMETHANE	ND	U	5	ND	U	5	ND	U	5	ND	U	0.5
	VINYL CHLORIDE	ND	U	2.5	ND	U	2.5	ND	U	2.5	ND	U	0.5
	XYLENES	610		5	710		5	730		5	930		25

Refer to notes at the end of the table.

Table 11
Analytical Data Table for KAFB-106IN1

Notes:

Sampling frequency for each analytical method is outlined in Table 4.

a. EPA analytical methods listed are for the most recent sampling event.

b. Samples were collected using Geotech Bladder Pumps.

c. Samples were recollected (except for QuantArray-Chlor analysis) using replacement QED Bladder Pumps.

d. Sample was collected from sound tube using a stainless steel bailer.

-- = Not applicable.

δ2H - Delta Deuterium.

0/00 - Per mil.

cells/mL = Cells per milliliter.

EPA = Environmental Protection Agency.

FD = Field duplicate.

ID = Identification.

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base.

LOQ = Limit of Quantitation

µg/L = Microgram per liter.

mg/L = Milligram per liter.

NA = Not analyzed.

ND = Not detected.

NS = Not sampled.

REG = Regular/parent sample.

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

UJ = Analyte was not detected. The reported value is estimated.

VAL QUAL = Validation qualifier.

VFA - Volatile fatty acid.

VOC = Volatile organic compound.

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106MW1I-BL-071817			106MW1I-BL-091817			106MW1I-P1R-100417			106MW1I-P1R-100617		
	Sample Date	7/18/2017			9/18/2017			10/4/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community	1,1 DCA Reductase (DCA)	ND	U	4.8	NS	--	--	NS	--	--	NS	--	--
(cells/mL)	1,2 DCA Reductase (DCAR)	ND	U	4.8	NS	--	--	NS	--	--	NS	--	--
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	4.8	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	4.8	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	5170		4.8	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	5830		4.8	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	4.8	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	2980		4.8	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	9.8		4.8	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.8	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	ND	U	4.8	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	4.8	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	115		4.8	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	2870		4.8	NS	--	--	NS	--	--	NS	--	--
	PMMO	14.9		4.8	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	930		4.8	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	2470		4.8	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	482		4.8	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	0.7	J	4.8	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	6730		4.8	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	862000		4.8	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	2740		4.8	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	UJ	0.0191	ND	UJ	0.0191	NS	--	--	NS	--	--
VFAs (mg/L)	ACETIC ACID	ND	U	1	1.22		1	NS	--	--	NS	--	--
EPA Method 300m	BUTYRIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	FORMIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	LACTIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	PROPIONIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	PYRUVIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	VALERIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	NS	--	--	NS	--	--
RSKSOP-175	ETHANE	ND	U	4	ND	U	4	NS	--	--	NS	--	--
	ETHYLENE	ND	U	5	ND	U	5	NS	--	--	NS	--	--
	METHANE	ND	U	2	ND	U	2	NS	--	--	NS	--	--
	PROPANE	ND	U	6	ND	U	6	NS	--	--	NS	--	--
General Chemistry (mg/L)	ALKALINITY	146		1	182		1	NS	--	--	NS	--	--
SM2320b, EPA Method 300,	BROMIDE	0.424		0.125	0.409		0.125	NS	--	--	NS	--	--
EPA Method 353.2, SM4500	CHLORIDE	37.5		0.33	40.1		0.33	NS	--	--	NS	--	--
Pec	IODIDE	ND	U	0.2	ND	U	0.75	NS	--	--	NS	--	--
	NITRATE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	NITRITE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	0.0142		0.02	ND	U	0.02	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	SULFATE	27.6		1	23.8		1	NS	--	--	NS	--	--

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106MW1I-BL-071817			106MW1I-BL-091817			106MW1I-P1R-100417			106MW1I-P1R-100617		
	Sample Date	7/18/2017			9/18/2017			10/4/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	ND	U	0.06	ND	UJ	0.06	NS	--	--	NS	--	--
	MANGANESE	0.0363		0.006	0.0293	J-	0.006	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-97.11		-99	-94.92		-99	-95.52		-99	-96.51		-99
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	1.22	J	1	1.12	J	1	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	1.15	J	1	ND	U	1	NS	--	--	NS	--	--
	2-BUTANONE	ND	U	10	ND	U	10	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	2-HEXANONE	ND	U	5	ND	U	5	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	ND	U	5	ND	U	5	NS	--	--	NS	--	--
	ACETONE	35.5		10	22.5		10	NS	--	--	NS	--	--
	BENZENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	CARBON DISULFIDE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	CHLOROMETHANE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	ND	U	2	ND	U	2	NS	--	--	NS	--	--
	ETHYLBENZENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	12.9		1	1.91	J	1	NS	--	--	NS	--	--
	M,P-XYLENES	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	0.655	J	1	ND	U	1	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	ND	U	2	ND	U	2	NS	--	--	NS	--	--
	NAPHTHALENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	N-BUTYLBENZENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	N-PROPYLBENZENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	O-XYLENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	2.02		1	ND	U	1	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TOLUENE	0.642	J	1	0.612	J	1	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	ND	U	2	ND	U	2	NS	--	--	NS	--	--
	VINYL CHLORIDE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	XYLENES	ND	U	3	ND	U	3	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106MW1I-P1R-100917			106MW1I-P1R-100917-FD			106MW1I-P1R-101217			106MW1I-P1R-101617		
	Sample Date	10/9/2017			10/9/2017			10/12/2017			10/16/2017		
	Sample Purpose	REG			FD			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BUTYRIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	FORMIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	LACTIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPIONIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PYRUVIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VALERIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	IODIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 1 Recirculation											
	Sample ID	**106MW1I-P1R-100917**			**106MW1I-P1R-100917-FD**			**106MW1I-P1R-101217**			**106MW1I-P1R-101617**		
	Sample Date	**10/9/2017**			**10/9/2017**			**10/12/2017**			**10/16/2017**		
	Sample Purpose	**REG**			**FD**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	MANGANESE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-96.02		-99	-96.54		-99	-95.6		-99	-95.5		-99
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ACETONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 1 Recirculation									Phase 1 Passive		
	Sample ID	106MW1I-P1R-102017			106MW1I-P1R-102517			106MW1I-P1R-110117			106MW1I-P1P-111517		
	Sample Date	10/20/2017			10/25/2017			11/1/2017			11/15/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	6.28		1.88	NS	--	--	19.7		3.79
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	ND	U	1	NS	--	--	1.62		1
	BUTYRIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	FORMIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	LACTIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	PROPIONIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	PYRUVIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	VALERIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	26.642		0.01	50.107		0.01	16.293		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	ND	U	10	NS	--	--	ND	U	10
	ETHANE	NS	--	--	ND	U	4	NS	--	--	ND	U	4
	ETHYLENE	NS	--	--	ND	U	5	NS	--	--	ND	U	5
	METHANE	NS	--	--	ND	U	2	NS	--	--	ND	U	2
	PROPANE	NS	--	--	ND	U	6	NS	--	--	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	NS	--	--	284		1	NS	--	--	188		1
	BROMIDE	NS	--	--	0.309		0.125	NS	--	--	0.591		0.125
	CHLORIDE	NS	--	--	27.8		0.33	NS	--	--	45.9		0.33
	IODIDE	NS	--	--	ND	U	0.75	NS	--	--	ND	U	0.75
	NITRATE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	NITRITE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	ND	U	0.375	NS	--	--	0.371	J	0.375
	O-PHOSPHATE (AS P)	NS	--	--	ND	U	0.02	NS	--	--	0.0116	J	0.02
	ORTHOPHOSPHATE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	PHOSPHORUS	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	SULFATE	NS	--	--	24.4		1	NS	--	--	17.1		1

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	**Phase 1 Recirculation**									**Phase 1 Passive**		
	Sample ID	**106MW1I-P1R-102017**			**106MW1I-P1R-102517**			**106MW1I-P1R-110117**			**106MW1I-P1P-111517**		
	Sample Date	**10/20/2017**			**10/25/2017**			**11/1/2017**			**11/15/2017**		
	Sample Purpose	**REG**			**REG**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	ND	U	0.06	NS	--	--	1.11		0.06
	MANGANESE	NS	--	--	0.26		0.006	NS	--	--	0.318		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-95.32		-99	-73.33		-99	-62.43		-99	-84.99		-99
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	ND	U	2.5	NS	--	--	ND	U	2.5
	1,2,4-TRICHLOROBENZENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	50.7		2.5	NS	--	--	31.3		2.5
	1,2-DIBROMOETHANE	NS	--	--	8.58		2.5	NS	--	--	27.4		2.5
	1,2-DICHLOROETHANE	NS	--	--	1.46	J	2.5	NS	--	--	1.98	J	2.5
	1,3,5-TRIMETHYLBENZENE	NS	--	--	18.4		2.5	NS	--	--	19		2.5
	2-BUTANONE	NS	--	--	28.3	J	25	NS	--	--	ND	U	25
	2-CHLOROTOLUENE	NS	--	--	ND	U	2.5	NS	--	--	ND	U	2.5
	2-HEXANONE	NS	--	--	27.9		12.5	NS	--	--	ND	U	12.5
	4-METHYL-2-PENTANONE	NS	--	--	24.8	J	12.5	NS	--	--	7.24	J	12.5
	ACETONE	NS	--	--	147		25	NS	--	--	43.3	J	25
	BENZENE	NS	--	--	371		2.5	NS	--	--	361		2.5
	CARBON DISULFIDE	NS	--	--	ND	U	2.5	NS	--	--	ND	U	2.5
	CHLOROMETHANE	NS	--	--	ND	U	2.5	NS	--	--	ND	U	2.5
	CIS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	ND	U	5	NS	--	--	ND	U	5
	ETHYLBENZENE	NS	--	--	97		2.5	NS	--	--	24.6		2.5
	ISOPROPYLBENZENE	NS	--	--	15.3		2.5	NS	--	--	8.93		2.5
	M,P-XYLENES	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	ND	U	2.5	NS	--	--	ND	U	2.5
	METHYLENE CHLORIDE	NS	--	--	ND	U	5	NS	--	--	ND	U	5
	NAPHTHALENE	NS	--	--	13.7		2.5	NS	--	--	10.4		2.5
	N-BUTYLBENZENE	NS	--	--	1.51	J	2.5	NS	--	--	1.52	J	2.5
	N-PROPYLBENZENE	NS	--	--	8.96		2.5	NS	--	--	1.72	J	2.5
	O-XYLENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	2.14	J	2.5	NS	--	--	2.53	J	2.5
	SEC-BUTYLBENZENE	NS	--	--	1.78	J	2.5	NS	--	--	ND	U	2.5
	TERT-BUTYLBENZENE	NS	--	--	ND	U	2.5	NS	--	--	ND	U	2.5
	TETRACHLOROETHENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	TOLUENE	NS	--	--	230		2.5	NS	--	--	117		2.5
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	TRICHLOROETHENE	NS	--	--	ND	U	2.5	NS	--	--	ND	U	2.5
	TRICHLOROFLUOROMETHANE	NS	--	--	ND	U	5	NS	--	--	ND	U	5
	VINYL CHLORIDE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	XYLENES	NS	--	--	271		7.5	NS	--	--	266		7.5

Refer to notes at the end of the table.

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation								
	Sample ID	106MW1I-P1P-112817			106MW1I-P2R-010918			106MW1I-P2R-011618			106MW1I-P2R-012418		
	Sample Date	11/28/2017			1/9/2018			1/16/2018			1/24/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	5.2	NS	--	--	NS	--	--	ND	U	4.9
	1,2 DCA Reductase (DCAR)	ND	U	5.2	NS	--	--	NS	--	--	ND	U	4.9
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.5
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	ND	U	4.9
	Chloroform Reductase (CFR)	ND	U	5.2	NS	--	--	NS	--	--	ND	U	4.9
	Dehalobacter DCM (DCM)	ND	U	5.2	NS	--	--	NS	--	--	ND	U	4.9
	Dehalobacter spp. (DHBt)	1280		5.2	NS	--	--	NS	--	--	219000		4.9
	Dehalobium chlorocoercia (DECO)	ND	U	5.2	NS	--	--	NS	--	--	6200		4.9
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.5
	Dehalogenimonas spp. (DHG)	ND	U	5.2	NS	--	--	NS	--	--	ND	U	4.9
	Desulfitobacterium spp. (DSB)	3190		5.2	NS	--	--	NS	--	--	107000		4.9
	Desulfuromonas spp. (DSM)	73.5		5.2	NS	--	--	NS	--	--	69.2		4.9
	Dichloromethane Dehalogenase (DCMA)	ND	U	5.2	NS	--	--	NS	--	--	ND	U	4.9
	Epoxyalkane Transferase (EtnE)	ND	U	5.2	NS	--	--	NS	--	--	160		4.9
	Ethene Monooxygenase (EtnC)	ND	U	5.2	NS	--	--	NS	--	--	ND	U	4.9
	Methanogens (MGN)	0.3	J	5.2	NS	--	--	NS	--	--	4.4	J	4.9
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	ND	U	4.9
	Phenol Hydroxylase (PHE)	1740		5.2	NS	--	--	NS	--	--	55300		4.9
	PMMO	ND	U	5.2	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	5.2	NS	--	--	NS	--	--	1170		4.9
	Sulfate Reducing Bacteria (APS)	19600		5.2	NS	--	--	NS	--	--	80200		4.9
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.5
	Toluene Dioxygenase (TOD)	2290		5.2	NS	--	--	NS	--	--	8450		4.9
	Toluene Monooxygenase (RMO)	2400		5.2	NS	--	--	NS	--	--	127000		4.9
	Toluene Monooxygenase 2 (RDEG)	590		5.2	NS	--	--	NS	--	--	35900		4.9
	Total Eubacteria (EBAC)	284000		5.2	NS	--	--	NS	--	--	3820000		4.9
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	ND	U	4.9
	Trichlorobenzene Dioxygenase (TCBO)	427		5.2	NS	--	--	NS	--	--	531		4.9
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.302		0.0189	43.4		1.91	49.6		1.89	44.2		1.89
VFAs (mg/L) EPA Method 300m	ACETIC ACID	1.31		1	0.39	J	1	ND	U	1	0.98	J	1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	ND	U	1	1.59		1	0.69	J	1	0.97	J	1
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	1	0.67	J	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	0.064		0.01	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	ND	U	4	ND	U	4	0.75	J	4
	ETHYLENE	ND	U	5	2.1	J	5	2.9	J	5	3.55	J	5
	METHANE	ND	U	2	1.14	J	2	ND	U	2	1.31	J	2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	164		1	325		1	358		1	366		1
	BROMIDE	0.779		0.125	0.547		0.25	0.636		0.25	0.529	J-	0.25
	CHLORIDE	50.1		0.33	47.5		0.66	54.2		0.66	48.5		0.66
	IODIDE	ND	U	0.75	ND	U	0.75	ND	U	0.75	0.56	J	0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	ND	U	0.02	ND	U	0.02	ND	U	0.02	ND	U	0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	11.7		1	7.22		2	4.61	J	2	1.73	J	2

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation								
	Sample ID	106MW1I-P1P-112817			106MW1I-P2R-010918			106MW1I-P2R-011618			106MW1I-P2R-012418		
	Sample Date	11/28/2017			1/9/2018			1/16/2018			1/24/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	ND	U	0.06	1.39		0.06	5.68		0.06	6.41	J-	0.06
	MANGANESE	0.0213		0.006	3.29		0.006	0.968		0.006	1.09	J-	0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-95.69		-99	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	1	ND	U	12.5	ND	U	25	ND	U	25
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	0.631	J	1	131		12.5	140		25	195		25
	1,2-DIBROMOETHANE	ND	U	1	32.5		12.5	34	J	25	30.7	J	25
	1,2-DICHLOROETHANE	3.43		1	ND	U	12.5	ND	U	25	ND	U	25
	1,3,5-TRIMETHYLBENZENE	1.31	J	1	81.8		12.5	79.1		25	98.1		25
	2-BUTANONE	ND	U	10	ND	U	125	ND	U	250	ND	U	250
	2-CHLOROTOLUENE	ND	U	1	ND	U	12.5	ND	U	25	ND	U	25
	2-HEXANONE	ND	U	5	ND	U	62.5	ND	U	125	ND	U	125
	4-METHYL-2-PENTANONE	ND	U	5	33.8	J	62.5	ND	U	125	ND	U	125
	ACETONE	13.7	J	10	157	J	125	195	J	250	193	J	250
	BENZENE	0.635	J	1	1200		12.5	1380		25	1570		25
	CARBON DISULFIDE	ND	U	1	ND	U	12.5	ND	U	25	ND	U	25
	CHLOROMETHANE	ND	U	1	ND	U	12.5	ND	U	25	ND	U	25
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	2	ND	U	25	ND	U	50	ND	U	50
	ETHYLBENZENE	ND	U	1	449		12.5	537		25	614		25
	ISOPROPYLBENZENE	2.07		1	36.6		12.5	41.4	J	25	51		25
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	1.82	J	1	ND	U	12.5	ND	U	25	ND	U	25
	METHYLENE CHLORIDE	ND	U	2	ND	U	25	ND	U	50	ND	U	50
	NAPHTHALENE	ND	U	1	43.8		12.5	40.1	J	25	55.6		25
	N-BUTYLBENZENE	ND	U	1	8.08	J	12.5	ND	U	25	ND	U	25
	N-PROPYLBENZENE	ND	U	1	35.5		12.5	34.2	J	25	44.3	J	25
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	1	25	J	12.5	25.5	J	25	ND	U	25
	SEC-BUTYLBENZENE	ND	U	1	6.56	J	12.5	ND	U	25	ND	U	25
	TERT-BUTYLBENZENE	ND	U	1	ND	U	12.5	ND	U	25	ND	U	25
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	0.918	J	1	2530		12.5	3930		25	5000		25
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	1	ND	U	12.5	ND	U	25	ND	U	25
	TRICHLOROFLUOROMETHANE	ND	U	2	ND	U	25	ND	U	50	ND	U	50
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	4.89	J	3	1190		37.5	1510		75	1770		75

Refer to notes at the end of the table.

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 2 Recirculation			Phase 2 Passive								
	Sample ID	106MW1I-P2R-012418-FD			106MW1I-P2P-030618			106MW1I-P2P-041018			106MW1I-P2P-050818		
	Sample Date	1/24/2018			3/6/2018			4/10/2018			5/8/2018		
	Sample Purpose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
(cells/mL)	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	1620		4.8
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	103000		4.8
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	11700		4.8
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	35300		4.8
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	9.4		4.8
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	13.6		4.8
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	15300		4.8
	PMMO	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	82200		4.8
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	19600		4.8
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	8320		4.8
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	4040000		4.8
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	385		4.8
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	32.1		1.9	22.9	J+	1.91	16.2	J	1.9	7.7		0.379
VFAs (mg/L)	ACETIC ACID	0.39	J	1	3.31		1	1.15		1	0.8	J	1
EPA Method 300m	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	0.39	J	1	1.15		1	0.79	J	1	0.79	J	1
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
RSKSOP-175	ETHANE	0.78	J	4	0.9	J	4	1.24	J	4	1	J	4
	ETHYLENE	4.05	J	5	3.01	J	5	2.6		5	1.26	J	5
	METHANE	1.35	J	2	1.4	J	2	1.58		2	1.2	J	2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	1.2	J	6
General Chemistry (mg/L)	ALKALINITY	360		1	389		1	267		1	320	J-	1
SM2320b, EPA Method 300,	BROMIDE	0.548		0.25	0.568		0.25	0.564		0.25	0.576	J-	0.25
EPA Method 353.2, SM4500	CHLORIDE	48.9		0.66	49.9		0.66	50.3		0.66	50.8		0.66
Pec	IODIDE	0.58	J	0.75	1.2		0.75	ND	U	0.75	ND	U	0.75
	NITRATE	NA	--	--	NA	--	--	ND	U	0.2	ND	U	0.2
	NITRITE	NA	--	--	NA	--	--	ND	U	0.2	ND	U	0.2
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	NA	--	--	NA	--	--
	O-PHOSPHATE (AS P)	ND	U	0.02	ND	U	0.02	0.0436		0.02	0.0167	J	0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	1.75	J	2	1.2	J	2	1.23	J	2	ND	U	2

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 2 Recirculation			Phase 2 Passive								
	Sample ID	106MW1I-P2R-012418-FD			106MW1I-P2P-030618			106MW1I-P2P-041018			106MW1I-P2P-050818		
	Sample Date	1/24/2018			3/6/2018			4/10/2018			5/8/2018		
	Sample Purpose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	6.51	J-	0.06	15.2		0.06	9.99	J-	0.06	11		0.06
EPA Method 6010	MANGANESE	1.05	J-	0.006	2.23		0.006	2.37	J+	0.006	2.65		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	25	ND	U	1	ND	U	2.5
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	200		25	85.3		25	25.3		1	11.8		2.5
	1,2-DIBROMOETHANE	31.1	J	25	16.9	J	25	9.78		1	9.48		2.5
	1,2-DICHLOROETHANE	ND	U	25	ND	U	25	2.77		1	2.36	J	2.5
	1,3,5-TRIMETHYLBENZENE	100		25	51.8		25	26.8		1	19.9		2.5
	2-BUTANONE	ND	U	250	ND	U	250	8.17	J	10	ND	U	25
	2-CHLOROTOLUENE	ND	U	25	ND	U	25	ND	U	1	ND	U	2.5
	2-HEXANONE	ND	U	125	ND	U	125	ND	U	5	ND	U	12.5
	4-METHYL-2-PENTANONE	ND	U	125	ND	U	125	5.06	J	5	ND	U	12.5
	ACETONE	196	J	250	ND	U	250	38.9		10	33.6	J	25
	BENZENE	1660		25	573		25	97.7		1	54.7		2.5
	CARBON DISULFIDE	ND	U	25	ND	U	25	ND	U	1	ND	U	2.5
	CHLOROMETHANE	ND	U	25	ND	U	25	ND	U	1	ND	U	2.5
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	50	ND	U	50	ND	U	2	ND	U	5
	ETHYLBENZENE	634		25	321		25	28.4		1	8.56		2.5
	ISOPROPYLBENZENE	49.5	J	25	33.4	J	25	31.2		1	36.3		2.5
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	25	ND	U	1	ND	U	2.5
	METHYLENE CHLORIDE	ND	U	50	ND	U	50	ND	U	2	ND	U	5
	NAPHTHALENE	50.6		25	26.3	J	25	8.31		1	3.02	J	2.5
	N-BUTYLBENZENE	ND	U	25	ND	U	25	ND	U	1	ND	U	2.5
	N-PROPYLBENZENE	46	J	25	23	J	25	2.57		1	ND	U	2.5
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	25	125		25	134		1	153		2.5
	SEC-BUTYLBENZENE	ND	U	25	ND	U	25	0.761	J	1	ND	U	2.5
	TERT-BUTYLBENZENE	ND	U	25	ND	U	25	ND	U	1	ND	U	2.5
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	5090		25	2640		25	89		1	19.6		2.5
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	25	ND	U	25	ND	U	1	ND	U	2.5
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	50	ND	U	2	ND	U	5
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	1780		75	955		75	260		3	182		7.5

Refer to notes at the end of the table.

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 2 Passive			Phase 3 Recirculation								
	Sample ID	106MW1I-P2P-061218			106MW1I-P3R-080718			106MW1I-P3R-081518			106MW1I-P3R-082118		
	Sample Date	6/12/2018			8/7/2018			8/15/2018			8/21/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	539		5
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	151000		5
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	12100		5
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	105000		5
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	18.8		5
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	183		5
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	151		5
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	2080		5
	PMMO	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	187		5
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	148000		5
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	69200		5
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	4550		5
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	13600000		5
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	4.5		0.192	NS	--	--	2.3		0.006	2.7		0.03
VFAs (mg/L) EPA Method 300m	ACETIC ACID	3		1	14.4		1	27.7		1	40.7		10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	4.5	J	10	ND	U	1	0.9	J	10
	LACTIC ACID	0.8	J	1	0.3	J	1	0.6	J	1	0.7	J	1
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	1.2	J	4	1.1	J	4	1	J	4	1.1	J	4
	ETHYLENE	2.3	J	5	2.1	J	5	3.8	J	5	3.7	J	5
	METHANE	7.4		2	18.5		2	16.6		2	13.9		2
	PROPANE	1.8	J	6	1.2	J	6	1.1	J	6	1.3	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	348		1	NA	--	--	360		5	400		5
	BROMIDE	0.619		0.25	NA	--	--	0.85		0.5	0.81		0.5
	CHLORIDE	56.8		0.66	NA	--	--	49		0.5	49		0.5
	IODIDE	0.62	J	0.75	10		0.75	12		0.75	13		0.75
	NITRATE	ND	U	0.2	NA	--	--	NA	--	--	NA	--	--
	NITRITE	ND	U	0.2	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	NA	--	--	NA	--	--	ND	U	0.05	ND		0.05
	O-PHOSPHATE (AS P)	0.0418		0.02	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	ND	U	0.15	ND		0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	2	NA	--	--	ND	U	1	1.9		1

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 2 Passive			Phase 3 Recirculation								
	Sample ID	106MW1I-P2P-061218			106MW1I-P3R-080718			106MW1I-P3R-081518			106MW1I-P3R-082118		
	Sample Date	6/12/2018			8/7/2018			8/15/2018			8/21/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	12.9		0.06	NA	--	--	7.3		0.05	6.9		0.05
	MANGANESE	3.87		0.006	NA	--	--	4.3		0.003	4.2		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	1	NA	--	--	ND	U	50	ND	U	2.5
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	41.3		1	NA	--	--	710		100	350		5
	1,2-DIBROMOETHANE	7.18		1	NA	--	--	ND	U	100	3.9	J	5
	1,2-DICHLOROETHANE	2.97		1	NA	--	--	ND	U	100	ND	U	5
	1,3,5-TRIMETHYLBENZENE	28.1		1	NA	--	--	240		50	110		2.5
	2-BUTANONE	6.42	J	10	NA	--	--	ND	U	1000	44	J	50
	2-CHLOROTOLUENE	ND	U	1	NA	--	--	ND	U	50	ND	U	2.5
	2-HEXANONE	ND	U	5	NA	--	--	ND	U	500	90		25
	4-METHYL-2-PENTANONE	4.1	J	5	NA	--	--	ND	U	500	73		25
	ACETONE	25.4		10	NA	--	--	ND	U	1000	190		50
	BENZENE	128		1	NA	--	--	3500		100	2800		50
	CARBON DISULFIDE	ND	U	1	NA	--	--	ND	U	200	ND	U	10
	CHLOROMETHANE	ND	U	1	NA	--	--	ND	U	100	ND	U	5
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	2	NA	--	--	ND	U	100	ND	U	5
	ETHYLBENZENE	91.3		1	NA	--	--	1800		100	980		5
	ISOPROPYLBENZENE	64.4		1	NA	--	--	200		100	120		5
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	0.631	J	1	NA	--	--	ND	U	50	ND	U	2.5
	METHYLENE CHLORIDE	ND	U	2	NA	--	--	ND	U	500	ND	U	25
	NAPHTHALENE	11.3		1	NA	--	--	820		500	140		25
	N-BUTYLBENZENE	ND	U	1	NA	--	--	51	J	100	14		5
	N-PROPYLBENZENE	11.3		1	NA	--	--	200		100	110		5
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	138		1	NA	--	--	160		100	41		5
	SEC-BUTYLBENZENE	2.49		1	NA	--	--	ND	U	100	14		5
	TERT-BUTYLBENZENE	ND	U	1	NA	--	--	ND	U	100	ND	U	5
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	109		1	NA	--	--	8000		100	4900		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	1	NA	--	--	ND	U	100	ND	U	5
	TRICHLOROFLUOROMETHANE	ND	U	2	NA	--	--	ND	U	100	ND	U	5
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	293		3	NA	--	--	5100		50	3100		25

Refer to notes at the end of the table.

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 3 Recirculation						Phase 3 Passive					
	Sample ID	106MW1I-P3R-082118-FD			106MW1I-P3R-082818			106MW1I-P3P-091118			106MW1I-P3P-100318		
	Sample Date	8/21/2018			8/28/2018			9/11/2018			10/3/2018		
	Sample Purpose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	2.9		0.03	0.94		0.006	1.2		0.003	0.68		0.0031
VFAs (mg/L) EPA Method 300m	ACETIC ACID	39.5		10	49.3		10	67.3		10	22.4		1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	1	J	10	1	J	10	0.9	J	10	1	J	10
	LACTIC ACID	1.1		1	0.5	J	1	0.4	J	1	0.6	J	1
	PROPIONIC ACID	ND	U	1	ND	U	1	6.8	J	10	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	1.1	J	4	1.3	J	4	1.7	J	4	1.7	J	4
	ETHYLENE	3.8	J	5	6.3		5	8.6		5	7.8		5
	METHANE	14.8		2	13.8		2	18.9		2	14		2
	PROPANE	1.2	J	6	1.4	J	6	1.6	J	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	410		5	430		5	440		5	420		5
	BROMIDE	0.8		0.5	1		0.5	0.98		0.5	2.1		0.5
	CHLORIDE	49		0.5	51		0.5	55		0.5	50		0.5
	IODIDE	13		0.75	15		0.75	12		0.75	15		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND		0.05	ND	U	0.05	ND	U	0.1	ND	U	0.05
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND		0.15	ND	U	0.15	ND	U	0.15	ND	UJ	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	2.1		1	ND	U	1	ND	U	1	ND	U	1

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 3 Recirculation						Phase 3 Passive					
	Sample ID	106MW1I-P3R-082118-FD			106MW1I-P3R-082818			106MW1I-P3P-091118			106MW1I-P3P-100318		
	Sample Date	8/21/2018			8/28/2018			9/11/2018			10/3/2018		
	Sample Purpose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	7.1		0.05	7.4		0.05	7.1		0.05	8.8		0.05
	MANGANESE	4.3		0.003	4.3		0.003	4		0.003	3.4		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	2.5	ND	U	50	ND	U	50	ND	U	50
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	360		5	450		100	440		100	410		100
	1,2-DIBROMOETHANE	3.4	J	5	ND	U	100	ND	U	100	ND	U	100
	1,2-DICHLOROETHANE	3.6	J	5	ND	U	100	ND	U	100	ND	U	100
	1,3,5-TRIMETHYLBENZENE	110		2.5	140		50	140		50	130		50
	2-BUTANONE	49	J	50	ND	U	1000	ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	ND	U	2.5	ND	U	50	ND	U	50	ND	U	50
	2-HEXANONE	82		25	ND	U	500	ND	U	500	ND	U	500
	4-METHYL-2-PENTANONE	76		25	ND	U	500	ND	U	500	ND	U	500
	ACETONE	180		50	ND	U	1000	ND	U	1000	ND	U	1000
	BENZENE	2900		50	3600		100	3100		100	3100		100
	CARBON DISULFIDE	ND	U	10	ND	U	200	ND	U	200	ND	U	200
	CHLOROMETHANE	ND	U	5	ND	U	100	ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	5	ND	U	100	ND	U	100	ND	U	100
	ETHYLBENZENE	980		5	1300		100	1500		100	1000		100
	ISOPROPYLBENZENE	120		5	150		100	150		100	180		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	2.5	ND	U	50	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	25	490	J	500	ND	U	500	ND	U	500
	NAPHTHALENE	130		25	ND	U	500	ND	U	500	ND	U	500
	N-BUTYLBENZENE	14		5	ND	U	100	ND	U	100	ND	U	100
	N-PROPYLBENZENE	110		5	130		100	140		100	120		100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	40		5	ND	U	100	ND	U	100	ND	U	100
	SEC-BUTYLBENZENE	13		5	ND	U	100	ND	U	100	ND	U	100
	TERT-BUTYLBENZENE	ND	U	5	ND	U	100	ND	U	100	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	5100		50	5900		100	7300		100	3200		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	5	ND	U	100	ND	U	100	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	5	ND	U	100	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	3300		25	4600		50	4700		50	3800		50

Refer to notes at the end of the table.

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 3 Passive			Phase 4 Passive								
	Sample ID	106MW1I-P3P-111418			106MW1I-P4P-011619			106MW1I-LTM-031220			106MW1I-LTM-051920		
	Sample Date	11/14/2018			1/16/2019			3/12/2020			5/19/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	4.9	ND	U	4.9	ND	U	4.8	ND	U	5
	1,2 DCA Reductase (DCAR)	ND	U	4.9	ND	U	4.9	ND	U	4.8	ND	U	5
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
	cer A Reductase	ND	U	4.9	ND	U	4.9	ND	U	4.8	ND	U	5
	Chloroform Reductase (CFR)	ND	U	4.9	ND	U	4.9	ND	U	4.8	ND	U	5
	Dehalobacter DCM (DCM)	5900		4.9	3200		4.9	ND	U	4.8	539		5
	Dehalobacter spp. (DHBt)	340000		4.9	304000		4.9	97900		4.8	394000		5
	Dehalobium chlorocoercia (DECO)	7860		4.9	12900		4.9	2160		4.8	41900		5
	Dehalococcoides (DHC)	ND	U	0.5	0.7		0.5	0.4	J	0.5	0.5		0.5
	Dehalogenimonas spp. (DHG)	6680		4.9	6090		4.9	455		4.8	6830		5
	Desulfitobacterium spp. (DSB)	93700		4.9	92900		4.9	46000		4.8	107000		5
	Desulfuromonas spp. (DSM)	ND	U	4.9	35.6		4.9	ND	U	4.8	ND	U	5
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	ND	U	4.9	ND	U	4.8	ND	U	5
	Epoxyalkane Transferase (EtnE)	75.6		4.9	294		4.9	155		4.8	ND	U	5
	Ethene Monooxygenase (EtnC)	ND	U	4.9	112		4.9	ND	U	4.8	ND	U	5
	Methanogens (MGN)	ND	U	4.9	50.8		4.9	6620		4.8	654		5
	PCE Reductase (PCE-1)	ND	U	4.9	ND	U	4.9	ND	U	4.8	ND	U	5
	Phenol Hydroxylase (PHE)	2210		4.9	5110		4.9	154		4.8	10400		5
	PMMO	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	4.9	67.2		4.9	ND	U	4.8	ND	U	5
	Sulfate Reducing Bacteria (APS)	59300		4.9	930000		4.9	145000		4.8	965000		5
	tceA Reductase (TCE)	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
	Toluene Dioxygenase (TOD)	ND	U	4.9	ND	U	4.9	75.3		4.8	ND	U	5
	Toluene Monooxygenase (RMO)	7030		4.9	14000		4.9	184		4.8	12300		5
	Toluene Monooxygenase 2 (RDEG)	2180		4.9	12700		4.9	983		4.8	6640		5
	Total Eubacteria (EBAC)	3360000		4.9	10900000		4.9	9130000		4.8	25900000		5
	trans-1,2-DCE Reductase (TDR)	ND	U	4.9	ND	U	4.9	ND	U	4.8	ND	U	5
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.9	ND	U	4.9	ND	U	4.8	ND	U	5
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	0.2	J	0.5	ND	U	0.5	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.77		0.0029	0.22	J-	0.0015	ND	U	0.011	ND	U	0.01
VFAs (mg/L) EPA Method 300m	ACETIC ACID	8.4		1	10.1		1	0.8	J	10	ND	U	10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	10
	FORMIC ACID	0.4	J	1	ND	U	1	0.8	J	10	0.5	J	10
	LACTIC ACID	1		1	0.7	J	1	0.8	J	10	ND	U	10
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	10
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	10
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	1.4	J	4	1	J	4	ND	U	4	2.3	J	4
	ETHYLENE	6.7		5	2.2	J	5	ND	U	5	ND	U	5
	METHANE	14.5		2	8.4		2	21.9		2	42.2		2
	PROPANE	1	J	6	1.4	J	6	ND	U	6	2.5	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	420		5	360		5	400		5	357		5
	BROMIDE	1.2		0.5	1.1		0.5	0.884		0.1	0.91		0.1
	CHLORIDE	48		0.5	50		0.5	56.8		0.5	68.5		0.5
	IODIDE	16	J+	0.75	13		0.75	4.6		0.2	3.2		0.2
	NITRATE	NA	--	--	NA	--	--	ND	U	0.1	ND	U	0.1
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.05	ND	UJ	0.05	ND	U	0.1	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	U	0.15	ND	U	0.15	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	ND	U	0.025	ND	U	0.025
	SULFATE	ND	U	1	ND	U	1	3.63		0.5	10.6		0.5

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 3 Passive			Phase 4 Passive								
	Sample ID	**106MW1I-P3P-111418**			**106MW1I-P4P-011619**			**106MW1I-LTM-031220**			**106MW1I-LTM-051920**		
	Sample Date	**11/14/2018**			**1/16/2019**			**3/12/2020**			**5/19/2020**		
	Sample Purpose	**REG**			**REG**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	ND	U	0.001	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	7.1		0.05	5.8		0.05	6.45		0.05	4.76		0.05
	MANGANESE	3.2		0.003	2.6		0.003	3.44		0.05	3.3		0.05
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	13	ND	U	0.5	ND	U	1
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	ND	U	0.5	ND	U	1
	1,2,4-TRIMETHYLBENZENE	380		100	290		25	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	100	ND	U	25	ND	U	0.5	ND	U	0.5
	1,2-DICHLOROETHANE	ND	U	100	NA	--	--	ND	U	0.5	ND	U	0.5
	1,3,5-TRIMETHYLBENZENE	130		50	50		13	5.6		0.5	2.7		1
	2-BUTANONE	ND	U	1000	ND	U	250	1	J	1	1.7	J	1
	2-CHLOROTOLUENE	ND	U	50	ND	U	13	ND	U	0.5	ND	U	1
	2-HEXANONE	ND	U	500	ND	U	130	ND	U	1	ND	U	2
	4-METHYL-2-PENTANONE	ND	U	500	ND	U	130	ND	U	1	ND	U	2
	ACETONE	ND	U	1000	ND	U	250	ND	U	1	7.7		1
	BENZENE	3300		100	2200		25	560		2.5	450		2.5
	CARBON DISULFIDE	ND	U	200	ND	U	50	ND	U	1	ND	U	1
	CHLOROMETHANE	ND	U	100	ND	U	25	ND	U	0.5	ND	U	0.5
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	ND	U	0.5	ND	U	0.5
	DICHLORODIFLUOROMETHANE	ND	U	100	NA	--	--	ND	U	0.5	ND	U	1
	ETHYLBENZENE	1300		100	NA	--	--	390		2.5	290		5
	ISOPROPYLBENZENE	170		100	160		25	95		0.5	59		1
	M,P-XYLENES	NA	--	--	NA	--	--	380		5	290		1
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	13	ND	U	0.5	ND	U	0.5
	METHYLENE CHLORIDE	ND	U	500	ND	U	130	ND	U	1	ND	U	1
	NAPHTHALENE	ND	U	500	94	J	130	42		0.5	33		1
	N-BUTYLBENZENE	ND	U	100	15	J	25	6.8		0.5	4.3		1
	N-PROPYLBENZENE	130		100	86		25	45		0.5	26		1
	O-XYLENE	NA	--	--	NA	--	--	200		2.5	180		1
	P-ISOPROPYLTOLUENE	ND	U	100	49		25	110		0.5	85		1
	SEC-BUTYLBENZENE	ND	U	100	20	J	25	12		0.5	7.2		1
	TERT-BUTYLBENZENE	ND	U	100	ND	U	25	ND	U	0.5	ND	U	1
	TETRACHLOROETHENE	NA	--	--	NA	--	--	ND	U	0.5	ND	U	1
	TOLUENE	2100		100	740		25	3.5		0.5	2.4		0.5
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	ND	U	0.5	ND	U	0.5
	TRICHLOROETHENE	ND	U	100	ND	U	25	ND	U	0.5	ND	U	0.5
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	25	ND	U	0.5	ND	U	1
	VINYL CHLORIDE	NA	--	--	NA	--	--	ND	U	0.5	ND	U	0.5
	XYLENES	3900		50	1600		13	580		2.5	480		1

Refer to notes at the end of the table.

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 4 Passive					
	Sample ID	106MW1I-LTM-080520			106MW1I-LTM-101320		
	Sample Date	8/5/2020			10/13/2020		
	Sample Purpose	REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	5.4	4.8		4.8
	1,2 DCA Reductase (DCAR)	ND	U	5.4	4.8		4.8
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	0.1		0.5
	cer A Reductase	ND	U	5.4	4.8		4.8
	Chloroform Reductase (CFR)	ND	U	5.4	4.8		4.8
	Dehalobacter DCM (DCM)	189		5.4	4.8		4.8
	Dehalobacter spp. (DHBt)	202000		5.4	82800		4.8
	Dehalobium chlorocoercia (DECO)	50000		5.4	10800		4.8
	Dehalococcoides (DHC)	0.7		0.5	6.9		0.5
	Dehalogenimonas spp. (DHG)	861		5.4	4.8		4.8
	Desulfitobacterium spp. (DSB)	71200		5.4	11200		4.8
	Desulfuromonas spp. (DSM)	ND	U	5.4	4.8		4.8
	Dichloromethane Dehalogenase (DCMA)	ND	U	5.4	4.8		4.8
	Epoxyalkane Transferase (EtnE)	63.4		5.4	4.8		4.8
	Ethene Monooxygenase (EtnC)	29.2		5.4	4.8		4.8
	Methanogens (MGN)	652		5.4	357		4.8
	PCE Reductase (PCE-1)	ND	U	5.4	4.8		4.8
	Phenol Hydroxylase (PHE)	1450		5.4	1750		4.8
	PMMO	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	5.4	4.8		4.8
	Sulfate Reducing Bacteria (APS)	622000		5.4	355000		4.8
	tceA Reductase (TCE)	ND	U	0.5	0.5		0.5
	Toluene Dioxygenase (TOD)	ND	U	5.4	87.5		4.8
	Toluene Monooxygenase (RMO)	5780		5.4	3080		4.8
	Toluene Monooxygenase 2 (RDEG)	3540		5.4	1660		4.8
	Total Eubacteria (EBAC)	13500000		5.4	14200000		4.8
	trans-1,2-DCE Reductase (TDR)	ND	U	5.4	4.8		4.8
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	5.4	4.8		4.8
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	0.7		0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	U	0.01	ND	U	0.011
VFAs (mg/L) EPA Method 300m	ACETIC ACID	ND	U	10	ND	U	10
	BUTYRIC ACID	ND	U	10	ND	U	10
	FORMIC ACID	1.1	J	10	1.5	J	10
	LACTIC ACID	1.1	J	10	0.6	J	10
	PROPIONIC ACID	ND	U	10	ND	U	10
	PYRUVIC ACID	ND	U	10	ND	U	10
	VALERIC ACID	ND	U	10	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10
	ETHANE	3	J	4	2.4	J	4
	ETHYLENE	ND	U	5	ND	U	5
	METHANE	80.9		2	71.5		20
	PROPANE	2.8	J	6	2.8	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	394		5	359		5
	BROMIDE	1.94		0.1	1.74		0.1
	CHLORIDE	59.8		0.5	59.1		0.5
	IODIDE	4.1		2	1.4		
	NITRATE	0.1		0.1	ND	U	0.1
	NITRITE	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--
	PHOSPHORUS	ND	U	0.025	ND	U	0.025
	SULFATE	12.9		0.5	8.35		0.5

Table 12
Analytical Data Table for KAFB-106MW1-I

	Phase Designation	Phase 4 Passive					
	Sample ID	106MW1I-LTM-080520			106MW1I-LTM-101320		
	Sample Date	8/5/2020			10/13/2020		
	Sample Purpose	REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	ND	U	0.001	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	7.23		0.05	5.37		0.05
	MANGANESE	4.28		0.125	3.59		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	1	ND	U	1
	1,2,4-TRICHLOROBENZENE	ND	U	1	ND	U	1
	1,2,4-TRIMETHYLBENZENE	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	0.5	ND	U	0.5
	1,2-DICHLOROETHANE	ND	U	0.5	ND	U	0.5
	1,3,5-TRIMETHYLBENZENE	ND	U	1	ND	U	0.5
	2-BUTANONE	ND	U	1	ND	U	1
	2-CHLOROTOLUENE	ND	U	1	ND	U	1
	2-HEXANONE	ND	U	2	ND	U	2
	4-METHYL-2-PENTANONE	ND	U	1	ND	U	2
	ACETONE	15		1	8.9		1
	BENZENE	660		5	65	J+	0.5
	CARBON DISULFIDE	ND	U	1	ND	U	2
	CHLOROMETHANE	ND	U	0.5	ND	U	0.5
	CIS-1,2-DICHLOROETHENE	ND	U	0.5	ND	U	0.5
	DICHLORODIFLUOROMETHANE	ND	U	1	ND	U	0.5
	ETHYLBENZENE	520		10	180		1
	ISOPROPYLBENZENE	94		1	70	J+	0.5
	M,P-XYLENES	400		10	17	J+	1
	METHYL TERT-BUTYL ETHER	ND	U	0.5	ND	U	0.5
	METHYLENE CHLORIDE	ND	U	1	ND	U	1
	NAPHTHALENE	58		1	18	J+	0.5
	N-BUTYLBENZENE	10		1	8	J+	1
	N-PROPYLBENZENE	57		1	23	J+	1
	O-XYLENE	240		10	11	J+	1
	P-ISOPROPYLTOLUENE	99		1	96		0.5
	SEC-BUTYLBENZENE	15		1	12	J+	0.5
	TERT-BUTYLBENZENE	ND	U	1	ND	U	1
	TETRACHLOROETHENE	ND	U	1	ND	U	0.5
	TOLUENE	ND	U	0.5	1.5	J+	0.5
	TRANS-1,2-DICHLOROETHENE	ND	U	0.5	ND	U	0.5
	TRICHLOROETHENE	ND	U	0.5	ND	U	0.5
	TRICHLOROFLUOROMETHANE	ND	U	1	ND	U	1
	VINYL CHLORIDE	ND	U	0.5	ND	U	0.5
	XYLENES	640		10	28	J+	0.5

Refer to notes at the end of the table.

Table 12
Analytical Data Table for KAFB-106MW1-I

Notes:

Sampling frequency for each analytical method is outlined in Table 4.

a. EPA analytical methods listed are for the most recent sampling event.

b. Samples were collected using Geotech Bladder Pumps.

c. Samples were recollected (except for QuantArray-Chlor analysis) using replacement QED Bladder Pumps.

-- = Not applicable.

δ2H - Delta Deuterium.

0/00 - Per mil.

cells/mL = Cells per milliliter.

EPA = Environmental Protection Agency.

FD = Field duplicate.

ID = Identification.

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base.

LOQ = Limit of Quantitation

μg/L = Microgram per liter.

mg/L = Milligram per liter.

NA = Not analyzed.

ND = Not detected.

NS = Not sampled.

REG = Regular/parent sample.

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

UJ = Analyte was not detected. The reported value is estimated.

VAL QUAL = Validation qualifier.

VFA - Volatile fatty acid.

VOC = Volatile organic compound.

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Baseline - QED Pumps[b]			Phase 1 Recirculation								
	Sample ID	106MW1S-BL-091917			106MW1S-P1R-100417			106MW1S-P1R-100617			106MW1S-P1R-100617-FD		
	Sample Date	9/19/2017			10/4/2017			10/6/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	12900		5.5	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	2150		5.5	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	122000		5.5	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	52.4		5.5	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	51600		5.5	NS	--	--	NS	--	--	NS	--	--
	PMMO	87.7		5.5	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	272		5.5	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	76800		5.5	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	1680		5.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	80500		5.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	48100		5.5	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	13300000		5.5	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	5.5	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	432	J+	9.66	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	1.29		1	NS	--	--	NS	--	--	NS	--	--
	BUTYRIC ACID	ND	U	1	NS	--	--	NS	--	--	NS	--	--
	FORMIC ACID	ND	U	1	NS	--	--	NS	--	--	NS	--	--
	LACTIC ACID	0.62	J	1	NS	--	--	NS	--	--	NS	--	--
	PROPIONIC ACID	ND	U	1	NS	--	--	NS	--	--	NS	--	--
	PYRUVIC ACID	ND	U	1	NS	--	--	NS	--	--	NS	--	--
	VALERIC ACID	ND	U	1	NS	--	--	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	NS	--	--	NS	--	--	NS	--	--
	ETHANE	2.48	J	4	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	6.35		5	NS	--	--	NS	--	--	NS	--	--
	METHANE	2		2	NS	--	--	NS	--	--	NS	--	--
	PROPANE	3.34	J	6	NS	--	--	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	386		1	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	0.329		0.125	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	32.7		0.33	NS	--	--	NS	--	--	NS	--	--
	IODIDE	ND	U	0.75	NS	--	--	NS	--	--	NS	--	--
	NITRATE	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	NS	--	--	NS	--	--	NS	--	--

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Baseline - QED Pumps[b]			Phase 1 Recirculation								
	Sample ID	106MW1S-BL-091917			106MW1S-P1R-100417			106MW1S-P1R-100617			106MW1S-P1R-100617-FD		
	Sample Date	9/19/2017			10/4/2017			10/6/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	O-PHOSPHATE (AS P)	0.0525		0.02	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	3.43		1	NS	--	--	NS	--	--	NS	--	--
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	1.02		0.06	NS	--	--	NS	--	--	NS	--	--
	MANGANESE	2.62		0.006	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-93.89		-99	-95.45		-99	-96.06		-99	-95.87		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	-19.6 ±2‰	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	469	J-	100	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	415	J-	100	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	165	J-	100	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	ND	UJ	1000	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	523	J-	500	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	ND	UJ	500	NS	--	--	NS	--	--	NS	--	--
	ACETONE	2210	J-	1000	NS	--	--	NS	--	--	NS	--	--
	BENZENE	7320	J-	100	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	ND	UJ	200	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	1460	J-	100	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	113	J	100	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	ND	UJ	200	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	141	J-	100	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	118	J-	100	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	13200	J-	100	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	ND	UJ	100	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	ND	UJ	200	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	5620	J-	300	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106MW1S-P1R-100917			106MW1S-P1R-101217			106MW1S-P1R-101617			106MW1S-P1R-102017		
	Sample Date	10/9/2017			10/12/2017			10/16/2017			10/20/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BUTYRIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	FORMIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	LACTIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPIONIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PYRUVIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VALERIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	0.151		0.01	64.884		0.01	33.977		0.01	10.78		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	IODIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106MW1S-P1R-100917			106MW1S-P1R-101217			106MW1S-P1R-101617			106MW1S-P1R-102017		
	Sample Date	10/9/2017			10/12/2017			10/16/2017			10/20/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	MANGANESE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-95.69		-99	-31.49		-99	-55.24		-99	-83.98		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ACETONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 1 Recirculation						Phase 1 Passive					
	Sample ID	106MW1S-P1R-102417			106MW1S-P1R-110117			106MW1S-P1P-111517			106MW1S-P1P-112817		
	Sample Date	10/24/2017			11/1/2017			11/15/2017			11/28/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	252000		4.8
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	11200		4.8
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	1400000		4.8
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	71.4		4.8
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	22100		4.8
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	18400		4.8
	PMMO	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	2640		4.8
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	192000		4.8
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	175000		4.8
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	61400		4.8
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	14200000		4.8
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	ND	U	4.8
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	104		9.67	NS	--	--	108		3.78	47.8		3.81
VFAs (mg/L) EPA Method 300m	ACETIC ACID	0.72	J	1	NS	--	--	3.23		1	3.77		1
	BUTYRIC ACID	ND	U	1	NS	--	--	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	NS	--	--	ND	U	1	ND	U	1
	LACTIC ACID	ND	U	1	NS	--	--	ND	U	1	ND	U	1
	PROPIONIC ACID	ND	U	1	NS	--	--	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	NS	--	--	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	NS	--	--	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	6.306		0.01	6.629		0.01	7.462		0.01	4.108		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	NS	--	--	ND	U	10	ND	U	10
	ETHANE	ND	U	4	NS	--	--	ND	U	4	ND	U	4
	ETHYLENE	3.07	J	5	NS	--	--	ND	U	5	ND	U	5
	METHANE	1.01	J	2	NS	--	--	ND	U	2	ND	U	2
	PROPANE	ND	U	6	NS	--	--	ND	U	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	337		1	NS	--	--	327		1	319		1
	BROMIDE	0.466		0.125	NS	--	--	0.571		0.125	0.631		0.25
	CHLORIDE	39.7		0.33	NS	--	--	44		0.33	45.2		0.66
	IODIDE	ND	U	0.75	NS	--	--	ND	U	0.75	ND	U	0.75
	NITRATE	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	NS	--	--	ND	U	0.375	ND	U	0.375

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 1 Recirculation						Phase 1 Passive					
	Sample ID	106MW1S-P1R-102417			106MW1S-P1R-110117			106MW1S-P1P-111517			106MW1S-P1P-112817		
	Sample Date	10/24/2017			11/1/2017			11/15/2017			11/28/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	O-PHOSPHATE (AS P)	ND	U	0.02	NS	--	--	0.0171	J	0.02	ND	U	0.02
	ORTHOPHOSPHATE	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	SULFATE	19.1		1	NS	--	--	3.35		1	0.804	J	2
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	0.497		0.06	NS	--	--	1.38		0.06	2.72		0.06
	MANGANESE	2.28		0.006	NS	--	--	2.68		0.006	2.87		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-89.2		-99	-88.68		-99	-88.7		-99	-89.43		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	-18.2 ±2‰	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	1,2,4-TRICHLOROBENZENE	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	386		50	NS	--	--	305		50	362		100
	1,2-DIBROMOETHANE	130		50	NS	--	--	115		50	53.6	J	100
	1,2-DICHLOROETHANE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	1,3,5-TRIMETHYLBENZENE	129		50	NS	--	--	114		50	139	J	100
	2-BUTANONE	ND	U	500	NS	--	--	ND	U	500	ND	U	1000
	2-CHLOROTOLUENE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	2-HEXANONE	243	J	250	NS	--	--	202	J	250	ND	U	500
	4-METHYL-2-PENTANONE	166	J	250	NS	--	--	138	J	250	ND	U	500
	ACETONE	ND	U	500	NS	--	--	305	J	500	ND	U	1000
	BENZENE	3630		50	NS	--	--	4720		50	3800		100
	CARBON DISULFIDE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	CHLOROMETHANE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	NS	--	--	ND	U	100	ND	U	200
	ETHYLBENZENE	1130		50	NS	--	--	1120		50	1100		100
	ISOPROPYLBENZENE	93.2	J	50	NS	--	--	84.4	J	50	92.6	J	100
	M,P-XYLENES	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	METHYLENE CHLORIDE	ND	U	100	NS	--	--	ND	U	100	ND	U	200
	NAPHTHALENE	130		50	NS	--	--	139		50	115	J	100
	N-BUTYLBENZENE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	N-PROPYLBENZENE	92.9	J	50	NS	--	--	88.4	J	50	95.4	J	100
	O-XYLENE	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	SEC-BUTYLBENZENE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	TERT-BUTYLBENZENE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	TOLUENE	9330		50	NS	--	--	11700		50	11100		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	NS	--	--	ND	U	50	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	100	NS	--	--	ND	U	100	ND	U	200
	VINYL CHLORIDE	NA	--	--	NS	--	--	NA	--	--	NA	--	--
	XYLENES	4380		150	NS	--	--	3910		150	4060		300

Refer to notes at the end of the table.

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 2 Recirculation									Phase 2 Passive		
	Sample ID	106MW1S-P2R-010918			106MW1S-P2R-011818			106MW1S-P2R-012418			106MW1S-P2P-030618		
	Sample Date	1/9/2018			1/18/2018			1/24/2018			3/6/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
(cells/mL)	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	61700		5.3	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	12400		5.3	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	345		5.3	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	82500		5.3	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	6.1		5.3	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	0.5	J	5.3	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	34600		5.3	NS	--	--
	PMMO	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	290		5.3	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	161000		5.3	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	34400		5.3	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	20100		5.3	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	4230000		5.3	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	5.3	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	63.5		1.89	104	J	1.9	66.4		1.89	92.5	J+	9.49
VFAs (mg/L)	ACETIC ACID	60.4		1	67.5		1	91.5		1	71.6		10
EPA Method 300m	BUTYRIC ACID	ND	U	1	0.51	J	1	1.21		1	1.2		1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	1.61		1	1.35		1	1.93		1	1		1
	PROPIONIC ACID	25.5		1	19.4		1	26		1	22.1		1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN												
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
RSKSOP-175	ETHANE	1.64	J	4	1.63	J	4	2.22	J	4	3.85	J	4
	ETHYLENE	6.25		5	6.2		5	7.84		5	11.57		5
	METHANE	1.92	J	2	2.13		2	3.46		2	19.3		2
	PROPANE	1.86	J	6	2.07	J	6	2.68	J	6	5.39	J	6
General Chemistry (mg/L)	ALKALINITY	308		1	303		1	368		1	423		1
SM2320b, EPA Method 300,	BROMIDE	0.469	J	0.25	0.294		0.125	0.49	J	0.25	0.532	J	0.625
EPA Method 353.2, SM4500	CHLORIDE	49.4		0.66	21.9		0.33	45.8		0.66	48.4		1.65
PE[c]	IODIDE	8.7		0.75	9.7		0.75	11		0.75	14		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	ND	U	0.375

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 2 Recirculation									Phase 2 Passive		
	Sample ID	106MW1S-P2R-010918			106MW1S-P2R-011818			106MW1S-P2R-012418			106MW1S-P2P-030618		
	Sample Date	1/9/2018			1/18/2018			1/24/2018			3/6/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	O-PHOSPHATE (AS P)	ND	U	0.02	0.0154	J	0.02	ND	U	0.02	ND	U	0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	1.44	J	2	5.56	J+	1	0.698	J	2	ND	U	5
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	1.62		0.06	0.186		0.06	2.24	J-	0.06	5.9		0.06
	MANGANESE	3.22		0.006	0.413		0.006	3.48	J-	0.006	4.84		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	-11.7 ±2‰	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	50	ND	U	50	ND	U	100
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	441		25	305		50	416		50	419		100
	1,2-DIBROMOETHANE	78.7		25	59.7	J	50	56.5	J	50	128	J	100
	1,2-DICHLOROETHANE	ND	U	25	ND	U	50	ND	U	50	ND	U	100
	1,3,5-TRIMETHYLBENZENE	144		25	106		50	136		50	141	J	100
	2-BUTANONE	ND	U	250	ND	U	500	ND	U	500	ND	U	1000
	2-CHLOROTOLUENE	ND	U	25	ND	U	50	ND	U	50	ND	U	100
	2-HEXANONE	145	J	125	129	J	250	ND	U	250	ND	U	500
	4-METHYL-2-PENTANONE	102	J	125	ND	U	250	ND	U	250	ND	U	500
	ACETONE	326	J	250	585	J	500	292	J	500	ND	U	1000
	BENZENE	3470		25	3530		50	3490		50	8100		100
	CARBON DISULFIDE	ND	U	25	ND	U	50	ND	U	50	ND	U	100
	CHLOROMETHANE	ND	U	25	ND	U	50	ND	U	50	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	50	ND	U	100	ND	U	100	ND	U	200
	ETHYLBENZENE	1150		25	974		50	1110		50	1360		100
	ISOPROPYLBENZENE	95.7		25	85	J	50	89.5	J	50	87.6	J	100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	50	ND	U	50	ND	U	100
	METHYLENE CHLORIDE	ND	U	50	ND	U	100	ND	U	100	ND	U	200
	NAPHTHALENE	135		25	136		50	102		50	122	J	100
	N-BUTYLBENZENE	22.3	J	25	ND	U	50	ND	U	50	ND	U	100
	N-PROPYLBENZENE	109		25	97.8	J	50	103		50	109	J	100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	38.2	J	25	41.8	J	50	ND	U	50	ND	U	100
	SEC-BUTYLBENZENE	18.6	J	25	ND	U	50	ND	U	50	ND	U	100
	TERT-BUTYLBENZENE	ND	U	25	ND	U	50	ND	U	50	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	8310		25	8480		50	9110		50	16000		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	25	ND	U	50	ND	U	50	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	100	ND	U	100	ND	U	200
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	3380		75	3250		150	3710		150	4420		300

Refer to notes at the end of the table.

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 2 Passive									Phase 3 Recirculation		
	Sample ID	106MW1S-P2P-041118			106MW1S-P2P-050818			106MW1S-P2P-061418			106MW1S-P3R-080718		
	Sample Date	4/11/2018			5/8/2018			6/14/2018			8/7/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	ND	U	6.3	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	ND	U	6.3	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	ND	U	0.6	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	ND	U	6.3	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	ND	U	6.3	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	6950		6.3	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	70500		6.3	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	5300		6.3	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	ND	U	0.6	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	276		6.3	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	20700		6.3	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	50.6		6.3	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	ND	U	6.3	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	ND	U	6.3	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	ND	U	6.3	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	189		6.3	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	0.1	J	6.3	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	25000		6.3	NS	--	--	NS	--	--
	PMMO	NS	--	--	NA	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	676		6.3	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	16800		6.3	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	ND	U	0.6	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	ND	U	6.3	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	44300		6.3	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	16100		6.3	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	6470000		6.3	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	ND	U	6.3	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	304		6.3	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	ND	U	0.6	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	85.5	J	1.92	24.7		0.958	12.2		0.474	NA	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	81.3		20	90.3		20	83.3	J	10	85.5		10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	UJ	10	ND	U	1
	FORMIC ACID	2.4		1	0.2	J	1	ND	UJ	10	4.7	J	10
	LACTIC ACID	1.06		1	ND	U	1	ND	UJ	10	ND	U	1
	PROPIONIC ACID	16.3		20	12.3		1	ND	UJ	10	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	UJ	10	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	UJ	10	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN												
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	UJ	10	ND	U	10
	ETHANE	4.7		4	5.65		4	6.3	J	4	4.7		4
	ETHYLENE	18.57		5	14.46		5	13.4	J	5	12.4		5
	METHANE	25.4		2	25.37		2	24.7	J	2	17.9		2
	PROPANE	8.1		6	12.07		6	8.9	J	6	7.1		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	441		1	454		1	494	J-	1	NA	--	--
	BROMIDE	0.659		0.25	0.522	J-	0.625	0.457	J	0.625	NA	--	--
	CHLORIDE	50.8		0.66	50		1.65	50.6		1.65	NA	--	--
	IODIDE	14		0.75	16		0.75	13		0.75	15		0.75
	NITRATE	ND	U	0.2	ND	U	0.5	ND	U	0.5	NA	--	--
	NITRITE	ND	U	0.2	ND	U	0.5	ND	U	0.5	NA	--	--
	NITROGEN, NITRATE-NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 2 Passive									Phase 3 Recirculation		
	Sample ID	106MW1S-P2P-041118			106MW1S-P2P-050818			106MW1S-P2P-061418			106MW1S-P3R-080718		
	Sample Date	4/11/2018			5/8/2018			6/14/2018			8/7/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	O-PHOSPHATE (AS P)	ND	U	0.02	ND	U	0.02	ND	U	0.02	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	2	ND	U	5	ND	U	5	NA	--	--
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	5.91	J-	0.06	8.18		0.06	8.07		0.06	NA	--	--
	MANGANESE	5.35	J+	0.006	5.96		0.006	5.73		0.006	NA	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	-9.6 ±1‰	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	125	ND	U	100	ND	U	100	NA	--	--
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	426		125	470		100	404		100	NA	--	--
	1,2-DIBROMOETHANE	62.9	J	125	ND	U	100	ND	U	100	NA	--	--
	1,2-DICHLOROETHANE	ND	U	125	ND	U	100	ND	U	100	NA	--	--
	1,3,5-TRIMETHYLBENZENE	162	J	125	159	J	100	143	J	100	NA	--	--
	2-BUTANONE	ND	U	1250	ND	U	1000	ND	U	1000	NA	--	--
	2-CHLOROTOLUENE	ND	U	125	ND	U	100	ND	U	100	NA	--	--
	2-HEXANONE	ND	U	625	ND	U	500	ND	U	500	NA	--	--
	4-METHYL-2-PENTANONE	ND	U	625	ND	U	500	ND	U	500	NA	--	--
	ACETONE	ND	U	1250	ND	U	1000	ND	U	1000	NA	--	--
	BENZENE	8920		125	6100		100	4190		100	NA	--	--
	CARBON DISULFIDE	ND	U	125	ND	U	100	ND	U	100	NA	--	--
	CHLOROMETHANE	ND	U	125	ND	U	100	ND	U	100	NA	--	--
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	250	ND	U	200	ND	U	200	NA	--	--
	ETHYLBENZENE	1360		125	1560		100	1300		100	NA	--	--
	ISOPROPYLBENZENE	114	J	125	113	J	100	108	J	100	NA	--	--
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	125	ND	U	100	ND	U	100	NA	--	--
	METHYLENE CHLORIDE	ND	U	250	ND	U	200	ND	U	200	NA	--	--
	NAPHTHALENE	147	J	125	153	J	100	139	J	100	NA	--	--
	N-BUTYLBENZENE	ND	U	125	ND	U	100	ND	U	100	NA	--	--
	N-PROPYLBENZENE	116	J	125	118	J	100	101	J	100	NA	--	--
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	130	J	125	ND	U	100	ND	U	100	NA	--	--
	SEC-BUTYLBENZENE	ND	U	125	ND	U	100	ND	U	100	NA	--	--
	TERT-BUTYLBENZENE	ND	U	125	ND	U	100	ND	U	100	NA	--	--
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	14900		125	16700		100	11000		100	NA	--	--
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	125	ND	U	100	68	J	100	NA	--	--
	TRICHLOROFLUOROMETHANE	ND	U	250	ND	U	200	ND	U	200	NA	--	--
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	4260		375	5320		300	4610		300	NA	--	--

Refer to notes at the end of the table.

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 3 Recirculation									Phase 3 Passive		
	Sample ID	106MW1S-P3R-081518			106MW1S-P3R-082118			106MW1S-P3R-082818			106MW1S-P3P-091118		
	Sample Date	8/15/2018			8/21/2018			8/28/2018			9/11/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	ND	U	0.5	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	926		4.8	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	212000		4.8	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	21800		4.8	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	ND	U	0.5	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	71700		4.8	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	123		4.8	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	1160		4.8	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	17000		4.8	NS	--	--	NS	--	--
	PMMO	NS	--	--	NA	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	412		4.8	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	177000		4.8	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	ND	U	0.5	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	58600		4.8	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	11400		4.8	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	12900000		4.8	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	ND	U	4.8	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	ND	U	0.5	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	11		0.03	8.4		0.03	8.5		0.03	5.5		0.029
VFAs (mg/L) EPA Method 300m	ACETIC ACID	98.2		10	105		10	105.2		10	90.5		10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	0.8	J	10	0.8	J	10	0.9	J	10	ND	U	1
	LACTIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	PROPIONIC ACID	15.2		10	38.5		10	56.1		10	62.1		10
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN												
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	4.5		4	4.4		4	5.2		4	3.7	J	4
	ETHYLENE	11.5		5	11.2		5	14.3		5	10.9		5
	METHANE	24		2	36.2		2	170.2		2	771.1		2
	PROPANE	6.7		6	6.6		6	8.2		6	6.8		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	410		5	420		5	440		5	440		5
	BROMIDE	0.89		0.5	0.82		0.5	1		0.5	0.82		0.5
	CHLORIDE	53		0.5	53		0.5	55		0.5	52		0.5
	IODIDE	6.3		0.75	5.8		0.75	6.2		0.75	6.3		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.05	ND		0.05	ND	U	0.05	ND	U	0.1

Table 13
Analytical Data Table for KAFB-106MW1-S

Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
	Phase Designation	Phase 3 Recirculation									Phase 3 Passive		
	Sample ID	106MW1S-P3R-081518			106MW1S-P3R-082118			106MW1S-P3R-082818			106MW1S-P3P-091118		
	Sample Date	8/15/2018			8/21/2018			8/28/2018			9/11/2018		
	Sample Purpose	REG			REG			REG			REG		
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	U	0.15	ND		0.15	ND	U	0.15	ND	U	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	0.5	J	1	ND		1	ND	U	1	ND	U	1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	5		0.05	4.9		0.05	5.4		0.05	6.2		0.05
	MANGANESE	5.9		0.003	6.1		0.003	6		0.003	6.6		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	-4.1 ±1.5‰	--	--	NS	--	--	-5.6 ±1.5‰	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	50	83	J	50	ND	U	50
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	470		100	440		100	670		100	430		100
	1,2-DIBROMOETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	160		50	150		50	380		50	140		50
	2-BUTANONE	ND	U	1000	ND	U	1000	ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	ND	U	50	ND	U	50	280		50	ND	U	50
	2-HEXANONE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	4-METHYL-2-PENTANONE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	ACETONE	ND	U	1000	ND	U	1000	ND	U	1000	ND	U	1000
	BENZENE	3400		100	3400		100	3700		100	3100		100
	CARBON DISULFIDE	ND	U	200	ND	U	200	ND	U	200	ND	U	200
	CHLOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	20	ND	U	100	ND	U	100
	ETHYLBENZENE	1200		100	1100		20	1500		100	1200		100
	ISOPROPYLBENZENE	130		100	120		100	360		100	100		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	500	ND	U	500	410	J	500	ND	U	500
	NAPHTHALENE	ND	U	500	ND	U	500	360	J	500	ND	U	500
	N-BUTYLBENZENE	ND	U	100	ND	U	100	200		100	ND	U	100
	N-PROPYLBENZENE	120		100	110		100	340		100	100		100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	71	J	100	51	J	100	260		100	ND	U	100
	SEC-BUTYLBENZENE	ND	U	100	ND	U	100	220		100	ND	U	100
	TERT-BUTYLBENZENE	ND	U	100	ND	U	100	220		100	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	7800		100	8400		100	9900		100	8200		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	100	ND	U	100	120		100	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	4100		50	4100		50	4900		50	4000		50

Refer to notes at the end of the table.

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 3 Passive									Phase 4 Passive		
	Sample ID	106MW1S-P3P-100318			106MW1S-P3P-100318-FD			106MW1S-P3P-111418			106MW1S-P4P-011619		
	Sample Date	10/3/2018			10/3/2018			11/14/2018			1/16/2019		
	Sample Purpose	REG			FD			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.5	ND	U	0.5
	cer A Reductase	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	4430		5.2	983		5.1
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	341000		5.2	330000		5.1
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	3830		5.2	6510		5.1
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	ND	U	0.5	0.4	J	0.5
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	42200		5.2	74100		5.1
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	5.3		5.2	5.2		5.1
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	70.2		5.2	ND	U	5.1
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	Methanogens (MGN)	NS	--	--	NS	--	--	27100		5.2	6250		5.1
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	35600		5.2	9940		5.1
	PMMO	NS	--	--	NS	--	--	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	ND	U	5.2	318		5.1
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	16200		5.2	37300		5.1
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	0.5	ND	U	0.5
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	28700		5.2	32800		5.1
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	15500		5.2	9280		5.1
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	9780000		5.2	27900000		5.1
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	5.2	ND	U	5.1
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	0.5	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	3.2		0.015	3.9		0.03	5.2		0.029	1.1	J-	0.003
VFAs (mg/L) EPA Method 300m	ACETIC ACID	105.1		10	106.6		10	111.2		10	115.6		10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	1.6	J	10	1.5	J	10	0.9	J	1	1.9	J	10
	LACTIC ACID	ND	U	1	ND	U	1	0.9	J	1	0.9	J	1
	PROPIONIC ACID	57.7		10	60		10	24.4		10	10.1		10
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN												
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	4.9		4	4.7		4	12.2		4	15.7		4
	ETHYLENE	13.4		5	13.3		5	28.3		5	21.6		5
	METHANE	1436.2		2	1384		2	1071.6		2	3114.4		2
	PROPANE	7.2		6	7		6	11.2		6	11.6		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	460		5	470		5	470		5	470		5
	BROMIDE	2		0.5	2.1		0.5	1.3		0.5	0.89		0.5
	CHLORIDE	49		0.5	50		0.5	49		0.5	50		0.5
	IODIDE	5		0.75	5.1		0.75	4.2	J+	0.75	3.9	J+	1.5
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.05	ND	U	0.05	0.027	J	0.05	ND	UJ	0.05

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 3 Passive									Phase 4 Passive		
	Sample ID	106MW1S-P3P-100318			106MW1S-P3P-100318-FD			106MW1S-P3P-111418			106MW1S-P4P-011619		
	Sample Date	10/3/2018			10/3/2018			11/14/2018			1/16/2019		
	Sample Purpose	REG			FD			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	U	0.15	ND	U	0.15	ND	U	0.75	ND	U	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	7.3		0.05	7.5		0.05	9.2		0.05	9		0.05
	MANGANESE	7.2		0.003	7.5		0.003	8		0.003	7.7		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	430		100	420		100	420		100	440		100
	1,2-DIBROMOETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	140		50	140		50	150		50	150		50
	2-BUTANONE	ND	U	1000	ND	U	1000	ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	4-METHYL-2-PENTANONE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	ACETONE	ND	U	1000	ND	U	1000	ND	U	1000	ND	U	1000
	BENZENE	4100		100	4000		100	9800		100	8800		100
	CARBON DISULFIDE	ND	U	200	ND	U	200	ND	U	200	ND	U	200
	CHLOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	NA	--	--
	ETHYLBENZENE	1300		100	1300	--	100	1500		100	NA	--	--
	ISOPROPYLBENZENE	110		100	110		100	110		100	110		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	NAPHTHALENE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	N-BUTYLBENZENE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	N-PROPYLBENZENE	130		100	120		100	120		100	120		100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	SEC-BUTYLBENZENE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	TERT-BUTYLBENZENE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	11000		100	11000		100	18000		100	23000		200
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	4400		50	4200		50	5000		50	4600		50

Refer to notes at the end of the table.

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 4 Passive											
	Sample ID	106MW1S-LTM-031220			106MW1S-LTM-052020			106MW1S-LTM-080520			106MW1S-LTM-101320		
	Sample Date	3/12/2020			5/20/2020			8/5/2020			10/13/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	1,2 DCA Reductase (DCAR)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	ND	U	0.5	ND	U	0.5	0.5		0.5
	cer A Reductase	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	Chloroform Reductase (CFR)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	Dehalobacter DCM (DCM)	324		5.3	ND	U	5.1	ND	U	4.8	5		5
	Dehalobacter spp. (DHBt)	399000		5.3	153000		5.1	211000		4.8	31500		5
	Dehalobium chlorocoercia (DECO)	2910		5.3	3140		5.1	5680		4.8	899		5
	Dehalococcoides (DHC)	0.5	J	0.5	0.5		0.5	0.2	J	0.5	0.6		0.5
	Dehalogenimonas spp. (DHG)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	Desulfitobacterium spp. (DSB)	135000		5.3	78800		5.1	113000		4.8	23800		5
	Desulfuromonas spp. (DSM)	ND	U	5.3	ND	U	5.1	9.5		4.8	1.4		5
	Dichloromethane Dehalogenase (DCMA)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	Epoxyalkane Transferase (EtnE)	5.8		5.3	26.8		5.1	ND	U	4.8	11.2		5
	Ethene Monooxygenase (EtnC)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	Methanogens (MGN)	39600		5.3	51000		5.1	43600		4.8	16700		5
	PCE Reductase (PCE-1)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	Phenol Hydroxylase (PHE)	6780		5.3	8020		5.1	6750		4.8	1970		5
	PMMO	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	588		5.3	599		5.1	2280		4.8	137		5
	Sulfate Reducing Bacteria (APS)	27600		5.3	18700		5.1	56400		4.8	11200		5
	tceA Reductase (TCE)	ND	U	0.5	ND	U	0.5	ND	U	0.5	0.5		0.5
	Toluene Dioxygenase (TOD)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	Toluene Monooxygenase (RMO)	15400		5.3	15100		5.1	134000		4.8	20900		5
	Toluene Monooxygenase 2 (RDEG)	3470		5.3	4100		5.1	5410		4.8	1050		5
	Total Eubacteria (EBAC)	15200000		5.3	7470000		5.1	17900000		4.8	4310000		5
	trans-1,2-DCE Reductase (TDR)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	5.3	ND	U	5.1	ND	U	4.8	5		5
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	ND	U	0.5	ND	U	0.5	0.5		0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	1.2		0.053	0.21		0.01	0.15		0.011	ND	U	0.01
VFAs (mg/L) EPA Method 300m	ACETIC ACID	11.4		10	ND	U	10	ND	U	10	ND	U	10
	BUTYRIC ACID	ND	U	1	ND	U	10	ND	U	10	ND	U	10
	FORMIC ACID	0.7	J	10	0.3	J	10	0.7	J	10	1.6	J	10
	LACTIC ACID	0.8	J	10	ND	U	10	ND	U	10	0.6	J	10
	PROPIONIC ACID	ND	U	1	ND	U	10	ND	U	10	ND	U	10
	PYRUVIC ACID	ND	U	1	ND	U	10	ND	U	10	ND	U	10
	VALERIC ACID	ND	U	1	ND	U	10	ND	U	10	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN												
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	2.2	J	4	9.2		4	6.4		4	2.1		4
	ETHYLENE	1.9	J	5	13.4		5	8.5		5	2.9		5
	METHANE	2874.8		2	7863.8		2	6344.1		2	3672.3		2
	PROPANE	1.3	J	6	7.7		6	6.6		6	2.9	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	602		5	574		5	543		5	484		5
	BROMIDE	1.36		0.1	1.42		0.1	2.51		0.1	1.84		0.1
	CHLORIDE	58.2		0.5	72.6		0.5	65.8		0.5	48.6		0.5
	IODIDE	6		0.2	4.8		0.2	4.9		2	4.7		
	NITRATE	0.0687	J	0.1	0.0678	J	0.1	0.112		0.1	0.0764	J	0.1
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1	ND	U	0.1	ND	U	0.1	ND	U	0.1

Table 13
Analytical Data Table for KAFB-106MW1-S

	Phase Designation	Phase 4 Passive											
	Sample ID	106MW1S-LTM-031220			106MW1S-LTM-052020			106MW1S-LTM-080520			106MW1S-LTM-101320		
	Sample Date	3/12/2020			5/20/2020			8/5/2020			10/13/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	ND	U	0.025	ND	U	0.025	ND	U	0.025	0.012	J	0.025
	SULFATE	ND	U	0.5	0.218	J	0.5	2.2		0.5	0.469	J	0.5
Metals (mg/L) EPA Method 6010	LEAD	ND	U	0.001	ND	U	0.001	ND	U	0.001	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	8.74		0.05	9.08		0.05	11.2		0.05	8.85		0.05
	MANGANESE	7.46		0.125	7.19		0.125	6.95		0.125	5.72		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	5	ND	U	5	ND	U	10	ND	U	10
	1,2,4-TRICHLOROBENZENE	ND	UJ	5	ND	U	5	ND	U	10	ND	U	10
	1,2,4-TRIMETHYLBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	5	ND	U	2.5	ND	U	5	ND	U	5
	1,2-DICHLOROETHANE	ND	U	5	ND	U	2.5	ND	U	5	ND	U	5
	1,3,5-TRIMETHYLBENZENE	130		5	130		5	140		10	170		5
	2-BUTANONE	ND	U	10	ND	U	5	ND	U	10	ND	U	10
	2-CHLOROTOLUENE	ND	U	5	ND	U	5	ND	U	10	ND	U	10
	2-HEXANONE	ND	U	10	ND	U	10	ND	U	20	ND	U	20
	4-METHYL-2-PENTANONE	97		10	63		10	ND	U	20	ND	U	20
	ACETONE	ND	U	10	20		5	75		10	ND	U	10
	BENZENE	5300	J+	50	4500		25	4800		50	2700		50
	CARBON DISULFIDE	ND	U	10	ND	U	5	ND	U	10	ND	U	20
	CHLOROMETHANE	ND	U	5	ND	U	2.5	ND	U	5	ND	U	5
	CIS-1,2-DICHLOROETHENE	ND	U	5	ND	U	2.5	ND	U	5	ND	U	5
	DICHLORODIFLUOROMETHANE	ND	U	5	ND	U	5	ND	U	10	ND	U	10
	ETHYLBENZENE	1300		5	1300		50	1300		10	1200		10
	ISOPROPYLBENZENE	90		5	86		5	100		10	98		10
	M,P-XYLENES	2900		10	3100		50	3100		10	2900		10
	METHYL TERT-BUTYL ETHER	ND	U	5	ND	U	2.5	ND	U	5	ND	U	5
	METHYLENE CHLORIDE	ND	U	10	ND	U	5	ND	U	10	ND	U	10
	NAPHTHALENE	100		5	130		5	160		10	150		10
	N-BUTYLBENZENE	16		5	15		5	17		10	ND	U	10
	N-PROPYLBENZENE	99		5	84		5	110		10	100		5
	O-XYLENE	1300		5	1400		50	1400		10	1300		5
	P-ISOPROPYLTOLUENE	ND	U	5	ND	U	5	ND	U	10	ND	U	5
	SEC-BUTYLBENZENE	19		5	16		5	18		10	22		10
	TERT-BUTYLBENZENE	ND	U	5	ND	U	5	ND	U	10	ND	U	5
	TETRACHLOROETHENE	ND	U	5	ND	U	5	ND	U	10	ND	U	10
	TOLUENE	12000		50	5800		25	4600		50	1000		5
	TRANS-1,2-DICHLOROETHENE	ND	U	5	ND	U	2.5	ND	U	5	ND	U	5
	TRICHLOROETHENE	ND	U	5	ND	U	2.5	ND	U	5	ND	U	5
	TRICHLOROFLUOROMETHANE	ND	U	5	ND	U	5	ND	U	10	ND	U	5
	VINYL CHLORIDE	ND	U	5	ND	U	2.5	ND	U	5	ND	U	5
	XYLENES	4200		5	4500		50	4500		10	4200		5

Refer to notes at the end of the table.

Table 13
Analytical Data Table for KAFB-106MW1-S

Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ
	Phase Designation	Phase 4 Passive		
	Sample ID	106MW1S-LTM-101320-FD		
	Sample Date	10/13/2020		
	Sample Purpose	FD		
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--
	cer A Reductase	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--
	Dehalococcoides (DHC)	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--
	Methanogens (MGN)	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--
	PMMO	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--
	tceA Reductase (TCE)	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	U	0.011
VFAs (mg/L) EPA Method 300m	ACETIC ACID	10		10
	BUTYRIC ACID	ND	U	10
	FORMIC ACID	2.05	J	10
	LACTIC ACID	1.08	J	10
	PROPIONIC ACID	ND	U	10
	PYRUVIC ACID	ND	U	10
	VALERIC ACID	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN			
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10
	ETHANE	1.63157029		4
	ETHYLENE	2.192087622		5
	METHANE	2800.23343		2
	PROPANE	2.375250736		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 PE[c]	ALKALINITY	482		5
	BROMIDE	1.89		0.1
	CHLORIDE	50.4		0.5
	IODIDE	5		
	NITRATE	0.531		0.1
	NITRITE	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1

Table 13
Analytical Data Table for KAFB-106MW1-S

Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ
	Phase Designation	Phase 4 Passive		
	Sample ID	106MW1S-LTM-101320-FD		
	Sample Date	10/13/2020		
	Sample Purpose	FD		
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	O-PHOSPHATE (AS P)	NA	--	--
	ORTHOPHOSPHATE	NA	--	--
	PHOSPHORUS	ND	U	0.025
	SULFATE	0.232	J	0.5
Metals (mg/L) EPA Method 6010	LEAD	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	8		0.05
	MANGANESE	4.92		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	5
	1,2,4-TRICHLOROBENZENE	ND	U	10
	1,2,4-TRIMETHYLBENZENE	NA	--	--
	1,2-DIBROMOETHANE	ND	U	5
	1,2-DICHLOROETHANE	ND	U	5
	1,3,5-TRIMETHYLBENZENE	170		10
	2-BUTANONE	ND	U	10
	2-CHLOROTOLUENE	ND	U	10
	2-HEXANONE	ND	U	20
	4-METHYL-2-PENTANONE	ND	U	20
	ACETONE	ND	U	10
	BENZENE	3100		50
	CARBON DISULFIDE	ND	U	20
	CHLOROMETHANE	ND	U	5
	CIS-1,2-DICHLOROETHENE	ND	U	5
	DICHLORODIFLUOROMETHANE	ND	U	5
	ETHYLBENZENE	1200		10
	ISOPROPYLBENZENE	100		5
	M,P-XYLENES	2900		10
	METHYL TERT-BUTYL ETHER	ND	U	5
	METHYLENE CHLORIDE	ND	U	10
	NAPHTHALENE	170		5
	N-BUTYLBENZENE	39		10
	N-PROPYLBENZENE	100		10
	O-XYLENE	1300		5
	P-ISOPROPYLTOLUENE	ND	U	10
	SEC-BUTYLBENZENE	22		5
	TERT-BUTYLBENZENE	ND	U	5
	TETRACHLOROETHENE	ND	U	5
	TOLUENE	1000		5
	TRANS-1,2-DICHLOROETHENE	ND	U	5
	TRICHLOROETHENE	ND	U	5
	TRICHLOROFLUOROMETHANE	ND	U	10
	VINYL CHLORIDE	ND	U	5
	XYLENES	4300		10

Refer to notes at the end of the table.

Table 13
Analytical Data Table for KAFB-106MW1-S

Notes:

Sampling frequency for each analytical method is outlined in Table 4.

a. EPA analytical methods listed are for the most recent sampling event.

b. Samples were collected using replacement QED Bladder Pumps. This well was not sampled using the Geotech pumps.

-- = Not applicable.

δ2H - Delta Deuterium.

0/00 - Per mil.

cells/mL = Cells per milliliter.

EPA = Environmental Protection Agency.

FD = Field duplicate.

ID = Identification.

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base.

LOQ = Limit of Quantitation

μg/L = Microgram per liter.

mg/L = Milligram per liter.

NA = Not analyzed.

ND = Not detected.

NS = Not sampled.

REG = Regular/parent sample.

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

UJ = Analyte was not detected. The reported value is estimated.

VAL QUAL = Validation qualifier.

VFA - Volatile fatty acid.

VOC = Volatile organic compound.

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Original Baseline[b]						New Baseline - QED Pumps[c]					
	Sample ID	106MW2I-BL-072417			106MW2I-BL-FD-072417			106MW2I-BL-091917			106MW2I-BL-FD-091917		
	Sample Date	7/24/2017			7/24/2017			9/19/2017			9/19/2017		
	Sample Purpose	REG			FD			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	5.1	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	ND	U	5.1	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	5.1	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	5.1	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	3830		5.1	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	144		5.1	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	5.1	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	11000		5.1	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	36.8		5.1	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	5.1	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	ND	U	5.1	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	5.1	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	695		5.1	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	10900		5.1	NS	--	--	NS	--	--	NS	--	--
	PMMO	696		5.1	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	2380		5.1	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	222		5.1	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	206		5.1	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	10500		5.1	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	15600		5.1	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	209000		5.1	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	1390		5.1	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	UJ	0.019	ND	UJ	0.0189	0.072		0.0192	0.122		0.0193
VFAs (mg/L) EPA Method 300m	ACETIC ACID	ND	U	1	ND	U	1	0.59	J	1	0.31	J	1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	ND	U	1	ND	U	1	1.08		1	0.97	J	1
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	ND	U	0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	ND	U	4	ND	U	4	ND	U	4
	ETHYLENE	ND	U	5	ND	U	5	ND	U	5	ND	U	5
	METHANE	ND	U	2	ND	U	2	7.2		2	6.86		2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	190		1	186		1	194		1	207		1
	BROMIDE	0.196		0.125	0.193		0.125	0.249		0.125	0.287		0.125
	CHLORIDE	20.4		0.33	20.4		0.33	31.6		0.33	32.1		0.33
	IODIDE	ND	U	0.2	ND	U	0.2	ND	U	0.75	ND	U	0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	ND	U	0.02	0.0125		0.02	ND	U	0.02	ND	U	0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	23		1	23.1		1	19.2		1	19.8		1

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Original Baseline[b]						New Baseline - QED Pumps[c]					
	Sample ID	106MW2I-BL-072417			106MW2I-BL-FD-072417			106MW2I-BL-091917			106MW2I-BL-FD-091917		
	Sample Date	7/24/2017			7/24/2017			9/19/2017			9/19/2017		
	Sample Purpose	REG			FD			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	0.053		0.06	0.0514		0.06	0.955		0.06	0.996		0.06
EPA Method 6010	MANGANESE	0.154		0.006	0.142		0.006	0.392		0.006	0.405		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-97.17		-99	-97.04		-99	-96.44		-99	-96.4		-99
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	1,2-DIBROMOETHANE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	1,2-DICHLOROETHANE	ND	U	1	ND	U	1	ND	U	2.5	0.78	J	1
	1,3,5-TRIMETHYLBENZENE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	2-BUTANONE	ND	U	10	ND	U	10	ND	U	25	ND	J-	10
	2-CHLOROTOLUENE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	2-HEXANONE	ND	U	5	ND	U	5	ND	U	12.5	ND	UJ	5
	4-METHYL-2-PENTANONE	ND	U	5	ND	U	5	ND	U	12.5	ND	UJ	5
	ACETONE	19.8	J	10	15.9	J	10	24.6	J	25	11.3	J	10
	BENZENE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	CARBON DISULFIDE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	CHLOROMETHANE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	2	ND	U	2	ND	U	5	ND	U	2
	ETHYLBENZENE	ND	U	1	ND	U	1	ND	U	2.5	0.619	J	1
	ISOPROPYLBENZENE	ND	U	1	ND	U	1	1.46	J	2.5	1.51	J	1
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	METHYLENE CHLORIDE	ND	U	2	ND	U	2	ND	U	5	ND	U	2
	NAPHTHALENE	ND	U	1	ND	U	1	1.34	J	2.5	ND	U	1
	N-BUTYLBENZENE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	N-PROPYLBENZENE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	1	ND	U	1	1.29	J	2.5	ND	U	1
	SEC-BUTYLBENZENE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	TERT-BUTYLBENZENE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	ND	U	1	0.69	J	1	5.61		2.5	2.71		1
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	1	ND	U	1	ND	U	2.5	ND	U	1
	TRICHLOROFLUOROMETHANE	ND	U	2	ND	U	2	ND	U	5	ND	U	2
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	ND	U	3	ND	U	3	9.02	J	7.5	4.36	J	3

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106MW2I-P1R-100417			106MW2I-P1R-100617			106MW2I-P1R-100917			106MW2I-P1R-101217		
	Sample Date	10/4/2017			10/6/2017			10/9/2017			10/12/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BUTYRIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	FORMIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	LACTIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPIONIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PYRUVIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VALERIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	0.177		0.01	92.107		0.01	14.269		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	IODIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106MW2I-P1R-100417			106MW2I-P1R-100617			106MW2I-P1R-100917			106MW2I-P1R-101217		
	Sample Date	10/4/2017			10/6/2017			10/9/2017			10/12/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EPA Method 6010	MANGANESE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-96.22		-99	-96.38		-99	19.52		-99	-78.78		-99
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ACETONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106MW2I-P1R-101617			106MW2I-P1R-102017			106MW2I-P1R-102017-FD			106MW2I-P1R-102517		
	Sample Date	10/16/2017			10/20/2017			10/20/2017			10/25/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	71.6		1.89
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	NS	--	--	NS	--	--	ND	U	1
	BUTYRIC ACID	NS	--	--	NS	--	--	NS	--	--	ND	U	1
	FORMIC ACID	NS	--	--	NS	--	--	NS	--	--	ND	U	1
	LACTIC ACID	NS	--	--	NS	--	--	NS	--	--	ND	U	1
	PROPIONIC ACID	NS	--	--	NS	--	--	NS	--	--	ND	U	1
	PYRUVIC ACID	NS	--	--	NS	--	--	NS	--	--	ND	U	1
	VALERIC ACID	NS	--	--	NS	--	--	NS	--	--	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	4.089		0.01	20.097		0.01	NS	--	--	8.078		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	ND	U	10
	ETHANE	NS	--	--	NS	--	--	NS	--	--	ND	U	4
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	METHANE	NS	--	--	NS	--	--	NS	--	--	ND	U	2
	PROPANE	NS	--	--	NS	--	--	NS	--	--	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	328		1
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	0.546		0.125
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	45.9		0.33
	IODIDE	NS	--	--	NS	--	--	NS	--	--	ND	U	0.75
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	ND	U	0.375
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.02
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	15.4		1

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106MW2I-P1R-101617			106MW2I-P1R-102017			106MW2I-P1R-102017-FD			106MW2I-P1R-102517		
	Sample Date	10/16/2017			10/20/2017			10/20/2017			10/25/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	NS	--	--	NS	--	--	10.4		0.06
	MANGANESE	NS	--	--	NS	--	--	NS	--	--	1.74		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-90.22		-99	-80.81		-99	-81.53		-99	-88.07		-99
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	183		25
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	72.6		25
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	65.2		25
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	130	J	250
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	148	J	125
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	107	J	125
	ACETONE	NS	--	--	NS	--	--	NS	--	--	724		250
	BENZENE	NS	--	--	NS	--	--	NS	--	--	2290		25
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	ND	U	50
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	361		25
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	32.9	J	25
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	ND	U	50
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	77.1		25
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	30.8	J	25
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	3310		25
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	ND	U	25
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	ND	U	50
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	1860		75

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 1 Recirculation			Phase 1 Passive								
	Sample ID	106MW2I-P1R-110117			106MW2I-P1P-111517			106MW2I-P1P-112917			106MW2I-P1P-112917-FD		
	Sample Date	11/1/2017			11/15/2017			11/29/2017			11/29/2017		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	406000		5.1	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	24200		5.1	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	327000		5.1	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	37.4		5.1	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	19.1		5.1	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	5820		5.1	NS	--	--
	PMMO	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	1030		5.1	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	178000		5.1	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	10300		5.1	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	2860		5.1	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	6550000		5.1	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	33.7		3.83	20.1		1.91	17.1		1.9
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	12.1		1	20.5		1	17.6		1
	BUTYRIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	PROPIONIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	NS	--	--	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	8.207		0.01	12.564		0.01	7.694		0.01	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	ND	U	10	ND	U	10	ND	U	10
	ETHANE	NS	--	--	ND	U	4	ND	U	4	ND	U	4
	ETHYLENE	NS	--	--	2.3	J	5	2.24	J	5	1.99	J	5
	METHANE	NS	--	--	2.61	J	2	17.2		2	16.3		2
	PROPANE	NS	--	--	ND	U	6	ND	U	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	NS	--	--	323		1	260		1	274		1
	BROMIDE	NS	--	--	0.599		0.125	0.599		0.125	0.6		0.125
	CHLORIDE	NS	--	--	44.1		0.33	42.9		0.33	42.8		0.33
	IODIDE	NS	--	--	ND	U	0.75	ND	U	0.75	ND	U	0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	NS	--	--	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	NS	--	--	0.019	J	0.02	ND	U	0.02	ND	U	0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	NS	--	--	2.98		1	2.37	J	1	2.42	J	1

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 1 Recirculation			Phase 1 Passive								
	Sample ID	106MW2I-P1R-110117			106MW2I-P1P-111517			106MW2I-P1P-112917			106MW2I-P1P-112917-FD		
	Sample Date	11/1/2017			11/15/2017			11/29/2017			11/29/2017		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	18.7		0.06	18.3		0.06	17.8		0.06
	MANGANESE	NS	--	--	2.95		0.006	2.81		0.006	2.76		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-84.91		-99	-82.97		-99	-87.37		-99	-87.91		-99
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	ND	U	5	ND	U	2.5	ND	U	2.5
	1,2,4-TRICHLOROBENZENE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	115		5	54.9		2.5	57.7		2.5
	1,2-DIBROMOETHANE	NS	--	--	40.2		5	21.7		2.5	22.3		2.5
	1,2-DICHLOROETHANE	NS	--	--	2.69	J	5	1.72	J	2.5	1.93	J	2.5
	1,3,5-TRIMETHYLBENZENE	NS	--	--	50		5	28.6		2.5	29.5		2.5
	2-BUTANONE	NS	--	--	43	J	50	16.6	J	25	16.8	J	25
	2-CHLOROTOLUENE	NS	--	--	ND	U	5	ND	U	2.5	ND	U	2.5
	2-HEXANONE	NS	--	--	87.4		25	31.1		12.5	34.6		12.5
	4-METHYL-2-PENTANONE	NS	--	--	64.1		25	32.6		12.5	34		12.5
	ACETONE	NS	--	--	228		50	97.2		25	104		25
	BENZENE	NS	--	--	1060		5	410		2.5	411		2.5
	CARBON DISULFIDE	NS	--	--	ND	U	5	ND	U	2.5	ND	U	2.5
	CHLOROMETHANE	NS	--	--	ND	U	5	ND	U	2.5	ND	U	2.5
	CIS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	ND	U	10	ND	U	5	ND	U	5
	ETHYLBENZENE	NS	--	--	166		5	31.3		2.5	32.5		2.5
	ISOPROPYLBENZENE	NS	--	--	23.9		5	16.2		2.5	16.9		2.5
	M,P-XYLENES	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	ND	U	5	ND	U	2.5	ND	U	2.5
	METHYLENE CHLORIDE	NS	--	--	ND	U	10	ND	U	5	ND	U	5
	NAPHTHALENE	NS	--	--	59.7		5	29		2.5	31.9		2.5
	N-BUTYLBENZENE	NS	--	--	4.6	J	5	1.72	J	2.5	1.89	J	2.5
	N-PROPYLBENZENE	NS	--	--	16.7		5	3.59	J	2.5	4.06	J	2.5
	O-XYLENE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	56.1		5	47		2.5	49.3		2.5
	SEC-BUTYLBENZENE	NS	--	--	5.14	J	5	1.55	J	2.5	1.67	J	2.5
	TERT-BUTYLBENZENE	NS	--	--	ND	U	5	ND	U	2.5	ND	U	2.5
	TETRACHLOROETHENE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	NS	--	--	336		5	62.6		2.5	63.9		2.5
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	NS	--	--	ND	U	5	ND	U	2.5	ND	U	2.5
	TRICHLOROFLUOROMETHANE	NS	--	--	ND	U	10	ND	U	5	ND	U	5
	VINYL CHLORIDE	NS	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	NS	--	--	1270		15	760		7.5	773		7.5

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 2 Recirculation									Phase 2 Passive		
	Sample ID	106MW2I-P2R-010918			106MW2I-P2R-011818			106MW2I-P2R-012418			106MW2I-P2P-030618		
	Sample Date	1/9/2018			1/18/2018			1/24/2018			3/6/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	306000		5	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	36400		5	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	147000		5	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	156		5	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	107		5	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	107		5	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	21600		5	NS	--	--
	PMMO	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	157000		5	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	73000		5	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	15700		5	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	5230000		5	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	5	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	39.2		1.9	37.1		1.88	31.3		1.9	1.98	J+	0.192
VFAs (mg/L) EPA Method 300m	ACETIC ACID	45.2	J	1	22.1		1	51.5		1	26.8		1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	1.33	J-	1	0.57	J	1	ND	U	1	1.31		1
	PROPIONIC ACID	14.9	J	1	5.95		1	19.3		1	1		1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	1.08	J	4	1.06		4	1.31	J	4	0.51	J	4
	ETHYLENE	5.62		5	4.51	J	5	5.43		5	2.84	J	5
	METHANE	3.42		2	2.88		2	4.56		2	211		2
	PROPANE	1.21	J	6	ND	U	6	1.47	J	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	305		1	334		1	342		1	277		1
	BROMIDE	0.544		0.25	0.685		0.25	0.547		0.25	0.251		0.125
	CHLORIDE	52.9		0.66	57.3	J+	0.66	47.1		0.66	26.4		0.33
	IODIDE	5.5		0.75	6		0.75	7.3		0.75	2.2		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	ND	U	0.02	0.0136	J	0.02	ND	U	0.02	ND	U	0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	2	ND	U	2	ND	U	2	1.77	J	1

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 2 Recirculation									Phase 2 Passive		
	Sample ID	106MW2I-P2R-010918			106MW2I-P2R-011818			106MW2I-P2R-012418			106MW2I-P2P-030618		
	Sample Date	1/9/2018			1/18/2018			1/24/2018			3/6/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	22.1		0.06	20.7		0.06	20.4	J-	0.06	12.3		0.06
EPA Method 6010	MANGANESE	3.75		0.006	3.73		0.006	3.32	J-	0.006	1.92		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	12.5	ND	U	25	ND	U	25	ND	U	5
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	143		12.5	130		25	220		25	38.7		5
	1,2-DIBROMOETHANE	40.7		12.5	31.1	J	25	25.9	J	25	ND	U	5
	1,2-DICHLOROETHANE	ND	U	12.5	ND	U	25	ND	U	25	ND	U	5
	1,3,5-TRIMETHYLBENZENE	83.2		12.5	70		25	94.3		25	23.9		5
	2-BUTANONE	ND	U	125	ND	U	250	ND	U	250	ND	U	50
	2-CHLOROTOLUENE	ND	U	12.5	ND	U	25	ND	U	25	ND	U	5
	2-HEXANONE	60.6	J	62.5	79.4	J	125	86.7	J	125	14.9	J+	25
	4-METHYL-2-PENTANONE	48.4	J	62.5	68.2	J	125	72.4	J	125	13.6	J	25
	ACETONE	163	J	125	257	J	250	239	J	250	48.5	J+	50
	BENZENE	1720		12.5	2300		25	3270		25	427		5
	CARBON DISULFIDE	ND	U	12.5	ND	U	25	ND	U	25	ND	U	5
	CHLOROMETHANE	ND	U	12.5	ND	U	25	ND	U	25	ND	U	5
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	25	ND	U	50	ND	U	50	ND	U	10
	ETHYLBENZENE	354		12.5	383		25	491		25	89.8		5
	ISOPROPYLBENZENE	50.2		12.5	66.2		25	89.1		25	44.6		5
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	12.5	ND	U	25	ND	U	25	ND	U	5
	METHYLENE CHLORIDE	ND	U	25	ND	U	50	ND	U	50	ND	U	10
	NAPHTHALENE	62.7		12.5	72.5		25	72.9		25	17.5		5
	N-BUTYLBENZENE	8.28	J	12.5	ND	U	25	ND	U	25	2.71	J	5
	N-PROPYLBENZENE	29.5		12.5	37.7	J	25	49.4	J	25	8.66	J	5
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	126		12.5	111		25	121		25	ND	U	5
	SEC-BUTYLBENZENE	8.17	J	12.5	ND	U	25	ND	U	25	2.52	J	5
	TERT-BUTYLBENZENE	ND	U	12.5	ND	U	25	ND	U	25	ND	U	5
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	2670		12.5	3570		25	3840		25	217		5
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	12.5	ND	U	25	ND	U	25	ND	U	5
	TRICHLOROFLUOROMETHANE	ND	U	25	ND	U	50	ND	U	50	ND	U	10
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	1410		37.5	1580		75	1900		75	356		15

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 2 Passive											
	Sample ID	106MW2I-P2P-030618-FD			106MW2I-P2P-041118			106MW2I-P2P-050818			106MW2I-P2P-061218		
	Sample Date	3/6/2018			4/11/2018			5/8/2018			6/12/2018		
	Sample Purpose	FD			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
(cells/mL)	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	3.9	J	4.9	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	299		4.9	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	174000		4.9	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	6240		4.9	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	25500		4.9	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	18.4		4.9	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	219		4.9	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	10700		4.9	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	3120		4.9	NS	--	--
	PMMO	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	189000		4.9	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	24500		4.9	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	5880		4.9	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	4360000		4.9	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	4.9	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	1.61	J+	0.188	1.08	J	0.0382	1.35		0.0378	2.82		0.192
VFAs (mg/L)	ACETIC ACID	16.8		1	20.4		1	24.87		1	11.8		1
EPA Method 300m	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	0.8	J	1	0.9	J	1	0.66	J	1	0.6	J	1
	PROPIONIC ACID	ND	U	1	1		1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
RSKSOP-175	ETHANE	ND	U	4	0.4	J	4	0.45	J	4	0.6	J	4
	ETHYLENE	3.2	J	5	3.11		5	3.07		5	2.1	J	5
	METHANE	220		2	767.8		2	1440		2	1560.2		2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	0.9	J	6
General Chemistry (mg/L)	ALKALINITY	283		1	255		1	313		1	364		1
SM2320b, EPA Method 300,	BROMIDE	0.251		0.125	0.29		0.125	0.517		0.25	0.632		0.25
EPA Method 353.2, SM4500	CHLORIDE	26.5		0.33	31.3		0.33	47.7		0.66	56.8		0.66
Pec	IODIDE	2.2		0.75	0.62	J	0.75	0.64	J	0.75	2.3		0.75
	NITRATE	NA	--	--	ND	U	0.1	ND	U	0.2	ND	U	0.2
	NITRITE	NA	--	--	ND	U	0.1	ND	U	0.2	ND	U	0.2
	NITROGEN, NITRATE-NITRITE	ND	U	0.375	NA	--	--	NA	--	--	NA	--	--
	O-PHOSPHATE (AS P)	ND	U	0.02	ND	U	0.02	0.0113	J	0.02	0.022		0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	1.74	J	1	2.77		1	ND	U	2	ND	U	2

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 2 Passive											
	Sample ID	**106MW2I-P2P-030618-FD**			**106MW2I-P2P-041118**			**106MW2I-P2P-050818**			**106MW2I-P2P-061218**		
	Sample Date	**3/6/2018**			**4/11/2018**			**5/8/2018**			**6/12/2018**		
	Sample Purpose	**FD**			**REG**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L)	IRON	11.5		0.06	8.55	J-	0.06	17.6		0.06	18.7		0.06
EPA Method 6010	MANGANESE	1.86		0.006	2.04	J+	0.006	3.29		0.006	3.8		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	5	ND	U	1	ND	U	2.5	ND	U	1
EPA Method 8260	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	42.2		5	16.1		1	20.8		2.5	17.7		1
	1,2-DIBROMOETHANE	ND	U	5	1.37	J	1	2.53	J	2.5	3.56		1
	1,2-DICHLOROETHANE	ND	U	5	1.32	J	1	2.37	J	2.5	3.03		1
	1,3,5-TRIMETHYLBENZENE	25.6		5	16.3		1	30.9		2.5	30.7		1
	2-BUTANONE	ND	U	50	ND	U	10	ND	U	25	ND	U	10
	2-CHLOROTOLUENE	ND	U	5	ND	U	1	ND	U	2.5	ND	U	1
	2-HEXANONE	15	J+	25	2.85	J	5	ND	U	12.5	ND	U	5
	4-METHYL-2-PENTANONE	15.2	J	25	6.86	J	5	12.1	J	12.5	8.08	J	5
	ACETONE	36.3	J+	50	22	J+	10	38.6	J	25	21.5		10
	BENZENE	439		5	151		1	129		2.5	52.7		1
	CARBON DISULFIDE	ND	U	5	ND	U	1	ND	U	2.5	ND	U	1
	CHLOROMETHANE	ND	U	5	ND	U	1	ND	U	2.5	ND	U	1
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	10	ND	U	2	ND	U	5	ND	U	2
	ETHYLBENZENE	90.5		5	26.8		1	21.6		2.5	6.61		1
	ISOPROPYLBENZENE	45		5	57.7		1	130		2.5	137		1
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	5	ND	U	1	ND	U	2.5	0.546	J	1
	METHYLENE CHLORIDE	ND	U	10	ND	U	2	ND	U	5	ND	U	2
	NAPHTHALENE	18.5		5	12.9		1	11.3		2.5	4.9		1
	N-BUTYLBENZENE	2.96	J	5	1.53	J	1	3.16	J	2.5	ND	U	1
	N-PROPYLBENZENE	8.99	J	5	3.49		1	4.66	J	2.5	1.78	J	1
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	38.2		5	48.6		1	117		2.5	130		1
	SEC-BUTYLBENZENE	2.57	J	5	1.45	J	1	2.38	J	2.5	1.16	J	1
	TERT-BUTYLBENZENE	ND	U	5	ND	U	1	ND	U	2.5	ND	U	1
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	221		5	40.3		1	33		2.5	12.1		1
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	5	ND	U	1	ND	U	2.5	ND	U	1
	TRICHLOROFLUOROMETHANE	ND	U	10	ND	U	2	ND	U	5	ND	U	2
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	369		15	265		3	333		7.5	311		3

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 3 Recirculation											
	Sample ID	106MW2I-P3R-080718			106MW2I-P3R-081518			106MW2I-P3R-082118			106MW2I-P3R-082818		
	Sample Date	8/7/2018			8/15/2018			8/21/2018			8/28/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	314		5.1	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	107000		5.1	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	6580		5.1	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	23200		5.1	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	3500		5.1	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	275		5.1	NS	--	--
	PMMO	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	94500		5.1	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	5180		5.1	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	702		5.1	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	4050000		5.1	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	5.1	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	ND	U	0.5	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NA	--	--	0.77		0.003	0.62		0.003	5.1		0.029
VFAs (mg/L) EPA Method 300m	ACETIC ACID	22.1		1	44.7		10	39.3		10	28.1		10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	4	J	10	ND	U	1	ND	U	1	0.9	J	10
	LACTIC ACID	0.2	J	1	0.6	J	1	0.6	J	1	0.6	J	1
	PROPIONIC ACID	ND	U	1	4.5	J	10	5.6	J	10	10.3		10
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	0.9	J	4	1.2	J	4	1.4	J	4	1.6	J	4
	ETHYLENE	4.1	J	5	4	J	5	4.1	J	5	4.7	J	5
	METHANE	1028.2		2	1376.3		2	1683.1		2	2159.4		2
	PROPANE	1.1	J	6	1.3	J	6	1.4	J	6	1.5	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	NA	--	--	350		5	380		5	390		5
	BROMIDE	NA	--	--	0.9		0.5	0.83		0.5	0.96		0.5
	CHLORIDE	NA	--	--	53		0.5	52		0.5	53		0.5
	IODIDE	8.1		0.75	6.9		0.75	8		0.75	10		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	NA	--	--	ND	U	0.05	ND		0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	ND	U	0.15	ND		0.15	ND	U	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	NA	--	--	ND	U	1	ND		1	ND	U	1

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 3 Recirculation											
	Sample ID	106MW2I-P3R-080718			106MW2I-P3R-081518			106MW2I-P3R-082118			106MW2I-P3R-082818		
	Sample Date	8/7/2018			8/15/2018			8/21/2018			8/28/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NA	--	--	15		0.05	14		0.05	15		0.05
	MANGANESE	NA	--	--	4.5		0.003	4.2		0.003	4.5		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NA	--	--	ND	U	25	ND	U	5	ND	U	25
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	NA	--	--	190		50	180		10	220		50
	1,2-DIBROMOETHANE	NA	--	--	ND	U	50	ND	U	10	ND	U	50
	1,2-DICHLOROETHANE	NA	--	--	ND	U	50	ND	U	10	ND	U	50
	1,3,5-TRIMETHYLBENZENE	NA	--	--	83		25	71		5	82		25
	2-BUTANONE	NA	--	--	ND	U	500	ND	U	100	ND	U	500
	2-CHLOROTOLUENE	NA	--	--	ND	U	25	ND	U	5	ND	U	25
	2-HEXANONE	NA	--	--	ND	U	250	48	J	50	ND	U	250
	4-METHYL-2-PENTANONE	NA	--	--	ND	U	250	53	J	50	ND	U	250
	ACETONE	NA	--	--	ND	U	500	100		100	ND	U	500
	BENZENE	NA	--	--	1700		50	1900		20	3100		50
	CARBON DISULFIDE	NA	--	--	ND	U	100	ND	U	20	ND	U	100
	CHLOROMETHANE	NA	--	--	ND	U	50	ND	U	10	ND	U	50
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	NA	--	--	ND	U	50	ND	U	10	ND	U	50
	ETHYLBENZENE	NA	--	--	420		50	430		10	640		50
	ISOPROPYLBENZENE	NA	--	--	120		50	95		10	120		50
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	NA	--	--	ND	U	25	ND	U	5	ND	U	25
	METHYLENE CHLORIDE	NA	--	--	ND	U	250	ND	U	50	240	J	250
	NAPHTHALENE	NA	--	--	170	J	250	89		50	ND	U	250
	N-BUTYLBENZENE	NA	--	--	ND	U	50	6.8	J	10	ND	U	50
	N-PROPYLBENZENE	NA	--	--	49	J	50	37		10	50		50
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	NA	--	--	140		50	90		10	97		50
	SEC-BUTYLBENZENE	NA	--	--	ND	U	50	7.6	J	10	ND	U	50
	TERT-BUTYLBENZENE	NA	--	--	ND	U	50	ND	U	10	ND	U	50
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	NA	--	--	2700		50	2000		20	3000		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	NA	--	--	ND	U	50	ND	U	10	ND	U	50
	TRICHLOROFLUOROMETHANE	NA	--	--	ND	U	50	ND	U	10	ND	U	50
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	NA	--	--	1200		25	1200		5	1900		25

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 3 Passive											
	Sample ID	**106MW2I-P3P-091118**			**106MW2I-P3P-100218**			**106MW2I-P3P-111518**			**106MW2I-P3P-111518-FD**		
	Sample Date	**9/11/2018**			**10/2/2018**			**11/15/2018**			**11/15/2018**		
	Sample Purpose	**REG**			**REG**			**REG**			**FD**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	ND	U	0.6	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	193		5.6	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	82300		5.6	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	1590		5.6	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	0.5	J	0.6	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	33900		5.6	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	0.4	J	5.6	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	27.7		5.6	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	7040		5.6	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	806		5.6	NS	--	--
	PMMO	NS	--	--	NS	--	--	NA	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	131000		5.6	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	0.2	J	0.6	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	4420		5.6	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	5620		5.6	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	1440000		5.6	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	ND	U	5.6	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	0.9		0.6	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.81		0.003	0.38	J+	0.0015	0.24		0.003	0.27		0.003
VFAs (mg/L) EPA Method 300m	ACETIC ACID	31.3		10	4		1	ND	U	1	ND	U	1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	ND	U	1	0.5	J	1	0.5	J	1
	LACTIC ACID	0.6	J	1	0.7	J	1	1.2		1	1		1
	PROPIONIC ACID	14.2		10	ND	U	1	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	1.4	J	4	0.8	J	4	1.1	J	4	1	J	4
	ETHYLENE	3.5	J	5	1.3	J	5	1.1	J	5	1.1	J	5
	METHANE	2745.2		2	2903.9		2	2646		2	2704.5		2
	PROPANE	1.3	J	6	ND	U	6	1.1	J	6	1	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	410		5	370		5	350		5	350		5
	BROMIDE	0.93		0.5	1.4		0.5	1		0.5	1		0.5
	CHLORIDE	52		0.5	49		0.5	47		0.5	47		0.5
	IODIDE	13		0.75	11		0.75	6.7		0.75	6.9		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	U	0.1	ND	U	0.05	ND	U	0.5	ND	U	0.5
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	U	0.15	ND	UJ	0.15	ND	UJ	0.15	ND	UJ	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	1	ND	U	1	ND	U	1	ND	U	1

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 3 Passive											
	Sample ID	106MW2I-P3P-091118			106MW2I-P3P-100218			106MW2I-P3P-111518			106MW2I-P3P-111518-FD		
	Sample Date	9/11/2018			10/2/2018			11/15/2018			11/15/2018		
	Sample Purpose	REG			REG			REG			FD		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	15		0.05	13		0.05	22		0.05	21		0.05
	MANGANESE	5.2		0.003	4.8		0.003	3.9		0.003	3.8		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	240		100	170		100	55	J	100	57	J	100
	1,2-DIBROMOETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	1,2-DICHLOROETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	1,3,5-TRIMETHYLBENZENE	85	J	50	72	J	50	33	J	50	ND	U	50
	2-BUTANONE	ND	U	1000	ND	U	1000	ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	4-METHYL-2-PENTANONE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	ACETONE	ND	U	1000	ND	U	1000	ND	U	1000	ND	U	1000
	BENZENE	3100		100	2300		100	630		100	610		100
	CARBON DISULFIDE	ND	U	200	ND	U	200	ND	U	200	ND	U	200
	CHLOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	ETHYLBENZENE	730		100	410		100	170		100	170		100
	ISOPROPYLBENZENE	140		100	150		100	94	J	100	92	J	100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	50	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	NAPHTHALENE	ND	U	500	ND	U	500	ND	U	500	ND	U	500
	N-BUTYLBENZENE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	N-PROPYLBENZENE	58	J	100	43	J	100	ND	U	100	ND	U	100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	100		100	180		100	ND	U	100	ND	U	100
	SEC-BUTYLBENZENE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	TERT-BUTYLBENZENE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	3400		100	300		100	410		100	390		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	100	ND	U	100	280		100	98	J	100
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2100		50	1200		50	430		50	400		50

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 4 Passive											
	Sample ID	106MW2I-P4P-011719			106MW2I-LTM-031120			106MW2I-LTM-052020			106MW2I-LTM-080520		
	Sample Date	1/17/2019			3/11/2020			5/20/2020			8/5/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	1,2 DCA Reductase (DCAR)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
	cer A Reductase	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Chloroform Reductase (CFR)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Dehalobacter DCM (DCM)	95.5		4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Dehalobacter spp. (DHBt)	70400		4.9	30700		5.1	22500		4.9	25100		4.7
	Dehalobium chlorocoercia (DECO)	3950		4.9	5000		5.1	8000		4.9	8650		4.7
	Dehalococcoides (DHC)	0.9		0.5	2.2		0.5	0.6		0.5	0.9		0.5
	Dehalogenimonas spp. (DHG)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Desulfitobacterium spp. (DSB)	13300		4.9	6500		5.1	7810		4.9	5590		4.7
	Desulfuromonas spp. (DSM)	65.2		4.9	5.2		5.1	18.6		4.9	ND	U	4.7
	Dichloromethane Dehalogenase (DCMA)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Epoxyalkane Transferase (EtnE)	90.2		4.9	ND	U	5.1	2450		4.9	ND	U	4.7
	Ethene Monooxygenase (EtnC)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Methanogens (MGN)	7070		4.9	1200		5.1	215		4.9	153		4.7
	PCE Reductase (PCE-1)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Phenol Hydroxylase (PHE)	771		4.9	659		5.1	32500		4.9	181		4.7
	PMMO	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	261		4.9	3280		5.1	844		4.9	1520		4.7
	Sulfate Reducing Bacteria (APS)	304000		4.9	574000		5.1	460000		4.9	593000		4.7
	tceA Reductase (TCE)	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
	Toluene Dioxygenase (TOD)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Toluene Monooxygenase (RMO)	14800		4.9	465		5.1	732		4.9	543		4.7
	Toluene Monooxygenase 2 (RDEG)	42200		4.9	1460		5.1	17400		4.9	4620		4.7
	Total Eubacteria (EBAC)	6240000		4.9	2890000		5.1	4410000		4.9	6190000		4.7
	trans-1,2-DCE Reductase (TDR)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	4.9	ND	U	5.1	ND	U	4.9	ND	U	4.7
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	0.4	J	0.5	ND	U	0.5	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.41		0.003	0.17		0.011	0.038		0.01	ND	U	0.01
VFAs (mg/L) EPA Method 300m	ACETIC ACID	0.5	J	1	ND	U	1	ND	U	10	ND	U	10
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	FORMIC ACID	ND	U	1	0.9	J	10	0.3	J	10	5.2	J	10
	LACTIC ACID	1.5		1	1.8	J	10	1.4	J	10	1.9	J	10
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	ND	U	4	ND	U	4	ND	U	4	1	J	4
	ETHYLENE	ND	U	5	ND	U	5	ND	U	5	ND	U	5
	METHANE	1989.6		2	45		2	203.8		2	137.5		2
	PROPANE	ND	U	6	ND	U	6	ND	U	6	ND	U	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	230		5	185		5	224		5	266		5
	BROMIDE	ND	U	0.5	0.254		0.1	0.636		0.1	2.77		0.1
	CHLORIDE	27		0.5	24.7		0.5	61.1		0.5	149		5
	IODIDE	2.1	J+	0.75	ND	U	0.2	ND	U	0.2	ND	U	2
	NITRATE	NA	--	--	0.144		0.1	0.0964	J	0.1	ND	U	0.1
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	UJ	0.05	ND	U	0.1	ND	U	0.1	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	UJ	0.15	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	ND	U	0.025	ND	U	0.025	ND	U	0.025
	SULFATE	12		1	34.7		0.5	28.7		0.5	33.7		0.5

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 4 Passive											
	Sample ID	106MW2I-P4P-011719			106MW2I-LTM-031120			106MW2I-LTM-052020			106MW2I-LTM-080520		
	Sample Date	1/17/2019			3/11/2020			5/20/2020			8/5/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	ND	U	0.001	ND	U	0.001	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	6.4		0.05	0.885		0.05	2.37		0.05	6.36		0.05
	MANGANESE	2.1		0.003	0.641		0.0025	1.93		0.05	4.12		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	1	ND	U	0.5	ND	U	1	ND	U	1
	1,2,4-TRICHLOROBENZENE	NA	--	--	ND	U	0.5	ND	U	1	ND	U	1
	1,2,4-TRIMETHYLBENZENE	14		2	NA	--	--	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	2	ND	U	0.5	ND	U	0.5	ND	U	0.5
	1,2-DICHLOROETHANE	NA	--	--	ND	U	0.5	ND	U	0.5	ND	U	0.5
	1,3,5-TRIMETHYLBENZENE	5.1		1	ND	U	0.5	ND	U	1	ND	U	1
	2-BUTANONE	ND	U	20	ND	U	1	ND	U	1	ND	U	1
	2-CHLOROTOLUENE	ND	U	1	ND	U	0.5	ND	U	1	ND	U	1
	2-HEXANONE	ND	U	10	ND	U	1	ND	U	2	ND	U	2
	4-METHYL-2-PENTANONE	ND	U	10	ND	U	1	ND	U	2	ND	U	2
	ACETONE	ND	U	20	ND	U	1	ND	U	1	ND	U	1
	BENZENE	130		2	1.2		0.5	ND	U	0.5	1.2		0.5
	CARBON DISULFIDE	ND	U	4	ND	U	1	ND	U	1	ND	U	1
	CHLOROMETHANE	ND	U	2	ND	U	0.5	ND	U	0.5	ND	U	0.5
	CIS-1,2-DICHLOROETHENE	NA	--	--	ND	U	0.5	ND	U	0.5	ND	U	0.5
	DICHLORODIFLUOROMETHANE	NA	--	--	ND	U	0.5	ND	U	1	ND	U	1
	ETHYLBENZENE	NA	--	--	ND	U	0.5	ND	U	1	ND	UJ	1
	ISOPROPYLBENZENE	48		2	12		0.5	10		1	10		1
	M,P-XYLENES	NA	--	--	ND	U	1	ND	U	1	ND	U	1
	METHYL TERT-BUTYL ETHER	ND	U	1	ND	U	0.5	ND	U	0.5	ND	U	0.5
	METHYLENE CHLORIDE	ND	U	10	ND	U	1	ND	U	1	ND	U	1
	NAPHTHALENE	ND	U	10	ND	U	0.5	ND	U	1	ND	U	1
	N-BUTYLBENZENE	ND	U	2	ND	U	0.5	ND	U	1	ND	U	1
	N-PROPYLBENZENE	2.7		2	ND	U	0.5	ND	U	1	ND	U	1
	O-XYLENE	NA	--	--	ND	U	0.5	ND	U	1	ND	U	1
	P-ISOPROPYLTOLUENE	38		2	12		0.5	11		1	ND	U	1
	SEC-BUTYLBENZENE	ND	U	2	ND	U	0.5	ND	U	1	1.7		1
	TERT-BUTYLBENZENE	ND	U	2	ND	U	0.5	ND	U	1	ND	U	1
	TETRACHLOROETHENE	NA	--	--	ND	U	0.5	ND	U	1	ND	U	1
	TOLUENE	7.4		2	ND	U	0.5	ND	U	0.5	ND	U	0.5
	TRANS-1,2-DICHLOROETHENE	NA	--	--	ND	U	0.5	ND	U	0.5	ND	U	0.5
	TRICHLOROETHENE	ND	U	2	ND	U	0.5	ND	U	0.5	ND	U	0.5
	TRICHLOROFLUOROMETHANE	ND	U	2	ND	U	0.5	ND	U	1	ND	U	1
	VINYL CHLORIDE	NA	--	--	ND	U	0.5	ND	U	0.5	ND	U	0.5
	XYLENES	82		1	ND	U	0.5	ND	U	1	ND	U	1

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ
	Phase Designation	Phase 4 Passive		
	Sample ID	106MW2I-LTM-101420		
	Sample Date	10/14/2020		
	Sample Purpose	REG		
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	4.8		4.8
	1,2 DCA Reductase (DCAR)	4.8		4.8
	BAV1 Vinyl Chloride Reductase (BVC)	0.5		0.5
	cer A Reductase	4.8		4.8
	Chloroform Reductase (CFR)	4.8		4.8
	Dehalobacter DCM (DCM)	4.8		4.8
	Dehalobacter spp. (DHBt)	8900		4.8
	Dehalobium chlorocoercia (DECO)	5780		4.8
	Dehalococcoides (DHC)	3.3		0.5
	Dehalogenimonas spp. (DHG)	4.8		4.8
	Desulfitobacterium spp. (DSB)	2380		4.8
	Desulfuromonas spp. (DSM)	4.8		4.8
	Dichloromethane Dehalogenase (DCMA)	4.8		4.8
	Epoxyalkane Transferase (EtnE)	4.8		4.8
	Ethene Monooxygenase (EtnC)	4.8		4.8
	Methanogens (MGN)	131		4.8
	PCE Reductase (PCE-1)	4.8		4.8
	Phenol Hydroxylase (PHE)	825		4.8
	PMMO	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	199		4.8
	Sulfate Reducing Bacteria (APS)	450000		4.8
	tceA Reductase (TCE)	0.5		0.5
	Toluene Dioxygenase (TOD)	4.8		4.8
	Toluene Monooxygenase (RMO)	4.8		4.8
	Toluene Monooxygenase 2 (RDEG)	1780		4.8
	Total Eubacteria (EBAC)	5410000		4.8
	trans-1,2-DCE Reductase (TDR)	4.8		4.8
	Trichlorobenzene Dioxygenase (TCBO)	4.8		4.8
	Vinyl Chloride Reductase (VCR)	0.5		0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	U	0.01
VFAs (mg/L) EPA Method 300m	ACETIC ACID	ND	U	10
	BUTYRIC ACID	ND	U	10
	FORMIC ACID	1.3	J	10
	LACTIC ACID	0.5	J	10
	PROPIONIC ACID	ND	U	10
	PYRUVIC ACID	ND	U	10
	VALERIC ACID	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10
	ETHANE	0.6		4
	ETHYLENE	5		5
	METHANE	21.9		2
	PROPANE	6		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	ALKALINITY	327		5
	BROMIDE	2.33		0.1
	CHLORIDE	153		5
	IODIDE	0.35		
	NITRATE	ND	UJ	0.1
	NITRITE	NA	--	--
	NITROGEN, NITRATE-NITRITE	ND	UJ	0.1
	O-PHOSPHATE (AS P)	NA	--	--
	ORTHOPHOSPHATE	NA	--	--
	PHOSPHORUS	ND	U	0.025
	SULFATE	16.7		0.5

Table 14
Analytical Data Table for KAFB-106MW2-I

	Phase Designation	Phase 4 Passive		
	Sample ID	106MW2I-LTM-101420		
	Sample Date	10/14/2020		
	Sample Purpose	REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**
Metals (mg/L) EPA Method 6010	LEAD	ND	U	0.001
Dissolved Metals (mg/L)	IRON	5.49		0.05
EPA Method 6010	MANGANESE	4.19		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--
VOCs (µg/L)	1,1,2-TRICHLOROETHANE	ND	U	0.5
EPA Method 8260	1,2,4-TRICHLOROBENZENE	ND	U	1
	1,2,4-TRIMETHYLBENZENE	NA	--	--
	1,2-DIBROMOETHANE	ND	U	0.5
	1,2-DICHLOROETHANE	ND	U	0.5
	1,3,5-TRIMETHYLBENZENE	ND	U	0.5
	2-BUTANONE	ND	U	1
	2-CHLOROTOLUENE	ND	U	1
	2-HEXANONE	ND	U	2
	4-METHYL-2-PENTANONE	ND	U	2
	ACETONE	2.8		1
	BENZENE	0.67	J	0.5
	CARBON DISULFIDE	ND	U	2
	CHLOROMETHANE	ND	U	0.5
	CIS-1,2-DICHLOROETHENE	ND	U	0.5
	DICHLORODIFLUOROMETHANE	ND	U	1
	ETHYLBENZENE	7.6	J+	1
	ISOPROPYLBENZENE	21		0.5
	M,P-XYLENES	ND	U	1
	METHYL TERT-BUTYL ETHER	ND	U	0.5
	METHYLENE CHLORIDE	ND	U	1
	NAPHTHALENE	ND	U	0.5
	N-BUTYLBENZENE	ND	U	1
	N-PROPYLBENZENE	ND	U	1
	O-XYLENE	ND	U	1
	P-ISOPROPYLTOLUENE	ND	U	1
	SEC-BUTYLBENZENE	5.1		0.5
	TERT-BUTYLBENZENE	1	J+	0.5
	TETRACHLOROETHENE	ND	U	0.5
	TOLUENE	ND	U	0.5
	TRANS-1,2-DICHLOROETHENE	ND	U	0.5
	TRICHLOROETHENE	ND	U	0.5
	TRICHLOROFLUOROMETHANE	ND	U	0.5
	VINYL CHLORIDE	ND	U	0.5
	XYLENES	ND	U	0.5

Refer to notes at the end of the table.

Table 14
Analytical Data Table for KAFB-106MW2-I

Notes:

Sampling frequency for each analytical method is outlined in Table 4.

a. EPA analytical methods listed are for the most recent sampling event.

b. Samples were collected using replacement QED Bladder Pumps. This well was not sampled using the Geotech pumps.

-- = Not applicable.

δ2H - Delta Deuterium.

0/00 - Per mil.

cells/mL = Cells per milliliter.

EPA = Environmental Protection Agency.

FD = Field duplicate.

ID = Identification.

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base.

LOQ = Limit of Quantitation

µg/L = Microgram per liter.

mg/L = Milligram per liter.

NA = Not analyzed.

ND = Not detected.

NS = Not sampled.

REG = Regular/parent sample.

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

UJ = Analyte was not detected. The reported value is estimated.

VAL QUAL = Validation qualifier.

VFA - Volatile fatty acid.

VOC = Volatile organic compound.

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106MW2S-BL-080717			106MW2S-BL-091917			106MW2S-P1R-100417			106MW2S-P1R-100617		
	Sample Date	8/7/2017			9/19/2017			10/4/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	ND	U	5.2	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	ND	U	5.2	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	ND	U	5.2	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	ND	U	5.2	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	129000		5.2	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	6350		5.2	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	2.6		0.5	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	ND	U	5.2	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	129000		5.2	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	ND	U	5.2	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	ND	U	5.2	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	ND	U	5.2	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	ND	U	5.2	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	3080		5.2	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	408000		5.2	NS	--	--	NS	--	--	NS	--	--
	PMMO	301		5.2	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	1190		5.2	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	73400		5.2	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	1.3		0.5	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	68.1		5.2	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	521000		5.2	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	124000		5.2	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	12100000		5.2	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	79.8		5.2	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	42.5	J+	0.0189	84.9	J+	3.87	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	84.8		10	45		1	NS	--	--	NS	--	--
	BUTYRIC ACID	9.87		1	ND	U	1	NS	--	--	NS	--	--
	FORMIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	LACTIC ACID	ND	U	1	1.29		1	NS	--	--	NS	--	--
	PROPIONIC ACID	11.8		1	6.22		1	NS	--	--	NS	--	--
	PYRUVIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
	VALERIC ACID	ND	U	1	ND	U	1	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	ND	U	0.01	ND	U	0.01	ND	U	0.01	207.7		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	NS	--	--	NS	--	--
	ETHANE	1.12	J	4	4.08		4	NS	--	--	NS	--	--
	ETHYLENE	8.67		5	19.2		5	NS	--	--	NS	--	--
	METHANE	23.2		2	19		2	NS	--	--	NS	--	--
	PROPANE	1.19	J	6	4.88	J	6	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	374	J-	1	326		1	NS	--	--	NS	--	--
	BROMIDE	0.306	J	0.25	0.283		0.125	NS	--	--	NS	--	--
	CHLORIDE	11.5		0.66	11.4		0.33	NS	--	--	NS	--	--
	IODIDE	ND	U	0.2	ND	U	0.75	NS	--	--	NS	--	--
	NITRATE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	NITRITE	NA	--	--	NA	--	--	NS	--	--	NS	--	--

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Original Baseline[b]			New Baseline - QED Pumps[c]			Phase 1 Recirculation					
	Sample ID	106MW2S-BL-080717			106MW2S-BL-091917			106MW2S-P1R-100417			106MW2S-P1R-100617		
	Sample Date	8/7/2017			9/19/2017			10/4/2017			10/6/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	0.0608		0.02	0.0392	J	0.02	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	SULFATE	ND	U	2	0.807		1	NS	--	--	NS	--	--
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	12.8		0.06	11.7		0.06	NS	--	--	NS	--	--
	MANGANESE	5.52		0.006	5.19		0.006	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-96		-99	-95.38		-99	-94.21		-99	127.94		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	-8.9 ±2‰	--	--	-8.7 ±2‰	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	105		10	110		12.5	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	54.7		10	106		12.5	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	34.6		10	40.7		12.5	NS	--	--	NS	--	--
	2-BUTANONE	447		100	496		125	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	2-HEXANONE	754		50	906		62.5	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	569		50	665		62.5	NS	--	--	NS	--	--
	ACETONE	2480		100	2340		125	NS	--	--	NS	--	--
	BENZENE	1390		10	586		12.5	NS	--	--	NS	--	--
	CARBON DISULFIDE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	CHLOROMETHANE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	ND	U	20	ND	U	25	NS	--	--	NS	--	--
	ETHYLBENZENE	245		10	209		12.5	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	141		10	116		12.5	NS	--	--	NS	--	--
	M,P-XYLENES	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	ND	U	20	ND	U	25	NS	--	--	NS	--	--
	NAPHTHALENE	81.6	J+	10	113		12.5	NS	--	--	NS	--	--
	N-BUTYLBENZENE	6.22	J	10	6.76	J	12.5	NS	--	--	NS	--	--
	N-PROPYLBENZENE	16.5	J	10	14.1	J	12.5	NS	--	--	NS	--	--
	O-XYLENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	310		10	354		12.5	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	6.2	J	10	ND	U	12.5	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TOLUENE	2260		10	1540		12.5	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	ND	U	10	ND	U	12.5	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	ND	U	20	ND	U	25	NS	--	--	NS	--	--
	VINYL CHLORIDE	NA	--	--	NA	--	--	NS	--	--	NS	--	--
	XYLENES	1350		30	1690		37.5	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106MW2S-P1R-100917			106MW2S-P1R-101217			106MW2S-P1R-101217-FD			106MW2S-P1R-101617		
	Sample Date	10/9/2017			10/12/2017			10/12/2017			10/16/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VFAs (mg/L) EPA Method 300m	ACETIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BUTYRIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	FORMIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	LACTIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPIONIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PYRUVIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VALERIC ACID	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	16.789		0.01	1.535		0.01	1.527		0.01	2.485		0.01
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PROPANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BROMIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	IODIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 1 Recirculation											
	Sample ID	106MW2S-P1R-100917			106MW2S-P1R-101217			106MW2S-P1R-101217-FD			106MW2S-P1R-101617		
	Sample Date	10/9/2017			10/12/2017			10/12/2017			10/16/2017		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	NITROGEN, NITRATE-NITRITE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-PHOSPHATE (AS P)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ORTHOPHOSPHATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PHOSPHORUS	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SULFATE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	MANGANESE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-72.81		-99	-93.69		-99	-93.42		-99	-92.61		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRICHLOROBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,2-DICHLOROETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	1,3,5-TRIMETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-BUTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-CHLOROTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	2-HEXANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	4-METHYL-2-PENTANONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ACETONE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	BENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CARBON DISULFIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CHLOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	CIS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ETHYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	ISOPROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	M,P-XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	METHYLENE CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	NAPHTHALENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	N-PROPYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	O-XYLENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	SEC-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TERT-BUTYLBENZENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TETRACHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TOLUENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROETHENE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	TRICHLOROFLUOROMETHANE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	VINYL CHLORIDE	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	XYLENES	NS	--	--	NS	--	--	NS	--	--	NS	--	--

Refer to notes at the end of the table.

Table 15
Analytical Data Table for KAFB-106MW2-S

Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
	Phase Designation	Phase 1 Recirculation									Phase 1 Passive		
	Sample ID	106MW2S-P1R-102017			106MW2S-P1R-102517			106MW2S-P1R-110117			106MW2S-P1P-111617		
	Sample Date	10/20/2017			10/25/2017			11/1/2017			11/16/2017		
	Sample Purpose	REG			REG			REG			REG		
Microbial Community	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
(cells/mL)	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	PMMO	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	NS	--	--
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	NS	--	--	NS	--	--	NS	--	--	32.1		3.89
VFAs (mg/L)	ACETIC ACID	NS	--	--	8.59		1	NS	--	--	39.9		1
EPA Method 300m	BUTYRIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	FORMIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	LACTIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	PROPIONIC ACID	NS	--	--	ND	U	1	NS	--	--	1.04		1
	PYRUVIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
	VALERIC ACID	NS	--	--	ND	U	1	NS	--	--	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	3.547		0.01	4.53		0.01	7.517		0.01	5.964		0.01
Reduced Gases (µg/L)	ACETYLENE	NS	--	--	ND	U	10	NS	--	--	ND	U	10
RSKSOP-175	ETHANE	NS	--	--	ND	U	4	NS	--	--	ND	U	4
	ETHYLENE	NS	--	--	ND	U	5	NS	--	--	9.56		5
	METHANE	NS	--	--	ND	U	2	NS	--	--	30.1		2
	PROPANE	NS	--	--	ND	U	6	NS	--	--	ND	U	6
General Chemistry (mg/L)	ALKALINITY	NS	--	--	325		1	NS	--	--	338		1
SM2320b, EPA Method 300,	BROMIDE	NS	--	--	0.527		0.125	NS	--	--	0.61		0.25
EPA Method 353.2, SM4500	CHLORIDE	NS	--	--	44.7		0.33	NS	--	--	45.2		0.66
Pe[c]	IODIDE	NS	--	--	ND	U	0.75	NS	--	--	ND	U	0.75
	NITRATE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	NITRITE	NS	--	--	NA	--	--	NS	--	--	NA	--	--

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 1 Recirculation									Phase 1 Passive		
	Sample ID	106MW2S-P1R-102017			106MW2S-P1R-102517			106MW2S-P1R-110117			106MW2S-P1P-111617		
	Sample Date	10/20/2017			10/25/2017			11/1/2017			11/16/2017		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	NITROGEN, NITRATE-NITRITE	NS	--	--	ND	U	0.375	NS	--	--	ND	U	0.375
	O-PHOSPHATE (AS P)	NS	--	--	0.107		0.02	NS	--	--	0.0281	J	0.02
	ORTHOPHOSPHATE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	PHOSPHORUS	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	SULFATE	NS	--	--	15		1	NS	--	--	ND	U	2
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	NS	--	--	1.53		0.06	NS	--	--	1.77		0.06
	MANGANESE	NS	--	--	2.16		0.006	NS	--	--	2.48		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-91.61		-99	-90.59		-99	-85.76		-99	-87.39		-99
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	NS	--	--	ND	U	50				ND	U	50
	1,2,4-TRICHLOROBENZENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	NS	--	--	194		50	NS	--	--	159		50
	1,2-DIBROMOETHANE	NS	--	--	86.5	J	50	NS	--	--	37.7	J	50
	1,2-DICHLOROETHANE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	1,3,5-TRIMETHYLBENZENE	NS	--	--	74.2	J	50	NS	--	--	61.7	J	50
	2-BUTANONE	NS	--	--	ND	U	500	NS	--	--	ND	U	500
	2-CHLOROTOLUENE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	2-HEXANONE	NS	--	--	143	J	250	NS	--	--	ND	U	250
	4-METHYL-2-PENTANONE	NS	--	--	ND	U	250	NS	--	--	ND	U	250
	ACETONE	NS	--	--	701	J	500	NS	--	--	272	J-	500
	BENZENE	NS	--	--	2730		50	NS	--	--	2650		50
	CARBON DISULFIDE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	CHLOROMETHANE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	CIS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	NS	--	--	ND	U	100	NS	--	--	ND	U	100
	ETHYLBENZENE	NS	--	--	512		50	NS	--	--	468		50
	ISOPROPYLBENZENE	NS	--	--	47	J	50	NS	--	--	90.2	J	50
	M,P-XYLENES	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	METHYLENE CHLORIDE	NS	--	--	ND	U	100	NS	--	--	ND	U	100
	NAPHTHALENE	NS	--	--	83.7	J	50	NS	--	--	68.1	J	50
	N-BUTYLBENZENE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	N-PROPYLBENZENE	NS	--	--	44.3	J	50	NS	--	--	31.7	J	50
	O-XYLENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	NS	--	--	118		50	NS	--	--	112		50
	SEC-BUTYLBENZENE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	TERT-BUTYLBENZENE	NS	--	--	ND	U	50	NS	--	--	ND	U	50
	TETRACHLOROETHENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	TOLUENE	NS	--	--	4740		50	NS	--	--	3580		50
	TRANS-1,2-DICHLOROETHENE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	TRICHLOROETHENE	NS	--	--	ND	U	50	NS	--	--	38.2	J	50
	TRICHLOROFLUOROMETHANE	NS	--	--	ND	U	100	NS	--	--	ND	U	100
	VINYL CHLORIDE	NS	--	--	NA	--	--	NS	--	--	NA	--	--
	XYLENES	NS	--	--	1970		150	NS	--	--	1680		150

Refer to notes at the end of the table.

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation								
	Sample ID	**106MW2S-P1P-112817**			**106MW2S-P2R-010918**			**106MW2S-P2R-011618**			**106MW2S-P2R-012418**		
	Sample Date	**11/28/2017**			**1/9/2018**			**1/16/2018**			**1/24/2018**		
	Sample Purpose	**REG**			**REG**			**REG**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community	1,1 DCA Reductase (DCA)	ND	U	5	NS	--	--	NS	--	--	ND	U	5.7
(cells/mL)	1,2 DCA Reductase (DCAR)	ND	U	5	NS	--	--	NS	--	--	ND	U	5.7
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.6
	cer A Reductase	NA	--	--	NS	--	--	NS	--	--	ND	U	5.7
	Chloroform Reductase (CFR)	ND	U	5	NS	--	--	NS	--	--	ND	U	5.7
	Dehalobacter DCM (DCM)	ND	U	5	NS	--	--	NS	--	--	626		5.7
	Dehalobacter spp. (DHBt)	15000		5	NS	--	--	NS	--	--	67200		5.7
	Dehalobium chlorocoercia (DECO)	4610		5	NS	--	--	NS	--	--	12300		5.7
	Dehalococcoides (DHC)	0.5	J	0.5	NS	--	--	NS	--	--	ND	U	0.6
	Dehalogenimonas spp. (DHG)	ND	U	5	NS	--	--	NS	--	--	370		5.7
	Desulfitobacterium spp. (DSB)	43100		5	NS	--	--	NS	--	--	39800		5.7
	Desulfuromonas spp. (DSM)	9.8		5	NS	--	--	NS	--	--	86.6		5.7
	Dichloromethane Dehalogenase (DCMA)	ND	U	5	NS	--	--	NS	--	--	ND	U	5.7
	Epoxyalkane Transferase (EtnE)	ND	U	5	NS	--	--	NS	--	--	ND	U	5.7
	Ethene Monooxygenase (EtnC)	ND	U	5	NS	--	--	NS	--	--	ND	U	5.7
	Methanogens (MGN)	1470		5	NS	--	--	NS	--	--	91.2		5.7
	PCE Reductase (PCE-1)	NA	--	--	NS	--	--	NS	--	--	ND	U	5.7
	Phenol Hydroxylase (PHE)	9650		5	NS	--	--	NS	--	--	16600		5.7
	PMMO	ND	U	5	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	ND	U	5	NS	--	--	NS	--	--	418		5.7
	Sulfate Reducing Bacteria (APS)	124000		5	NS	--	--	NS	--	--	140000		5.7
	tceA Reductase (TCE)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.6
	Toluene Dioxygenase (TOD)	ND	U	5	NS	--	--	NS	--	--	ND	U	5.7
	Toluene Monooxygenase (RMO)	14600		5	NS	--	--	NS	--	--	14000		5.7
	Toluene Monooxygenase 2 (RDEG)	6380		5	NS	--	--	NS	--	--	6110		5.7
	Total Eubacteria (EBAC)	4850000		5	NS	--	--	NS	--	--	4160000		5.7
	trans-1,2-DCE Reductase (TDR)	NA	--	--	NS	--	--	NS	--	--	ND	U	5.7
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	5	NS	--	--	NS	--	--	ND	U	5.7
	Vinyl Chloride Reductase (VCR)	ND	U	0.5	NS	--	--	NS	--	--	ND	U	0.6
EDB (μg/L) EPA Method 8011	1,2-DIBROMOETHANE	15		1.92	54.9		1.9	77.7		1.91	68.1		1.92
VFAs (mg/L)	ACETIC ACID	67.8		1	75.2		1	97.2		1	33.8		1
EPA Method 300m	BUTYRIC ACID	2.95		1	ND	U	1	ND	U	1	0.39	J	1
	FORMIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	LACTIC ACID	ND	U	1	2.04		1	ND	U	1	0.52	J	1
	PROPIONIC ACID	2.78		1	13.2		1	24.4		1	10		1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1.00	ND	U	1.00	ND	U	1	ND	U	1
Fluorometric (μg/L) Spectrofluorophotometry	FLUORESCEIN	5.133		0.01	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (μg/L)	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
RSKSOP-175	ETHANE	ND	U	4	2.02	J	4	1.8	J	4	1.59	J	4
	ETHYLENE	6.53		5	6.34		5	6.12		5	5.73		5
	METHANE	351		2	11.3		2	8.47		2	12.4		2
	PROPANE	ND	U	6	1.95	J	6	ND	U	6	ND	U	6
General Chemistry (mg/L)	ALKALINITY	349		1	372	J-	1	343		1	334		1
SM2320b, EPA Method 300,	BROMIDE	0.751		0.25	0.465	J	0.25	0.608		0.25	0.553		0.25
EPA Method 353.2, SM4500	CHLORIDE	45.6		0.66	50.2		0.66	52.5	J+	0.66	49		0.66
Pe[c]	IODIDE	ND	U	0.75	9.4		0.75	16		0.75	17		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 1 Passive			Phase 2 Recirculation								
	Sample ID	106MW2S-P1P-112817			106MW2S-P2R-010918			106MW2S-P2R-011618			106MW2S-P2R-012418		
	Sample Date	11/28/2017			1/9/2018			1/16/2018			1/24/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	NITROGEN, NITRATE-NITRITE	ND	U	0.375	ND	U	0.375	ND	U	0.375	ND	U	0.375
	O-PHOSPHATE (AS P)	0.0153	J	0.02	0.113		0.02	0.285		0.02	0.718		0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	2	1.96	J	2	1.16	J+	2	ND	U	2
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	4.17		0.06	3.85	J-	0.06	4.08		0.06	4.93	J-	0.06
	MANGANESE	3.14		0.006	4.99		0.006	5.91		0.006	6.81	J-	0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	-86.24		-99	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	-1.6 ±2‰	--	--	NS	--	--	NS	--	--	-11.7 ±2‰	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	203		25	253		25	258		50	291		50
	1,2-DIBROMOETHANE	19.3	J	25	71.1		25	66.3	J	50	55.4	J	50
	1,2-DICHLOROETHANE	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	1,3,5-TRIMETHYLBENZENE	76.7		25	98.8		25	98.9	J	50	106		50
	2-BUTANONE	ND	U	250	ND	U	250	ND	U	500	ND	U	500
	2-CHLOROTOLUENE	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	125	120	J	125	ND	U	250	ND	U	250
	4-METHYL-2-PENTANONE	ND	U	125	88.6	J	125	ND	U	250	ND	U	250
	ACETONE	177	J	250	371	J	250	450	J	500	256	J	500
	BENZENE	2870		25	3240		25	3430		50	3820		50
	CARBON DISULFIDE	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	CHLOROMETHANE	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	ETHYLBENZENE	582		25	729		25	739		50	912		50
	ISOPROPYLBENZENE	132		25	77.5		25	73.6	J	50	101		50
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	NAPHTHALENE	68.5		25	90.1		25	79.4	J	50	88.8	J	50
	N-BUTYLBENZENE	ND	U	25	12.6	J	25	ND	U	50	ND	U	50
	N-PROPYLBENZENE	43.5	J	25	62.7		25	58.6	J	50	71.5	J	50
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	125		25	146		25	138		50	ND	U	50
	SEC-BUTYLBENZENE	ND	U	25	14.9	J	25	ND	U	50	ND	U	50
	TERT-BUTYLBENZENE	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	4210		25	6070		25	7440		50	8920		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	25	ND	U	25	ND	U	50	ND	U	50
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	50	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2070		75	2240		75	2430		150	2900		150

Refer to notes at the end of the table.

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	**Phase 2 Passive**											
	Sample ID	**106MW2S-P2P-030718**			**106MW2S-P2P-041018**			**106MW2S-P2P-041018-FD**			**106MW2S-P2P-050918**		
	Sample Date	**3/7/2018**			**4/10/2018**			**4/10/2018**			**5/9/2018**		
	Sample Purpose	**REG**			**REG**			**FD**			**REG**		
Chemical Class and Analytical Method[a]	**Parameter**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**	**Result**	**Val Qual**	**LOQ**
Microbial Community	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
(cells/mL)	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.9
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	58500		9.4
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	5330		9.4
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.9
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	6490		9.4
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	23300		9.4
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	122		9.4
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	48.9		9.4
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	77100		9.4
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	4870		9.4
	PMMO	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	303		9.4
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	76000		9.4
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.9
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	4290		9.4
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	3240		9.4
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	9060000		9.4
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	ND	U	9.4
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.9
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	8.25	J+	1.92	0.154		0.0192	0.139		0.0191	0.0331	J	0.0189
VFAs (mg/L)	ACETIC ACID	151		10	113.5		10	118.4		10	15.7		1
EPA Method 300m	BUTYRIC ACID	11.8		1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	U	1	2.1		1	2.8		1	ND	U	1
	LACTIC ACID	ND	U	1	ND	U	1	1		1	0.75	J	1
	PROPIONIC ACID	32		1	25.8		10	27.9		10	12.8		1
	PYRUVIC ACID	1.1		1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	2.60		1	1.10		1	2.30		1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
RSKSOP-175	ETHANE	1.7	J	4	1.02	J	4	0.97	J	4	0.95	J	4
	ETHYLENE	8.9		5	5.5		5	5.02		5	3.45	J	5
	METHANE	3110		20	11800		20	11600		20	11800		20
	PROPANE	1.7	J	6	1.39	J	6	1.2	J	6	ND	U	6
General Chemistry (mg/L)	ALKALINITY	375		1	399		1	382		1	517		1
SM2320b, EPA Method 300,	BROMIDE	0.798	J	0.625	0.561		0.25	0.567		0.25	0.556		0.25
EPA Method 353.2, SM4500	CHLORIDE	48		1.65	49.5		0.66	49.8		0.66	52.3		0.66
Pe[c]	IODIDE	19		0.75	18		0.75	19		0.75	21		1.5
	NITRATE	NA	--	--	ND	U	0.2	ND	U	0.2	ND	U	0.2
	NITRITE	NA	--	--	ND	U	0.2	ND	U	0.2	ND	U	0.2

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 2 Passive											
	Sample ID	106MW2S-P2P-030718			106MW2S-P2P-041018			106MW2S-P2P-041018-FD			106MW2S-P2P-050918		
	Sample Date	3/7/2018			4/10/2018			4/10/2018			5/9/2018		
	Sample Purpose	REG			REG			FD			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	NITROGEN, NITRATE-NITRITE	ND	U	0.375	NA	--	--	NA	--	--	NA	--	--
	O-PHOSPHATE (AS P)	0.846	J-	0.02	0.623		0.02	0.571		0.04	0.334		0.02
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	5	ND	U	2	ND	U	2	ND	U	2
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	11		0.06	12.3	J-	0.06	12.1	J-	0.06	13.4		0.06
	MANGANESE	8.79		0.006	9.47	J+	0.006	9.42	J+	0.006	9.26		0.006
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	2.5
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	193		50	194		50	189		50	185		2.5
	1,2-DIBROMOETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	2.5
	1,2-DICHLOROETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	2.5
	1,3,5-TRIMETHYLBENZENE	78.2	J	50	70.3	J	50	69.2	J	50	65.8		2.5
	2-BUTANONE	ND	U	500	ND	U	500	ND	U	500	45.1	J	25
	2-CHLOROTOLUENE	ND	U	50	ND	U	50	ND	U	50	ND	U	2.5
	2-HEXANONE	ND	U	250	ND	U	250	ND	U	250	63.4		12.5
	4-METHYL-2-PENTANONE	ND	U	250	ND	U	250	ND	U	250	52.8		12.5
	ACETONE	ND	U	500	379	J	500	343	J	500	65.5		25
	BENZENE	3240		50	2360		50	2210		50	1680		12.5
	CARBON DISULFIDE	ND	U	50	ND	U	50	ND	U	50	ND	U	2.5
	CHLOROMETHANE	ND	U	50	ND	U	50	ND	U	50	ND	U	2.5
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	5
	ETHYLBENZENE	677		50	628		50	591		50	506	J-	2.5
	ISOPROPYLBENZENE	139		50	150		50	150		50	134		2.5
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	ND	U	50	ND	U	50	ND	U	2.5
	METHYLENE CHLORIDE	ND	U	100	ND	U	100	ND	U	100	ND	U	5
	NAPHTHALENE	54.3	J	50	78.6	J	50	80.1	J	50	89.6		2.5
	N-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	50	7.13		2.5
	N-PROPYLBENZENE	43.4	J	50	52.4	J	50	50.4	J	50	47.8		2.5
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	ND	U	50	83.4	J	50	81.7	J	50	77.4		2.5
	SEC-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	50	8.23		2.5
	TERT-BUTYLBENZENE	ND	U	50	ND	U	50	ND	U	50	ND	U	2.5
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	6980		50	5440		50	5190		50	3600		12.5
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	ND	U	50	ND	U	50	ND	U	2.5
	TRICHLOROFLUOROMETHANE	ND	U	100	ND	U	100	ND	U	100	ND	U	5
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2160		150	1870		150	1810		150	1510	J-	7.5

Refer to notes at the end of the table.

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 2 Passive			Phase 3 Recirculation								
	Sample ID	106MW2S-P2P-061418			106MW2S-P3R-080718			106MW2S-P3R-081518			106MW2S-P3R-082118		
	Sample Date	6/14/2018			8/7/2018			8/15/2018			8/21/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	954		5
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	51000		5
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	21100		5
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	127000		5
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	36.3		5
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	831		5
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	893		5
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	41200		5
	PMMO	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	198		5
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	238000		5
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	152		5
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	269000		5
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	23600		5
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	22300000		5
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	ND	U	5
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	ND	U	0.0191	NS	--	--	8.5		0.031	6.7	J	0.029
VFAs (mg/L) EPA Method 300m	ACETIC ACID	4.7	J	1	80.2		10	102.2		10	60.8		10
	BUTYRIC ACID	ND	UJ	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	ND	UJ	1	1.6	J	10	ND	U	1	1	J	10
	LACTIC ACID	0.4	J	1	3.4	J	10	0.6	J	1	1.5		1
	PROPIONIC ACID	ND	UJ	1	29.9		10	43.6		10	56.3		10
	PYRUVIC ACID	ND	UJ	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	UJ	1	ND	U	1.00	ND	U	1.00	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	UJ	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	0.9	J	4	2.1		4	1.8	J	4	2	J	4
	ETHYLENE	2.6	J	5	8.4		5	11.1		5	11.1		5
	METHANE	10800	J	20	4728.7		2	4434.8		2	5542.2		2
	PROPANE	1.1	J	6	2.9	J	6	2.3	J	6	2.4	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	526	J-	1	NA	--	--	390		5	420		5
	BROMIDE	0.412	J	0.625	NA	--	--	1.3		0.5	1.4		0.5
	CHLORIDE	52.7		1.65	NA	--	--	52		0.5	52		0.5
	IODIDE	19		1.5	3.8		0.75	4.2		0.75	4.1		0.75
	NITRATE	ND	U	0.5	NA	--	--	NA	--	--	NA	--	--
	NITRITE	ND	U	0.5	NA	--	--	NA	--	--	NA	--	--

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 2 Passive			Phase 3 Recirculation								
	Sample ID	106MW2S-P2P-061418			106MW2S-P3R-080718			106MW2S-P3R-081518			106MW2S-P3R-082118		
	Sample Date	6/14/2018			8/7/2018			8/15/2018			8/21/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	NITROGEN, NITRATE-NITRITE	NA	--	--	NA	--	--	0.099		0.05	ND		0.05
	O-PHOSPHATE (AS P)	0.399		0.04	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	NA	--	--	NA	--	--	ND	U	0.15	0.15	J	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	5	NA	--	--	0.89	J	1	2.9		1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	13		0.06	NA	--	--	8.2		0.05	7.9		0.05
	MANGANESE	9.33		0.006	NA	--	--	10		0.003	10		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	-9.05 ±1.5‰	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	50				ND	U	25	ND	U	10
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	218		50	NA	--	--	300		50	210		20
	1,2-DIBROMOETHANE	ND	U	50	NA	--	--	ND	U	50	ND	U	20
	1,2-DICHLOROETHANE	ND	U	50	NA	--	--	ND	U	50	ND	U	20
	1,3,5-TRIMETHYLBENZENE	78.4	J	50	NA	--	--	100		25	81		10
	2-BUTANONE	ND	U	500	NA	--	--	ND	U	500	ND	U	200
	2-CHLOROTOLUENE	ND	U	50	NA	--	--	ND	U	25	ND	U	10
	2-HEXANONE	ND	U	250	NA	--	--	ND	U	250	67	J	100
	4-METHYL-2-PENTANONE	ND	U	250	NA	--	--	ND	U	250	54	J	100
	ACETONE	ND	U	500	NA	--	--	ND	U	500	200		200
	BENZENE	2640		50	NA	--	--	3600		50	2700		20
	CARBON DISULFIDE	ND	U	50	NA	--	--	ND	U	100	ND	U	40
	CHLOROMETHANE	ND	U	50	NA	--	--	ND	U	50	ND	U	20
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	ND	U	100	NA	--	--	860		50	650		20
	ETHYLBENZENE	691		50	NA	--	--	89		50	71		20
	ISOPROPYLBENZENE	183		50	NA	--	--	89		50	71		20
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	50	NA	--	--	ND	U	25	ND	U	10
	METHYLENE CHLORIDE	ND	U	100	NA	--	--	ND	U	250	ND	U	100
	NAPHTHALENE	69.1	J	50	NA	--	--	140	J	250	110		100
	N-BUTYLBENZENE	ND	U	50	NA	--	--	ND	U	50	11	J	20
	N-PROPYLBENZENE	52.4	J	50	NA	--	--	72		50	57		20
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	87.7	J	50	NA	--	--	110		50	88		20
	SEC-BUTYLBENZENE	ND	U	50	NA	--	--	ND	U	50	10	J	20
	TERT-BUTYLBENZENE	ND	U	50	NA	--	--	ND	U	50	ND	U	20
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	6020		50	NA	--	--	8000		50	6000		50
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	82.5	J	50	NA	--	--	ND	U	50	ND	U	20
	TRICHLOROFLUOROMETHANE	ND	U	100	NA	--	--	ND	U	50	ND	U	20
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2240		150	NA	--	--	2800		25	2100		10

Refer to notes at the end of the table.

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 3 Recirculation			Phase 3 Passive								
	Sample ID	106MW2S-P3R-082818			106MW2S-P3P-091118			106MW2S-P3P-100218			106MW2S-P3P-111518		
	Sample Date	8/28/2018			9/11/2018			10/2/2018			11/15/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	NS	--	--	NS	--	--	NS	--	--	ND	U	26.3
	1,2 DCA Reductase (DCAR)	NS	--	--	NS	--	--	NS	--	--	ND	U	26.3
	BAV1 Vinyl Chloride Reductase (BVC)	NS	--	--	NS	--	--	NS	--	--	ND	U	2.6
	cer A Reductase	NS	--	--	NS	--	--	NS	--	--	ND	U	26.3
	Chloroform Reductase (CFR)	NS	--	--	NS	--	--	NS	--	--	679		26.3
	Dehalobacter DCM (DCM)	NS	--	--	NS	--	--	NS	--	--	5070		26.3
	Dehalobacter spp. (DHBt)	NS	--	--	NS	--	--	NS	--	--	381000		26.3
	Dehalobium chlorocoercia (DECO)	NS	--	--	NS	--	--	NS	--	--	11400		26.3
	Dehalococcoides (DHC)	NS	--	--	NS	--	--	NS	--	--	0.9	J	2.6
	Dehalogenimonas spp. (DHG)	NS	--	--	NS	--	--	NS	--	--	1150		26.3
	Desulfitobacterium spp. (DSB)	NS	--	--	NS	--	--	NS	--	--	193000		26.3
	Desulfuromonas spp. (DSM)	NS	--	--	NS	--	--	NS	--	--	3010		26.3
	Dichloromethane Dehalogenase (DCMA)	NS	--	--	NS	--	--	NS	--	--	ND	U	26.3
	Epoxyalkane Transferase (EtnE)	NS	--	--	NS	--	--	NS	--	--	372		26.3
	Ethene Monooxygenase (EtnC)	NS	--	--	NS	--	--	NS	--	--	ND	U	26.3
	Methanogens (MGN)	NS	--	--	NS	--	--	NS	--	--	201000		26.3
	PCE Reductase (PCE-1)	NS	--	--	NS	--	--	NS	--	--	ND	U	26.3
	Phenol Hydroxylase (PHE)	NS	--	--	NS	--	--	NS	--	--	61500		26.3
	PMMO	NS	--	--	NS	--	--	NS	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	NS	--	--	NS	--	--	NS	--	--	90.1		26.3
	Sulfate Reducing Bacteria (APS)	NS	--	--	NS	--	--	NS	--	--	88600		26.3
	tceA Reductase (TCE)	NS	--	--	NS	--	--	NS	--	--	ND	U	2.6
	Toluene Dioxygenase (TOD)	NS	--	--	NS	--	--	NS	--	--	ND	U	26.3
	Toluene Monooxygenase (RMO)	NS	--	--	NS	--	--	NS	--	--	45600		26.3
	Toluene Monooxygenase 2 (RDEG)	NS	--	--	NS	--	--	NS	--	--	64200		26.3
	Total Eubacteria (EBAC)	NS	--	--	NS	--	--	NS	--	--	23300000		26.3
	trans-1,2-DCE Reductase (TDR)	NS	--	--	NS	--	--	NS	--	--	ND	U	26.3
	Trichlorobenzene Dioxygenase (TCBO)	NS	--	--	NS	--	--	NS	--	--	ND	U	26.3
	Vinyl Chloride Reductase (VCR)	NS	--	--	NS	--	--	NS	--	--	ND	U	2.6
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.57		0.003	1.2		0.0029	0.074		0.00029	0.019	J	0.00029
VFAs (mg/L) EPA Method 300m	ACETIC ACID	45.2		10	9.8	J	10	ND	U	1	ND	U	1
	BUTYRIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	FORMIC ACID	0.3	J	1	2.4	J	10	ND	U	1	0.5	J	1
	LACTIC ACID	0.4	J	1	0.4	J	1	0.9	J	1	0.8	J	1
	PROPIONIC ACID	55.5		10	47.6		10	ND	U	1	ND	U	1
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
	ETHANE	2.1	J	4	1.5	J	4	1.2	J	4	1.6	J	4
	ETHYLENE	9.1		5	6		5	3.6	J	5	2.7	J	5
	METHANE	7211.5		2	9000.4		2	9674		2	11240.9		2
	PROPANE	2.5	J	6	1.8	J	6	ND	U	6	1.8	J	6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	460		5	430		5	460		5	500		5
	BROMIDE	1		0.5	0.81		0.5	1.5		0.5	1.1		0.5
	CHLORIDE	53		0.5	50		0.5	47		0.5	46		0.5
	IODIDE	4.5		0.75	3.9		0.75	3.6		0.75	4.3		0.75
	NITRATE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 3 Recirculation			Phase 3 Passive								
	Sample ID	106MW2S-P3R-082818			106MW2S-P3P-091118			106MW2S-P3P-100218			106MW2S-P3P-111518		
	Sample Date	8/28/2018			9/11/2018			10/2/2018			11/15/2018		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	NITROGEN, NITRATE-NITRITE	ND	U	0.05	ND	U	0.1	ND	U	0.05	ND	U	0.05
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	1.1		0.15	1.5		0.15	0.18	J	0.15	ND	UJ	0.15
	PHOSPHORUS	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	SULFATE	ND	U	1	ND	U	1	2.2		1	ND	U	1
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Dissolved Metals (mg/L) EPA Method 6010	IRON	8.2		0.05	7.6		0.05	9.2		0.05	10		0.05
	MANGANESE	10		0.003	10		0.003	11		0.003	11		0.003
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	-4.6 ±8‰	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	1,2,4-TRICHLOROBENZENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	1,2,4-TRIMETHYLBENZENE	220		50	220		100	200		100	190		100
	1,2-DIBROMOETHANE	ND	U	50	ND	U	100	ND	U	100	ND	U	100
	1,2-DICHLOROETHANE	ND	U	50	ND	U	100	ND	U	100	ND	U	100
	1,3,5-TRIMETHYLBENZENE	79		25	76	J	50	78	J	50	75	J	50
	2-BUTANONE	ND	U	500	ND	U	1000	ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	2-HEXANONE	ND	U	250	ND	U	500	ND	U	500	ND	U	500
	4-METHYL-2-PENTANONE	ND	U	250	ND	U	500	ND	U	500	ND	U	500
	ACETONE	ND	U	500	ND	U	1000	ND	U	1000	ND	U	1000
	BENZENE	2800		50	2300		100	1900		100	2100		100
	CARBON DISULFIDE	ND	U	100	ND	U	200	ND	U	200	ND	U	200
	CHLOROMETHANE	ND	U	50	ND	U	100	ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	DICHLORODIFLUOROMETHANE	690		50	640		100	540		100	620		100
	ETHYLBENZENE	73		50	78	J	100	98	J	100	130		100
	ISOPROPYLBENZENE	73		50	78	J	100	98	J	100	130		100
	M,P-XYLENES	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	50	ND	U	50	ND	U	50
	METHYLENE CHLORIDE	150	J	250	ND	U	500	ND	U	500	ND	U	500
	NAPHTHALENE	ND	U	250	ND	U	500	ND	U	500	ND	U	500
	N-BUTYLBENZENE	ND	U	50	ND	U	100	ND	U	100	ND	U	100
	N-PROPYLBENZENE	58		50	57	J	100	55	J	100	56	J	100
	O-XYLENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	P-ISOPROPYLTOLUENE	81		50	76	J	100	84	J	100	63	J	100
	SEC-BUTYLBENZENE	ND	U	50	ND	U	100	ND	U	100	ND	U	100
	TERT-BUTYLBENZENE	ND	U	50	ND	U	100	ND	U	100	ND	U	100
	TETRACHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TOLUENE	6600		50	5800		100	5000		100	4900		100
	TRANS-1,2-DICHLOROETHENE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	TRICHLOROETHENE	ND	U	50	ND	U	100	ND	U	100	53	J	100
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	100	ND	U	100	ND	U	100
	VINYL CHLORIDE	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	XYLENES	2300		25	2000		50	1800		50	2000		50

Refer to notes at the end of the table.

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 4 Passive											
	Sample ID	106MW2S-P4P-0111719			106MW2S-LTM-031120			106MW2S-LTM-052020			106MW2S-LTM-080520		
	Sample Date	1/17/2019			3/11/2020			5/20/2020			8/5/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
Microbial Community	1,1 DCA Reductase (DCA)	ND	U	14.3	ND	U	4.8	ND	U	4.9	ND	U	5.1
(cells/mL)	1,2 DCA Reductase (DCAR)	ND	U	14.3	ND	U	4.8	ND	U	4.9	ND	U	5.1
QuantArray-Chlor	BAV1 Vinyl Chloride Reductase (BVC)	ND	U	1.4	ND	U	0.5	ND	U	0.5	ND	U	0.5
	cer A Reductase	ND	U	14.3	ND	U	4.8	ND	U	4.9	ND	U	5.1
	Chloroform Reductase (CFR)	ND	U	14.3	ND	U	4.8	ND	U	4.9	ND	U	5.1
	Dehalobacter DCM (DCM)	ND	U	14.3	524		4.8	1670		4.9	ND	U	5.1
	Dehalobacter spp. (DHBt)	155000		14.3	45300		4.8	119000		4.9	147000		5.1
	Dehalobium chlorocoercia (DECO)	12800		14.3	3190		4.8	6330		4.9	14600		5.1
	Dehalococcoides (DHC)	1.6		1.4	2.4		0.5	2.5		0.5	2.6		0.5
	Dehalogenimonas spp. (DHG)	1190		14.3	762		4.8	777		4.9	ND	U	5.1
	Desulfitobacterium spp. (DSB)	60600		14.3	14000		4.8	26300		4.9	21100		5.1
	Desulfuromonas spp. (DSM)	433		14.3	35.2		4.8	2810		4.9	270		5.1
	Dichloromethane Dehalogenase (DCMA)	ND	U	14.3	ND	U	4.8	ND	U	4.9	ND	U	5.1
	Epoxyalkane Transferase (EtnE)	ND	U	14.3	ND	U	4.8	31.9		4.9	186		5.1
	Ethene Monooxygenase (EtnC)	ND	U	14.3	ND	U	4.8	ND	U	4.9	ND	U	5.1
	Methanogens (MGN)	583000		14.3	61800		4.8	23100		4.9	26600		5.1
	PCE Reductase (PCE-1)	ND	U	14.3	ND	U	4.8	ND	U	4.9	ND	U	5.1
	Phenol Hydroxylase (PHE)	8080		14.3	2100		4.8	18800		4.9	25200		5.1
	PMMO	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	213		14.3	45.7		4.8	404		4.9	2440		5.1
	Sulfate Reducing Bacteria (APS)	28200		14.3	14700		4.8	79200		4.9	131000		5.1
	tceA Reductase (TCE)	ND	U	1.4	ND	U	0.5	ND	U	0.5	ND	U	0.5
	Toluene Dioxygenase (TOD)	ND	U	14.3	ND	U	4.8	ND	U	4.9	ND	U	5.1
	Toluene Monooxygenase (RMO)	20800		14.3	21800		4.8	56500		4.9	243000		5.1
	Toluene Monooxygenase 2 (RDEG)	15800		14.3	3710		4.8	17100		4.9	9630		5.1
	Total Eubacteria (EBAC)	14500000		14.3	5430000		4.8	12800000		4.9	27200000		5.1
	trans-1,2-DCE Reductase (TDR)	ND	U	14.3	ND	U	4.8	ND	U	4.9	ND	U	5.1
	Trichlorobenzene Dioxygenase (TCBO)	ND	U	14.3	98.9		4.8	136		4.9	ND	U	5.1
	Vinyl Chloride Reductase (VCR)	0.3	J	1.4	0.2	J	0.5	ND	U	0.5	ND	U	0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.016	J	0.00029	ND	U	0.011	0.13		0.01	0.024	J	0.011
VFAs (mg/L)	ACETIC ACID				ND	U	1	ND	U	10	ND	U	10
EPA Method 300m	BUTYRIC ACID				ND	U	1	ND	U	10	ND	U	10
	FORMIC ACID				0.5	J	10	ND	U	10	2.6	J	10
	LACTIC ACID	1		1	1.1	J	10	ND	U	10	ND	U	10
	PROPIONIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	PYRUVIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
	VALERIC ACID	ND	U	1	ND	U	1	ND	U	10	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--	NS	--	--	NS	--	--	NS	--	--
Reduced Gases (µg/L)	ACETYLENE	ND	U	10	ND	U	10	ND	U	10	ND	U	10
RSKSOP-175	ETHANE	2	J	4	0.9	J	4	4.3		4	2.6	J	4
	ETHYLENE	2.4	J	5	ND	U	5	1.9	J	5	1.7	J	5
	METHANE	11940.9		20	3147.7		2	9877.3		2	7487.4		2
	PROPANE	2	J	6	ND	U	6	3	J	6	2	J	6
General Chemistry (mg/L)	ALKALINITY	520		5	568		5	533		5	506		5
SM2320b, EPA Method 300,	BROMIDE	0.67		0.5	0.838		0.1	0.762		0.1	1.25		0.1
EPA Method 353.2, SM4500	CHLORIDE	46		0.5	47.9		0.5	46.8		0.5	49.9		0.5
Pe[c]	IODIDE	3.9	J+	1.5	4.3		0.2	5		0.2	5.6		2
	NITRATE	NA	--	--	0.056	J	0.1	0.0627	J	0.1	ND	U	0.1
	NITRITE	NA	--	--	NA	--	--	NA	--	--	NA	--	--

Table 15
Analytical Data Table for KAFB-106MW2-S

	Phase Designation	Phase 4 Passive											
	Sample ID	106MW2S-P4P-0111719			106MW2S-LTM-031120			106MW2S-LTM-052020			106MW2S-LTM-080520		
	Sample Date	1/17/2019			3/11/2020			5/20/2020			8/5/2020		
	Sample Purpose	REG			REG			REG			REG		
Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ	Result	Val Qual	LOQ
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	NITROGEN, NITRATE-NITRITE	ND	UJ	0.05	ND	U	0.1	ND	U	0.1	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--	NA	--	--	NA	--	--	NA	--	--
	ORTHOPHOSPHATE	ND	UJ	0.15	NA	--	--	NA	--	--	NA	--	--
	PHOSPHORUS	NA	--	--	0.022	J	0.025	ND	U	0.025	ND	U	0.025
	SULFATE	ND	U	1	ND	U	0.5	0.414	J	0.5	0.546		0.5
Metals (mg/L) EPA Method 6010	LEAD	NS	--	--	ND	U	0.001	ND	U	0.001	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	13		0.05	15.2		0.05	15.2		0.05	14.4		0.05
	MANGANESE	11		0.003	8.65		0.125	8.45		0.25	8.26		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--	NS	--	--	NS	--	--	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--	NS	--	--	NS	--	--	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	25	ND	U	2.5	ND	U	5	ND	U	1
	1,2,4-TRICHLOROBENZENE	NA	--	--	ND	U	2.5	ND	U	5	ND	U	1
	1,2,4-TRIMETHYLBENZENE	240		50	NA	--	--	NA	--	--	NA	--	--
	1,2-DIBROMOETHANE	ND	U	50	ND	U	2.5	ND	U	2.5	ND	U	0.5
	1,2-DICHLOROETHANE	NA	--	--	ND	U	2.5	ND	U	2.5	ND	U	0.5
	1,3,5-TRIMETHYLBENZENE	92		25	100		2.5	100		5	83		1
	2-BUTANONE	ND	U	500	ND	U	5	ND	U	5	3.1		1
	2-CHLOROTOLUENE	ND	U	25	ND	U	2.5	ND	U	5	ND	U	1
	2-HEXANONE	ND	U	250	ND	U	5	ND	U	10	ND	U	2
	4-METHYL-2-PENTANONE	ND	U	250	ND	U	5	ND	U	10	ND	U	2
	ACETONE	ND	U	500	ND	U	5	ND	U	5	19		1
	BENZENE	2400		50	2700		25	2200		12	1500		12
	CARBON DISULFIDE	ND	U	100	ND	U	5	ND	U	5	ND	U	1
	CHLOROMETHANE	ND	U	50	ND	U	2.5	ND	U	2.5	ND	U	0.5
	CIS-1,2-DICHLOROETHENE	NA	--	--	ND	U	2.5	ND	U	2.5	ND	U	0.5
	DICHLORODIFLUOROMETHANE	NA	--	--	ND	U	2.5	ND	U	5	ND	U	1
	ETHYLBENZENE	190		50	970		2.5	880		5	590		25
	ISOPROPYLBENZENE	190		50	170		2.5	160		5	120		1
	M,P-XYLENES	NA	--	--	2000		5	1800		5	1300		25
	METHYL TERT-BUTYL ETHER	ND	U	25	ND	U	2.5	ND	U	2.5	ND	U	0.5
	METHYLENE CHLORIDE	ND	U	250	ND	U	5	10		5	ND	U	1
	NAPHTHALENE	ND	U	250	94		2.5	110		5	94		1
	N-BUTYLBENZENE	ND	U	50	11		2.5	12		5	13		1
	N-PROPYLBENZENE	65		50	88		2.5	85		5	72		1
	O-XYLENE	NA	--	--	950		2.5	870		5	670		25
	P-ISOPROPYLTOLUENE	80		50	58		2.5	60		5	76		1
	SEC-BUTYLBENZENE	ND	U	50	14		2.5	14		5	17		1
	TERT-BUTYLBENZENE	ND	U	50	ND	U	2.5	ND	U	5	ND	U	1
	TETRACHLOROETHENE	NA	--	--	ND	U	2.5	ND	U	5	ND	U	1
	TOLUENE	150		50	11		2.5	7.5		2.5	ND	U	0.5
	TRANS-1,2-DICHLOROETHENE	NA	--	--	ND	U	2.5	ND	U	2.5	ND	U	0.5
	TRICHLOROETHENE	ND	U	50	ND	U	2.5	ND	U	2.5	ND	U	0.5
	TRICHLOROFLUOROMETHANE	ND	U	50	ND	U	2.5	ND	U	5	ND	U	1
	VINYL CHLORIDE	NA	--	--	ND	U	2.5	ND	U	2.5	ND	U	0.5
	XYLENES	2600		25	2900		2.5	2700		5	2000		25

Refer to notes at the end of the table.

Table 15
Analytical Data Table for KAFB-106MW2-S

Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ
	Phase Designation	Phase 4 Passive		
	Sample ID	106MW2S-LTM-101420		
	Sample Date	10/14/2020		
	Sample Purpose	REG		
Microbial Community (cells/mL) QuantArray-Chlor	1,1 DCA Reductase (DCA)	5.2		5.2
	1,2 DCA Reductase (DCAR)	5.2		5.2
	BAV1 Vinyl Chloride Reductase (BVC)	0.5		0.5
	cer A Reductase	5.2		5.2
	Chloroform Reductase (CFR)	5.2		5.2
	Dehalobacter DCM (DCM)	1740		5.2
	Dehalobacter spp. (DHBt)	83200		5.2
	Dehalobium chlorocoercia (DECO)	7370		5.2
	Dehalococcoides (DHC)	4.2		0.5
	Dehalogenimonas spp. (DHG)	5890		5.2
	Desulfitobacterium spp. (DSB)	20900		5.2
	Desulfuromonas spp. (DSM)	212		5.2
	Dichloromethane Dehalogenase (DCMA)	5.2		5.2
	Epoxyalkane Transferase (EtnE)	116		5.2
	Ethene Monooxygenase (EtnC)	5.2		5.2
	Methanogens (MGN)	40600		5.2
	PCE Reductase (PCE-1)	5.2		5.2
	Phenol Hydroxylase (PHE)	9520		5.2
	PMMO	NA	--	--
	Soluble Methane Monooxygenase (SMMO)	1100		5.2
	Sulfate Reducing Bacteria (APS)	96600		5.2
	tceA Reductase (TCE)	0.5		0.5
	Toluene Dioxygenase (TOD)	5.2		5.2
	Toluene Monooxygenase (RMO)	60800		5.2
	Toluene Monooxygenase 2 (RDEG)	9540		5.2
	Total Eubacteria (EBAC)	25200000		5.2
	trans-1,2-DCE Reductase (TDR)	5.2		5.2
	Trichlorobenzene Dioxygenase (TCBO)	5.2		5.2
	Vinyl Chloride Reductase (VCR)	0.5		0.5
EDB (µg/L) EPA Method 8011	1,2-DIBROMOETHANE	0.087		0.01
VFAs (mg/L) EPA Method 300m	ACETIC ACID	ND	U	10
	BUTYRIC ACID	ND	U	10
	FORMIC ACID	1.9	J	10
	LACTIC ACID	0.6	J	10
	PROPIONIC ACID	ND	U	10
	PYRUVIC ACID	ND	U	10
	VALERIC ACID	ND	U	10
Fluorometric (µg/L) Spectrofluorophotometry	FLUORESCEIN	NS	--	--
Reduced Gases (µg/L) RSKSOP-175	ACETYLENE	ND	U	10
	ETHANE	1.3		4
	ETHYLENE	0.9		5
	METHANE	3155.1		2
	PROPANE	0.9		6
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pe[c]	ALKALINITY	490		5
	BROMIDE	1.74		0.1
	CHLORIDE	49.3		0.5
	IODIDE	6.3		
	NITRATE	0.884		0.1
	NITRITE	NA	--	--

Table 15
Analytical Data Table for KAFB-106MW2-S

Chemical Class and Analytical Method[a]	Parameter	Result	Val Qual	LOQ
	Phase Designation	Phase 4 Passive		
	Sample ID	106MW2S-LTM-101420		
	Sample Date	10/14/2020		
	Sample Purpose	REG		
General Chemistry (mg/L) SM2320b, EPA Method 300, EPA Method 353.2, SM4500 Pec	NITROGEN, NITRATE-NITRITE	ND	U	0.1
	O-PHOSPHATE (AS P)	NA	--	--
	ORTHOPHOSPHATE	NA	--	--
	PHOSPHORUS	ND	U	0.025
	SULFATE	0.841		0.5
Metals (mg/L) EPA Method 6010	LEAD	ND	U	0.001
Dissolved Metals (mg/L) EPA Method 6010	IRON	11.3		0.05
	MANGANESE	6.72		0.125
δ2H (‰) Mass Spectrometry, USGS Reston, VA	DELTA2H	NS	--	--
CSIA EDB δ13C (‰) Kuder et al, 2012	EDB δ	NS	--	--
VOCs (µg/L) EPA Method 8260	1,1,2-TRICHLOROETHANE	ND	U	5
	1,2,4-TRICHLOROBENZENE	ND	U	5
	1,2,4-TRIMETHYLBENZENE	NA	--	--
	1,2-DIBROMOETHANE	ND	U	2.5
	1,2-DICHLOROETHANE	ND	U	2.5
	1,3,5-TRIMETHYLBENZENE	73		5
	2-BUTANONE	ND	U	5
	2-CHLOROTOLUENE	ND	U	2.5
	2-HEXANONE	ND	U	10
	4-METHYL-2-PENTANONE	ND	U	10
	ACETONE	ND	U	5
	BENZENE	1700		25
	CARBON DISULFIDE	ND	U	10
	CHLOROMETHANE	ND	U	2.5
	CIS-1,2-DICHLOROETHENE	ND	U	2.5
	DICHLORODIFLUOROMETHANE	ND	U	2.5
	ETHYLBENZENE	630		5
	ISOPROPYLBENZENE	110		2.5
	M,P-XYLENES	1400		5
	METHYL TERT-BUTYL ETHER	ND	U	2.5
	METHYLENE CHLORIDE	ND	U	5
	NAPHTHALENE	79		2.5
	N-BUTYLBENZENE	27		5
	N-PROPYLBENZENE	67		5
	O-XYLENE	700		5
	P-ISOPROPYLTOLUENE	75		5
	SEC-BUTYLBENZENE	15		2.5
	TERT-BUTYLBENZENE	ND	U	5
	TETRACHLOROETHENE	ND	U	2.5
	TOLUENE	5.1		2.5
	TRANS-1,2-DICHLOROETHENE	ND	U	2.5
	TRICHLOROETHENE	ND	U	2.5
	TRICHLOROFLUOROMETHANE	ND	U	2.5
	VINYL CHLORIDE	ND	U	2.5
	XYLENES	2100		2.5

Refer to notes at the end of the table.

Table 15
Analytical Data Table for KAFB-106MW2-S

Notes:

Sampling frequency for each analytical method is outlined in Table 4.

a. EPA analytical methods listed are for the most recent sampling event.

b. Samples were collected using replacement QED Bladder Pumps. This well was not sampled using the Geotech pumps.

-- = Not applicable.

δ2H - Delta Deuterium.

0/00 - Per mil.

cells/mL = Cells per milliliter.

EPA = Environmental Protection Agency.

FD = Field duplicate.

ID = Identification.

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base.

LOQ = Limit of Quantitation

μg/L = Microgram per liter.

mg/L = Milligram per liter.

NA = Not analyzed.

ND = Not detected.

NS = Not sampled.

REG = Regular/parent sample.

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

UJ = Analyte was not detected. The reported value is estimated.

VAL QUAL = Validation qualifier.

VFA - Volatile fatty acid.

VOC = Volatile organic compound.

Table 16
Measures of Tracer Distribution during Phase 1

Well ID	Distance from Injection Well at Surface (Feet)	Greatest Fluorescein Concentration (µg/L)	Greatest δ^2H Value (‰)	Date of Greatest Tracer Contribution (fluorescein and δ^2H)	Transport Time (as indicated by date of greatest tracer contribution [days])
KAFB-106IN1	--	570[a]	+590[a]	10/2/2017	--
KAFB-106MW2-S	28	207.7	+128	10/6/2017	3.5
KAFB-106064	31	144.5	+124	10/6/2017	3.5
KAFB-106MW1-S	47	64.9	-31	10/12/2017	9.5
KAFB-106EX2	76	10.1	-83	10/26/2017 (fluorescein) 11/1/2017 (δ^2H)[b]	22.5-29.5[b]
KAFB-106EX1	92	3.7	-90	11/1/2017[b]	29.5[b]

Notes:

[a] Average injected concentration over 24-hour period.

[b] Greatest quantities occurred at the last sampling of recirculation period and it is unknown if greater quantities might have been observed later had recirculation continued

‰ - Per mil.

δ^2H - delta deuterium (measure of hydrogen isotope composition).

ID - Identification.

KAFB - Kirtland Air Force Base.

µg/L - Micrograms per liter.

Table 17
Contaminant Reduction during Test Phases

Well ID	n - Log_{10} Concentration Reduction During Passive Phase Relative to Recirculation											
	Phase 1			Phase 2			Phase 3			Phase 4[a]		
	Benzene	Toluene	EDB	Benzene	Toluene	EDB	Benzene	Toluene	EDB	Benzene	Toluene	EDB
KAFB-106064	-0.1	-0.4	0.6	0.0	-0.1	1.1	0.1	0.0	2.5	0.1	1.2	4.2
KAFB-106MW1-S	0.0	-0.1	0.3	-0.1	-0.1	0.9	-0.4	-0.3	0.3	0.5	1.1	4.6
KAFB-106MW2-S	0.0	0.1	0.7	0.2	0.2	3.6	0.2	0.2	2.7	-0.5	2.5	3.0
KAFB-106EX1	0.1	0.1	0.6	0.0	0.0	1.5	0.1	0.0	1.4	-0.1	2.7	3.5
KAFB-106EX2	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.3	-0.3	0.0	2.6
KAFB-106IN1	0.0	0.0	0.6	0.1	0.2	3.6	0.7	0.5	3.0	0.3	2.7	3.3
KAFB-106063	-[b]	-[b]	-[b]	0.0	-0.8	0.2	-0.2	-0.4	0.5	0.2	1.0	2.8
KAFB-106MW1-I	2.8	2.4	1.3	1.1	1.7	1.0	0.0	0.6	0.6	1.7	3.7	3.7
KAFB-106MW2-I	0.7	1.7	0.6	1.8	2.5	1.1	0.7	0.9	0.5	3.7	3.9	3.9
Percent Reduction												
KAFB-106064	-17.20%	-158.62%	73.29%	6.14%	-14.60%	92.13%	20.00%	8.33%	99.69%	23.89%	94.27%	99.99%
KAFB-106MW1-S	-4.68%	-18.97%	54.04%	-18.70%	-20.75%	88.27%	-164.86%	-81.82%	52.73%	64.81%	92.62%	100.00%
KAFB-106MW2-S	-5.13%	11.18%	77.94%	30.89%	32.51%	99.98%	41.67%	38.75%	99.78%	-190.10%	99.67%	99.90%
KAFB-106EX1	25.58%	17.15%	75.19%	-10.38%	-5.76%	96.58%	21.05%	10.20%	95.61%	-19.62%	99.79%	99.97%
KAFB-106EX2	-8.61%	-0.73%	13.87%	-2.35%	15.74%	-11.11%	25.00%	27.84%	47.42%	-104.89%	6.06%	99.75%
KAFB-106IN1	3.65%	9.37%	74.81%	21.69%	32.19%	99.98%	78.50%	66.21%	99.89%	48.19%	99.81%	99.95%
KAFB-106063	-[b]	-[b]	-[b]	6.96%	-501.90%	38.01%	-70.49%	-181.48%	71.20%	39.06%	90.53%	99.84%
KAFB-106MW1-I	99.83%	99.60%	95.19%	91.85%	97.82%	90.93%	8.33%	73.75%	72.50%	98.19%	99.98%	99.98%
KAFB-106MW2-I	82.10%	98.11%	74.02%	98.39%	99.68%	92.81%	80.00%	86.67%	66.88%	99.98%	99.99%	99.99%

Notes:

[a] Reduction Relative to Baseline Before Pilot Test for shallow wells, and to maximum concentration for intermediate wells.

[b] No previous quantity for comparison.

% - Percent.

EDB - ethylene dibromide.

ID - Identification.

KAFB - Kirtland Air Force Base.

APPENDICES
(SOME APPENDICES NOT PROVIDED HERE DUE TO THE FILE SIZE; SEE USAF KAFB AR FOR COMPLETE DOCUMENTATION)

APPENDIX A
NMED NOTICE OF DISAPPROVAL, RESPONSE TO COMMENTS TABLE, AND REDLINED REVISED FINAL REPORT

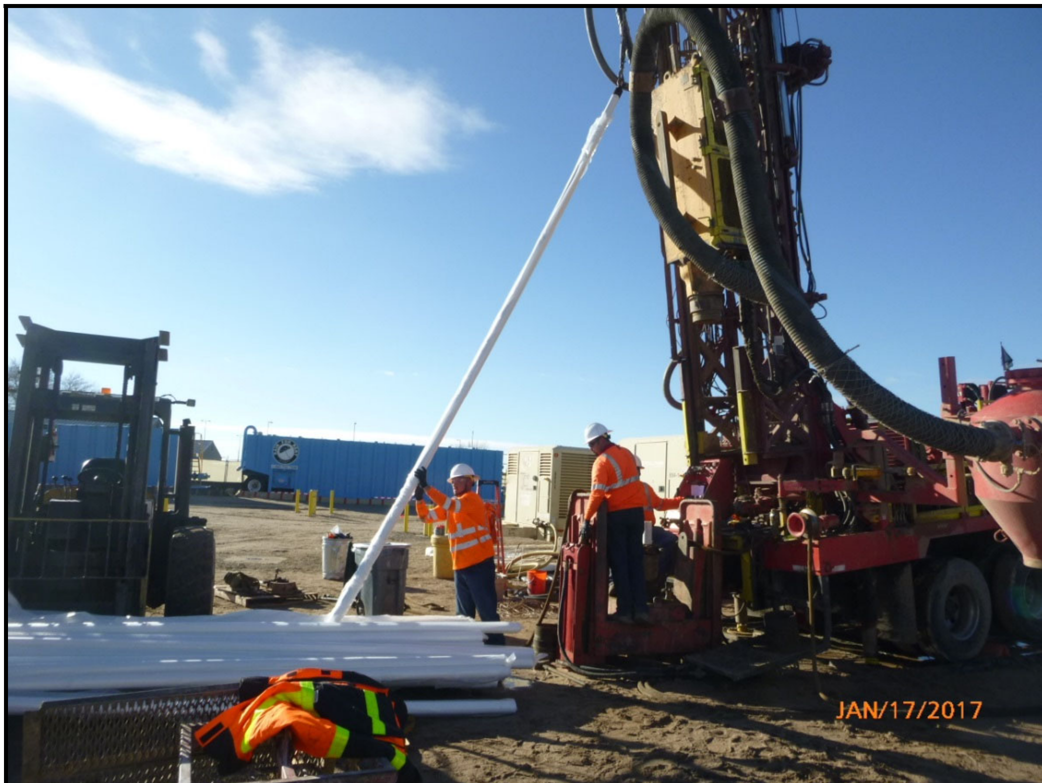
APPENDIX B
SITE PHOTOGRAPHS

Description: High Mesa potholing for utilities at KAFB-106IN1.

Description: Cascade drilling with ARCH rig; lifting drive casing and drill string.

Description: Geologist collecting soil cuttings from hopper during drilling operations for lithologic classification.

Description: EZ Trac ready for downhole deviation testing.

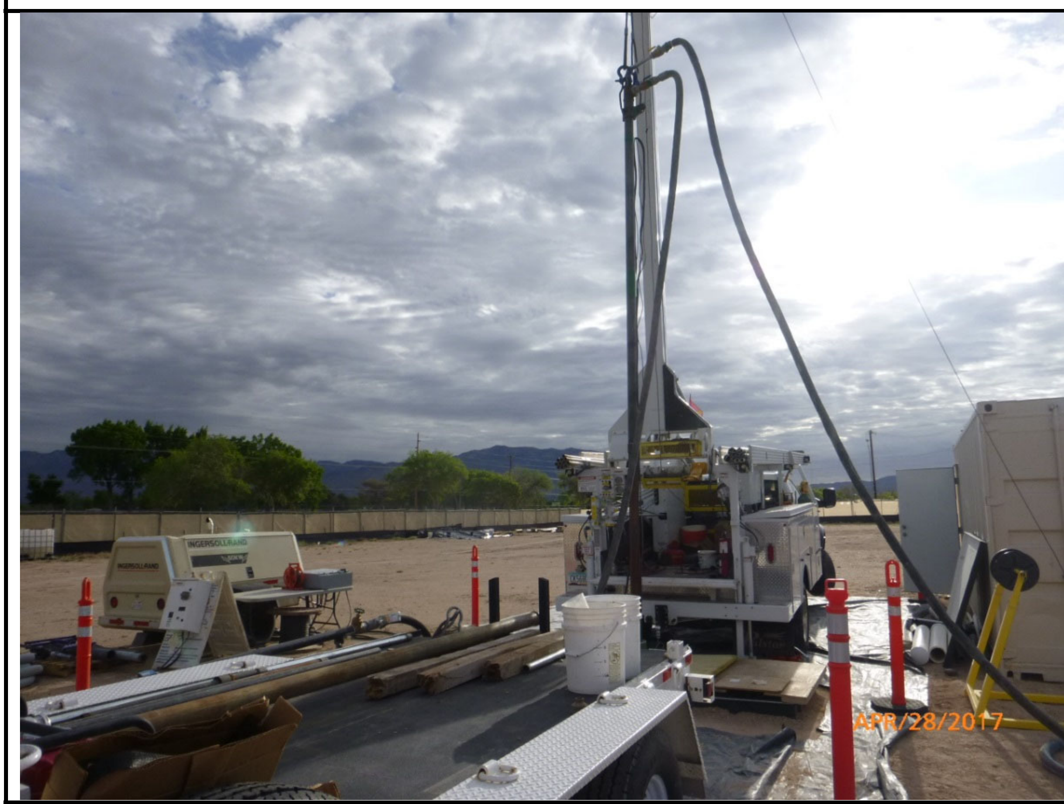


Description: Cascade installing PVC casing during well installation activities.

Description: ACT removing roll-off containing soil cuttings.

Aptim Federal Services, LLC				USACE Rapid Response Program Photo Log	
PROJECT No.:	500433	**Project Title:**	Kirtland Air Force Base, Bulk Fuels Facility	**Program/TO:**	W9128F-12-D-0003 Task Order 0025

Description: Cascade well development rig setup.



Description: Well development setup at KAFB-106IN1, with jetting tool.

Aptim Federal Services, LLC				USACE Rapid Response Program Photo Log	
PROJECT No.:	500433	**Project Title:**	Kirtland Air Force Base, Bulk Fuels Facility	**Program/TO:**	W9128F-12-D-0003 Task Order 0025

Description: Installing KAFB-106EX1 well vault and trenching for utilities/pipeline.

Description: Installing Grunfos pump at KAFB-106EX2.

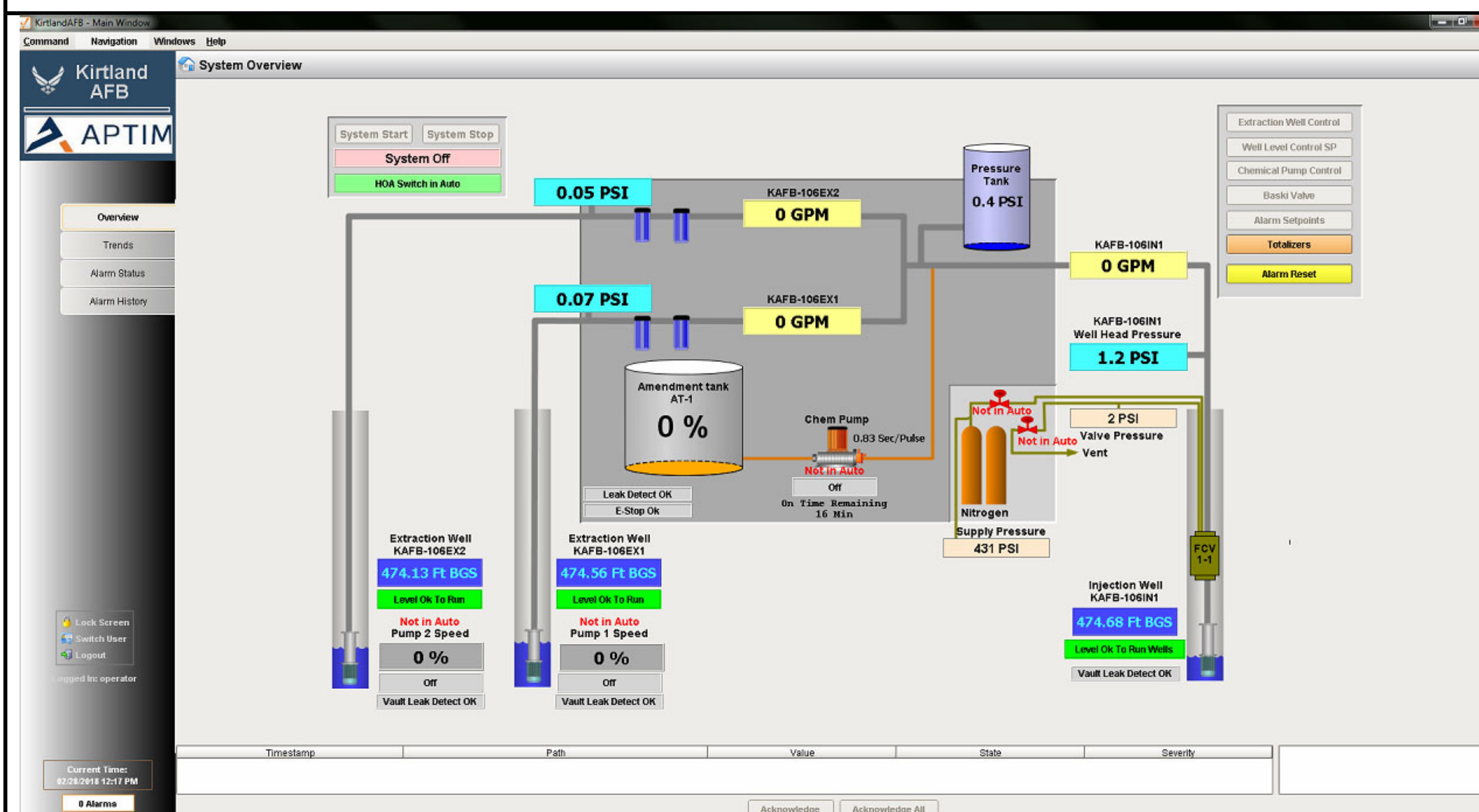
Description: Recirculation system conex box prior to connection to electrical and conveyance piping.

Description: Trenching to place conveyance piping.

Description: Interior of conex box recirculation system (wet side); showing extraction and injection well piping, amendment tank, flow meters (yellow), pressure transmitters, emergency stop button, and blue filter canisters.

Description: Interior of recirculation system control room.

Description: Working on the main electrical disconnect and meter wiring.

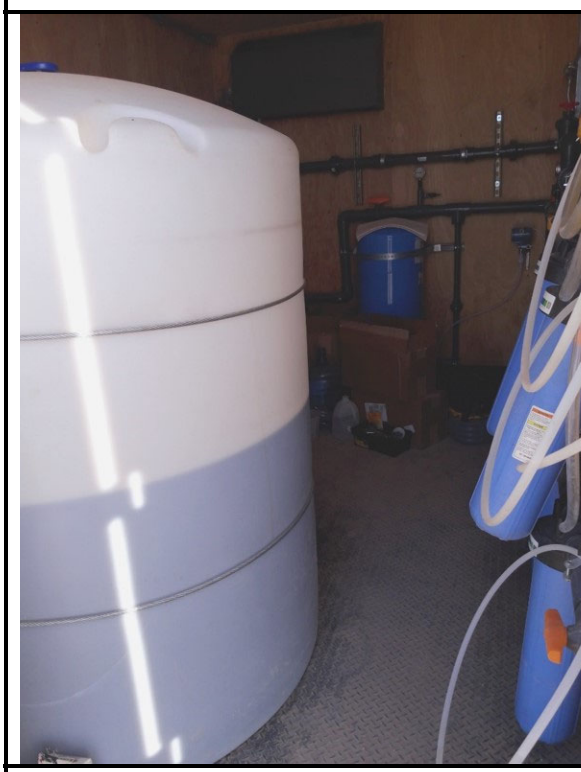


Description: SCADA system main control screen, allowing both local and remote access and control of the recirculation system.

Description: Description: Fluorescein being introduced to the recirculated groundwater through the injection port, and flowing through the static mixer during Phase 1 tracer test.

Description: Chemical feed pump (right) and calibration column.

Description: Weighing amendments for Phase 2 recirculation.



Description: Treatment amendments homogenized in tank and ready for injection.

Description: Completed extraction/injection well vault and wellhead manifold.

Description: NAPL bailed from KAFB-106MW1-S.

Description: Groundwater sampling at KAFB-106MW2.

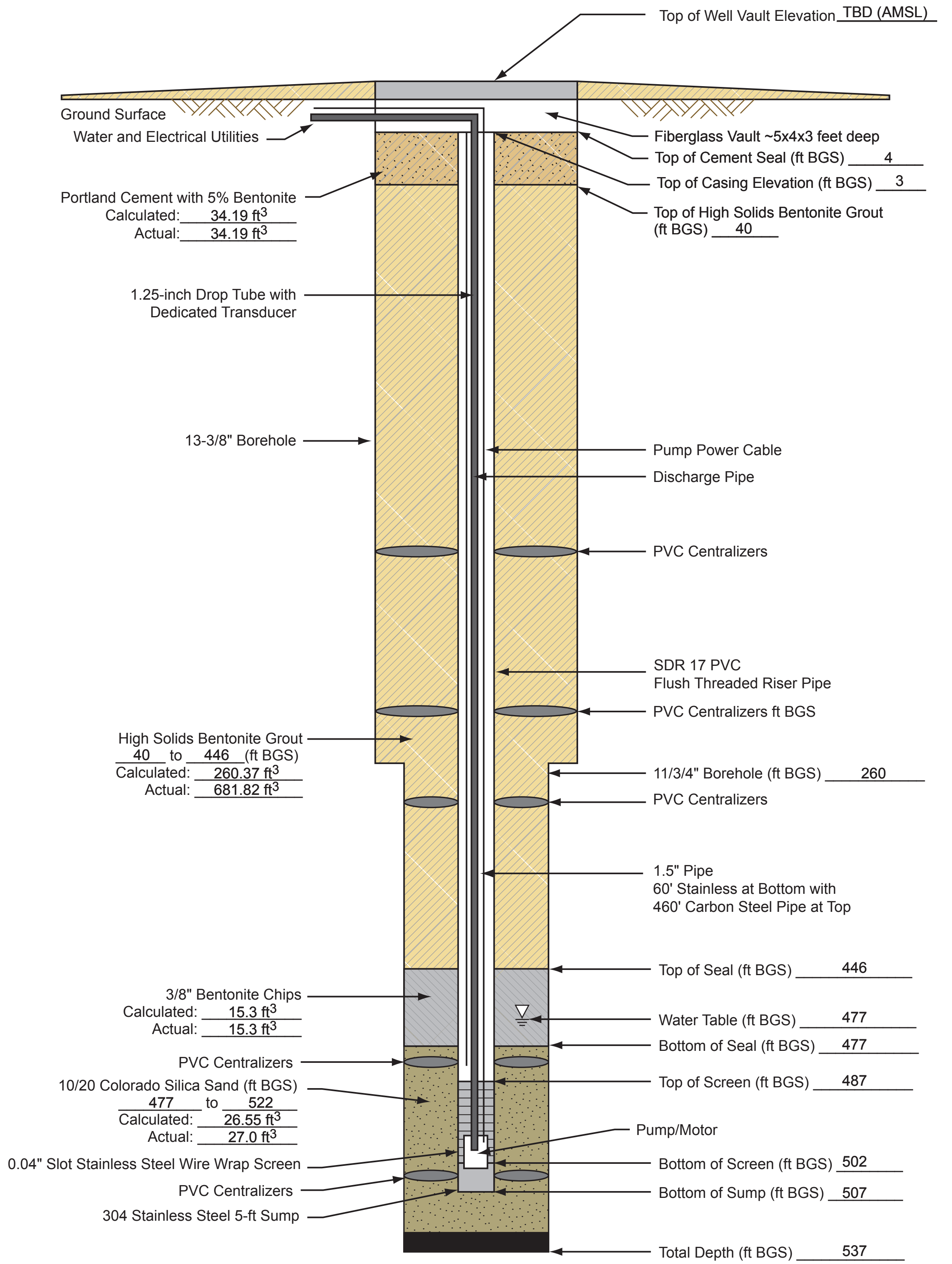
Description: Groundwater sampling setup with high pressure controller for bladder pump.

APPENDIX C
APPROVED PERMITS

APPENDIX D
WELL INSTALLATION FORMS

Extraction Well Completion Diagram KAFB-106EX1

Installation Start Date/Time: 3/3/17@1206
Installation End Date/Time: 3/12/17@1625
Completion Date: 4/19/17



500433_03050100_A7

(4,816.90) = *Elevations are NAVD 88 Datum values based on NGS Control Station "Hanger", Elevation = 5,343.43 ft. GPS/RTK methods and GEO1D99 model were used to determine elevations of all surveyed points.*

Not to Scale
BGS = Below Ground Surface

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

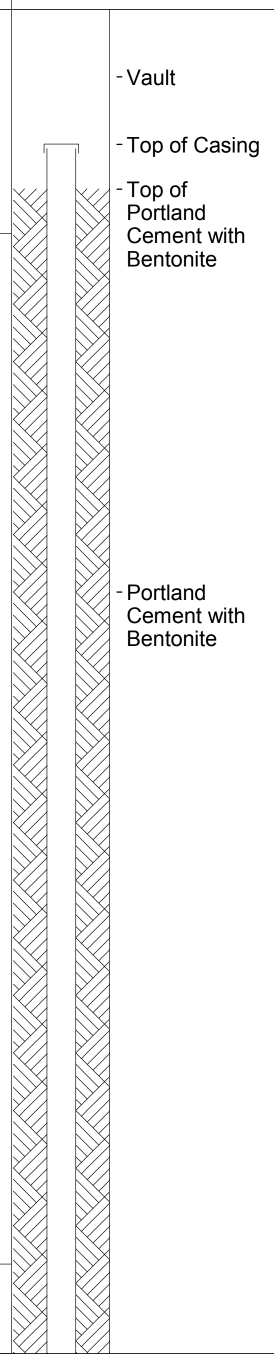
Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Material Description	U.S.C.S.	Remarks
0–5				No Lithologic Description.		Borehole was pot holed with air knife to 5 feet bgs. No cuttings returned.
5				SILT with Gravel (ML); brown (7.5YR 4/4); 75% silt; 25% fine gravel to 3/4"; subangular to subrounded; trace sand. Note: gravel is granitic.	ML	Began drilling with 13-3/8 inch casing @ 1206 on 3/3/17. Using under reamer.
10				Same as above (5 ft).	ML	PID = 0.0 ppm @ cyclone and breathing zone (BZ).
16				Gravelly SILT (ML); brown (7.5YR 4/4); 60% silt; 40% coarse gravel to 2"; subangular to subrounded. Note: method of drilling is causing gravel to fracture.	ML	PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ. Kelly down @ 1212, new 20' connection @ 1231.
26				SILT with Gravel (ML); reddish brown (5YR 5/3); 80% silt; 20% gravel; subangular; trace coarse sand. Note: some fractured gravel.	ML	Water added @ cyclone for dust suppression.
28				Lean CLAY with Gravel (CL); reddish brown (5YR 5/3); nonplastic; 80% clay; 20% fine gravel; subangular.	CL	

Well Diagram



Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Lean CLAY with Gravel (CL); reddish brown (5YR 5/3); nonplastic; 80% clay; 20% fine gravel; subangular.	CL		PID = 0.0 ppm @ cyclone and BZ.
					SILT with Sand (ML); light brown (7.5YR 6/4); 85% silt; 15% fine to coarse sand; subangular to subrounded.			
35					Same as above (31 ft).		Portland Cement with Bentonite	Kelly down @ 1242, new 20' connection @ 1253.
40							Top of High Solids Bentonite Grout	Water added at cyclone.
					SILT (ML); light brown (7.5YR 6/3); 90% silt; 10% coarse sand; subangular to subrounded; trace gravel.	ML		
45					Same as above (42 ft).			No hammering.
50					Same as above (42 ft); 10% gravel to 1/8"; subangular.			PID = 0.0 ppm @ cyclone and BZ.
55					Same as above (42 ft); 10% gravel to 1/8"; subangular.			Kelly down @ 1328; trip out drill rod, add drill collars and 2 stabilizers. New 20' connection @
60								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:19 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					SILT (ML); brown (7.5YR 5/4); 90% silt; trace clay; 10% fine gravel to 3/4"; subangular.			1433. Hammering.
65					Same as above (60 ft).			PID = 0.0 ppm @ cyclone and BZ.
70					SILT with Sand (ML); light brown (7.5YR 6/4); 75% silt; 20% fine to coarse sand; subangular to subrounded; 5% fine gravel to 3/4"; subangular to subrounded.			
75					Same as above (70 ft).	ML	High Solids Bentonite Grout	Hammering. Kelly down @ 1453, new 20' connection @ 1514.
80					Same as above (70 ft).			
85					Same as above (70 ft); 75% silt; 25% fine to coarse sand.			PID = 0.0 ppm @ cyclone and BZ. Water added at cyclone for dust suppression; hammering.
90								

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					SILT (ML); reddish brown (5YR 5/3); 90% silt; 5% fine to coarse sand; 5% gravel; subangular to subrounded.	ML		Hammering intermittently.
95					Same as above (90 ft).			Kelly down @ 1528, new 20' connection @ 1537.
100					Silty SAND (SM); brown (7.5YR 5/3); 60% fine sand; subrounded to rounded; trace fine gravel; 40% silt.	SM		Hammering intermittently.
105					Same as above (99 ft).		High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and BZ.
					Same as above (99 ft); 80% fine to coarse sand; trace gravel; 20% silt.			
110								Hammering intermittently. Water added at cyclone for dust suppression.
					Same as above (99 ft); 80% fine to coarse sand; trace gravel; 20% silt.			
115					Well-graded SAND (SW); pale brown (10YR 6/3); 90% fine to coarse sand; subangular to subrounded; 10% fine gravel to 3/4"; subangular to subrounded; trace silt.	SW		Kelly down @ 1551, new 20' connection @ 1613.
120					Description on next page.	SM		

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
∇ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00
Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Silty SAND (SM); light brown (7.5YR 6/4); 70% very fine sand; subrounded; 30% silt.	SM		PID = 0.0 ppm @ cyclone and BZ.
125					Same as above (120 ft).			Hammering intermittently.
130					Same as above (120 ft); trace coarse sand; subangular; trace gravel to 1/2"; subrounded.			Water added at cylcone for dust suppression; hammering.
135					Same as above (120 ft); trace coarse sand; subangular; trace gravel to 1/2"; subrounded.		High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and BZ. Kelly down @ 1630, new 20' connection @ 1639.
140					Same as above (120 ft); brown (7.5YR 5/4); 60% fine sand; trace coarse sand; subrounded; 40% silt.			Water added @ cyclone and on hammer for dust suppression.
145								Slow drilling; hammering. PID = 0.0 ppm @ cyclone and BZ.
					Lean CLAY with Sand (CL); brown (7.5YR 5/3); very hard; 85% clay; 15% fine sand; trace gravel.	CL		
150								

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 479.00
Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Lean CLAY with Sand (CL); brown (7.5YR 5/3); very hard; 85% clay; 15% fine sand; trace gravel.	CL		Water added at cylcone and hammer for dust suppression; hammering. PID = 0.0 ppm @ cyclone and BZ.
155					SILT (ML); brown (7.5YR 5/4); 90% silt; trace clay; 10% fine sand; subrounded.	ML		Kelly down @ 1710, new 20' connection @ 1718. End of 3/3/17. Resume drilling @ 0747 on 3/4/17. Slow drilling; hammering.
160					SILT with Sand (ML); brown (7.5YR 5/4); 70% silt; 5% clay; 25% fine to coarse sand; subrounded.			
					Well-graded SAND (SW); brown (7.5YR 5/4); 90% fine to coarse sand; subrounded to rounded; 10% silt.	SW		
165					Silty SAND (SM); brown (7.5YR 4/4); 50% fine to coarse sand; subrounded; 35% silt; 15% clay.	SM	High Solids Bentonite Grout	
170					Well-graded SAND with Silt (SW-SM); light brown (7.5YR 6/4); 90% fine to coarse sand; subrounded; 10% silt; trace clay.	SW-SM		PID = 0.0 ppm @ cyclone and BZ. Hammering intermittently.
175					Well-graded SAND (SW); light brown (7.5YR 6/4); 100% fine to very coarse sand; subrounded; trace silt.	SW		Kelly down @ 0833, new 20' connection @ 0839.
180								

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Well-graded SAND (SW); light brown (7.5YR 6/4); 100% fine to very coarse sand; subangular to subrounded; trace fine gravel; trace silt. Note: sand is granitic minerals.			Some hammering. PID = 0.0 ppm @ cyclone and BZ.
								Hammering.
185								
								Water used at surface for dust suppression while drilling.
					Same as above (180 ft); 90% fine to very coarse sand; 10% gravel to 1/4"; subangular to subrounded.			
190								
								Hammering. PID = 0.0 ppm @ cyclone and BZ.
195					Same as above (180 ft); pale brown (10YR 6/3); 90% fine to very coarse sand; subrounded; 10% fine gravel to 1/8".	SW	High Solids Bentonite Grout	
								Kelly down @ 0929, new 20' connection @ 1036.
200								
					Well-graded SAND with Gravel (SW); pale brown (10YR 6/3); 80% fine to very coarse sand; subrounded; 20% gravel to 3/8"; subrounded.			
205								Slow drilling; hammering.
					Same as above (202 ft).			
210								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:19 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▽ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well-graded SAND with Gravel (SW); pale brown (10YR 6/3); 80% fine to very coarse sand; subrounded; 20% gravel to 3/8"; subrounded.	SW		PID = 0.0 ppm @ cyclone and BZ.
215					Poorly graded GRAVEL (GP); 100% fine gravel to 1/4"; subrounded.	GP		Hammering intermittently.
					Well-graded SAND (SW); pale brown (10YR 10/3); 100% sand; subrounded; trace gravel. Note: sand and gravel are granitic minerals.	SW		Kelly down @ 1108, new 20' connection @ 1116.
220					Same as above (216 ft).			Very slow drilling; hammering.
225					Same as above (216); 90% sand; 10% fine gravel to 1/4".		High Solids Bentonite Grout	Hammering continuously.
230					Same as above (216); 90% sand; 10% fine gravel to 1/4".			PID = 0.0 ppm @ cyclone and BZ.
235					Well-graded SAND with Gravel (SW); pale brown (10YR 10/3); 80% fine to very coarse sand; subrounded; 20% gravel to 1/4". Note: sand and gravel are granitic minerals.			Water added at cyclone for dust suppression. Kelly down @ 1238, new 20' connection @ 1244.
240								

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND (SW); pale brown (10YR 6/3); 100% fine to coarse sand; trace gravel; subangular to subrounded. Note: gravel is granitic minerals.	SW		Hammering. PID = 0.0 ppm @ cyclone and BZ.
245					Same as above (240 ft).			Hammering almost continuously.
250					Same as above (240 ft); trace gravel to 1/8".			Hammering.
								PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ.
255					Same as above (240 ft); 90% fine to coarse sand; 10% gravel to 3/8"; subrounded.		High Solids Bentonite Grout	
								Kelly down @ 1330. Place 5 foot section of 13-3/4" casing @ 1354. Begin tripping in 260 feet of 11-3/4" casing. End of 3/4/17. Resume drilling @ 0805 on 3/5/17.
260					Sandy lean CLAY (CL); yellowish brown (10YR 5/4); dry; 75% clay; 25% fine sand; trace fine gravel to 1/4".	CL		
265					Same as above (260 ft).			
								No hammering; no water added downhole.
270								

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Sandy lean CLAY (CL); yellowish brown (10YR 5/4); dry; 75% clay; 25% fine sand; trace fine gravel to 1/4". Lens of fine to medium sand.	CL		PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ. Hammering intermittently.
275					Poorly graded SAND (SP); light brown (7.5YR 6/4); dry; 85% fine sand; 15% medium to coarse sand.	SP		Kelly down @ 0826, new 20' connection @ 0832.
280					Same as above (276 ft).			PID = 0.1 ppm @ cyclone and BZ.
285							High Solids Bentonite Grout	Hammering intermittently; no water added downhole.
290					SILT (ML); strong brown (7.5YR 5/6); dry; 100% silt; trace fine sand.	ML		
					Clayey SAND (SC); light brown (7.5YR 6/3); 75% fine sand; trace medium and coarse sand; trace fine gravel; 25% clay; low plasticity.	SC		
295					Same as above (291 ft); 15% fine gravel to 1/2". Note: gravel is mafics and quartz.			Kelly down @ 0851, new 20' connection @ 0858.
300								

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Clayey SAND (SC); light brown (7.5YR 6/3); 60% fine sand; trace medium and coarse sand; 15% fine gravel to 1/2"; 25% clay; low plasticity.	SC		PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); dry; 80% fine to coarse sand; 20% fine gravel to 1/2"; subangular to rounded. Note: gravel is mafics and granitic minerals.	SW		Some hammering.
305								
								Hammering; no water added downhole.
310					Same as above (303 ft).			
315					Same as above (303 ft).		High Solids Bentonite Grout	
								Kelly down @ 0922, new 20' connection @ 0929.
320					Same as above (303 ft).			PID = 0.3 ppm @ cyclone and 0.1 ppm @ BZ. Windy.
325					Same as above (303 ft).			Hammering; no water added downhole.
330								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:19 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); dry; 80% fine to coarse sand; 20% fine gravel to 1/8"; subangular to rounded. Note: gravel is mafics and granitic minerals.	SW		PID = 0.3 ppm @ cyclone and 0.2 ppm @ BZ. Hammering; no water added downhole.
335					Same as above (330 ft).			Kelly down @ 0954, new 20' connection @ 1000.
340					Same as above (330 ft).			PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
345					Same as above (330 ft).		High Solids Bentonite Grout	
350					Lean CLAY (CL); hard clay lens with sand and gravel.	CL		Very windy, gusts to 32 mph.
					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); dry; 80% fine to coarse sand; 20% fine gravel to 1/8"; subangular to rounded. Note: gravel is mafics and granitic minerals.	SW		
355								
					Well-graded SAND with Silt and Gravel (SW-SM); reddish yellow (7.5YR 6/6); dry; 60% fine to coarse sand; 30% fine gravel to 3/8"; subangular to rounded.	SW-SM		Kelly down @ 1048. Stop drilling for the day due to high winds. Resume drilling @ 1010 on
360								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:19 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-graded SAND with Silt and Gravel (SW-SM); reddish yellow (7.5YR 6/6); dry; 60% fine to coarse sand; 30% fine gravel to 3/8"; subangular to rounded. Note: gravel is fragmented from bit; mafics and granitic minerals.	SW-SM		3/11/17. Had to pull casing back and redrill part of the borehole. PID = 0.1 ppm @ cyclone and BZ.
365					Same as above (360 ft); gravel to 3/4".			Hammering with casing hammer; no water added downhole.
370					Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7.5YR 5/4); dry; 60% fine to coarse gravel to 3/4"; angular to rounded; 30% fine to coarse sand; 10% silt. Note: gravel is mafics and granitic minerals.	GW-GM		
					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 4/3); 70% fine to coarse sand; 20% fine gravel to 1/4"; 10% silt.	SW-SM		Hammering downhole and with casing hammer.
375							High Solids Bentonite Grout	
					Same as above (372 ft).			Kelly down @ 1036, new 20' connection @ 1045.
380								PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
					Same as above (372 ft).			
385								Hammering continuously.
390								

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 4/3); 70% fine to coarse sand; 20% fine gravel to 1/4"; 10% silt.	SW		Hammering; no water added downhole.
395					Poorly graded SAND (SP); brown (7.5YR 5/3); dry; 90% medium to coarse sand; trace fine gravel to 1/8"; 10% silt.	SP		
					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); dry; 70% fine to coarse sand; 30% fine gravel to 1/2"; subangular to rounded; trace silt. Note: gravel is mafics and granitic minerals.	SW		Kelly down @ 1118, new 20' connection @ 1134.
400								PID = 0.1 ppm @ cyclone and BZ.
					Same as above (396 ft).			
405							High Solids Bentonite Grout	
					Same as above (396 ft).			
410								
					Same as above (396 ft).			
415								
					Same as above (396 ft).			Kelly down @ 1216, new 20' connection @ 1457. Rig repairs.
420								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:19 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

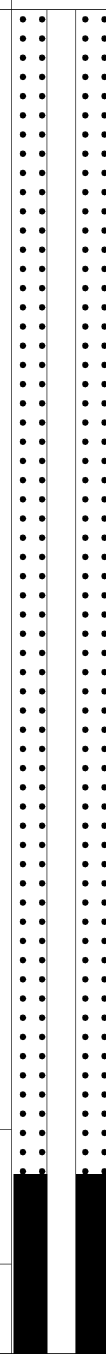
Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); dry; 70% fine to coarse sand; 30% fine gravel to 1/2"; subangular to rounded; trace silt. Note: gravel is mafics and granitic minerals.	SW		PID = 0.9 ppm @ cyclone and 0.0 ppm @ BZ.
425					Same as above (420 ft).			Hammering continuously with casing hammer. Hammering intermittently with downhole hammer.
430					Same as above (420 ft); light brown (7.5YR 6/4); 80% fine to coarse sand; 15% fine gravel to 1/4"; angular to rounded; 5% silt.			No water added downhole.
435					Same as above (420 ft); light brown (7.5YR 6/4); 80% fine to coarse sand; 15% fine gravel to 1/4"; angular to rounded; 5% silt.		High Solids Bentonite Grout	Kelly down @ 1520, new 20' connection. End of 3/11/17. Resume drilling @ 0746 on 3/12/17.
440					Same as above (420 ft); light brown (7.5YR 6/4); 80% fine to coarse sand; 15% fine gravel to 1/4"; angular to rounded; 5% silt.			PID = 0.1 ppm @ cyclone and BZ.
445					SILT (ML); lens.	ML	Top of Bentonite Seal	Hammering; no water added downhole.
					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); dry; 80% fine to coarse sand; 15% fine gravel to 1/2";	SW		
450								



Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					angular to rounded; 5% silt. Note: gravel is mafics and granitic minerals.			
					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); dry; 80% fine to coarse sand; 15% fine gravel to 1/2"; angular to rounded; 5% silt. Note: gravel is mafics and granitic minerals.	SW		Hammering.
455								
					Poorly graded SAND with Silt (SP-SM); yellowish brown (10YR 5/4); dry; 80% fine to medium sand; 10% fine gravel to 1/4"; rounded; 10% silt. Note: gravel is mafics and granitic minerals.	SP-SM		Kelly down @ 0806, new 20' connection @ 0823.
460								PID = 0.1 ppm @ cyclone and BZ.
							Bentonite Seal	
465			0.2		Same as above (457 ft).			PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
470			1.6		Same as above (457 ft).			PID = 0.1 ppm @ cyclone and BZ.
475			1.5		Same as above (457 ft).			PID = 1.8 ppm @ cyclone and 0.3 ppm @ BZ.
				▽			Top of 10/20 Sand	Kelly down @ 0852, new 20' connection @ 0927. Top of groundwater @ 477 feet bgs.
480				▼				

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480			12.8		Poorly graded SAND with Silt (SP-SM); yellowish brown (10YR 5/4); wet; 80% fine to medium sand; 10% fine gravel to 1/4"; rounded; 10% silt. Note: gravel is mafics and granitic minerals.	SP-SM		PID = 18.7 ppm @ cyclone and 0.3 ppm @ BZ.
485			37.8		Same as above (480 ft).		Top of Stainless Steel 0.040 Slot Screen	PID = 119.8 ppm @ cyclone and 0.5 ppm @ BZ.
490			63.4					PID = 850 ppm @ cyclone and 1.7 ppm @ BZ. Approximately 200 gallons of water added downhole.
492					Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); wet; 75% fine to coarse sand; 25% fine gravel to 1/2"; subangular to rounded. Note: gravel is mafics and granitic minerals.	SW		
495			58.3				Stainless Steel 0.040 Slot Screen	PID = 747 ppm @ cyclone and 6.2 ppm @ BZ. Kelly down @ 1020, new 20' connection @ 1039.
500			22.5		Same as above (492 ft).		Bottom of Screen	PID = 31.4 ppm @ cyclone and 1.7 ppm @ BZ.
505			6.8		Same as above (492 ft); poor cuttings returns.		Stainless Steel Sump; Bottom of Sump	PID = 9.8 ppm @ cyclone and 0.3 ppm @ BZ. Hammering. Approximately 50 gallons of water added
510								

Borehole ID: KAFB-106EX1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/3/2017
Date TD Reached: 3/12/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

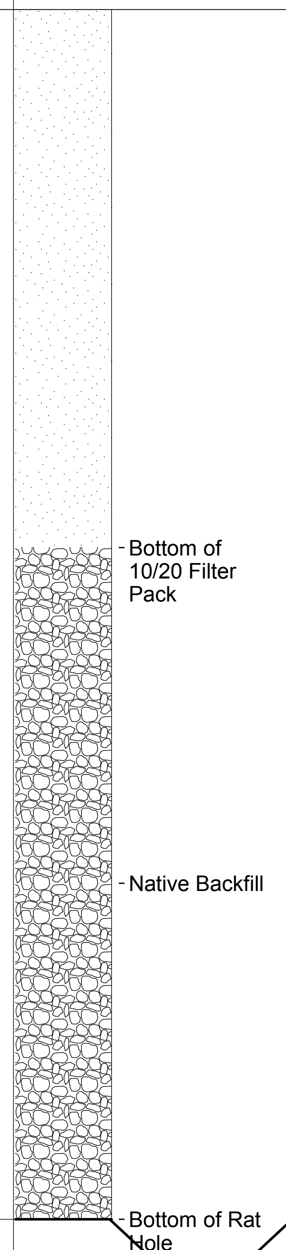
Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 479.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards/T. Kunkel

Depth (ft)	Sample Type	Number	Headspace PID	Material Description	U.S.C.S.	Remarks
510				Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); wet; 75% fine to coarse sand; 25% fine gravel to 1/2"; subangular to rounded. Note: poor cuttings returned.		downhole. PID = 4.6 ppm @ cyclone and 0.3 ppm @ BZ.
515				Same as above (510 ft); gravel to 1".		PID = 1.7 ppm @ cyclone and 0.3 ppm @ BZ. Kelly down @ 1130, new 20' connection @ 1600.
520			1.9	Same as above (510 ft); gravel to 1".	SW	
525			1.4	Same as above (510 ft); gravel to 1".		
530			1.6	Same as above (510 ft); gravel to 1".		Approximately 100 gallons of water added downhole. Total depth = 537 feet bgs. Reached total depth @ 1625 on 3/12/17.
535			0.9			
540						

Well Diagram



CB&I

Groundwater Extraction Well Development

Page 1 of ______

KAFB-106EX1

Bailing

Date	Time	Total Volume Bailed (gallons)	Imhoff Cone Measurement (mL sediment per L water)	Comments
4/4/17	0855	0	–	Purging begins
	0907	5	10	dark - not a lot of sand - odor present
	0914	15	20	
	0921	20	60	filter pack suspected
	0927	30	34	
	0934	35	33	
	0940	35	–	Empty
	1000	42	9	
	1006	44	22	Water very dark
	1010	50	20	Pump off drum
	1031	55	20	
	1037	60	20	
	1042	65	70	
	1105	70	10	switched to smaller bailer
	1110	74	2	
	1112	76	4	
↓	1116	80	3	Switching to pumping

Groundwater Extraction Well Development

Page 1 of ____

Pumping KAFB 106EX1

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
4/4/17	1520	4	479	NR →						Pump On
	1533	4.24	479.6	46	20.4	7.77	0.402	>1000	7	
	1548	4.22	479.6	101	20.5	7.68	0.400	14.2	7	
	1602	4.22	479.6	154	20.5	7.72	0.410	8.32	7	
	1615	4.24	479.6	215	20.6	7.68	0.417	5.63	7	
	1620	NR →								Pump off - surge
	1625	NR	478.7	222	NR →					Pump on
	1640	4.22	479.6	271	20.6	7.73	0.425	9.86		
	1656	4.24	479.7	340	20.6	7.69	0.430	4.88		Shutting pump off to surge
	1700	NR	4	362.74	NR →					
	1710	NR	479	362	NR →					Pump back on
	1730		479.7	397	20.8	7.68	0.428	7.31		
4/5/17	0720	4.22	NR		NR →					Pump on - clearing ice from lines
	0803	4.22	NR	571	20.4	7.71	0.419	3.81		
	0805									Pump off trip out
	1338	—	479.45	571	NR →					Pump on
	1342									Pump off - stopped working
*	16~~15~~28	7.5			~~26.6~~	~~7.76~~	~~0.436~~	~~7.48~~	~~Pump on~~	
	16~~15~~42	7.5	~~714~~	714	20.6	7.76	0.435	7.48		
	1715	8.5		875	NR →					Pump off
4/6/17	0747	Ø		884	NR →					Pump on
	0763	8.75	NR	931	19.4	8.22	0.426	36.4		
	0823	—		1201	20.0	7.72	0.432	21.9		Pump off - surge
	0833			1201	NR →					Pump on

* Total does not include Bailing water

Groundwater Extraction Well Development

Pumping KAFB-106EX1

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments Pump intake @ 497' bgs
4/7	0808	0	479.3	1201	NR →					Tag ∇ w/ pump in
	0825									Pump on
	0826									off - change wire direction
	0828									Pump on
	0830									Pump off - Blew fuse
	0945									Pump on
	0949	26	482.8	1254	20.2	8.06	0.437	22.1	7.4	
	0959	26	483.2	1654	20.1	8.37	0.448	9.21	6.7	
	1000									Pump off surge
	1010									Pump on
	1017	26	483.05	1810	20.1	8.42	0.456	17.6	7	
	1029			2122	NR →					Pump off - surge
	1037									on
	1045	26	483.25	2,330	20.1	8.14	0.464	22.6		
	1048			2,408	NR →					off - surge
	1058									on
	1102	26	483.2	2,512	20.2	8.24	0.468	32.0	6.7	
	1108	26	483.3	2,668	20.2	8.18	0.467	22.7	6.5	
	1112			2,772						off
	1122	→								on
	1129	26	483.3	2,954	20.2	8.24	0.472	26.8	6.5	
	1130			2,954	NR →					off
	1139			2954						on
	1147	26	483.4	3,136	20.2	8.20	0.475	28.9		
	1148									off
	1231			3,136						on
	1238	26	483.3	3,370	20.2	8.86	0.477	22.9	~~22.9~~	
	1239									off
	1248	26		3,370						on
	1257	26	483.4	3,604	20.2	8.89	0.479	24.6	6.3	off
	1305									on
	1315	26	483.4	3,890	20.2	8.83	0.484	23.9	6.3	
	1316									off
	1327	26		3,890	NR →					on
↓	1404		4800 →	~~4,670~~						done w/ 30 min pump test

* All ∇ measurements from BTOC

![CBI]

Groundwater Extraction Well Development

Page 3 of ______

Pumping

30 min Pump test KAFB 106EX1

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
4/7	1332	26	483.25	4020	20.2		0.482	22.8		
↓	1337	26	483.45	4150	20.2		0.479	19.6		
↓	1342	26	483.54	4280	20.2		0.479	17.2		
↓	1347	26	483.65	4410	20.2		0.478	10.9		
↓	1352	26	483.65	4540	20.2		0.480	9.6		
↓	1357	26	483.7	4670	20.2		0.479	8.4		
↓	1402	26	483.75	4800	20.2		0.481	7.90		
	1602	26	479.3	4800	NR →	→	→	→		Pump on
	1609	26	483.3	4982	20.2	7.74	0.491	28.1		Pump off
	1619									on
	1627	26	483.35	5190	20.2	7.24	0.500	24.8		off
	1638	–	479.3							on
	1646		483.4	5398	20.2	7.35	0.498	18.0		
	1653		483.5	~~5560~~ 5580	20.2	7.20	0.497	11.0		
4/8	0758	25								Pump on · Pump test
	0806	20		5,805						
	0900	20		6,885	20.2		0.490	13.7		
	0946	20		7,785	20.3	7.85	0.489	9.25		
	1023	20		8,545	20.3	7.38	0.487	8.48		
	1128	20		9,845	20.2	7.4	0.488	8.26		
	1208	20			20.3	7.4	0.489	7.42		final Readings
	1211			10,705						pump off

CB&I

Constant Rate Test
Water Levels

Page 1 of 3

Date 4/8/2017

Personnel Crystal Hardee / Chris Scott

Well ID 106EX1

Start Time 0805

Water Level					
Date/Time	Water Level (feet below TOC ~~vault~~)	Drawdown (feet) below TOC	~~Transducer Depth (feet)~~	~~Transducer battery (%)~~	Comments
0800	479.1	static			
0805					Started pumping 20 GPM
0810	482.8	3.7			
0815	482.9	3.8			
0820	483.0	3.9			
0825	483.1	4			
0830	483.1	4			
0835	483.15	4.05			
0840	483.17	4.07			
0845	483.2	4.1			
0850	483.25	4.15			
0865	483.3	4.2			
0900	483.3	4.2			
0905	483.3	4.2			
0915	483.35	4.25			
0925	483.35	4.25			
0940	483.4	4.3			
0950	483.45	4.35			
1005	483.45	4.35			
1020	483.5	4.4			
1035	483.55	4.45			
1050	483.6	4.5			
1105	483.6	4.5			
1120	483.62	4.52			
1135	483.65	4.65			
1150	483.68	4.58			
1211	483.68	4.58			Pump off

5 min

15

* Measurements from below Top of casing - 16" casing stick up

Constant Rate Test
Water Levels

Page 2 of 3

Date 4.8.17

Personnel CHRIS/CRYSTAL

Well ID 106063

Start Time 8:00 AM

5 MINS

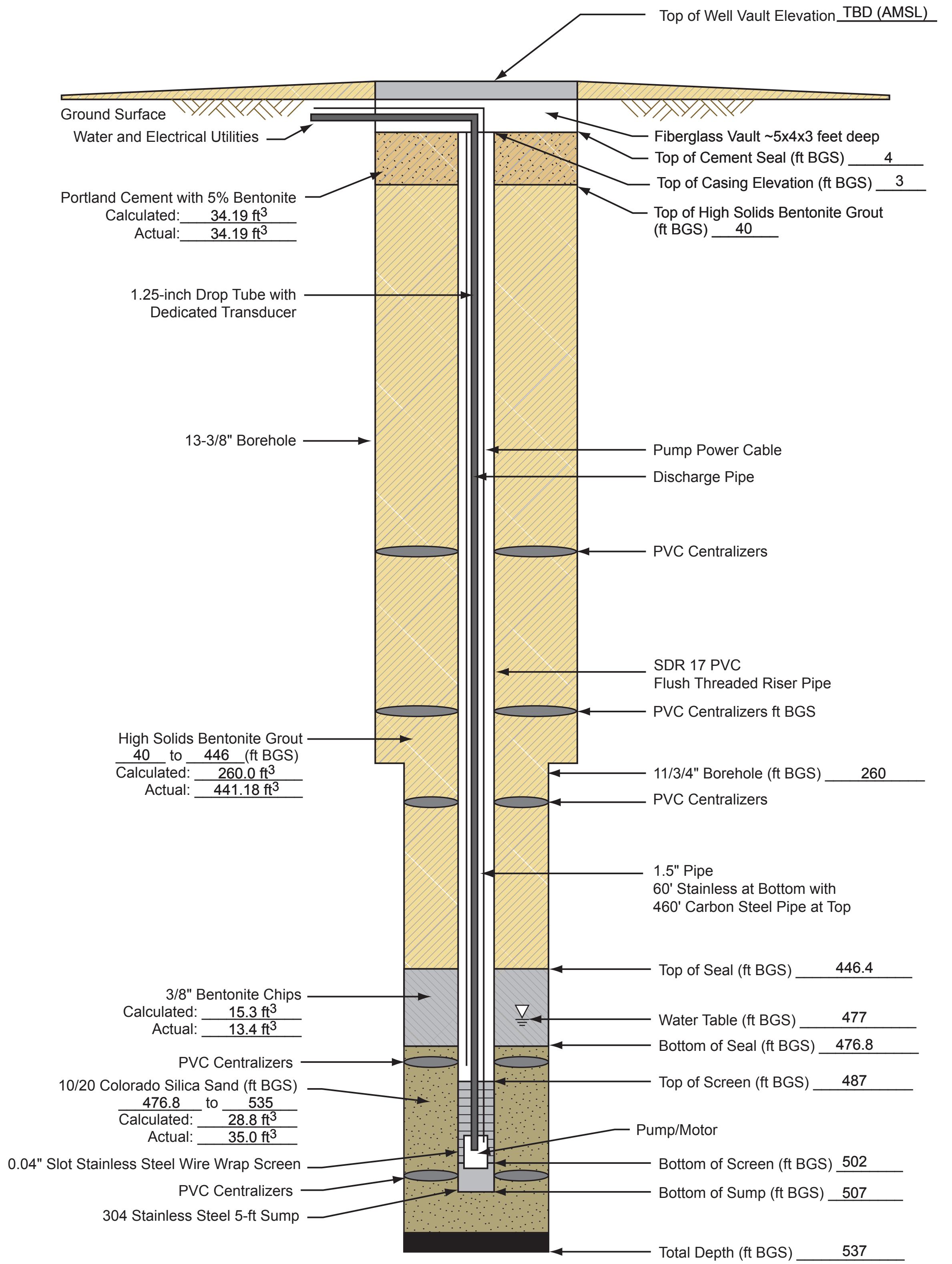
10 MINS

15 MINS

Water Level					
Date/Time 4.8.17	Water Level (feet below vault)	Drawdown (feet)	Transducer Depth (feet)	Transducer battery (%)	Comments
8:05	480.40	STATIC Δ	PUMP START @		20 GPM
8:10	480.40				
8:15	480.45				
8:20	480.45				
8:25	480.45				
8:30	480.45				
8:35	480.45				
8:40	480.45				
8:45	480.45				
8:50	480.45				
8:55	480.45				
9:00	480.45				
9:05	480.45				
9:15	480.45				
9:25	480.46				
9:35	480.46				
9:50	480.46				
10:05	480.46				
10:20	480.46				
10:35	480.46				
10:50	480.46				
11:05	480.46				
11:20	480.45				
11:35	480.45				
11:50					
12:05					
12:20					
12:35					
12:50					

Extraction Well Completion Diagram KAFB-106EX2

Installation Start Date/Time: 2/21/17@1622
Installation End Date/Time: 2/26/17@1628
Completion Date: 4/19/17



500433_03050100_A11

(4,816.90) = *Elevations are NAVD 88 Datum values based on NGS Control Station "Hanger", Elevation = 5,343.43 ft. GPS/RTK methods and GEO1D99 model were used to determine elevations of all surveyed points.*

Not to Scale
BGS = Below Ground Surface

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

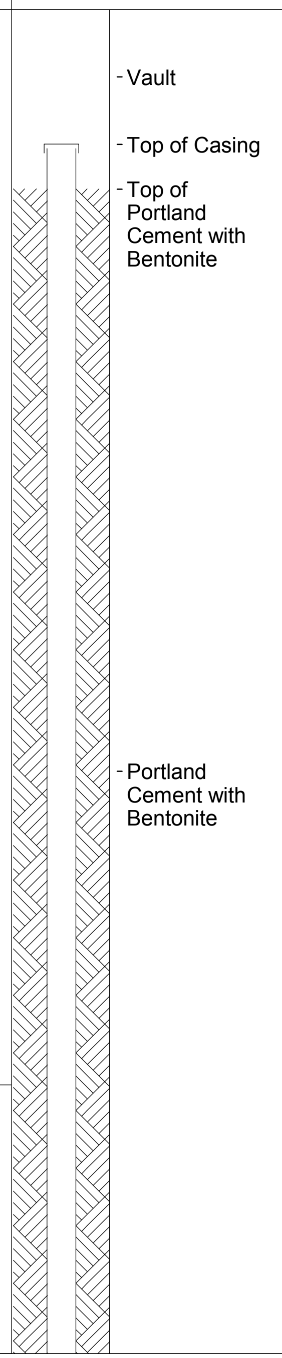
Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Remarks
0					SILT with Gravel (ML); based on water knief.	ML	Borehole was pot holed with air knife to 5 feet bgs. No cuttings returned.
5					SILT with Gravel (ML); yellowish red (5YR 4/6); dry; 80% silt; 20% fine gravel to 1/2"; subangular to rounded; trace coarse sand. Note: gravel is mafics and granitic minerals.	ML	Begin drilling with 13-3/8" drive casing @ 1622 on 2/21/17. Driller is using under reamer on downhole hammer, roller stabilizer, and two drill collars. Cuttings brought to surface will be biased fine.
10					Same as above (5 ft).	ML	
15					Same as above (5 ft); 70% silt; 30% gravel to 1".	ML	
					Gravelly SILT (ML); light reddish brown (5YR 6/4); dry; 60% silt; 30% fine to coarse gravel to 1"; 10% coarse sand; trace medium sand. Note: gravel is mafics and granitic minerals. Large gravel fragments present.	ML	No water added downhole. Kelly down @ 1638, new 20' connection @ 1644.
20						ML	PID = 0.1 ppm @ cyclone and BZ.
25					Sandy lean CLAY (CL); light brown (7.5YR 6/3); slightly moist; 70% clay; 30% fine to coarse sand; trace gravel to 1/4".	CL	No water added. Hammering downhole.
30							

Well Diagram:



Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Gravelly SILT (ML); light reddish brown (5YR 6/4); slightly moist; 60% silt; trace clay; 40% fine gravel to 1/2"; subangular to rounded; trace medium to coarse sand.	ML		Hammering downhole.
35					Same as above (30 ft).		Portland Cement with Bentonite Top of High Solids Bentonite Grout	Kelly down @ 1701. End of 2/21/17. Resume drilling @ 0923 on 2/22/17.
40					Fat CLAY with Sand (CH); light brown (7.5YR 6/4); slightly moist; medium plasticity; 75% clay; 25% fine to coarse sand.	CH		PID = 0.0 ppm @ cyclone and BZ.
45					Gravelly SILT (ML); reddish brown (5YR 5/4); dry; 60% silt; 20% fine to medium sand; trace coarse sand; 20% fine gravel to 1/4".	ML		Hammering downhole; no water added downhole.
50					Same as above (43 ft).			PID = 0.0 ppm @ cyclone and BZ.
55					Same as above (43 ft).			Kelly down @ 1008, new 20' connection @ 1052.
60								

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Sandy SILT (ML); reddish yellow (7.5YR 6/6); dry; 70% silt; 25% fine to coarse sand; 5% fine gravel to 1/4"; angular to rounded.	ML		PID = 0.1 ppm @ cyclone and BZ.
								Hammering downhole and with casing hammer.
65					Same as above (60 ft).			
70					Same as above (60 ft).			PID = 0.1 ppm @ cyclone and BZ.
								No water added downhole.
75					Sandy lean CLAY (CL); yellowish red (5YR 5/6); slightly moist; 70% clay; 25% fine to medium sand; 5% fine gravel to 1/8".	CL	High Solids Bentonite Grout	Kelly down @ 1102, new 20' connection @ 1110.
80					Same as above (75 ft).			PID = 0.1 ppm @ cyclone and BZ.
85					Sandy SILT with Gravel (ML); pink (5YR 7/4); 40% silt; 40% fine to medium sand; 20% gravel. Note: gravel is fragmented and coated with silt.	ML		Hammering downhole and with casing hammer.
90								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:28 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Sandy SILT with Gravel (ML); pink (5YR 7/4); 40% silt; 40% fine to medium sand; 20% gravel. Note: gravel is fragmented and coated with silt.	ML		No water added.
95					Sandy lean CLAY (CL); brown (7.5YR 5/4); nonplastic; 70% clay; 30% fine sand; trace gravel fragments. Note: gravel is mafics.	CL		Kelly down @ 1140, new 20' connection @ 1253.
100					Poorly graded SAND (SP); light brown (7.5YR 6/4); dry; 100% fine sand; trace medium and coarse sand; trace fine gravel to 1/4"; subangular to rounded. Note: gravel is mafics and granitic minerals.	SP		PID = 0.1 ppm @ cyclone and BZ.
105					Same as above (98 ft).		High Solids Bentonite Grout	Continuous hammering.
110					Same as above (98 ft).			PID = 0.1 ppm @ cyclone and BZ.
115					Same as above (98 ft).			Kelly down @ 1305, new 20' connection @ 1418.
120					Lean CLAY with Sand (CL); strong brown (7.5YR 5/6); slightly moist; 60% clay; 20% silt; 20% fine sand.	CL		

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:28 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Lean CLAY with Sand (CL); strong brown (7.5YR 5/6); slightly moist; 60% clay; 20% silt; 20% fine sand.			PID = 0.1 ppm @ cyclone and BZ.
125					Same as above (120 ft).			Hammering downhole and with casing hammer.
130					Same as above (120 ft).			No water added.
135					Same as above (120 ft).	CL	High Solids Bentonite Grout	Kelly down @ 1433, new 20' connection @ 1439.
140					Same as above (120 ft).			PID = 0.1 ppm @ cyclone and BZ.
145					Same as above (120 ft).			Hammering.
150								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:28 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150–157					Lean CLAY with Sand (CL); strong brown (7.5YR 5/6); slightly moist; 60% clay; 20% silt; 20% fine sand.	CL		
157–163					Poorly graded SAND (SP); brown (7.5YR 5/3); dry; 95% fine sand; trace medium sand; 5% gravel fragments.	SP		Kelly down @ 1459, new 20' connection @ 1525. PID = 0.1 ppm @ cyclone and BZ.
163–172					Lean CLAY with Sand (CL); reddish yellow (7.5YR 6/6); slightly moist; nonplastic; 80% clay; 20% fine to medium sand. Same as above (163 ft).	CL	High Solids Bentonite Grout	Added 20 gallons of water downhole to clear clay plug from under reamer.
172–175					Sandy SILT (ML); light brown (7.5YR 6/4); dry; 60% silt; 40% fine to coarse sand; trace gravel fragments.	ML		
175–177					Silty SAND (SM); light brown (7.5YR 6/4); dry; 80% fine to coarse sand; 20% silt.	SM		
177–180					Poorly graded SAND (SP); light brown (7.5YR 6/4); dry; 95% fine sand; trace medium and coarse sand; 5% gravel fragments.	SP		Kelly down @ 1636, new 20' connection @ 1649.

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:28 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); light brown (7.5YR 6/4); dry; 95% fine sand; trace medium and coarse sand; 5% gravel fragments.	SP		PID = 0.1 ppm @ cyclone and BZ.
185					Well-graded SAND (SW); light brown (7.5YR 6/3); dry; 95% fine to coarse sand; trace gravel fragments; 5% silt.	SW		Hammering; slow rate of penetration.
190					Same as above (184 ft).			
					Poorly graded SAND (SP); light brown (7.5YR 6/4); dry; 100% fine sand; trace medium and coarse sand; trace silt.	SP		
195							High Solids Bentonite Grout	
200					Same as above (192 t).			Kelly down @ 1525. End of 2/22/17. Resume drilling @ 1103 on 2/23/17.
205								PID = 0.0 ppm @ cyclone and BZ.
					Silty SAND (SM); light brown (7.5YR 6/4); dry; 75% fine sand; trace medium and coarse sand; 25% silt.	SM		Hammering; no water added downhole.
210								

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60
Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Sandy SILT (ML); light brown (7.5YR 6/3); dry; 70% silt; 30% fine to medium sand; trace coarse sand.	ML		Continuous hammering; no water added downhole.
215					Same as above (210 ft).			Kelly down @ 1149, new 20' connection @ 1300.
220					Well-graded SAND with Silt (SW-SM); brown (7.5YR 5/4); dry; 90% fine to coarse sand; 10% silt.	SW-SM		PID = 0.1 ppm @ cyclone and BZ.
					Sandy lean CLAY (CL); brown (7.5YR 5/3); nonplastic; 60% clay; 40% fine to coarse sand; trace gravel fragments.	CL		
225					@ 225 ft: Possible GRAVEL lens.		High Solids Bentonite Grout	@ 225 - 240 ft: almost no drill cuttings returned.
230					Same as above (222 ft).			
235					Same as above (222 ft).			Kelly down @ 1410, new 20' connection @ 1420.
240								

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Sandy lean CLAY (CL); brown (7.5YR 5/3); nonplastic; 60% clay; 40% fine to coarse sand; trace gravel fragments.	CL		Added approximately 200 gallons of water downhole.
245–247								
247					Silty SAND with Gravel (SM); brown (7.5YR 5/4); 40% fine to coarse sand; 20% gravel fragments; 40% silt. Note: possibly interbedded GRAVEL lens.	SM		Stop drilling @ 1450 on 2/23/17 due to casing hammer failure. Resume drilling @ 0837 on 2/24/17.
252					Same as above (247 ft).			Added approximately 40 gallons of water downhole to lift cuttings.
255							High Solids Bentonite Grout	
257					Silty GRAVEL (GM); 60% gravel fragments; 40% silt.	GM		Kelly down @ 0903, new 5' connection @ 0914. Trip to telescope in 11-3/4" casing. Resume drilling @ 1640. PID = 0.1 ppm @ cyclone and BZ.
263					Lean CLAY with Sand (CL); reddish brown (5YR 5/4); low plasticity; 75% clay; 25% fine to medium sand.	CL		Poor cuttings returned.
270								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:28 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Lean CLAY with Sand (CL); reddish brown (5YR 5/4); low plasticity; 75% clay; 25% fine to medium sand.	CL		Poor cuttings returned.
275					Same as above (270 ft).			Kelly down @ 1715. End of 2/24/17. Resume drilling @ 0807 on 2/25/17.
280					Same as above (270 ft).			PID = 0.1 ppm @ cyclone and BZ.
285					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); dry to slightly moist; 85% fine to coarse sand; 15% fine gravel to 1/4". Note: lots of gravel fragments.	SW	High Solids Bentonite Grout	Hammering.
290					Same as above (285 ft).			Poor cuttings returned.
295					Same as above (285 ft).			No water added downhole. Good returns. Kelly down @ 0905, new 20' connection @ 0928.
300								

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▽ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); dry to slightly moist; 85% fine to coarse sand; 15% fine gravel to 1/4". Note: lots of gravel fragments.	SW		PID = 0.1 ppm @ cyclone and BZ. No hammering; no water added downhole.
305					Same as above (300 ft).			
310					Same as above (300 ft).			Hammering downhole only. Add approximately 50 gallons of water to remove clay from hammer and bit.
315							High Solids Bentonite Grout	
317					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 4/4); 70% fine to coarse sand; 20% fine gravel to 1/2"; 10% silt.	SW-SM		Kelly down @ 1100, change to tricone bit. New 20' connection @ 1414. PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ.
320								
325					Same as above (317 ft).			
330								

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 4/4); dry to moist; 70% fine to coarse sand; 20% fine gravel to 1/2"; 10% silt.	SW-SM		Slow rate of penetration.
								Hammering; no water added downhole.
335					Same as above (330 ft).			
								Kelly down @ 1543, new 20' connection @ 1611.
340					Poorly graded SAND (SP); pink (7.5YR 7/3); dry; 100% fine sand; trace medium and coarse sand.	SP		PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ.
345					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); dry; 75% fine to coarse sand; 25% fine gravel to 1/2"; trace silt. Note: interbedded SAND (75%) with Silt (10%) and Gravel (15%).	SW	High Solids Bentonite Grout	Hammering; no water added downhole.
350					Same as above (344 ft).			
								Rate of penetration increases.
355					Same as above (344 ft).			
								Kelly down @ 1720, new 20' connection @ 1730.
360								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:28 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); dry; 75% fine to coarse sand; 25% fine gravel to 1/2"; trace silt. Note: interbedded SAND (75%) with Silt (10%) and Gravel (15%).	SW		PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ. Hammering; no water added downhole.
365					Same as above (360 ft).			
370					Same as above (360 ft).			Good cuttings returned.
375							High Solids Bentonite Grout	
377					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 4/4); 70% fine to coarse sand; 20% fine gravel to 1/2"; 10% silt.	SW-SM		Kelly down @ 1800. End of 2/25/17. Resume drilling @ 0900 on 2/26/17.
380								PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ.
385					Same as above (377 ft).			Hammering. No water added downhole.
390								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:28 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND with Silt and Gravel (SW-SM); brown (7.5YR 4/4); 70% fine to coarse sand; 20% fine gravel to 1/2"; 10% silt.	SW-SM		
395					Same as above (390 ft).			Kelly down @ 0920, new 20' connection @ 0928.
400					Same as above (390 ft).			PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ.
405							High Solids Bentonite Grout	
					Poorly graded SAND with Silt (SP-SM); brown (7.5YR 5/3); dry; 90% fine sand; trace medium and coarse sand; 10% silt.	SP-SM		
410					Same as above (407 ft).			Stop drilling to repair casing hammer.
415								
					Well-graded SAND with Silt and Gravel (SW-SM); pinkish gray (7.5YR 6/2); dry; 70% fine to coarse sand; 20% gravel to 1/4"; angular to rounded; 10% silt.	SW-SM		Kelly down @ 1047, new 20' connection @ 1128. Conduct rig repairs.
420								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:28 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
∇ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60
Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well-graded SAND with Silt and Gravel (SW-SM); pinkish gray (7.5YR 6/2); dry; 70% fine to coarse sand; 20% fine gravel to 1/4"; angular to rounded; 10% silt. Note: gravel is mafics and granitic minerals.			PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ. Hammering; no water added downhole.
425								
430					Same as above (420 ft).			PID = 0.1 ppm @ cyclone and BZ.
435					Same as above (420 ft).	SW-SM	High Solids Bentonite Grout	Kelly down @ 1204, new 20' connection @ 1244.
440					Same as above (420 ft).			PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
445					Same as above (420 ft).		Top of Bentonite Seal	Hammering; no water added downhole.
450								

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼̲ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450–455					Well-graded SAND with Silt and Gravel (SW-SM); pinkish gray (7.5YR 6/2); dry; 70% fine to coarse sand; 20% fine gravel to 1/4"; angular to rounded; 10% silt. Note: gravel is mafics and granitic minerals.	SW-SM		Hammering; no water added downhole.
455–456					Boulders or large cobbles.			
456					Silty SAND (SM); light brown (7.5YR 6/3); dry; 75% fine to coarse sand; 5% fine gravel to 1/8"; subrounded to rounded; 20% silt.	SM		Kelly down @ 1326, new 20' connection @ 1350.
460								PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
461					Same as above (456 ft).			
463							Bentonite Seal	
465			2.5					PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
466					Same as above (456 ft). Note: slight fuel odor.			
470			2.9					
472					Same as above (456 ft); moist. Note: slight fuel odor.			
475–480			3.3		Well-graded SAND with Silt (SW-SM); brown (7.5YR 4/3); moist; 90% fine to coarse sand; trace fine gravel to 1/8"; 10% silt. Note: slight fuel odor.	SW-SM	Top of 10/20 Sand	PID = 2.7 ppm @ cyclone and 0.2 ppm @ BZ. Kelly down @ 1420, new 20' connection @ 1429. Top of groundwater @ 477 feet bgs.

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Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480			3.9		Well-graded SAND with Silt (SW-SM); brown (7.5YR 4/3); wet; 90% fine to coarse sand; trace fine gravel to 1/8"; 10% silt. Note: Fuel odor.	SW-SM		Measurement based on level measured at monitoring well prior to drilling disturbance. PID = 44.7 ppm @ cyclone and 0.1 ppm @ BZ.
485			4.8					
					Same as above (480 ft). Note: strong fuel odor.		Top of Stainless Steel 0.040 Slot Screen	PID = 127.9 ppm @ cyclone and 0.3 ppm @ BZ.
490			19.5					
					Same as above (480 ft). Note: strong fuel odor.			PID = 293.6 ppm @ cyclone and 33.5 ppm @ BZ.
495			111.9				Stainless Steel 0.040 Slot Screen	PID = 227.9 ppm @ cyclone and 28.7 ppm @ BZ. Kelly down @ 1508, new 20' connection @ 1520.
					Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); wet; 75% fine to coarse sand; 25% fine gravel to 1/2"; subrounded to rounded; trace silt. Note: gravel is mafics and granitic minerals. Fuel odor.	SW		
500			31.2					
							Bottom of Screen	PID = 125.4 ppm @ cyclone and 12.2 ppm @ BZ.
505			7.9		Same as above (497 ft).		Stainless Steel Sump	
							Bottom of Sump	PID = 7.4 ppm @ cyclone and 4.2 ppm @ BZ.
510								

Borehole ID: KAFB-106EX2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 2/21/2017
Date TD Reached: 2/26/17
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510			3.7		Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); wet; 75% fine to coarse sand; 25% fine gravel to 1/2"; subrounded to rounded; trace silt. Note: gravel is mafics and granitic minerals. Fuel odor.	SW		PID = 5.6 ppm @ cyclone and 2.8 ppm @ BZ.
515			4.1		Same as above (510 ft).			PID = 2.2 ppm @ cyclone and 2.4 ppm @ BZ. Kelly down @ 1556, new 20' connection @ 1608.
520			4.2		Same as above (510 ft).			PID = 1.9 ppm @ cyclone and 2.2 ppm @ BZ.
525			2.1		Same as above (510 ft).			Poor cuttings returned. PID = 2.1 ppm @ cyclone and 0.8 ppm @ BZ.
529					No cuttings returned.			
530								PID = 3.3 ppm @ cyclone and 1.0 ppm @ BZ.
535							Bottom of 10/20 Filter Pack Native Backfill Bottom of Rat Hole	PID = 2.9 ppm @ cyclone and 1.2 ppm @ BZ. Total depth = 537 feet bgs. Reached total depth @ 1628 on 2/26/17.
540								

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Groundwater Extraction Well Development

Bailing KAFB 106EX2 Crystal Hardee

Date	Time	Total Volume Bailed (gallons)	Imhoff Cone Measurement (mL sediment per L water)	Comments
4/12/17	1351	5	5	Began Bailing
	1356	10	10	- sand + silt
	1359	15	5	- sand + some filter pack
	1402	20	10	
	1406		5	
	1409		10	
	1417	40	30	- Pulling more sand + filterpack from bottom
	1419		50	
	1422	50	70	- filter pack + silt
	1443		50	
	1454	70	15	
	1512	85	10	
	1516	90	38	
	1525	100	15	
	1540	105	20	
	1549	120	50	Switch to smaller bailer
	1558		10	
	1609		5	
	1610	125	.5	
	1630		.5	
	1636		1	
	1641	130	.5	

Groundwater Extraction Well Development

Pumping KAFB106EX2

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
	17									∇ @ 476.35 bTOC
4/13	1011	25	~~479.85~~	~~0.1~~	~~18.6~~		~~0.698~~			Pump is on
	1013		479.85	50	18.6		0.698			
	1016	25	479.79	125	20.2		0.667	107		
	1021	25	479.85	250					7.14	
	1026	25	479.95	375						
	1031	25	480.0	500						
	1036	25	480.05	625					6.7	
	1041	25	480.1	750						Pump off Surging cycles
	1049									Pump on
	1052	25	479.80	800				26.9		
	1054		480.0	850						
	1056		480.05	900				13.6		
	~~1059~~ 1100		480.15	975						off - Surge x2
	1106	Ø	476.4	975						
	1108			975						Pump on
	1111		479.85					23.7		
	1114				20.3		0.752			DO 1.36
	1115		480.05			7				
	1119		480.15	1,225						off - surge
	1131									on
	1134	25	479.9							
	1136	25			20.3	7	0.759	14.2		DO 1.50
	1137	25	480.1							
	1141	25	480.1	1,480	20.4	7	0.758	7.35		DO 1.44
	1142			1,505						Pump off x4
	1300	Ø	476.4	1,505	NR →					static
	1306									Pump test / on
	1311	25.5	479.9		19.3	7.94	0.773	18.3		DO 2.16
	1313		480							
	1316	25.5	480.05	1,760	20.2	7.59	0.769	16.3		
	1321		480.15							
	1324		480.2							
	1326		480.~~42~~26		20.2	7.47	0.777	3.56		1.82 ORP - 27
	1330		480.25							
	1332		480.26							
	1334		480.29		20.3	7.48	0.779	2.73		DO 1.58
	1336		480.3	2,525					8.8	Pump off

![CB&I]

Groundwater Extraction Well Development

Pumping

KAFB 106EX2

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
4/13/17	1403	25.5	479.9	2525						on
	1407	25.5	480.10		20.3	7.59	0.787	12.0		DO 1.79
	1413			2,780						off
	1422									on
	1424	25.5	480.05		20.7	7.53	0.804	20.2		2.18
	1430			3,035						off
1439	~~1449~~									on
1448	~~1445~~	25.5	480.50		20.2	7.46	0.795	4.42		
4/13	1450			3,290						off
	1459	25.5		3,290						on
	1509	25.5	480.35	3,545	20.2	7.45	0.798	4.25		off
	1517									
	1527		480.35		20.2	7.46	0.800	3.82		DO 1.74 ~~off~~ off
	1535			3,845						on
	1545		480.40	3,800	20.2	7.44	0.799	2.71		1.78 DO
	1553		480.45		20.2	7.47	0.808	4.17		on 1.92 DO ~~off~~ on
	1604			4,055						off
	1612									on
	1622		480.50	4,310	20.2	7.46	0.806	2.50		off
	1633		~~480.52~~							on
	1643		480.52	4,565	20.2	7.45	0.811	3.66		off
	1705	0	476.45							Pump test
	1706	25.5	480.2							
	1710	↓	480.4							
	1715		480.55							
	1720		480.70							
	1725		480.75							
	1730		480.8							
	1735	↓	480.85	5,330						
4/18/17	0727		476.6	5,330	NR →					Morning Static
	0740									Pump on
	0742	25.5	480.45	5,381	19.9	7.60	0.731	12.4		DO 1.28
	0755	NR	NR	5,712.5	NR →					off - surge
	0757	0	475.05		NR →					▽ level
	0806	25.5	NR	5,712.5	NR →					on
	0815	25.5	480.8		20.0	7.40	0.827	3.20		DO 1.41
	0818	25.5		6,018.5						Pump off - Surge
	0819	0	476.2	6,018.5	NR →					▽ level mound

Groundwater Extraction Well Development

Pumping

KAFB 106EX2

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
4/18/17	0828	25.5		6,018.5	NR →					Pump on
	0837	25.5	480.9		20.1	7.37	0.825	2.47	6	
	0839		NR	6,273.5	NR →					off
	0840	Ø	475.3	6,273.5	NR →					▽ level mound
	0849	25.5		↓	NR →					Pump on
	0858	25.5	480.9		20.1	7.36	0.826	4.10	6	DO 1.56 ORP -3.7
	0900		NR	6,528.5	NR →					off
	0902	Ø	474.9	↓						▽ level mound
	0916	25.5		6,528.5	NR →					on
	0925	25.5	480.9		20.1	7.41	0.825	2.52	6	DO 1.66
	0926			6,784	NR →					off
	0928	Ø	475.25	6,784	NR →					▽ level mound
	0938 → ~~0936~~	25.5		6,784	NR →					Pump on
	0948	25.5	481	7,039	20.2	7.45	0.825	2.08	5.8	
	0949	Ø								~~▽ level mound~~ off CH
	0951	Ø	475.25	7,039	NR →					▽ level mound
	1000	25.5	NR	7,039	NR →					Pump on
	1009	↓	481		20.2	7.38	0.824	2.26	5.8	DO 1.65
	1010	↓		7,293.5	NR →					Pump off
	1012	Ø	475.3	7,293.5	NR →					▽ level mound
	1021	25.5		7,293.5	NA →					Pump on
	1029	25.5 - 4			20.2	7.37	0.823	2.07		DO 1.67
	1031	25.5	481.1	7,548	NR →					Pump off
	1033	Ø	475.3	7,548	NR →					▽ level mound
	1256	20.5	NR		20.1	7.41	0.825	3.09		} Pump test
	1320	↓	NR		20.2	7.39	0.824	2.76		
	1426	↓	NR		20.2	7.38	0.824	1.89		
	1708	20.5	480.9		20.2	7.39	0.825	1.17		

Constant Rate Test
Water Levels

Date 4/18/17
Personnel Crystal Hardee & Chris Scott

Project Number 500433
Well ID KAFB106EX2
Start Time 1248 @ 20GPM
Stickup Length 16"

Static Water Level (feet BTOC) 476.65
Pump Depth (feet BTOC) 497
Gallons per Minute 20 to 20.5

Date/Time	Time Elapsed (minutes)	Water Level (feet BTOC)	Difference from Previous Reading (feet)	Drawdown (feet)	Gallons Purged	Comments
4/18/17					7,548 pumping 180 bailing 7,678 total	
1243	0	476.65	Static BTOC		7,678	starting pump wide open ~25.5
1245	2	480.40				then back off to 20
1248	0	~~480.1~~			~7,803	~20 GPM @ 1248
1250	8	480.1	3.45	3.45	7,843	
1255	13	480.2	.1	3.55	7,943	
1300	18	480.25	.05	3.6	8,043	
1305	23	480.28	.03	3.63	8,143	
1310	28	480.3	.02	3.65	8,243	
1315	33	480.32	.02	3.67	8,343	
1325	43	480.37	.05	3.72	8,543	
1335	53	480.39	.02	3.74	8,798	~20.5 GPM
1345	63	480.45	.06	3.8	9,053	
1355	73	480.5	.05	3.85	9,308	
1405	83	480.52	.02	3.87	9,563	
1415	93	480.55	.03	3.9	9,818	
1430	108	480.6	.05	3.95	10,~~200.5~~	10,125.5
1445	123	480.65	.05	4	10,433	
1500	138	480.7	.05	4.05	10,740.5	
1515	153	480.71	.01	4.06	11,048	
1530	168	480.74	.03	4.09	11,355	
1545	183	480.76	.02	4.11		
1600	198	480.79	.03	4.14		
1615	213	480.83	.04	4.18		
1630	228	480.85	.02	4.2		
1645	243	480.87	.02	4.22	12,585	
1700	258	480.9	.02	4.25	12,8925	
1702						Pump off, begin recovery
1703		475.15				
1708		476.8				
1714		476.9				

Margin notes: Dial into 20GPM; start; 5 min; 10 min; 15 min; Recovery

15,750

Constant Rate Test
Water Levels

Date 4/18/17
Personnel Chris Scott & Crystal Hardee

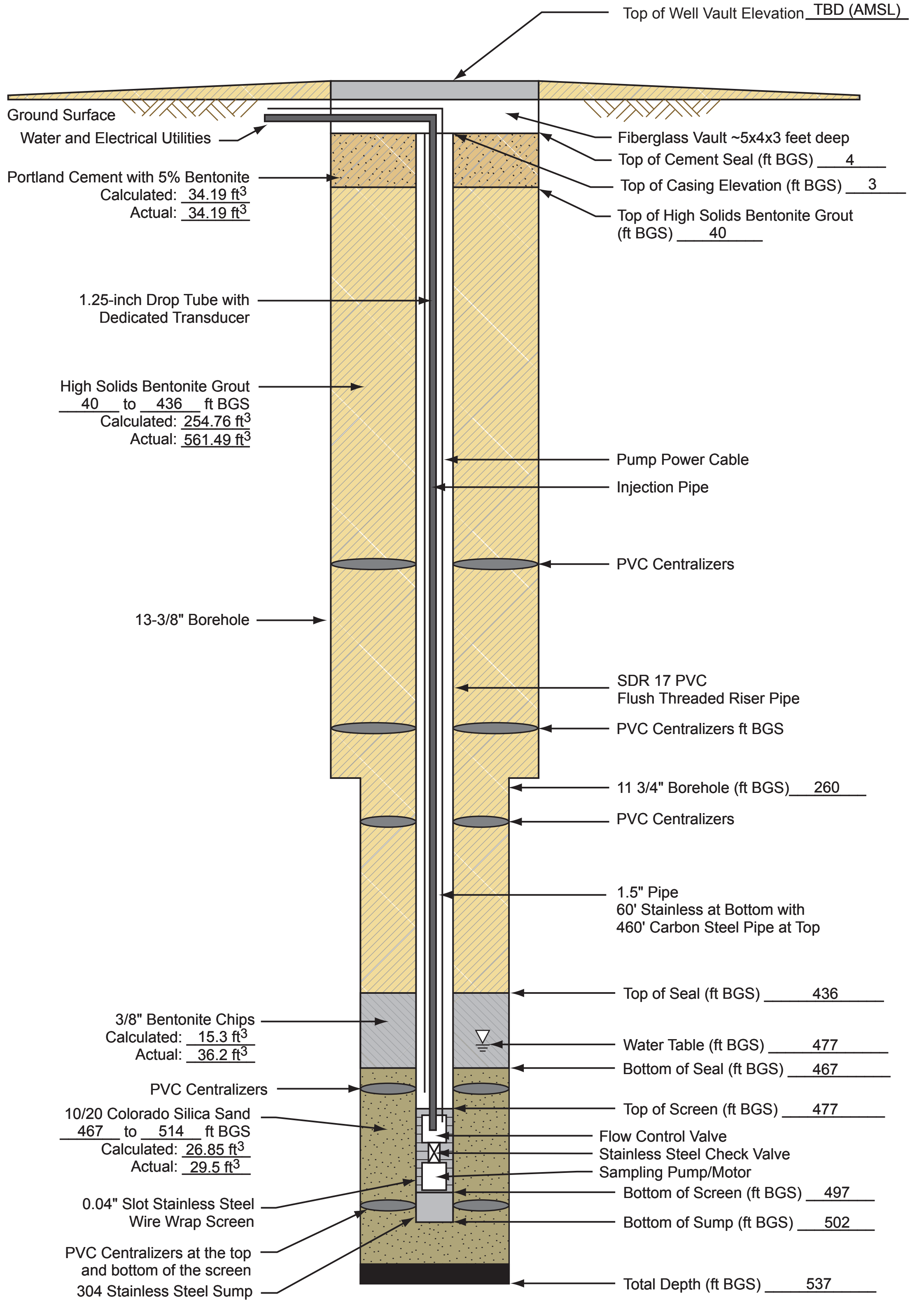
Project Number 500433
Well ID KAFB 106MW25 - obs well
Start Time
Stickup Length
Observation well

Static Water Level (feet BTOC) ~~476.~~ 475.9
Pump Depth (feet BTOC) — N/A
Gallons per Minute N/A

Date/Time 4/18/17	Time Elapsed (minutes)	Water Level (feet BTOC)	Difference from Previous Reading (feet)	Drawdown (feet)	Gallons Purged	Comments
12:45	0	475.90				STATIC T.O.C.
12:48	Ø	475.90	0	0	0	START PUMPING
12:58	10	475.90	0	0	0	STEADY BEEP
1:08	20	475.90	0	0	0	STEADY BEEP
1:18	30	475.90	0	0	0	STEADY BEEP
1:30	42	475.90	0	0	0	STEADY BEEP/CLEANED PROBE
1:45	57	475.90	0	0	0	INTERMITTENT BEEP
2:00	~~7~~2	475.90	0	0	0	" "
2:15	87	475.90	0	0	0	NO INFLUENCE
2:30	102	475.90	0	0	0	" "
2:45	117	475.90	0	0	0	" "
3:15	147	475.90	0	0	0	" "
3:45	170	475.90	0	0	0	NO INFLUENCE
4:00	185	475.90	0	0	0	" "
4:15	200	475.90	0	0	0	NO INFLUENCE
4:30	215					

Injection Well Completion Diagram KAFB-106IN1

Installation Start Date/Time: 3/16/17@0820
Installation End Date/Time: 3/20/17@1500
Completion Date: 4/19/17



500433_03050100_A8

(4,816.90) = *Elevations are NAVD 88 Datum values based on NGS Control Station "Hanger", Elevation = 5,343.43 ft. GPS/RTK methods and GEO1D99 model were used to determine elevations of all surveyed points.*

Not to Scale
BGS = Below Ground Surface

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

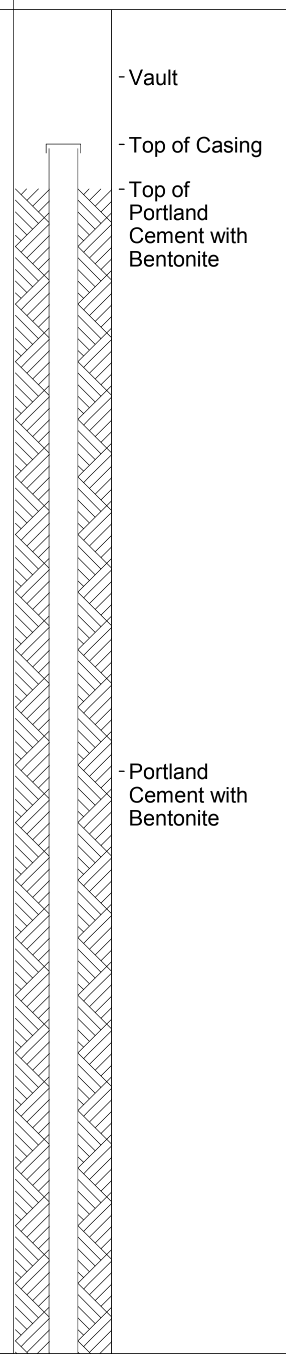
Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					SILT with Gravel (ML); based on water knife.		Vault; Top of Casing; Top of Portland Cement with Bentonite	Borehole was pot holed with air knife to 5 feet bgs. No cuttings returned.
5					SILT with Gravel (ML); yellowish red (5YR 5/6); dry; 80% silt; 20% fine gravel to 1/2"; subangular to rounded; trace coarse sand. Note: gravel is mafics and granitic minerals; fragmented by downhole hammer.			Begin drilling with 13-3/8" drive casing @ 0820 on 3/16/17. Driller is using underreamer and stabilizer.
10					Same as above (5 ft).			Hammering downhole only. No water added downhole.
15					Same as above (5 ft); gravel to 1".	ML	Portland Cement with Bentonite	Kelly down @ 0839, new 20' connection @ 0855.
20					Gravelly SILT (ML); light reddish brown (5YR 6/4); dry; 60% silt; 30% fine to coarse gravel; subangular to rounded; 10% coarse sand. Note: gravel is mafics and granitic minerals.			PID = 0.1 ppm @ breathing zone (BZ) and cyclone.
25					Sandy SILT (ML); yellowish red (5YR 4/6); dry; 70% silt; trace clay; 30% fine to coarse sand; trace fine gravel to 1/8".			Hammering downhole. No water added downhole.
30								



Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Sandy SILT (ML); yellowish red (5YR 4/6); dry; 70% silt; trace clay; 30% fine to coarse sand; trace fine gravel to 1/8".	ML		Hammering downhole. No water added downhole.
					Fat CLAY (CL); strong brown (7.5YR 5/8); medium plasticity; 100% clay; trace fine sand.	CH		
35					Gravelly SILT (ML); light reddish brown (5YR 6/4); dry; 60% silt; trace clay; 40% fine gravel to 3/4"; angular to subrounded; trace fine sand.	ML	Portland Cement with Bentonite	Kelly down @ 0925, new 20' connection @ 0937.
40					Same as above (35 ft).		Top of High Solids Bentonite Grout	PID = 0.2 ppm @ BZ and 0.4 ppm @ cyclone.
					Sandy lean CLAY (CL); light brown (7.5YR 6/3); nonplastic; 70% clay; 30% fine sand; trace fine gravel to 1/8".	CL		
45					Gravelly lean CLAY (CL); reddish brown (5YR 5/4); dry; 60% fines; 30% fine gravel to 1/2"; subrounded to rounded; 10% fine sand. Note: majority of the fines observed in cuttings were clay.			Hammering downhole. No water added downhole.
50					Same as above (46 ft).			
55								Kelly down @ 1015, new 20' connection @ 1355.
60								

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					Gravelly lean CLAY (CL); reddish brown (5YR 5/4); dry; 60% fines; 30% fine gravel to 1/2"; subrounded to rounded; 10% fine sand. Note: majority of the fines observed in cuttings were clay. @ 61 ft: Sandy lean CLAY with Gravel (CL); reddish yellow (7.5YR 4/6); dry; 70% fines; 15% fine to coarse sand; 15% fine gravel to 1/8". Note: majority of the fines observed in cuttings were clay.			PID = 0.1 ppm @ BZ and cyclone.
65								Hammering downhole. No water added downhole.
70					Same as above (61 ft).			
75					Same as above (61 ft).	CL	High Solids Bentonite Grout	Begin hammering with casing hammer. Kelly down @ 1424, new 20' connection @ 1439.
80								PID = 0.1 ppm @ BZ and 0.3 ppm @ cyclone.
85					Sandy lean CLAY (CL); yellowish red (5YR 5/6); dry; medium plasticity; 70% clay; 25% fine to medium sand; 5% gravel fragments.			Hammering downhole and with casing hammer. No water added downhole.
90								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:14 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▽ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90–97					Sandy lean CLAY (CL); yellowish red (5YR 5/6); dry; medium plasticity; 70% clay; 25% fine to medium sand; 5% gravel fragments. Color change to gray from 93 - 95 ft.	CL		Hammering downhole and with casing hammer. No water added downhole.
97–110					Poorly graded SAND (SP); brown (7.5YR 5/4); dry; 90% fine sand; 10% silt. Same as above (97 ft); trace coarse sand. Same as above (97 ft).	SP	High Solids Bentonite Grout	Kelly down @ 1520, new 20' connection @ 1530. PID = 0.2 ppm @ BZ and cyclone. Hammering downhole and with casing hammer.
110–119					Silty SAND with Gravel (SM); pink (5Y 7/4); dry; 40% fine to coarse sand; 20% gravel fragments; angular; 40% silt. Same as above (110 ft).	SM		No water added downhole. Kelly down @ 1553, new 20' connection @ 1640.
119–120					Description on following page.	CL		

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:14 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Lean CLAY with Sand (CL); light reddish brown (5YR 6/8); dry to slightly moist; 80% clay; 20% fine sand; trace medium and coarse sand.	CL		PID = 0.1 ppm @ BZ and 0.2 ppm @ cyclone. Hammering downhole and with casing hammer.
125					Same as above (120 ft).			
130								
					Well-graded SAND with Gravel (SW); reddish gray (5YR 5/2); dry; 80% fine to coarse sand; 20% fine gravel to 1/4"; subrounded to rounded.	SW		No water added downhole.
135							High Solids Bentonite Grout	
					Same as above (132 ft).			Kelly down @ 1710. End of 3/16/17. Resume drilling @ 0745 on 3/17/17.
140								PID = 0.1 ppm @ BZ and 0.2 ppm @ cyclone.
					Sandy lean CLAY (CL); reddish yellow (5YR 6/8); dry to slightly moist; low plasticity; 60% clay; 40% fine sand; trace gravel fragments.	CL		
145					Same as above (142 ft).			Hammering downhole and with casing hammer. No water added downhole.
150								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:14 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Sandy lean CLAY (CL); reddish yellow (5YR 6/8); dry to slightly moist; low plasticity; 60% clay; 40% fine sand; trace gravel fragments.	CL		Hammering. No water added dowhole or at cyclone.
155					Same as above (150 ft).			Kelly down @ 0819, new 20' connection @ 0829.
					Well-graded SAND (SW); reddish yellow (5YR 6/6); dry; 95% fine to coarse sand; trace gravel fragments; 5% silt.	SW		
160								PID = 0.2 ppm @ BZ and 0.3 ppm @ cyclone.
165					Poorly graded SAND (SP); light brown (7.5YR 6/4); dry; 100% fine sand; trace medium and coarse.	SP	High Solids Bentonite Grout	Hammering downhole and with casing hammer.
170					Same as above (165 ft).			
175					Same as above (165 ft).			Kelly down @ 0907, new 20' connection @ 0927.
180								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:14 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); light brown (7.5YR 6/4); dry; 100% fine sand; trace medium and coarse.	SP		PID = 0.1 ppm @ BZ and cyclone.
185					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 85% fine to coarse sand; 15% fine gravel to 1/4"; subrounded to rounded. Note: gravel is mafics and granitic minerals.	SW		No hammering. Suspend drive casing while moving down.
190					Same as above (185 ft).			No water added downhole.
195					Same as above (185 ft).		High Solids Bentonite Grout	Kelly down @ 0952, new 20' connection.
200								PID = 0.1 ppm @ BZ and cyclone.
					Poorly graded SAND (SP); light brown (7.5YR 6/3); dry; 100% medium sand; trace coarse sand.	SP		
205					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 80% fine to coarse sand; 20% fine gravel to 1/2"; angular to rounded. Note: gravel is mafics and granitic minerals.	SW		Hammering downhole and with casing hammer. No water added downhole.
210								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:14 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 80% fine to coarse sand; 20% fine gravel to 1/2"; angular to rounded. Note: gravel is mafics and granitic minerals.	SW		Hammering downhole and with casing hammer.
215					Well-graded SAND (SW); pinkish gray (7.5YR 6/2); dry; 100% fine to coarse sand.	SW		
					Well-graded SAND with Gravel (SW); pinkish gray (7.5YR 6/2); 70% fine to coarse sand; 30% fine gravel to 1/4"; angular to rounded.	SW		Kelly down @ 1026, new 20' connection @ 1034.
220					Lean CLAY with Sand (CL); strong brown (7/5YR 5/6); moist; 80% clay; 20% fine to medium sand.	CL		PID = 0.1 ppm @ BZ and cyclone.
					Well-graded GRAVEL with Sand (GW); dark brown (7.5YR 3/3); 50% fine to coarse gravel to 1-1/4"; angular to rounded; 45% fine to coarse sand; 5% silt. Note: gravel is mafics and granitic minerals.	GW		Driller added approximately 100 gallons of water downhole.
225					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 75% fine to coarse sand; 25% fine to coarse gravel to 1"; subangular to rounded; trace silt. Note: gravel is mafics and granitic minerals.	SW	High Solids Bentonite Grout	Hard drilling.
230					Same as above (224 ft).	SW		Hammering.
235					Same as above (224 ft).	SW		Kelly down @ 1138, new 20' connection @ 1245.
240								

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 75% fine to coarse sand; 25% fine to coarse gravel to 1"; subangular to rounded; trace silt. Note: gravel is mafics and granitic minerals.	SW		Hammering downhole and with casing hammer. No water added downhole.
245					Same as above (240 ft).			
250					Silty SAND with Gravel (SM); brown (7.5YR 5/4); 60% fine to medium sand; 20% fine gravel to 1/2"; subangular to rounded; 20% silt.	SM	High Solids Bentonite Grout	
255								
258					Sandy lean CLAY (CL); yellowish brown (10YR 5/4); low plasticity; 70% clay; 25% fine sand; 5% fine gravel to 1/8"; subrounded to rounded.	CL		Kelly down @ 1305, new 5' connection @ 1333. Trip drill sting to run in with 11-3/4" casing. End of 3/17/17. Resume drilling @ 0835 on 3/18/17. PID = 0.1 ppm @ BZ and cyclone.
260								
265					Same as above (258 ft).			
270								Hammering downhole and intermittently with casing hammer.

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270–275					Sandy lean CLAY (CL); yellowish brown (10YR 5/4); low plasticity; 70% clay; 25% fine sand; 5% fine gravel to 1/8"; subrounded to rounded.	CL		PID = 0.0 ppm @ BZ and 0.1 ppm @ cyclone. No water added downhole.
275–283					No cuttings returned. Cyclone plugged and drill bit is stuck. Cuttings appear to be coarse sand with gravel and clay.			Kelly down @ 0800, new 20' connection @ 0910. PID = 0.1 ppm @ BZ and cyclone.
283–300					Poorly graded SAND (SP); light brown (7.5YR 6/4); 100% fine sand; trace medium and coarse sand.	SP	High Solids Bentonite Grout	Driller added approximately 100 gallons of water dowhole. Resume drilling @ 1310.
290					Same as above (283 ft).			Hammering downhole.
295					Same as above (283 ft).			Kelly down @ 1328, new 20' connection @ 1341.

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Poorly graded SAND (SP); light brown (7.5YR 6/4); 100% fine sand; trace medium and coarse sand.	SP		PID = 0.0 ppm @ BZ and cyclone.
					Well-graded SAND with Gravel (SW); brown (7.5YR 6/4); 80% fine to coarse sand; 20% fine to coarse gravel to 1"; subangular to rounded; trace silt.	SW		
305								Hammering downhole. No water added downhole.
					Same as above (302 ft).			
310								
					Same as above (302 ft).			
315							High Solids Bentonite Grout	
								Kelly down @ 1356, new 20' connection @ 1403.
320					Same as above (302 ft).			PID = 0.0 ppm @ BZ and cyclone.
					Sandy lean CLAY (CL); nonplastic; 60% clay; 20% fine to medium sand; 20% fine gravel to 1/4"; angular to rounded.	CL		
325								
					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 70% fine to coarse sand; 30% fine gravel to 1/4"; subrounded to rounded.	SW		No water added downhole.
330								

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 70% fine to coarse sand; 30% fine gravel to 1/4"; subrounded to rounded.	SW		Hammering downhole and with casing hammer. No water added downhole.
					Silty SAND with Gravel (SM); brown (7.5YR 4/2); 50% fine to coarse sand; 25% fine gravel to 1/2"; subrounded to rounded; 25% silt. Note: gravel is mafics and granitic minerals.	SM		
335					Well-graded GRAVEL with Silt and Sand (GW-GM); brown (7/5YR 4/2); 50% fine to coarse gravel to 1"; subangular to rounded; 40% fine to coarse sand; 10% silt. Note: sand and gravel are mafics and granitic minerals.	GW-GM		Kelly down @ 1442, new 20' connection @ 1555. PID = 0.0 ppm @ BZ and 0.1 ppm @ cyclone.
340					Well-graded SAND with Gravel (SW); brown (7.5YR 4/2); 70% fine to coarse sand; 25% fine gravel to 1/2"; subangular to rounded; 5% silt. Note: gravel is mafics and granitic minerals. Same as above (341 ft).	SW	High Solids Bentonite Grout	
345								
350					Poorly graded SAND (SP); brown (7.5YR 5/4); 100% fine sand; trace medium and coarse sand; trace fine gravel to 1/8"; rounded. Note: gravel is granitic minerals. Same as above (350 ft).	SP		No water added downhole. Kelly down @ 1613, new 20' connection @ 1621.
355								
360								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:14 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Poorly graded SAND (SP); brown (7.5YR 5/4); 100% fine sand; trace medium and coarse sand; trace fine gravel to 1/8"; rounded. Note: gravel is granitic minerals.	SP		PID = 0.0 ppm @ BZ and 0.1 ppm @ cyclone.
365–370					Well-graded SAND (SW); light brown (7.5YR 6/4); dry; 90% fine to coarse sand; 10% fine gravel to 1/4"; subrounded to rounded. Note: gravel is mafics and granitic minerals.	SW		
375					Silty GRAVEL with Sand (GM); pinkish gray (7.5YR 6/2); dry; 50% fine gravel to 1/2"; 30% fine to coarse sand; 20% silt. Note: gravel is mafics and granitic minerals.	GM	High Solids Bentonite Grout	No water added downhole. Kelly down @ 1656, new 20' connection @ 1704.
380					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 80% fine to coarse sand; 20% fine gravel to 1/2"; subrounded to rounded. Note: gravel is mafics and granitic minerals.	SW		PID = 0.1 ppm @ BZ and cyclone.
385–390					Same as above (380 ft).	SW		No water added downhole.

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:14 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 80% fine to coarse sand; 20% fine gravel to 1/2"; subrounded to rounded. Note: gravel is mafics and granitic minerals.	SW		
395					Same as above (390 ft).			No water added downhole. Kelly down @ 1730. End of 3/18/17. Resume drilling @ 0810 on 3/19/17.
400					Same as above (390 ft).			PID = 0.1 ppm @ BZ and cyclone.
405					Poorly graded SAND (SP); pale brown (10YR 6/3); 90% fine sand; trace medium sand; 5% fine gravel to 1/4"; rounded; 5% silt. Note: gravel is mafics and granitic minerals.	SP	High Solids Bentonite Grout	Hammering with casing hammer. No water added downhole.
410					SILT (ML); strong brown (7.5YR 4/6); 90% silt; 5% fine sand; 5% fine gravel to 1/8".	ML		
					Poorly graded SAND (SP); brown (7.5YR 5/2); 90% fine sand; 5% fine gravel to 1/8"; rounded; 5% silt. Note: gravel is mafics and granitic minerals.	SP		
415					Well-graded SAND (SW); light brown (7.5YR 6/3); dry; 90% fine to coarse sand; 5% fine gravel to 1/4"; 5% silt.	SW		Kelly down @ 0838, new 20' connection @ 0845.
420								

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
At Time of Drilling: 477.00
At End of Drilling: Not Recorded
After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well-graded SAND (SW); light brown (7.5YR 6/3); dry; 90% fine to coarse sand; 5% fine gravel to 1/4"; 5% silt.			PID = 0.1 ppm @ BZ and cyclone.
425					Same as above (420 ft).			
430								No water added downhole.
					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); dry; 80% fine to coarse sand; 20% fine gravel to 1/2"; trace silt.			
435						SW	Top of Bentonite Seal	
					Same as above (432 ft).			Kelly down @ 0914, new 20' connection @ 0925.
440								PID = 0.2 ppm @ BZ and cyclone.
445					Same as above (432 ft).			
450								

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); dry; 80% fine to coarse sand; 20% fine gravel to 1/2"; trace silt.	SW		Hammering with casing hammer. No water added downhole.
455					Same as above (450 ft); 70% sand; 30% gravel to 1-1/2".			Kelly down @ 0954, new 20' connection @ 1200.
					Poorly graded SAND with Silt (SP-SM); yellowish brown (10YR 5/4); dry; 80% fine sand; trace medium sand; 10% fine gravel to 1/4"; rounded; 10% silt. Note: gravel is mafics and quartz.	SP-SM	Bentonite Seal	
460								PID = 0.1 ppm @ BZ and 0.7 ppm @ cyclone. Slight fuel odor.
465			4.5		Same as above (458 ft).			PID = 0.1 ppm @ BZ and 7.5 ppm @ cyclone.
							Top of 10/20 Sand	Hammering with casing hammer.
470			4.3		Same as above (458 ft).			PID = 0.1 ppm @ BZ and 4.1 ppm @ cyclone.
475			5.8		Same as above (458 ft).			PID = 0.3 ppm @ BZ and 10.2 ppm @ cyclone.
					Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); wet; 75% fine to coarse sand; 25% fine gravel to 1"; subangular to rounded.	SW	Top of Stainless Steel 0.040 Slot Screen	Top of groundwater @ 477 feet bgs. Kelly down @ 1252, new 20' connection @ 1300.
480								

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
∇ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480			12.5		Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); wet; 75% fine to coarse sand; 25% fine gravel to 1"; subangular to rounded. Note: gravel is mafics and quartz.			PID = 0.2 ppm @ BZ and 11.5 ppm @ cyclone. Hammering. No water added downhole.
485			23.7		Same as above (480 ft).			PID = 0.2 ppm @ BZ and 18.9 ppm @ cyclone.
490			342.3		Same as above (480 ft).		Stainless Steel 0.040 Slot Screen	PID = 1.8 ppm @ BZ and 1,721 ppm @ cyclone.
495			365.7		Same as above (480 ft).	SW	Bottom of Screen	PID = 4.6 ppm @ BZ and 518.6 ppm @ cyclone. Kelly down @ 1344, new 20' connection.
500			95.7		Same as above (480 ft).		Stainless Steel Sump; Bottom of Sump	PID = 6.2 ppm @ BZ and 460.8 ppm @ cyclone.
505			96.3		Same as above (480 ft).			Hammering downhole and with casing hammer. No water added downhole. PID = 5.2 ppm @ BZ and 61.9 ppm @ cyclone.
510								

Borehole ID: KAFB-106IN1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 3/16/2017
Date TD Reached: 3/20/2017
Date Completed: 4/19/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Vault

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 477.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.60

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510			43.7		Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); wet; 75% fine to coarse sand; 25% fine gravel to 1"; subangular to rounded. Note: gravel is mafics and quartz.	SW	Bottom of 10/20 Filter Pack	PID = 6.0 ppm @ BZ and 54.3 ppm @ cyclone.
515			20.1		Same as above (510 ft).			PID = 1.7 ppm @ BZ and 16.8 ppm @ cyclone. Kelly down @ 1415. Added approximately 1,000 gallons of water downhole. End of 3/19/17. Resume drilling @ 1415 on 3/20/17. PID = 0.1 ppm @ BZ and 0.2 ppm @ cyclone.
520			2.7		Same as above (510 ft).			
525			0.7		Same as above (510 ft).		Native Backfill	PID = 0.0 ppm @ BZ and 0.1 ppm @ cyclone.
530			0.7		Same as above (510 ft).			PID = 0.1 ppm @ BZ and 0.3 ppm @ cyclone. PID = 0.1 ppm @ BZ and cyclone.
535			0.2				Bottom of Rat Hole	Kelly down @ 1500. Total depth = 537 feet bgs. Reached total depth on 3/20/17. Added approximately 1,000 gallons of water downhole.
540								

CBI

Groundwater Extraction Well Development

Crystal Hardee

Bailing KAFB 106IN1

Date	Time	Total Volume Bailed (gallons)	Imhoff Cone Measurement (mL sediment per L water)	Comments
4/10	0756		35	
	0804		40	
	0811	10	10	
	0815		20	
	0818		20	
	0823	20	3.5	
	0835		8	
	0843		1.5	
	0849		1	
	0852	46	1	Switch to swab
	0915	40	–	~~Start swabbing~~
	0942	40	-	begin bailing well again
	0946		-	lost most of sand from bailer
	0953		–	- x3 bailer up empty or close to
	0956		~~30~~ 30	- Successful trip
	0958		–	empty - switching bailers
	1006		4	New bailer working great
	1009		3	
	1012	50	5	stopping ~~to~~ pump off Drum
	1049	70	1.5	- switching to Swab
	1135		50	bailing
	1139		40	
	1142		25	
	1146		15	
	1148		30	
	1150		20	
	1154	80	1	
	1200		2	
	1205	95	1	~~Bailing / swabbing complete~~
	1245	97	1	Bailing / swabbing complete

Groundwater Extraction Well Development

Intake @ 492' bgs

Pumping KAFB-106IN-1 Crystal Hardee

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments DO / Comments
4/10	1536	25.5	477.75	~ Ø	19.9		0.507	>1000		~~10.9~~ 1.40
↓	1556	25.5	483.2	510	20.1		0.568	22.1		
	1606		476.8							surge - pump off
	1615									Pump on
	1619	25.5	483.2	862	20.1	7	0.571	16.8		2.68
	1631		476.4	1,168						Pump off
	1639									Pump on
	1650	25.5	483.85	1,678						~~off Surge~~
	1700			1,983						off for day
4/11	0720	Ø	477.85	1,983	NR →					static - pre pump
↓	0729	25.5								Pump on
	0733	25.5	483.5	2,035	19.9	7.65	0.589	~~7.93~~ 339		2.93
	0747	25.5	484.5	2,392	20.0	8.18	0.590	14.1		3.39
	0749			2,443						off - Surge
	0755	Ø	477.5	2,443	NR →					
	0759									on
	0806	25.5	484.4	2,596	20.1		0.595	8.61		3.31
	0809									off
	0819	Ø	478.0	2,596	NR →					
	0821									on
	0825	25.5	485.6	2,698	20.1	±9.00	0.594	7.95		3.82
	0834			2,927.5						off
	0836	Ø	476.3		NR →					
	0844	25.5								on
	0845		484.1							
	0849	25.5	485.1	3,055	20.0	±9.00	0.603	9.97	3.5	3.68
	0856									off
	0858		476.1							
	0908									on
	0913	25.5	484.9	3,182.5	20.1	7.87	0.603	10.2		3.95
	0918			3,310						off
	0921	Ø	476.05	3,310	NR →					
	0928	25.5		3,310	NR →					on
	0931		484.8	3,335.5	NR →					
	0935	25.5	485.3	3,437.5	20.1	7	0.603	9.19		3.52
	0940			3,565						off
	0942	Ø	476.2	3,565	NR →					
↓										on

Groundwater Extraction Well Development

Pumping KAFB 106IN-1

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
4/11	1006	- Pump off - letting Recover for test								Mini Pump test
	1040	Ø	478.0	3565						
	1100	25.5	477.95	3565						Pumping
	1101	25.5	484.4	3590.5						
	1102	25.5	484.6	3616						
	1103	25.5	484.85	3641.5						
	1104	25.5	485	3667						
	1105	25.5	485.2	3692.5						
	1110	25.5	485.8	3820						
	1115	25.5	486	3947.5	20.1	~~20.1~~	0.604	~~4.94~~ 4.94		4.01
	1120	25.5	486.25	4075						
	1125	25.5	486.45	4202.5						3.69
	1130	25.5	486.6	~~4203.~~ 4330		~~20.1~~	~~0.604~~	~~4.94~~		
	1140	25.5	488.95	4585						
	1150	25.5	487.3	4840						
	1200	25.5	487.6	5095						Pump off
	1249									Pump on surge cycle
	1255	25.5	486.7	5248	20.2	±7.00	0.615	10.5	2.9	1300 Pump off
	1302	Ø	475.85	5248	NR →					Recovery /mound
	1300									Pump on
	1316	25.5	486.8	5401	20.2	7	0.614	10.0		3.71
	1320			5503						off
	1321	Ø	475.9	5503 ~~546~~	NR →					Recovery /mound
	1334	25.5		5503	NR →					on
	1339	25.5	486.95	5630.5	20.2		0.614	21.0		3.89
	1344									off
	1346	Ø	475.8	5758	NR →					Recovery /mound
	1356	25.5								on
	1359	25.5	486.4	5,885.5	20.3	±9.00	0.612	13.5		Pump ON
	1406			6,013						off
	1408	Ø	475.8							Recovery /mound
	1500	Ø	477.96							
	1513	25.5	484.8	6,013						Pump test
	1514	25.5	485.95	6,038.5						
	1515	25.5	486	6,064						
	1516	↓	486.05	6,089.5						
	1517	↓	486.50	6,115						
↓	1518	↓	486.85	6,140.5						

Groundwater Extraction Well Development

Page 3 of ______

Pumping KAFB-106IN-1

Date	Time	Rate (gpm)	Depth to Water (ft BGS)	Volume Removed (gallons)	Temp (°C)	pH	EC (mS/cm)	Turbidity (NTU)	Specific Capacity (gpm/ft)	Comments
4/11	1523	25.5	487.40	6,268						~~Pump test~~
	1528	25.5	487.65	6,293.5						
	1533	25.5	487.82	6,319						
	1537	25.5	488	6,370						
	1543	25.5	488.1	6,497.5						Pump off
	1549	Ø	477.81	6,497.5						
	1550									Pump on
	1551	25.5								water
	1559	25.5	487.7	6,701.5	20.1	±7.00	0.620	7.76		
	1601			6,752.5						off
	1611	-	-	6,752.5	NR →					on.
	1615	25.5	487.3	6,854.5	20.2		0.615	10.3		
	1622	Ø		7,130						off
	1630	Ø	477.86	7,130	NR →					
	1632	25.5								on
	1633	25.5	486.15	7,155.5	20.5		0.604	14.4		
	1646			7,487						off
	1654	Ø								on
	1656	25.5	486.9	7538	20.1	±7.00	~~0.6~~ 0.602	16.0		
	1704	Ø								off
↓	1705	Ø	475.75	7538	NR	NR	NR	NR		- Done Surging 4 today
4/12	0709	Ø	477.75	7538	NR →					static
	~~0715~~	on + Pumping								Pump test
	~~0716~~									Tagger stuck
	0717	25.5	486.1	7614.5					3	
	0718	25.5	486.4	7640					2.9	
	0719	25.5	486.75	7665.5	20.0	±7	0.626	13.6	2.8	
	0720	↓	487.10	7793					2.7	
	0725		487.91	7,920.5					2.5	
	0730		488.33	8,048					2.4	
Pump	0735		488.35	8,175.5					2.4	
	0740		488.50	8,303	20.0	±7	0.624	11.8	2.3	
	0745	↓	488.70	8,430.5					2.3	
↓	0750		488.82	8,558	20.0	±7	0.623	9.1	2.3	
4/12	0755	Ø	477.65	8,558	NR →					
Recovery	0800	↓	477.9	↓	NR →					
	0805		477.9		NR →					
↓	0810	↓	477.85	↓	NR →					

Constant Rate Test
Water Levels

Page 1 of 1

Date 4/22/17
Personnel Crystal

Project Number 500433
Well ID 1060IW1
Start Time 4:25
Stickup Length 16 in

Static Water Level (feet BTOC) 477.55
Pump Depth (feet BTOC) 492
Gallons per Minute ~ 20.04

Intake @ ~492

Date/Time 4/22	Time Elapsed (minutes)	Water Level (feet BTOC)	Difference from Previous Reading (feet)	Drawdown (feet)	Gallons Purged	Comments
4:25	0	477.55				Started @ 28 GPM
4:27	2	483.75		6.2	56	
4:28	3	483.58		6.03	76	
4:33	16	483.95	.37	6.4	176	
4:35	12	484.1	.15	6.55	216	20 GPM
4:40	17	484.55	.45	7	316	
4:45	22	484.65	.10	7.1	416	
4:50	27	484.85	.2	7.3	516	
4:55	32	485.00	.15	7.45	616	
5:00	37	485.15	.15	7.6	716	
5:05	42	485.3	.15	7.75	816	
5:10	47	485.4	.1	7.85	1,016	
5:20	57	485.56	.16	8.01	1,216	
5:30	67	485.7	.14	8.15	1,416	
5:40	77	485.8	.1	8.25	1,616	
5:50	87	485.9	.1	8.35	1,816	
6:00	97	486	.1	8.45	2,016	
6:16	107	486.1	.1	8.55	2,216	
6:20	117	486.2	.1	8.65	2,416	
6:30	127	486.3	.1	8.75	2,616	
6:50	147	486.45	.15	8.9	3,016	Pump off

5 min

10 min

4/22/17

Groundwater Extraction Well Development

Jetting

106 IN-1 Crystal Hardbee

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
4/22/17	0849	478.5	19	22	0	Start Jet / Pump
	0850	479.5			under .5	
	0851	480.5			↓	
	0852	481.5			↓	minimal silt v. fine
	0853	482.5			↓	sand observed in
	0854	483.5			↓	each cone. About
	0855	484.5			↓	2-3 cones per interval
	0856	485.5			↓	
	0857	486.5			↓	
	0858	487.5			↓	
	0859	488.5			↓	
	0900	489.5			↓	
	0901	490.5			↓	
	0902	491.5			↓	
	0903	492.5			↓	
	0904	493.5			↓	
Stop jet	0905	494.5			↓	→ Jet off, pump running
	0913	495			Pump Imhoff under 0.5 ml/L	→ Stop pumping. Evaluate
	0925	495			- Under 0.5 during jet.	→ Jet on, pump running.
begin bottom up jet	0927	494				
	0928	493			↓	
	0929	492			↓	
	0930	491			↓	
	0931	490			↓	
	0932	489			↓	v. minimal silt and
	0933	488			↓	v. fine sand
	0934	487			↓	
	0935	486			↓	
	0936	485			↓	
	0937	484			↓	
	0938	483			↓	
	0939	482			↓	
	0940	481			↓	
Stop jet	0941	480			↓	→ Jet off, pump. Drop
	0948	494			Tank / Drum	Pump to near bottom of screen to
Start jet top down 3-ft increments 3 min each	1021	~480	35	22	Tank <0.5 / Drum <0.5	pump, shut off pump.
	1024	~483			↓ / ↓	- Jet @ 35 gpm
	1027	~486			↓ / ↓	→ pump to catch up
	1033	~489				→ jet again

4/22/17

Groundwater Extraction Well Development

Jetting KAFB-106IN 1

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
4/22/17	1035	~492	35 gpm	22 gpm	<0.5 mil/L	jet/pump
	1038	~495	35 gpm	~22 gpm	~0.2 mil	Imhoff from tank and drum v. clean.
	1040	~497	0 gpm	22 gpm	~0.2 mil	pump 22 gpm
	1048	~497				pump off

stop jet → 1040
pump off → 1048

Groundwater Extraction Well Development

Jetting 106IN1 4/28/17

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
4/28	0816	477.5	20.3	23.0		
4/28	0817	478.5	20.3	23.0	0 mL/L	Pump on, jet on
4/28	0818	479.5	20.3	23.0	0 mL/L	few grains
4/28	0819	480.5	20.3	23.0	0 mL/L	few grains
4/28	0820	481.5	20.3	23.0	~0.1 mL/L	slightly cloudy (Sample port and drum)
4/28	0821	482.5	20.3	23.0	0 mL/L	slightly cloudy
4/28	0822	483.5	20.3	23.0	0 mL/L	clear
4/28	0823	484.5	20.3	23.0	0 mL/L	clear, few grains from baker
4/28	0824	485.5	20.3	23.0	0 mL/L	few grains
4/28	0825	486.5	20.3	23.0	0 mL/L	slightly cloudy
4/28	0826	487.5	20.3	23.0	0 mL/L	Slightly cloudy
4/28	0827	488.5	20.3	23.0	<0.1 mL/L	few grains
4/28	0828	489.5	20.3	23.0	<0.1 mL/L	few grains, cloudy
4/28	0829	490.5	20.3	23.0	0 mL/L	
4/28	0830	491.5	20.3	23.0	0 mL/L	few grains
4/28	0831	492.5	20.3	23.0	0 mL/L	
4/28	0832	493.5	20.3	23.0	0 mL/L	Rotate jet, start downward
4/28	0833	493.5	20.3	23.0	0.2 mL/L	slightly cloudy all silt and fine sand accumulate (0833–0840)
4/28	0834	492.5	20.3	23.0	<0.2 mL/L	
4/28	0835	491.5	20.3	23.0	0.4 mL/L	
4/28	0836	490.5	20.3	23.0	~0.2 mL/L	
4/28	0836	489.5	20.3	23.0	0.5-0.6 mL/L	
4/28	0837	488.5	20.3	23.0	0.3 mL/L	
4/28	0838	487.5	20.3	23.0	0.3 mL/L	
4/28	0839	486.5	20.3	23.0	0.5 mL/L	
4/28	0840	485.5	20.3	23.0	0.5 mL/L	
4/28	0841	484.5	20.3	23.0	0.9 mL/L	
4/28	0842	483.5	20.3	23.0	0.9 mL/L	
4/28	0843	482.5	20.3	23.0	0.6 mL/L	
4/28	0844	481.5	20.3	23.0	0.9 mL/L	
4/28	0845	480.5	20.3	23.0	0.8 mL/L	
4/28	0846	479.5	20.3	23.0	~0.7 mL/L	
4/28	0847	478.5	20.3	23.0	~0.8 mL/L	
4/28	0848	477.5	20.3	23.0	~0.9 mL/L	Jet off, pump on to clear casing.
4/28	0910	—	—	23.0	—	
4/28	0928	— Short 23 gpm pump test, No jet, Log on transducer.				
4/28	0951	Put pump near bottom				← pump off. about 8.7 ft drawdown
Next page						

Margin notes: top to bottom (0816–0832); bottom to top (0833–0848); pump off (0928); pump on (0951).

Groundwater Extraction Well Development

Jetting 106IN1

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
4/28	1021	493.5	19	23	0 mL/L	jet on, pump on
4/28	1022	492.5	19	23	0 mL/L	
4/28	1023	491.5	19	23	0.1 mL/L	
4/28	1024	490.5	19	23	0.1 mL/L	
4/28	1025	489.5	19	23	0.1 mL/L	
4/28	1026	488.5	19	23	0.1 mL/L	
4/28	1027	487.5	19	23	0.1 mL/L	
4/28	1028	486.5	19	23	0.2 mL/L	
4/28	1029	485.5	19	23	0.2 mL/L	
4/28	1030	484.5	19	23	0.5 mL/L	
4/28	1031	483.5	19	23	0.6 mL/L	
4/28	1032	482.5	19	23	0.7 mL/L	
4/28	1033	481.5	19	23	0.8 mL/L	
4/28	1034	480.5	19	23	0.9 mL/L	
4/28	1035	479.5	19	23	0.8 mL/L	
4/28	1036	478.5	19	23	0.9 mL/L	
4/28	1037	479.5	19	23	0.6 mL/L	
4/28	1038	480.5	19	23	0.9 mL/L	
4/28	1039	481.5	19	23	1.1 mL/L	
4/28	1040	482.5	19	23	2 mL/L	
4/28	1041	483.5	19	23	2 mL/L	
4/28	1042	484.5	19	23	1 mL/L	
4/28	1043	485.5	19	23	0.5 mL/L	
4/28	1044	486.5	19	23	0.2 mL/L	
4/28	1045	487.5	19	23	0.2 mL/L	
4/28	1046	488.5	19	23	0.1 mL/L	
4/28	1047	489.5	19	23	0.1 mL/L	
4/28	1048	490.5	19	23	<0.1 mL/L	
4/28	1049	491.5	19	23	<0.1 mL/L	
4/28	1050	492.5	19	23	<0.1 mL/L	
4/28	1051	493.5	19	23	0.2 mL/L	
4/28	1052	492.5	19	23	0.1-0.2 mL/L	
4/28	1053	491.5	19	23	0.2 mL/L	
4/28	1054	490.5	19	23	0.2 mL/L	
4/28	1055	489.5	19	23	0.2 mL/L	
4/28	1056	488.5	19	23	0.2 mL/L	
4/28	1057	487.5	19	23	0.2 mL/L	
4/28	1058	486.5	19	23	0.3 mL/L	

Margin notes: bottom to top (1021–1036); top to bottom (1037–1051); bottom to top (1052–1058)

Groundwater Extraction Well Development

Jetting 106IN1

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
4/28	1059	485.5	19	23	0.3 mL/L	
4/28	1100	484.5	19	23	0.5 mL/L	
4/28	1101	483.5	19	23	0.4 mL/L	
4/28	1102	482.5	19	23	0.9 mL/L	
4/28	1103	481.5	19	23	1.5 mL/L	
4/28	1104	480.5	19	23	1.5 mL/L	
4/28	1105	479.5	19	23	0.7 mL/L	
4/28	1106	478.5	19	23	0.4 mL/L	
4/28	1107	479.5	19	23	0.4 mL/L	
4/28	1108	480.5	19	23	0.8 mL/L	
4/28	1109	481.5	19	23	2.0 mL/L	
4/28	1110	482.5	19	23	1.2 mL/L	
4/28	1111	483.5	19	23	1.0 mL/L	
4/28	1112	484.5	19	23	0.3 mL/L	
4/28	1113	485.5	19	23	0.3 mL/L	
4/28	1114	486.5	19	23	0.2 mL/L	
4/28	1115	487.5	19	23	0.1 mL/L	
4/28	1116	488.5	19	23	0.1 mL/L	
4/28	1117	489.5	19	23	0.2 mL/L	
4/28	1118	490.5	19	23	0.1 mL/L	
4/28	1119	491.5	19	23	0.2 mL/L	
4/28	1120	492.5	19	23	0.2 mL/L	
4/28	1121	493.5	19	23	0.2 mL/L	
4/28	1125	483	19	23	0.3 mL/L	Move jet up to 487'
4/28	1126	482	19	23	0.3 mL/L	Rotate jet
4/28	1127	481	19	23	0.3 mL/L	
4/28	1128	480	19	23	0.8 mL/L	
4/28	1129	479	19	23	0.5 mL/L	
4/28	1130	478.5	19	23	0.4 mL/L	
4/28	1132	478.5	19	23	0.5 mL/L	
4/28	1133	479.5	19	23	1.5 mL/L	
4/28	1134	480.5	19	23	0.5 mL/L	
4/28	1135	481.5	19	23	0.4 mL/L	
4/28	1136	482.5	19	23	0.2 mL/L	
4/28	1137	483.5	19	23	0.2 mL/L	
4/28	1138	484.5	19	23	0.2 mL/L	
4/28	1139	485.5	19	23	0.2 mL/L	
4/28	1140	486.5	19	23	0.1 mL/L	
4/28	1141	487.5	19	23	0.1 mL/L	

bottom to top

top to bottom

work on top 10 ft

Groundwater Extraction Well Development

Jetting 106IN1

Date	Time	Depth (ft bgs)	Jetting Rate (gpm)	Pumping Rate (gpm)	Imhoff Cone Measurement (mL sediment per L water)	Comments
4/28	1142	486.5	19	23	0.3	
4/28	1143	485.5	19	23	0.3	
4/28	1144	484.5	19	23	0.3	
4/28	1145	483.5	19	23	0.3	
4/28	1146	482.5	19	23	0.4	
4/28	1147	481.5	19	23	0.5	
4/28	1148	480.5	19	23	0.4	
4/28	1149	479.5	19	23	0.3	
4/28	1150	478	19	23	0.4	
4/28	1151	477.5	19	23	0.4	← jet off, ~~move~~
4/28	1152	493.5	—	23	←	pump down and pump to clean casing
4/28	1220	←		23		~~turn on~~ extraction pump. Drawdown test.
4/28	1402	493.5	30	23	0.3	← Continue jet/pump.
4/28	1403	492.5	30	23	<0.1	
4/28	1404	491.5	30	23	0.4	
4/28	1405	490.5	30	23	0.2	
4/28	1406	489.5	30	23	0.3	
4/28	1407	488.5	30	23	0.2	
4/28	1408	487.5	30	23	0.2	
4/28	1409	486.5	30	23	0.4	
4/28	1410	485.5	30	23	0.4	
4/28	1411	484.5	30	23	0.5	
4/28	1412	483.5	30	23	0.2	
4/28	1413	482.5	30	23	0.6	
4/28	1414	481.5	30	23	1.0	
4/28	1415	480.5	30	23	1.5	
4/28	1416	479.5	30	23	1.2	
4/28	1417	478.5	30	23	1.5	
4/28	1418	477.5	30	23	1.5	Rotate Jet
4/28	1419	478.5	30	23	1.2	
4/28	1420	479.5	30	23	1.0	
4/28	1421	480.5	30	23	0.8	
4/28	1422	481.5	30	23	0.7	
4/28	1423	482.5	30	23	0.5	
4/28	1424	483.5	30	23	0.4	
4/28	1425	484.5	30	23	0.2	
4/28	1426	485.5	30	23	0.2	
4/28	1427	486.5	30	23	0.1	

Jetting bottom to top

~~Constant Rate Test~~ Jetting

~~Water Levels~~

Page 5 of 5

Date 4/28/17

Personnel TK, CH

Well ID KAFB-106IN1

Start Time

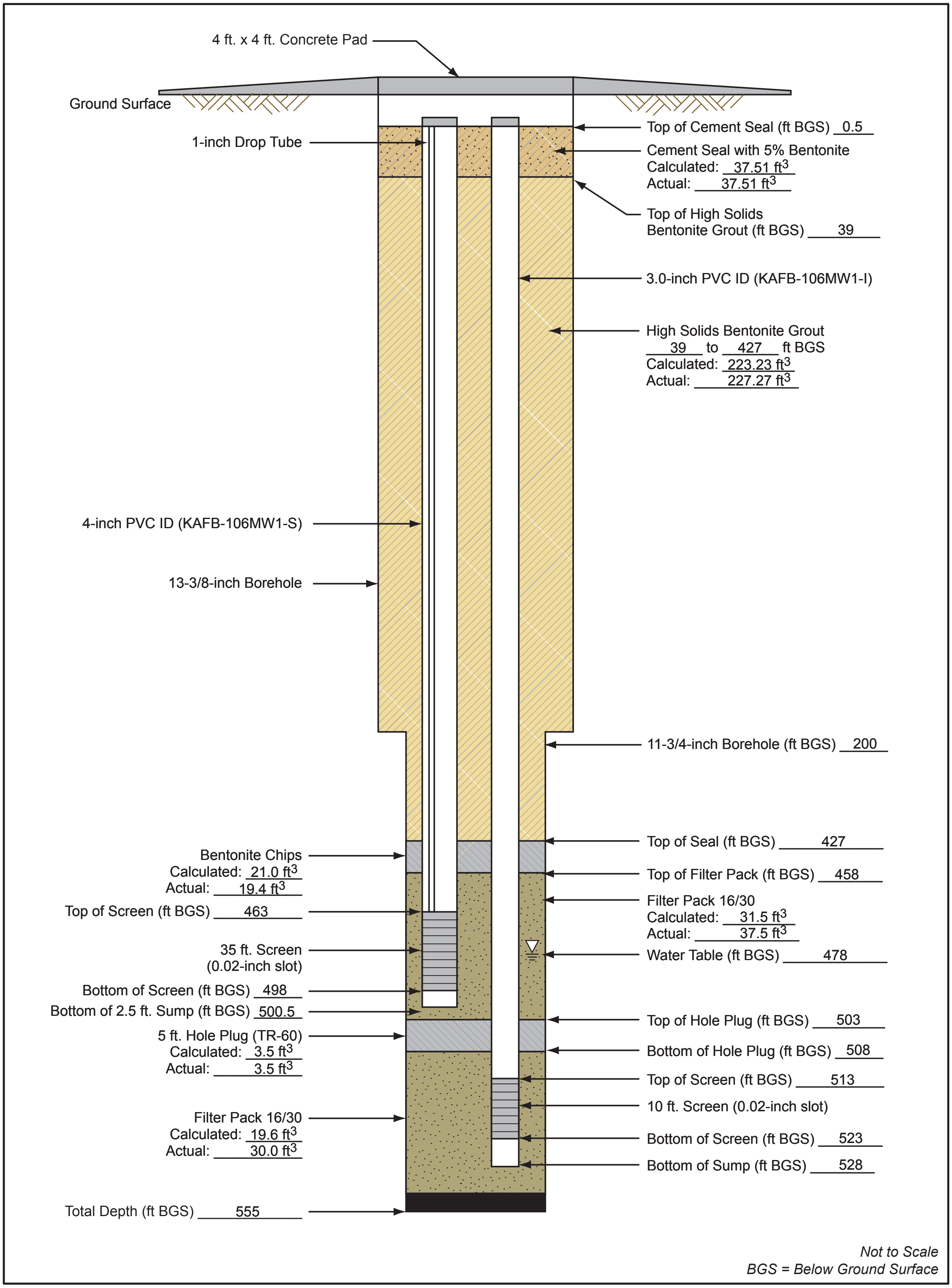
~~Water Level~~ Jetting

Date	Time	~~Water Level (feet below vault)~~ Depth ft bgs	~~Drawdown (feet)~~ Jetting Rate (gpm)	~~Transducer Depth (feet)~~ Pumping Rate (gpm)	~~Transducer battery (%)~~ Imhoff cone (mL/L)	Comments
4/28	1428	487.5	30	23	0.2	
4/28	1429	488.5	30	23	0.3	
4/28	1430	489.5	30	23	0.3	
4/28	1431	490.5	30	23	0.2	
4/28	1432	491.5	30	23	0.4	
4/28	1433	492.5	30	23	0.2	
4/28	1434	493.5	30	23	0.2	
4/28	1435	492.5	30	23	0.~~4~~	Rotate jet.
4/28	1436	491.5	30	23	0.5	
4/28	1437	490.5	30	23	0.7	
4/28	1438	489.5	30	23	1.0	
4/28	1439	488.5	30	23	1.5	
4/28	1440	487.5	30	23	2.0	
4/28	1441	486.5	30	23	2.3	
4/28	1442	485.5	30	23	2.0	
4/28	1441	484.5	30	23	2.0	
4/28	1442	483.5	30	23	1.9	
4/28	1443	482.5	30	23	~2.5	
4/28	1444	481.5	30	23	~2.7	
4/28	1445	480.5	30	23	2.0	
4/28	1446	479.5	30	23	2.5	
4/28	1447	478.5	30	23	~2.4	
4/28	1448	477.5	30	23	1.2	Rotate jet, from baker
4/28	1449	478.5	30	23	1.6	
4/28	1450	479.5	30	23	~1.5	Jet off, pump to
4/28	1451	480.5	30	23	~1.5	clear casing.
4/28	1452	481.5	30	23	1.8	1514 - pump off.
4/28	1453	482.5	30	23	3.5 Constant	1534 start insitu log.
4/28	1454	483.5	30	23	~2.0 Rate	1536 turn pump on. adjust flow
4/28	1455	484.5	30	23	~2.0	1540 pump at 20 gpm (adjusted)
4/28	1456	485.5	30	23	9.5	1740 pump off.
4/28	1457	486.5	30	23	3.0	End constant rate
4/28	1458	487.5	30	23	2.5	test.
4/28	1459	488.5	30	23	2.5	
4/28	1500	489.5	30	23	1.5	
4/28	1501	490.5	30	23	1.5	
4/28	1502	491.5	30	23	1.0	
4/28	1503	493	30	23	0.5	

Static was 17.8' under water.

Monitoring Well Completion Diagram KAFB-106MW1

Installation Start Date/Time: 1/8/17@ 0745
Installation End Date/Time: 1/12/17@1638
Completion Date: 3/24/17



500433_03050100_A10

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

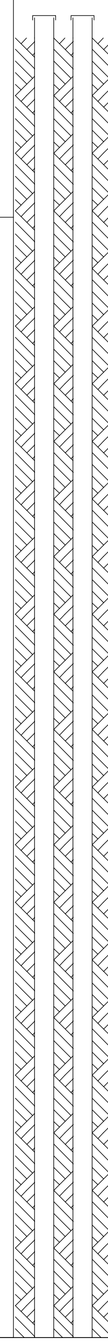
Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					No lithologic description.		Top of Casing/Top of Cement Seal	Location pot-holed with water knife to 5 feet bgs. No cuttings returned.
5					SILT with Gravel (ML); yellowish red (5YR 4/6); dry to slightly moist; 85% silt; 15% fine gravel; subrounded to rounded. Note: gravel is mafic.	ML		Begin drilling with 13 3/8" drive casing on 1/8/17 @ 0745.
10					Same as above (5 ft).			No hammering, no water added.
15					Same as above (5 ft).		Portland Cement with Bentonite	Kelly down @ 0750, new 20'connection @ 0755.
20					Same as above (5 ft).			PID = 0.0 ppm @ cyclone and breathing zone (BZ).
25					Gravelly SILT (ML); light reddish brown (5YR 6/4); dry; 60% silt; 40% fine gravel; angular to rounded; trace very fine sand.			No hammering.
30								



Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					Gravelly SILT (ML); light reddish brown (5YR 6/4); dry; 60% silt; 40% fine gravel; angular to rounded; trace very fine sand.			
35					Same as above (30 ft).			Kelly down @ 0804, new 20' connection @ 0811.
40							Top of High Solids Bentonite Grout	PID = 0.0 ppm @ cyclone and BZ. Hammering intermittently. No water added.
45					Same as above (30 ft); reddish brown (5YR 5/4); 50% silt; 50% fine to coarse gravel; angular to rounded; trace fine and medium sand. Note: gravel is mafics and quartz.	ML		
50					Same as above (30 ft); reddish brown (5YR 5/4); 50% silt; 50% fine to coarse gravel; angular to rounded; trace fine and medium sand. Note: gravel is mafics and quartz.			
55					Same as above (30 ft); reddish brown (5YR 5/4); 50% silt; 50% fine to coarse gravel; angular to rounded; trace fine and medium sand. Note: gravel is mafics			Kelly down @ 0818, new 20' connection @ 0826.
60								

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					and quartz. Gravelly SILT (ML); reddish brown (5YR 5/4); 50% silt; 50% fine to coarse gravel; angular to rounded; trace fine and medium sand. Note: gravel is mafics and quartz.			PID = 0.0 ppm @ cyclone and BZ.
65					Same as above (60 ft).			
70					SILT with Gravel (ML); yellowish red (5YR 5/6); dry; 80% silt; 20% fine gravel; angular to rounded.			Begin hammering. No water added.
75					Same as above (75 ft).	ML	High Solids Bentonite Grout	Kelly down @ 0831, new 20' connection @ 0837. PID = 0.0 ppm @ cyclone and BZ.
80					Same as above (70 ft).			
85					SILT (ML); light reddish brown (5YR 6/4); dry; 90% silt; 10% fine gravel; rounded; trace fine sand.			Hammering. No water added.
90								

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

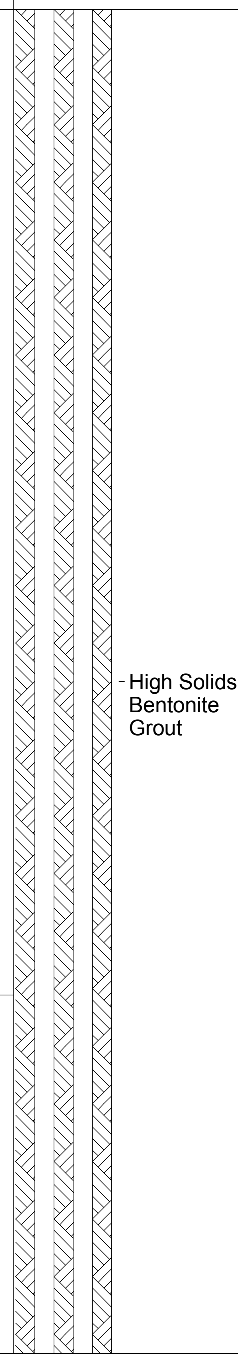
Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Remarks
90					SILT (ML); light reddish brown (5YR 6/4); dry; 90% silt; 10% fine gravel; rounded; trace fine sand.	ML	Hammering. No water added.
95					Same as above (90 ft).		Kelly down @ 0845, new 20' connection @ 0857. PID = 0.0 ppm @ cyclone and BZ.
100					Same as above (90 ft).		Hammering. No water added.
105					Same as above (90 ft).		
110					Same as above (90 ft).		
112					Poorly graded SAND with Silt and Gravel (SP-SM); very pale brown (10YR 7/3); dry; 60% fine to medium sand; 30% fine gravel; angular to rounded; 10% silt. Note: gravel is granitic minerals and mafics.	SP-SM	Hammering. No water added.
115–120							Kelly down @ 1416, new 20' connection @ 1423. PID = 0.0 ppm @ cyclone and BZ.

Well Diagram



Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120–126					Poorly graded SAND with Silt and Gravel (SP-SM); very pale brown (10YR 7/3); dry; 60% fine to medium sand; 30% fine gravel; angular to rounded; 10% silt. Note: gravel is granitic minerals and mafics.	SP-SM		
126–143					Silty SAND (SM); yellowish red (5YR 5/6); 50% fine sand; 10% fine gravel; subrounded to rounded; 40% silt. Note: gravel is granitic minerals and mafics.	SM		Hammering. No water added downhole. Water added at cyclone for dust suppression.
					Same as above (126 ft).			
					Same as above (126 ft).		High Solids Bentonite Grout	Kelly down @ 1515, new 20' connection @ 1523. PID = 0.0 ppm at cyclone and BZ.
143–150					Clayey SAND (SC); yellowish red (5YR 5/6); moist; 60% fine sand; trace fine gravel; 40% clay; trace silt.	SC		Hammering. No water added at cyclone or downhole.

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Clayey SAND (SC); yellowish red (5YR 5/6); moist; 60% fine sand; trace fine gravel; 40% clay; trace silt.	SC		PID = 0.0 ppm @ cyclone and BZ.
155					Same as above (150 ft).			Kelly down @ 1535, new 20' connection @ 1548.
159					Well-graded SAND (SW); reddish yellow (7.5YR 6/6); slightly moist; 90% fine to coarse sand; 10% fine gravel.	SW		PID = 0.0 ppm @ cyclone and BZ.
165					Same as above (159 ft).		High Solids Bentonite Grout	Hammering. No water added.
170					Poorly graded SAND (SP); light brown (7.5YR 6/4); slightly moist; 100% fine to medium sand; trace fine gravel.	SP		
175					Same as above (170 ft).			Kelly down @ 1602, new 20' connection @ 1608. PID = 0.0 ppm @ cyclone and BZ.
180								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/8/17 10:41 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Poorly graded SAND (SP); light brown (7.5YR 6/4); slightly moist; 100% fine to medium sand; trace fine gravel.	SP		Hammering. No water added.
185					Same as above (180 ft).			
190								
					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); moist; 80% fine to coarse sand; 20% fine gravel to 1/2"; angular to rounded. Note: gravel is granitic and mafics.	SW		Hammering. No water added.
195							High Solids Bentonite Grout	Kelly down @ 1627. End drilling with 13 3/8" casing at 200 ft. Begin drilling with 11 3/4" casing @ 1300 on 1/9/17.
200					Well-graded SAND (SW); light brown (7.5YR 6/4); slightly moist; 90% fine to medium sand; trace coarse sand; 10% fine gravel to <1/2"; angular to rounded.			
205					Same as above (200 ft).			No hammering. No water added.
210								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/8/17 10:41 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well-graded SAND with Gravel (SW); reddish yellow (7.5YR 6/6); moist; 75% fine to coarse sand; 25% fine gravel to 1"; subrounded to rounded. @ 212 ft: Same as above (210 ft); 70% fine to coarse sand; 30% fine gravel.			No hammering. No water added.
215								Hammering.
								Kelly down @ 1335, new 20' connection @ 1347.
220					Same as above (210 ft); 70% fine to coarse sand; 30% fine gravel.			End of 1/9/17. Resume drilling @ 1040 on 1/10/17.
225					Same as above (210 ft); brown (7.5YR 5/4); 70% fine to coarse sand; 30% fine gravel to 3/4". Note: gravel is granitic minerals and mafics.	SW	High Solids Bentonite Grout	
230								Hammering. No water added.
235					Same as above (210 ft); brown (7.5YR 5/4); 70% fine to coarse sand; 30% fine gravel to 3/4". Note: gravel is granitic minerals and mafics.			
240								Kelly down @ 1054, new 20' connection @ 1059. PID = 0.1 ppm @ cyclone and BZ.

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/8/17 10:41 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); moist; 70% fine to coarse sand; 30% fine gravel to 3/4"; subrounded to rounded. Note: gravel is granitic minerals and mafics.	SW		
245					Same as above (240 ft).	SW		Hammering. No water added.
250					Same as above (240 ft); % fine sand increases; fine gravel to 1"; trace silt.	SW		
255						SW	High Solids Bentonite Grout	
257					Silty SAND with Gravel (SM); brown (7.5YR 5/3); 60% fine to medium sand; 20% fine gravel to 7/8"; subangular to rounded; 20% silt. Note: gravel is granitic minerals and mafics.	SM		Kelly down @ 1109, new 20' connection @ 1115. PID = 0.1 ppm @ BZ and cyclone.
260						SM		Hammering. Water added at cyclone.
266					Sandy lean CLAY (CL); yellowish brown (10YR 5/4); firm; 65% clay; 30% fine sand; 5% fine gravel to 1/2"; subrounded to rounded. Note: gravel is granitic minerals and mafics.	CL		
270								

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270					Sandy lean CLAY (CL); yellowish brown (10YR 5/4); firm; 65% clay; 30% fine sand; 5% fine gravel to 1/2"; subrounded to rounded. Note: gravel is granitic minerals and mafics.	CL		Hammering. Water added at cyclone.
275					Same as above (270 ft).			Kelly down @ 1130, new 20' connection @ 1136.
280					Same as above (270 ft).			PID = 0.1 ppm @ BZ and 0.0 ppm @ cyclone.
285					Well-graded SAND (SW); light yellowish brown (10YR 6/4); moist; 95% fine to coarse sand; 5% fine gravel to 3/4"; subrounded to rounded. Note: gravel is granitic minerals and mafics.	SW	High Solids Bentonite Grout	Hammering. No water added downhole.
290					Same as above (290 ft).			
295					Poorly graded SAND (SP); very pale brown (10YR 7/4); slightly moist; 100% fine sand; trace fine gravel to 1/8".	SP		Kelly down @ 1149, new 20' connection @ 1153. PID = 0.0 ppm @ cyclone and 0.1 ppm @ BZ.
300								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/8/17 10:41 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Poorly graded SAND (SP); very pale brown (10YR 7/4); slightly moist; 100% fine sand; trace fine gravel to 1/8".	SP		Hammering. No water added downhole.
305					Well-graded SAND (SW); brown (7.5YR 5/4); moist; 100% fine to coarse sand; trace fine gravel to 1/8".	SW		
310					Same as above (305 ft).			
315					Well-graded SAND with Gravel (SW); strong brown (7.5YR 5/6); dry to slightly moist; 75% fine to coarse sand; 20% fine gravel to 3/4"; 5% silt.		High Solids Bentonite Grout	Hammering. No water added downhole.
320								Kelly down @ 1206, new 20' connection @ 1215. PID = 0.1 ppm @ BZ and top of casing, and 0.0 ppm @ cyclone.
325					Well-graded SAND (SW); brown (10YR 5/3); dry to slightly moist; 100% fine to coarse sand; trace silt.			
330					Well-graded GRAVEL with Sand (GW); yellowish brown (10YR 5/4); 60% fine to coarse gravel to 1.25"; 40% fine to coarse sand.	GW		Hammering. No water added downhole; added at cyclone.

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/8/17 10:41 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded GRAVEL with Sand (GW); slightly moist; yellowish brown (10YR 5/4); 60% fine to coarse gravel to 1.35"; 40% fine to coarse sand.	GW		Hammering. No water added downhole.
					Well-graded SAND (SW); brown (10YR 5/4); slightly moist; 95% fine to coarse sand; 5% fine gravel to 1/4"; trace silt.	SW		
335					Same as above (332 ft).			Kelly down @ 1323, new 20' connection @ 1330. PID = 0.0 ppm @ BZ, cyclone, and casing top.
340					Same as above (332 ft).			
345							High Solids Bentonite Grout	
					Well-graded SAND with Gravel (SW); yellowish brown (10YR 5/6); 75% fine to coarse sand; 25% fine gravel to 3/4"; subrounded to rounded. Note: gravel is granitic minerals and mafics.			Rig repair @ 1350, resume drilling @ 1540.
350								Hammering. No water added downhole; added at cyclone.
355					Same as above (348 ft.)			Kelly down @ 1550, new 20' connection @ 1555. PID = 0.0 ppm @ BZ, cyclone, and casing top.
360								

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.30
Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					Well-graded SAND with Gravel (SW); yellowish brown (10YR 5/6); 75% fine to coarse sand; 25% fine gravel to 3/4"; subrounded to rounded. Note: gravel is granitic minerals and mafics.			Hammering. No water added downhole.
365					Same as above (360 ft).			
370					Same as above (360 ft).			
375					Same as above (360 ft).	SW	High Solids Bentonite Grout	Kelly down @ 1623, new 20' connection @ 1630. PID = 0.1 ppm @ BZ and 0.0 ppm @ cyclone and casing top.
380					Same as above (360 ft).			
385					Same as above (360 ft).			Hammering. No water added downhole.
390								

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND with Gravel (SW); yellowish brown (10YR 5/6); 75% fine to coarse sand; 25% fine gravel to 3/4"; subrounded to rounded. Note: gravel is granitic minerals and mafics.	SW		Hammering. No water added downhole.
395					Same as above (390 ft).			Kelly down @ 1700, new 20' connection.
400					Same as above (390 ft)			End of 1/10/17. Resume drilling @ 0738 on 1/11/17.
405							High Solids Bentonite Grout	
406					Poorly graded SAND (SP); pale brown (10YR 6/3); dry to slightly moist; 100% fine sand; trace medium sand; trace silt.	SP		Hammering. No water added downhole
410					Same as above (406 ft).			
415					Same as above (406 ft).			Kelly down @ 0757, new 20' connection @ 0802. PID = 0.1 ppm @ BZ and 0.0 ppm @ cyclone.
420								

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Poorly graded SAND (SP); pale brown (10YR 6/4); dry to slightly moist; 100% fine sand; trace medium sand; trace silt.	SP		
421					Well-graded SAND (SW); yellowish brown (10YR 5/4); dry; 90% fine to coarse sand; 10% fine gravel to 1/2"; trace silt.	SW	High Solids Bentonite Grout	Hammering. No water added downhole.
425–426					Same as above (421 ft).		Top of Bentonite Seal	Stop drilling for rig repair @ 0815. Resume drilling @ 1315.
430–434					Same as above (421 ft); grayish brown (10YR 5/2); 5% fine gravel to 1/4"; 5% silt.			
438								Kelly down @ 1330, new 20' connection @1400. PID = 0.1 ppm @ BZ and 0.0 ppm @ cyclone.
443					Well-graded SAND with Gravel (SW); brownish yellow (10YR 6/6); dry; 80% fine to coarse sand; 20% fine gravel to 3/4"; trace silt. Note: gravel is granitic minerals and mafics.			Hammering. No water added downhole.
448								Stop drilling for rig repair @ 1420. Resume drilling @ 1425.
450								

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well-graded SAND (SW); strong brown (7.5YR 5/6); dry; 100% fine to coarse sand; trace silt.	SW	Bentonite Seal	Hammering. No water added downhole.
455					Same as above (450 ft).			
457					Poorly graded SAND (SP); dark yellowish brown (10YR 4/6); 90% fine sand; trace medium sand; 5% fine gravel to 3/4"; subrounded to rounded; 5% silt.	SP	Top of 16/30 Sand	Water added at cyclone. Kelly down @ 1440. Pull back 100' casing due to sand locking. End of 1/11/17. Resume drilling @ 1036 on 1/12/17.
460								
465			0.0				Top of 4" Schedule 80 PVC 0.020" Screen	PID = 0.0 ppm @ BZ and cyclone.
					Poorly graded SAND with Silt (SP); yellowish brown (10YR 5/4); 80% fine to medium sand; 10% fine gravel to 1/2"; rounded; 10% silt.			Hammering. No water added downhole.
470			0.8					
472					Well-graded SAND with Gravel (SW); yellowish brown (10YR 5/6); moist; 75% fine to coarse sand; 25% fine gravel to 3/4"; rounded; trace silt. Note: gravel is granitic minerals and mafics.	SW		Slight fuel odor @ 473 feet. Hammering. Rate of casing penetration slowing.
475			1.2					
476.3				▼				
478			8.4	▽	Poorly graded SAND (SP); description on next page.	SP		Kelly down @ 1115, new 20' connection @ 1120. PID = 0.0 ppm @ BZ and 3.7 ppm @ cyclone.
480								

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▽ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
480					Poorly graded SAND (SP); strong brown (7.5YR 5/6); wet; 90% fine sand; trace medium sand; 10% fine gravel to 1/2"; trace silt. Note: fuel odor.	SP		Hammering, slow drilling.
			1.5					
485					Same as above (480 ft).			PID = 3.8 ppm @ cyclone and 0.0 ppm @ BZ.
			9.1					
490					Same as above (480 ft).			PID = 23.4 ppm @ cyclone.
			11.1					PID = 90.1 ppm @ cyclone.
			347.7					PID = 392.5 ppm @ cyclone.
495					Same as above (480 ft).			
			111.3				Bottom of Screen	Kelly down @ 1215, new 20' connection @ 1315.
							Sump	
500					Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); wet; 80% fine to coarse sand; 20% fine gravel to 1"; subrounded to rounded. Note: gravel is granitic minerals and mafics.	SW		PID = 9.5 ppm @ BZ and 36.5 ppm @ top of casing.
			62.1				Top of TR-60 Plug	PID = 54.3 ppm @ cyclone and 2.7 ppm @ BZ.
505					Same as above (500 ft).			
			57.2					Hammering, slow drilling. PID = 54.7 ppm @ cyclone and 2.1 ppm @ BZ.
							Top of 16/30 Sand	
510								

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510			31.3		Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4); wet; 80% fine to coarse sand; 20% fine gravel to 1"; subrounded to rounded. Note: gravel is granitic minerals and mafics. @ 512 ft: Same as above (510 ft); yellowish brown (10YR 5/6); 60% fine to coarse sand; 40% fine to coarse gravel to 1.25".	SW	Top of 3" Schedule 80 PVC 0.020" Screen	Hammering. No water added.
515			2.4					Kelly down @ 1423, new 20' connection @ 1429. PID = 1.7 ppm @ top of casing and 0.2 ppm @ BZ.
520			1.7		Same as above (510 ft); yellowish brown (10YR 5/6); 60% fine to coarse sand; 40% fine to coarse gravel to 1.25".		Bottom of Screen	Hammering. PID = 0.8 ppm @ cyclone. No water added.
525			1.6		Same as above (510 ft); yellowish brown (10YR 5/6); 60% fine to coarse sand; 40% fine to coarse gravel to 1.25".		Sump; Bottom of Sump	PID = 0.5 ppm @ cyclone.
530			1.4					PID = 0.1 ppm @ cyclone. Hammering, slow drilling.
535			0.7		Well-graded SAND (SW); dark yellowish brown (10YR 4/6); wet; 90% fine to coarse sand; 10% fine gravel to 3/4"; rounded. Note: gravel is granitic minerals and mafics.		Bottom of 16/30 Filter Pack; Native Backfill	Kelly down @ 1530, new 20' connection @ 1535. PID = 0.2 ppm @ cyclone, 0.3 ppm @ top
540								

Borehole ID: KAFB-106MW1

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/8/2017
Date TD Reached: 1/12/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.30

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					Well-graded SAND (SW); dark yellowish brown (10YR 4/6); wet; 90% fine to coarse sand; 10% fine gravel to 3/4"; rounded. Note: gravel is granitic minerals and mafics.			of casing, and 0.1 ppm @ BZ.
			1.0					PID = 0.4 ppm @ cyclone and 0.1 ppm @ BZ.
545					Same as above (540 ft).			
			0.4				Native Backfill	PID = 0.3 ppm @ cyclone and 0.1 ppm @ BZ.
						SW		
550					Same as above (540 ft).			Hammering, slow drilling.
			0.3					PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
555								
			0.2					PID = 0.1 ppm @ cyclone and BZ.
							Bottom of Rat Hole	Total Depth = 558 feet bgs. Reached total depth @ 1638 on 1/12/17.
560								
565								
570								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/8/17 10:41 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Well Development Record

Project Name: RAPID ESTCP
Location: KAFB
Personnel: Crystal Hardee + Chris Scott
Date: 3/26/17

Well/Piez. No.: KAFB-106MW1-S
Date Installed:
Csg. Diameter (I.D.): 4"
Total Depth (ft. BGL): 500.5

X Bailing
X Pumping
X Original Development
☐ Redevelopment
☐ Other

Development Date: 3/36/17 - 3/28/17 (CAD 26)
Depth to Water Before Developing Well (ft. BGL): 475.7

Vol. (V) Purge Factor Volume to Purge

Height of Water Column: 25 feet = gal. * 1 =

$V=(B * r_c^2 * L_c * 7.48)+(B * (r_w^2 - r_c^2) * L_s * Ø_s * 7.48)+(H_2O$ added during drilling/installation) = 36 gallons

Depth Purging From: 500-463, 3/27
Time Purging Begins: 1605
Weather: Sunny warm 3/26 Raining 3/28
Screened Interval (ft BGL): 463-498
Equipment Nos.: pH Meter: 106407 EC Meter: 106407 Turbidity Meter: 6203

Equipment Decontaminated Prior to Development: Y X N
Describe: Steam Cleaned
Collected Sample of Water Added to Well: Y N X
Describe: N/A
Comment:

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp.°C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
3/36	1605	475.7	0	NR	NR	NR	NR	Begin bailing - strong odor
	1726	NR	45	NR	NR	NR	NR	done bailing for day
3/27	0735	NR	45	NR	→	→	→	begin bailing 3/27
↓	0835	NR	90	NR	→	→	→	continue bailing - still removing sand
↓	0856	NR	95	NR	→	→	→	switching to swab
↓	0920	NR	95	NR	→	→	→	switching to bailer
↓	1024	NR	140	NR	→	→	→	bailing
↓	1230	NR	185	NR	→	→	→	stop for lunch

Notes:
* Water Levels - Reported to the nearest 0.01 foot
* pH - Reading rounded to 0.1 pH units
* Water temperature - Reported to nearest 0.1C
* Turbidity report in NTV nearest whole #
GPM = Gallons Per Minute

Where:
B=3.14
$Ø_s$= porosity of the sand pack
r_c= radius of the well casing and screen in feet
L_c= length of water column inside the casing and screen in feet
r_w= radius of the well bore in feet
L_s= length of saturated portion of the sand pack in feet
7.48 gallons/cubic foot= conversion from cubic feet to gallons

CBI

Well Development Record

Project: KAFB ESTCP

Project Number: 500433

Date: 3/28/17

Time Start:

Well No: KAFB-106MW1-S

Samplers: Crystal Hardee

Checked By: [signature]

Time Finish:

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp.°C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
3/27	1300	NR	185	NR →			→	begin to swab - ↑sand content
	1439	NR	230	NR →			→	
	1713	NR	210	NR →			→	Pump tripped in - Ready for AM
3/28	0740	NR	240	NR →			→	
	0746	NR	240	17.6	8.15	0.608	24.4	Pump intake @ 423' - pump on
	0756	NR	276	19.3	7.48	0.623	7.66	
	0807	NR	312	19.0	7.45	0.617	2.59	
	0817	NR	348	18.8	7.44	0.627	1.92	
	0827	NR	384	18.9	7.46	0.623	1.7	
	0836		414	19.0	7.5	0.625	1.42	Pump off
	0848	NR	419	NR →			→	pump on
	0858	NR	450	19.7	7.33	0.647	3.99	
	0908	NR	486	19.8	7.41	0.648	2.45	
	0920	NR	522	19.4	7.41	0.640	1.26	Development done
							+.cb	

first reading

3.8 gpm

3.3 gpm

* switched back to bailing @ 1340

Was well sampled after development? YES NO X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

Well Development Record

Project Name: RAPID ESTCP

Location: KAFB

Personnel: Crystal Hardee + Chris Scott

Date: 3/25/17 - 3/26/17

Well/Piez. No.: KAFB-106MW1 I

Date Installed: 1/19/17

Csg. Diameter (I.D.): 3"

Total Depth (ft. BGL): 528

X Bailing

X Pumping

X Original Development

☐ Redevelopment

☐ Other

Development Date: 3/25/17 - ~~X~~ 3/26/17

Depth to Water Before Developing Well (ft. BGL): 475.7' below top of casing

Vol. (V) Purge Factor Volume to Purge

Height of Water Column: ~~70.4~~ 52.3' feet = gal. * 1 =

V=(B * r_c^2 * L_c * 7.48)+(B * (r_w^2 - r_c^2) * L_s * $Ø_s$ * 7.48)+(H_2O added during drilling/installation) = 70.4+ gallons

Depth Purging From: 528-515

Time Purging Begins: 1224

Weather: warm, slight breeze

Screened Interval (ft BGL): 513 - 523

Equipment Nos.: pH Meter: 106407 EC Meter: 106407 Turbidity Meter: 0203

Equipment Decontaminated Prior to Development: Y X N

Describe: Steam Cleaned

Collected Sample of Water Added to Well: Y N X

Describe: N/A

Comment:

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp.°C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
3/25	1224	475.7	0	NR	NR	NR	NR	begin bailing - well silty + cloudy
↓	1330	NR	15	NR	→	→	→	switch to surging - switched to 15' ss bailer
	1405	NR	15	NR	→	→	→	start swabbing
	1450	NR	15	NR	→	→	→	start bailing
	1700	NR	40	NR	→	→	→	prepare for pumping tomorrow
3/26	1120		40	NR	→	→	→	start pump Intake @ 515
	1140		60	20.6	7.83	.402	>1000	water is clear
	1155		97.5	21.0	7.89	.400	13.8	

pump @ 2.5 GPM

Notes:
* Water Levels - Reported to the nearest 0.01 foot
* pH - Reading rounded to 0.1 pH units
* Water temperature - Reported to nearest 0.1C
* Turbidity report in NTV nearest whole #
GPM = Gallons Per Minute

Where:
B=3.14
$Ø_s$= porosity of the sand pack
r_c= radius of the well casing and screen in feet
L_c= length of water column inside the casing and screen in feet
r_w= radius of the well bore in feet
L_s= length of saturated portion of the sand pack in feet
7.48 gallons/cubic foot= conversion from cubic feet to gallons

CBI

Well Development Record

Project: KAFB ESTCP

Project Number: 500433

Date: 3/26/17

Time Start:

Well No: KAFB-106MW1-I

Samplers: Crystal Handel

Checked By: [signature]

Time Finish:

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp.°C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
	1210	NR	135	21.0	7.74	0.393	4.26	
	1215	↓	146	NR →				Shut pump off - surge
	1225		146	NR →				~2.76 gpm
	1240		1874	21.8	7.86	0.396	76.1	
	1250		215	21.1	7.77	0.401	17.4	
	1262		225	NR →				surge
	1311		263	21.7	7.77	0.403	45.7	~2.8 / 3.0 gpm
	1315		267	21.6	7.77	0.402	39.8	surge
	1325		284	21.5	7.76	0.404	35.8	
	1340		322	21.4	7.77	0.403	32.9	
	1345		336	21.8	7.78	0.400	17.7	
	1350		350	21.3	7.80	0.398	15.9	
	1355		385	20.8	7.80	0.399	8.84	
	1400		435	20.9	7.81	0.399	5.29	
	1415	↓	~470	21.0	7.80	0.400	4.09	Development complete

Was well sampled after development? YES ____ NO X

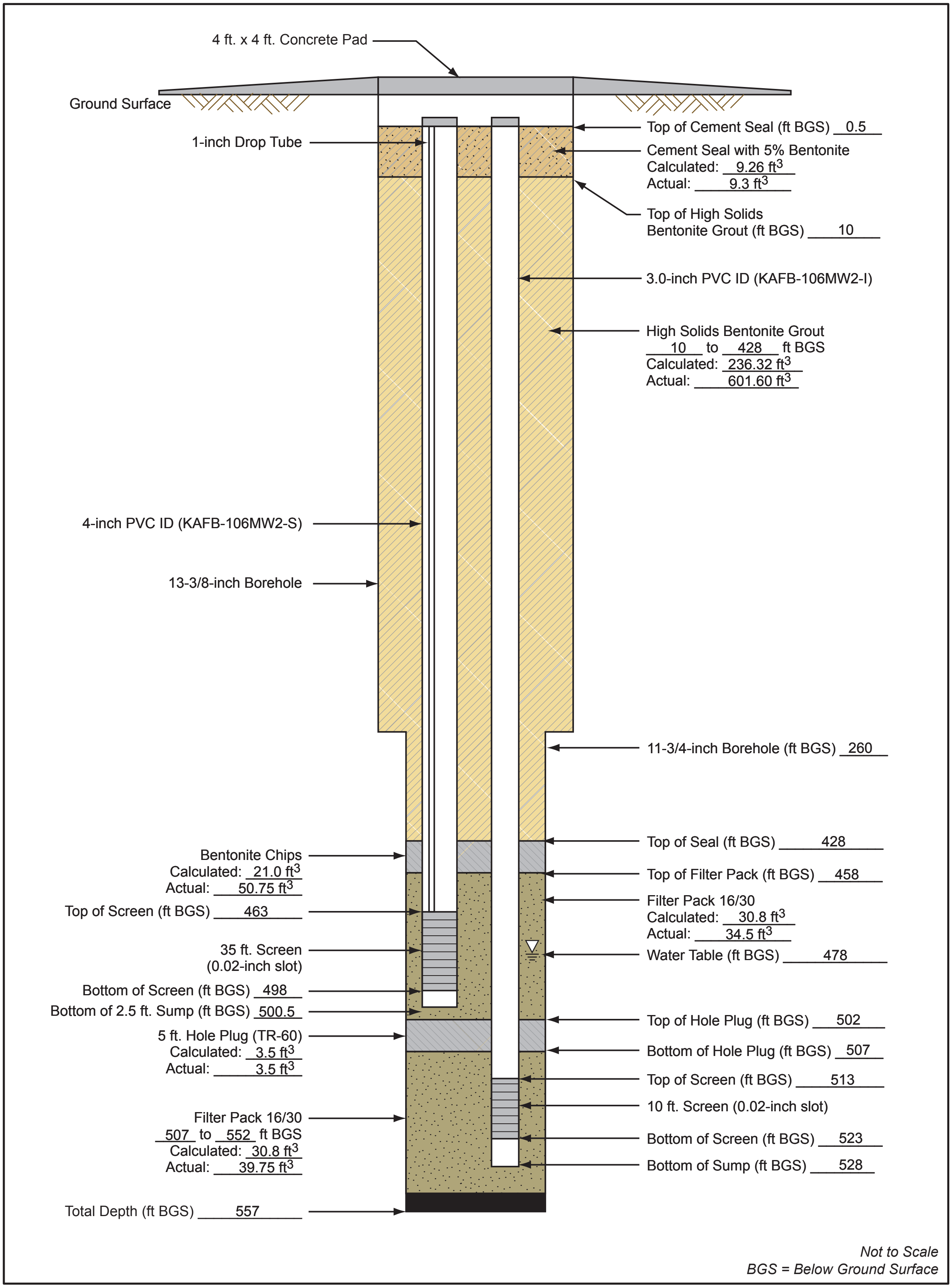
Sample Method: N/A

Sample Name: N/A

Analyses: N/A

Monitoring Well Completion Diagram KAFB-106MW2

Installation Start Date/Time: 1/31/17@1420
Installation End Date/Time: 2/16/17@1140
Completion Date: 3/24/17



Not to Scale
BGS = Below Ground Surface

500433_03050100_A9

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

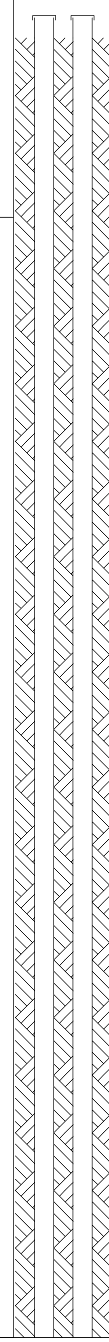
Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▽ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
0					No Lithologic Description.		Top of Casing/Top of Cement Seal	Borehole was pot holed with water knife to 5 feet bgs. No cuttings returned.
5					SILT with Gravel (ML); yellowish red (5YR 4/6); dry; 80% silt; 20% fine gravel to 3/4"; subangular to rounded; trace coarse sand. Note: gravel is mafics and granitic minerals.	ML		Begin drilling with 13-3/8 casing @ 1420 on 1/31/17. Driller is using drill rod assembly with roller stabilizer and 2 drill collars.
10					Same as above (5 ft).			No hammering. No water added downhole.
15					Same as above (5 ft); gravel to 1.25".			
					Gravelly SILT (ML); light reddish brown (5YR 6/4); dry; 60% silt; 30% fine to coarse gravel to 1.5"; angular to subrounded; 10% coarse sand; angular to rounded. Note: rock fragments to 1/4"; angular.		Portland Cement with Bentonite	Kelly down @ 1433, new 20' connected @ 1445.
20								PID = 0.0 ppm @ breathing zone (BZ) and cyclone.
					Sandy SILT (ML); yellowish red (5YR 4/6); dry; 70% silt; trace clay; 30% fine to coarse sand. Note: greater percentage of coarse sand present.			
25								No hammering. No water added downhole.
					Gravelly SILT (ML); light reddish brown (5YR 6/4); dry; 60% silt; trace clay; 40% fine gravel to 3/4"; angular to			Intermittent hammering.
30								



Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
30					subrounded; trace medium to coarse sand.			
					Gravelly SILT (ML); light reddish brown (5YR 6/4); dry; 60% silt; trace clay; 40% fine gravel to 3/4"; angular to subrounded; trace medium to coarse sand.			
35					Same as above (30 ft).	ML		Some hammering.
								Kelly down @ 1508, new 20' connection @ 1625.
40							Top of High Solids Bentonite Grout	
					Sandy lean CLAY (CL); light brown (7.5YR 6/3); 70% clay; 30% fine sand; trace fine gravel to 1/4"; angular. Note: gravel is coated with clay.	CL		PID = 0.0 ppm @ BZ and cyclone.
45								Hammering. No water added downhole.
					Gravelly SILT (ML); reddish brown (5YR 5/4); dry; 60% silt; trace clay; 40% fine gravel to 1/4"; rounded; trace fine sand. Note: gravel is coated with clay.			
50					Same as above (46 ft).	ML		
55					Same as above (46 ft).			
60					Description on next page.			Kelly down @ 1700. End of 1/31/17. Resume drilling @ 1424 on 2/2/17 with a button bit and

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
60					SILT with Sand (ML); reddish yellow (7.5YR 6/6); dry; 75% silt; trace clay; 25% fine to coarse sand; angular to rounded. Note: fragmented gravels.	ML		downhole hammer. Cuttings biased fine with current drill assembly.
65					Same as above (60 ft).			PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ.
70					Same as above (60 ft).			Downhole hammering. No water added downhole.
75					Same as above (60 ft).		High Solids Bentonite Grout	Kelly down @ 1436, new 20' connection @ 1445.
80					Same as above (60 ft).			PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ. Downhole hammering. No water added downhole.
85					Sandy lean CLAY (CL); yellowish red (5YR 5/6); dry to slightly moist; 70% clay; 25% fine to medium sand; 5% gravel fragments.	CL		Hammering downhole and with casing hammer.
90								

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
90					Sandy lean CLAY (CL); yellowish red (5YR 5/6); dry to slightly moist; 70% clay; 25% fine to medium sand; 5% gravel fragments.	CL		Hammering downhole. No water added downhole.
95					Same as above (90 ft).			Kelly down @ 1524, new 20' connection. End of 2/2/17. Resume drilling @ 0735 on 2/3/17.
100					Same as above (90 ft).			PID = 0.2 ppm @ cyclone and 0.0 ppm @ BZ.
105					Same as above (90 ft).		High Solids Bentonite Grout	
110					Sandy SILT with Gravel (ML); pink (5YR 7/4); dry; 40% silt and clay; 40% fine to medium sand; 20% gravel fragments; angular.	ML		
115					Same as above (110 ft).			Kelly down @ 0757, new 20' connection @ 0910. PID = 0.3 ppm @ cyclone and 0.1 ppm @ BZ.
118–120					Lean CLAY with Sand (CL); light reddish brown (5YR 6/4); dry to slightly moist; 80% clay; 20% fine to medium sand.	CL		

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
120					Lean CLAY with Sand (CL); light reddish brown (5YR 6/4); dry to slightly moist; 80% clay; 20% fine to medium sand. Note: gravel fragments.	CL		Hammering downhole and with casing hammer. No water added downhole.
125					Same as above (120 ft).			
130					Same as above (120 ft).			
					Well-graded SAND with Gravel (SW); reddish brown (5YR 5/3); dry; 80% fine to coarse sand; 20% gravel fragments; angular.	SW		Continuous hammering.
135							High Solids Bentonite Grout	
					Same as above (132 ft).			Kelly down @ 0946, new 20' connection @ 1000.
140					Sandy lean CLAY (CL); reddish yellow (5YR 6/8); slightly moist; low plasticity; 60% clay; 40% fine sand. Note: gravel fragments.	CL		Continuous hammering.
145					Same as above (141 ft).			
150								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:32 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▽ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
150					Sandy lean CLAY (CL); reddish yellow (5YR 6/8); slightly moist; low plasticity; 60% clay; 40% fine sand. Note: gravel fragments.	CL		
155					Well-graded SAND (SW); reddish yellow (5YR 6/6); dry; 95% fine to coarse sand; 5% silt. Note: gravel fragments present and higher percentage of fine sand.	SW		Kelly down @ 1023. Trip out drill rod to conduct repairs. End of 2/3/17. Resume drilling @ 0817 on 2/4/17.
160					Same as above (155 ft).			Stop drilling @ 0840 due to rig repairs. Resume drilling @ 0944 on 2/7/17.
165					Same as above (155 ft); light brown (7.5YR 6/4); dry to slightly moist; 100% fine to coarse sand.		High Solids Bentonite Grout	
170					Same as above (155 ft); light brown (7.5YR 6/4); dry to slightly moist; 100% fine to coarse sand.			Hammering downhole and with casing hammer. No water added downhole.
175					Same as above (155 ft); light brown (7.5YR 6/4); dry to slightly moist; 100% fine to coarse sand.			Kelly down @ 0954, new 20' connection.
180								

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
180					Well-graded SAND (SW); light brown (7.5YR 6/4); dry to slightly moist; 100% fine to coarse sand.			PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ. Hydraulic head failure, replace drill rig. Resume drilling @ 0812 on 2/9/17.
185					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); moist; 85% fine to coarse sand; 15% fine gravel to 1/4"; subrounded to rounded. Note: gravel is mafics and quartz.			Continuous hammering. No water added downhole.
190					Same as above (185 ft).			
195					Same as above (185 ft).	SW	High Solids Bentonite Grout	
								Kelly down @ 0830, new 20' conneciton @ 0838.
200								PID = 0.1 ppm @ cyclone and BZ.
					Same as above (185 ft); gravel to 3/4".			Continuous hammering.
205					Same as above (185 ft); gravel to 3/4".			
210								

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
210					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); moist; 85% fine to coarse sand; 15% fine gravel to 3/4"; subrounded to rounded. Note: gravel is mafics and quartz.	SW		Continuous hammering.
215					Same as above (210 ft); 80% fine to coarse sand; 20% gravel to 3/4"; angular to rounded.			Kelly down @ 0856, new 20' connection @ 0912.
220								PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
					Well-graded GRAVEL with Sand (GW); dark brown (7.5YR 3/3); 50% fine to caorse gravel to 1"; angular to rounded; 45% fine to coarse sand; 5% silt. Note: gravel is mafics and quartz.	GW	High Solids Bentonite Grout	
225					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 75% fine to coarse sand; 25% fine to coarse gravel to 1"; subangular to rounded; trace fines. Note: gravel is mafics and granitic minerals.	SW		
230								Hammering. No water added downhole.
235					Same as above (225 ft).			Kelly down @ 0946, new 20' connection @ 0952.
240								

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
240					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 75% fine to coarse sand; 25% fine to coarse gravel to 1"; subangular to rounded; trace fines. Note: gravel is mafics and granitic minerals. @ 241 ft: gravel is more rounded.	SW		PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ. Hammering. Bit in drive shoe.
245								
250					Silty SAND with Gravel (SM); brown (7.5YR 5/3); 60% fine to medium sand; 20% fine gravel to 1/2"; subrounded to rounded; 20% silt.	SM		Hammering.
255					Sandy lean CLAY (CL); yellowish brown (10YR 5/4); low plasticity; 70% clay; 30% fine sand; trace fine gravel to 1/8"; rounded.	CL	High Solids Bentonite Grout	Kelly down @ 1038, new 5' connection @ 1047. Water added at cyclone for dust suppression. Trip out drill bit to survey borehole and trip in 11-3/4" casing. End of 2/9/17. Resume drilling @ 1042 on 2/14/17. PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ. Driller using rod assembly with under reaming bit and downhole hammer.
260					Same as above (255 ft).			
265					Same as above (255 ft).			
270								

BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:32 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
270–276					Sandy lean CLAY (CL); yellowish brown (10YR 5/4); low plasticity; 70% clay; 30% fine sand; trace fine gravel to 1/8"; rounded.	CL		Hammering downhole. No water added downhole.
276–288					Poorly graded SAND (SP); light brown (7.5YR 6/4); 100% fine sand; trace medium and coarse sand; trace fine gravel.	SP		Kelly down @ 1053, new 20' connection @ 1400. Water added @ cyclone.
								PID = 0.1 ppm @ cyclone and BZ.
					Same as above (276 ft).		High Solids Bentonite Grout	Hammering downhole.
288–293					Clayey SAND with Gravel (SC); brown (7.5YR 5/4); 60% fine to medium sand; trace coarse sand; 15% fine gravel to 1/4"; subrounded to rounded; 25% clay. Note: clay is slightly plastic.	SC		Intermittent hammering of casing.
293–300					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 80% fine to coarse sand; 20% gravel fragments.	SW		Kelly down @ 1415, new 20' connection @ 1421.

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
300					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); 80% fine to coarse sand; 20% gravel fragments.	SW		PID = 0.1 ppm @ cyclone and BZ. Hammering downhole and with casing hammer. No water added downhole.
305					Same as above (300 ft).	SW		
310					Same as above (300 ft).	SW		
315					Same as above (300 ft).	SW	High Solids Bentonite Grout	Kelly down @ 1438, new 20' connection @ 1443.
320					Sandy lean CLAY with Gravel (CL); brown (10YR 4/3); 70% clay; 15% fine to medium sand; trace coarse sand; 15% fine gravel to 1/8"; subrounded to rounded.	CL		PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ. Hammering downhole and with casing hammer.
326					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 70% fine to coarse sand; 30% fine gravel to 1/8". Note: gravel fragments to 1/2".	SW		
330								

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
330					Well-graded SAND with Gravel (SW); brown (7.5YR 4/4); 70% fine to coarse sand; 30% fine gravel to 1/8". Note: gravel fragments to 1/2".	SW		Hammering downhole and with casing hammer.
335					Same as above (330 ft).			Kelly down @ 1516, new 20' connection @ 1523.
340					Same as above (330 ft).			PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
345							High Solids Bentonite Grout	
347					SILT (ML); light brown (7.5YR 6/4); 90% silt; 5% fine sand; 5% fine gravel to 1/4".	ML		No downhole hammering; using casing hammer intermittently.
350					Same as above (347 ft).			
355					Same as above (347 ft).			Kelly down @ 1535. End of 2/14/17. Resume drilling @ 0934 on 2/15/17.
360								

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
360					SILT (ML); light brown (7.5YR 6/4); 90% silt; 5% fine sand; 5% fine gravel to 1/4".	ML		Hammering downhole and with casing hammer. No water added downhole.
365					Well-graded SAND (SW); light brown (7.5YR 6/4); 90% fine to coarse sand; 10% fine gravel to 1/4"; trace silt. Note: gravel is mafics and quartz. Gravel fragments present.	SW		
370					Same as above (363 ft).			Coarse gravel @ 370 to 373 feet bgs.
375					Well-graded GRAVEL with Silt and Sand (GW-GM); pinkish gray (7.5YR 6/2); dry; 60% fine gravel to 1/4"; 30% fine to coarse sand; 10% silt. Note: gravel is mafics and quartz. Gravel fragments present.	GW-GM	High Solids Bentonite Grout	Kelly down @ 1020, new 20' connection @ 1127.
380					Same as above (375 ft).			PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
385					Well-graded SAND (SW); brown (7.5YR 5/4); 100% fine to coarse sand.	SW		Hammering downhole and with casing hammer.
390								

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
390					Well-graded SAND (SW); brown (7.5YR 5/4); 100% fine to coarse sand.			Water added @ cyclone for dust suppression.
395					Well-graded SAND with Gravel (SW); brown (7.5YR 5/4); 70% fine to coarse sand; 30% fine gravel to 1/2"; subrounded to rounded; trace silt. Note: gravel fragments present.			Kelly down @ 1213, new 20' connection @ 1300.
400					Same as above (394 ft).			PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
405					Same as above (394 ft).	SW	High Solids Bentonite Grout	
410					Well-graded SAND (SW); light brown (7.5YR 6/3); dry; 90% fine to coarse sand; 5% fine gravel to 1/8"; 5% silt. Note: gravel fragments present.			Hammering downhole and with casing hammer. No water added downhole.
415					Same as above (408 ft).			Kelly down @ 1326, new 20' connection @ 1336.
420								

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

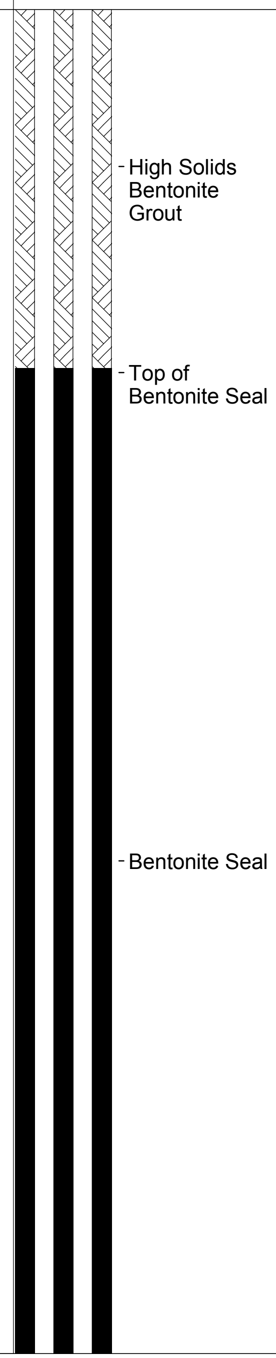
Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
420					Well-graded SAND (SW); light brown (7.5YR 6/3); dry; 90% fine to coarse sand; 5% fine gravel to 1/8"; 5% silt. Note: gravel fragments present.	SW		PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
425					Same as above (420 ft).			Hammering downhole and with casing hammer. No water added downhole.
430					Same as above (420 ft).			
435					Same as above (420 ft).			Kelly down @ 1406, new 20' connection @ 1601.
440					Same as above (420 ft).			PID = 0.2 ppm @ cyclone and 0.1 ppm @ BZ.
445					Same as above (420 ft).			Hammering downhole and with casing hammer.
450								



Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

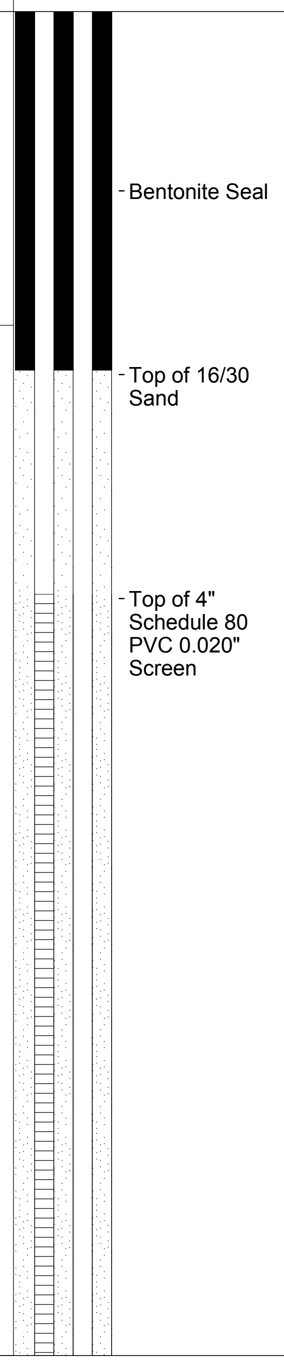
Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
450					Well-graded SAND with Gravel (SW); light brown (7.5YR 6/4); dry; 80% fine to coarse sand; 20% fine gravel to 1/4"; trace silt. Note: gravel fragments present.	SW	Bentonite Seal	
455								
457					Poorly graded SAND (SP); yellowish brown (10YR 5/4); dry; 80% fine to medium sand; 10% fine gravel to 1/4"; 10% silt.	SP	Top of 16/30 Sand	Kelly down @ 1650, new 20' connection @ 1700.
460								PID = 0.1 ppm @ cyclone and 0.0 ppm @ BZ.
							Top of 4" Schedule 80 PVC 0.020" Screen	
465			0.7		Same as above (457 ft).			
								Hammering.
470			0.4		Same as above (457 ft); moist.			
475			2.0		Same as above (457 ft); wet.			Top of saturated cuttings @ 474 feet bgs. Water level is artifically high from drilling.
476				▼				
478				▽	Same as above (457 ft); wet. Note: strong fuel odor.			Kelly down @ 1733. End of 2/15/17. Resume drilling @ 0740 on 2/16/17.
480								



BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:32 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

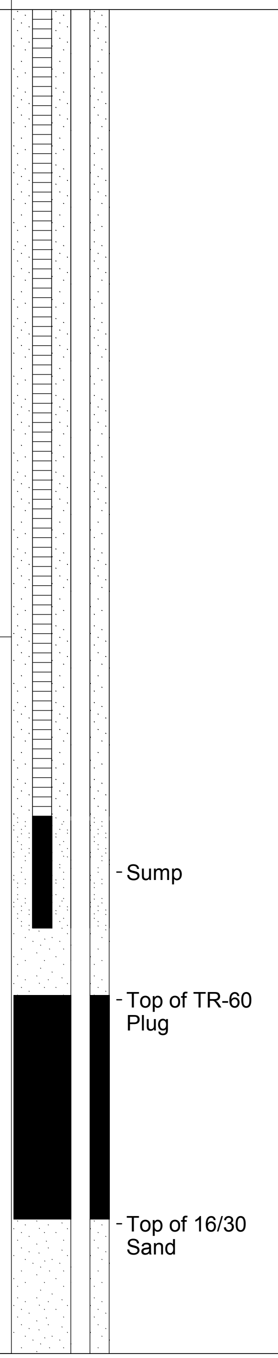
Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▼ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Remarks
480					Poorly graded SAND (SP); yellowish brown (10YR 5/4); wet; 80% fine to medium sand; 10% fine gravel to 1/4"; 10% silt.	SP	Static water level @ 478 feet bgs.
485			102.0		Same as above (480 ft).		Hammering downhole and with casing hammer.
							PID = 1135 ppm @ cyclone and 2.2 ppm @ BZ.
490			377.0		Same as above (480 ft).		Add approximately 25 gallons of clean water downhole to lift cuttings to surface.
							PID = 924 ppm @ cyclone and 1.8 ppm @ BZ.
494					Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4/); wet; 75% fine to coarse sand; 25% fine gravel to 1/2"; subangular to rounded. Note: gravel is mafics and quartz. Gravel fragments present.	SW	
495			185.0				Kelly down @ 0843, new 20' connection @ 0856.
500			81.2		Same as above (494 ft).		PID = 276 ppm @ cyclone and 4.6 ppm @ BZ.
							Hammering.
505			21.7		Same as above (494 ft).		PID = 63 ppm @ cyclone and 2.1 ppm @ BZ.
510							

Well Diagram



Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
At Time of Drilling: 478.00
At End of Drilling: Not Recorded
After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
510					Well-graded SAND with Gravel (SW); dark yellowish brown (10YR 4/4/); wet; 75% fine to coarse sand; 25% fine gravel to 1/2"; subangular to rounded. Note: gravel is mafics and quartz. Gravel fragments present.		Top of 3" Schedule 80 PVC 0.020" Screen	Poor cuttings return from 510 to 525 feet bgs. Add approximately 100 gallons of clean water downhole to lift cuttings to surface.
515			9.9		Same as above (510 ft).			PID = 21.2 ppm @ cyclone and 1.1 ppm @ BZ. Kelly down @ 0931, new 20' connection @ 0946.
520					Same as above (510 ft).			PID = 8.9 ppm @ cyclone and 1.0 ppm @ BZ.
525					Same as above (510 ft); dark yellowish brown (10YR 4/6); 80% fine to coarse sand; 20% fine gravel to 1/4"; rounded; trace silt.	SW	Sump; Bottom of Sump	
530			2.7		Same as above (510 ft); dark yellowish brown (10YR 4/6); 80% fine to coarse sand; 20% fine gravel to 1/4"; rounded; trace silt.			PID = 7.1 ppm @ cyclone and 0.8 ppm @ BZ.
535			1.5		No Lithologic Description; limited cuttings returned. Cuttings appear to be Well-graded SAND (SW) with trace gravel to 1/4".	SW		Kelly down @ 1041, new 20' connection @ 1050.
540								

Borehole ID: KAFB-106MW2

Client: US Army Corps of Engineers
Project Location: KAFB, Albuquerque, NM
Project Name: KAFB RAPID SWMU ST-106/SS-111
Project Number: 500433

Date Started: 1/31/2017
Date TD Reached: 2/16/2017
Date Completed: 3/24/2017

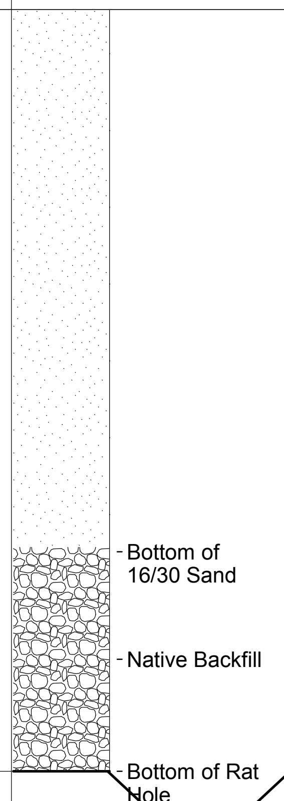
Ground Elevation AMSL (ft): Not Recorded
Y Coordinate:
X Coordinate:

Hole Diameter Upper (in.): 13-3/8
Hole Diameter Lower (in.): 11-3/4
Surface Completion Type: Flush

Groundwater Levels BGS (ft):
▽ At Time of Drilling: 478.00
▼ At End of Drilling: Not Recorded
▽ After Drilling: 476.00

Drillling Contractor: Cascade Drilling
Drilling Method: Air Rotary Casing Hammer
Logged By: T. Richards

Depth (ft)	Sample Type	Number	Headspace PID	Lithologic Log	Material Description	U.S.C.S.	Well Diagram	Remarks
540					No Lithologic Description; limited cuttings returned. Cuttings appear to be Well-graded SAND (SW) with trace gravel to 1/4".	SW		PID = 1.1 ppm @ cyclone and 0.5 ppm @ BZ. Hammering; very slow drilling.
545					Same as above (540 ft); No lithologic description.			PID = 10.1 ppm @ cyclone and 0.2 ppm @ BZ.
550					Same as above (540 ft); No lithologic description.			PID = 0.2 ppm @ cyclone and BZ.
555								PID = 0.2 ppm @ cyclone and BZ. Total depth = 557 feet bgs. Reached total depth @ 1140 on 2/16/17.
560								
565								
570								



BOREHOLE_LOG - CB&I_DRILLING.GDT - 5/9/17 16:32 - Z:\KAFB RAPID\GINT\KAFB_RAPID_11-1-2016.GPJ

Well Development Record

Project Name: RAPID ESTCP
Location: KAFB
Personnel: Crystal Hardee & Chris Scott
Date: 3/29/17

Well/Piez. No.: KAFB-106MW2-S
Date Installed:
Csg. Diameter (I.D.): 4"
Total Depth (ft. BGL): 500.5

X Original Development | X Bailing ☐ Redevelopment | X Pumping ☐ Other

Development Date: 3/29/17 – 3/30/17
Depth to Water Before Developing Well (ft. BGL): 476

Vol. (V) Purge Factor Volume to Purge

Height of Water Column: 24.3 feet = gal. * 1 =

$V=(B * r_c^2 * L_c * 7.48)+(B * (r_w^2 - r_c^2) * L_s * Ø_s * 7.48)+(H_2O$ added during drilling/installation) = 35 gallons

Depth Purging From: 500.5 – 480
Time Purging Begins: 1405
Weather:
Screened Interval (ft BGL): 463-498
Equipment Nos.: pH Meter: 106407 EC Meter: 106407 Turbidity Meter: 6203

Equipment Decontaminated Prior to Development: Y X N
Describe: Steam Cleaned
Collected Sample of Water Added to Well: Y N X
Describe: N/A
Comment:

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp.°C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
3/29	1405	476	0	NR →				swab
	1420	NR	0	NR →				bail
	1509	~~300~~	30	NR →				trip in pump
	1630	NR	30	NR →				pipe tripped in
3/30	0730	NR	30	NR →				Pump on ~3.9 GPM
	0740	NR	65	20.0	7.52	0.702	1100	
	0748	NR	100	20.5	7.48	.712	652	
	0753	NR	110	NR →				Pump off - surge

Notes:
* Water Levels - Reported to the nearest 0.01 foot
* pH - Reading rounded to 0.1 pH units
* Water temperature - Reported to nearest 0.1C
* Turbidity report in NTV nearest whole #
GPM = Gallons Per Minute

Where:
B=3.14
$Ø_s$= porosity of the sand pack
r_c= radius of the well casing and screen in feet
L_c= length of water column inside the casing and screen in feet
r_w= radius of the well bore in feet
L_s= length of saturated portion of the sand pack in feet
7.48 gallons/cubic foot= conversion from cubic feet to gallons

Well Development Record

Project: KAFB ESTCP

Project Number: 500433

Date:

Time Start:

Well No: KAFB 106MW2S

Samplers: Crystal Handel

Checked By:

Time Finish:

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp.°C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
	0800	NR	110	NR →		→	NR	Pump on
	0808	NR	145	20.9	7.58	.708	131	
	0816	NR	180	20.8	7.54	.710	15.8	
	0824	NR	215	20.4	7.55	.705	9.61	Pump off - surge
	0833	NR	215	NR →			→	pump on
	0841	NR	250	20.7	7.6	.706	20.6	
	0849	NR	285	20.4	7.54	0.701	6.48	
	0854	NR	309	NR →			→	Pump off - surge
	0859	NR	309	NR	→		→	pump on last cycle
	0909	NR	344	20.8	7.61	0.704	20.8	
	0916	NR	379	20.8	7.54	0.699	10.1	
	0924	NR	414	20.7	7.51	0.697	6.91	
	0932	NR	449	20.3	7.50	0.698	4.74	Development complete

Was well sampled after development? YES ___ NO X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

Well Development Record

Project Name: RAPID ESTCP
Location: KAFB
Personnel: Crystal Hardee + Chris Scott
Date: 3/28/17

Well/Piez. No.: KAFB-106MW2-I
Date Installed: 2/20/17
Csg. Diameter (I.D.): 3"
Total Depth (ft. BGL): 528

X Original Development | X Bailing | ☐ Redevelopment | X Pumping | ☐ Other

Development Date: 3/28/17 - 3/29/17
Depth to Water Before Developing Well (ft. BGL): 475.8

Height of Water Column: 52.2 feet = 97.6 gal. (Vol. (V)) · 1 (Purge Factor) = 97.6 (Volume to Purge)

$V=(B * r_c^2 * L_c * 7.48)+(B * (r_w^2 - r_c^2) * L_s * Ø_s * 7.48)+(H_2O$ added during drilling/installation) = 97.6 gallons

Depth Purging From: 528-515
Time Purging Begins: 1340
Weather: warm/cloudy - cool in AM
Screened Interval (ft BGL): 513-523
Equipment Nos.: pH Meter: 106407 EC Meter: 106407 Turbidity Meter: 0203

Equipment Decontaminated Prior to Development: Y X N
Describe: Steam Cleaned
Collected Sample of Water Added to Well: Y N X
Describe: N/A
Comment:

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp.°C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
3/28	1340	475.8	0	NR →				Swab / Bailing
↓	1523	NR	~~4~~ 8	NR →				bailing
↓	1625	NR	15	NR →				trip in pump
3/29	0753		15	NR →				Pumping / Pump on
↓	0758	NR	15	~~X~~ 17.2	7.46		>1000	
↓	0817	NR	95	20.3	7.70	.309	33.9	Pump off - surging
↓	0839	NR	95	NR →				Pump on
↓	0910	NR	192	20.7	7.77	.363	35.1	

Pumping @ ~6 to 7 gpm

3.8 gpm

0912 - pump off - surging

Notes:
* Water Levels - Reported to the nearest 0.01 foot
* pH - Reading rounded to 0.1 pH units
* Water temperature - Reported to nearest 0.1C
* Turbidity report in NTV nearest whole #
GPM = Gallons Per Minute

Where:
B=3.14
$Ø_s$= porosity of the sand pack
r_c= radius of the well casing and screen in feet
L_c= length of water column inside the casing and screen in feet
r_w= radius of the well bore in feet
L_s= length of saturated portion of the sand pack in feet
7.48 gallons/cubic foot= conversion from cubic feet to gallons

CB&I

Well Development Record

Project: KAFB ESTCP

Project Number: 500433

Date: 3/29/17

Time Start:

Well No: KAFB 106MW2 I

Samplers: Crystal Hardee

Checked By: C. LaChance

Time Finish: 1231

Field Chemistry (cont'd)

Date	Time	Water Level (ft. Below TOC)	Volume Removed (gal.)	Temp.°C	pH	EC (ms/cm)	Turbidity N.T.U.	Comments
3/29/17	0918	NR	192	NR →				Pump on 3.8gpm
	0943	NR	289	20.7	7.71	0.362	22.4	Intake @ 515
	1008	NR	386	20.6	7.77	0.368	12.9	
	1033	NR	486	20.7	7.81	0.372	11.1	
	1058	NR	583	20.4	7.80	0.371	5.43	
	1123	NR	680	20.8	7.84	0.369	6.42	shutting pump off-surge
	1133	NR	680	NR →				Surge- pump off
	1138	NR	680	NR →				Pump on
	1206	NR	777	20.8	7.85	0.368	6.83	
	1231	NR	875	20.8	7.88	0.366	4.99	Development complete

Was well sampled after development? YES ____ NO X

Sample Method: N/A

Sample Name: N/A

Analyses: N/A

APPENDIX E
BOREHOLE ABANDONMENT AND DEVIATION TEST DOCUMENTATION

APPENDIX F
FINAL PILOT TEST SYSTEM DESIGN DRAWINGS AND SPECIFICATION SHEETS

F-1. Final Design Drawings

F-2. Specification Sheets

Kirtland Air Force Base
Pilot System Control Panel
Albuquerque, New Mexico

DRAWING INDEX

Z:\CUSTOMERS\C_CUSTOMERS\CB&I\11765_KIRTLAND AFB PILOT SYSTEM\DRAWINGS\CALCON DWG FILES\11765_1000.DWG

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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WWW.CALCON.COM

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DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1000.DWG

CLIENT: KIRTLAND AFB

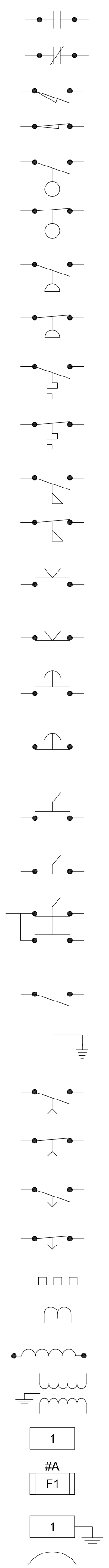
JOB: 11765

LOCATION: ALBUQUERQUE, NEW MEXICO

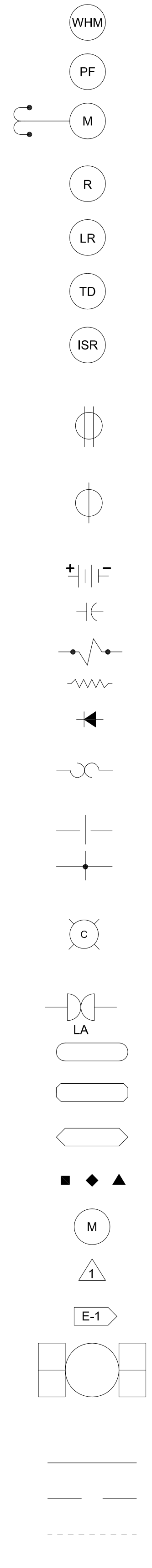
TITLE: KIRTLAND AIR FORCE BASE PILOT SYSTEM CONTROL PANEL

SHEET INDEX

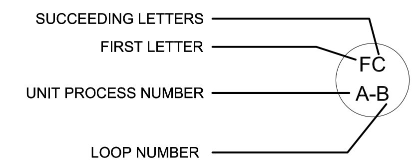
DRAWING NO. 1000 | REV 1 | SHEET 1 OF 15

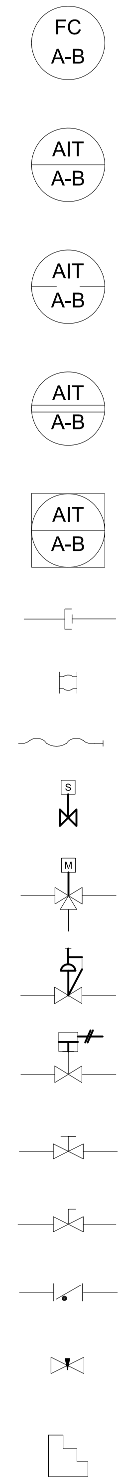


- NORMALLY OPEN CONTACT
- NORMALLY CLOSED CONTACT
- NORMALLY OPEN LIMIT SWITCH
- NORMALLY CLOSED LIMIT SWITCH
- NORMALLY OPEN FLOAT SWITCH
- NORMALLY CLOSED FLOAT SWITCH
- NORMALLY OPEN PRESSURE SWITCH
- NORMALLY CLOSED PRESSURE SWITCH
- NORMALLY OPEN TEMPERATURE SWITCH
- NORMALLY CLOSED TEMPERATURE SWITCH
- NORMALLY CLOSED FLOW SWITCH (AIR OR FLUID)
- NORMALLY OPEN FLOW SWITCH (AIR OR FLUID)
- NORMALLY OPEN PUSHBUTTON (MOMENTARY CONTACT)
- NORMALLY CLOSED PUSHBUTTON (MOMENTARY CONTACT)
- NORMALLY OPEN MUSHROOM PUSHBUTTON
- NORMALLY CLOSED MUSHROOM PUSHBUTTON, MOMENTARY OPEN.
- SWITCH 2 POSITION NORMALLY OPEN
- SWITCH 2 POSITION NORMALLY CLOSED
- SWITCH 3 POSITION HAND-OFF-AUTO
- SINGLE POLE TOGGLE SWITCH ("ON-OFF",ETC.)
- GROUND CONNECTION.
- NORMALLY OPEN SWITCH WITH TIME DELAY CLOSING.
- NORMALLY CLOSED SWITCH WITH TIME DELAY OPENING.
- NORMALLY OPEN SWITCH WITH TIME DELAY OPENING
- NORMALLY CLOSED WITH TIME DELAY CLOSING
- HEATER
- CURRENT TRANSFORMER
- COIL/INDUCTOR
- TRANSFORMER
- TERMINAL BLOCK
- FUSED TERMINAL BLOCK
- GROUNDED TERMINAL BLOCK
- CIRCUIT BREAKER



- WATT HOUR METER AND SOCKET
- POWER FAILURE RELAY
- METER & CURRENT TRANSFORMER
- RELAY
- LATCHING RELAY
- TIME DELAY RELAY
- INTRINSICALLY SAFE RELAY
- DUPLEX RECEPTACLE
- SIMPLEX RECEPTACLE
- BATTERY
- ELECTROLYTIC CAPACITOR
- SOLENOID
- RESISTOR
- DIODE
- MOTOR OVERLOAD
- CROSSING OF CONDUCTORS NOT CONNECTED.
- CONNECTION OF CONDUCTORS CONNECTED
- INDICATOR LIGHT COLOR AS INDICATED
- LIGHTNING ARRESTOR
- EQUIPMENT TAG REFERENCE
- I/O POINT REFERENCE PLC, I/O RACK, OR ANNUNCIATOR PANEL
- DRAWING REFERENCE
- LOCATION SYMBOL
- MOTOR STARTER CONTACTOR COIL
- SHEET NOTE TAG
- EDGE CONNECTOR
- INSTRUMENT (SEE IDENTIFICATION TABLE)
- PANEL WIRE
- BOUNDARY LINE
- FIELD WIRING
- INTERNALLY CONNECTED





- FIELD MOUNTED INSTRUMENT
- FACE MOUNTED INSTRUMENT MAIN PANEL, OPERATOR ACCESSIBLE
- PANEL MOUNTED INSTRUMENT OPERATOR INACCESSIBLE
- FACE MOUNTED INSTRUMENT FIELD PANEL, OPERATOR ACCESSIBLE
- MULTIFUNCTION INSTRUMENT
- QUICK DISCONNECT COUPLER
- EXPANSION JOINT OR RUBBER BOOT
- FLEX HOSE
- SOLENOID VALVE
- 3-WAY VALVE (MOTOR ACTUATED)
- PRESSURE REGULATOR, SELF-CONTAINED, WITH HANDWHEEL ADJUSTABLE SET POINT
- AIR ACTUATED VALVE
- MANUAL VALVE
- SAMPLE PORT
- CHECK VALVE
- NEEDLE VALVE
- METERING PUMP

	First Letter		Succeeding letters		
	Measured or Initiating Variable	Modifier	Readout or Passive Function	Output Function	Modifier
A	Analysis		Alarm		
B	Burner, Combustion				
C				Control	
D		Differential			
E	Voltage		Sensor		
F	Flow Rate	Ratio			
G			Glass		
H	Hand				High
I	Current (Electrical)		Indicate		
J	Power	Scan			
K	Time, Schedule	Time, Rate of Change		Control Station	
L	Level		Light		Low
M		Momentary			Middle, Intermediate
N					
O			Orifice, Restriction		
P	Pressure	Integrate	Point Connection		
Q	Quantity				
R	Radiation		Record		
S	Speed, Frequency	Safety		Switch	
T	Temperature			Transmit	
U	MultiVariable		Multifunction	Multifunction	Multifunction
V	Vibration			Valve, Damper, Louver	
W	Weight, Force		Well		
X		X Axis			
Y	Even, State, Presence	Y Axis		Relay, Compute, Convert	
Z	Position, Dimension	Z Axis		Driver, Actuator	

Abbreviations

A	AMPERES	DPST	DOUBLE POLE SINGLE THROW	M	MOTOR	SPDT	SINGLE POLE DOUBLE THROW
AC	ALTERNATING CURRENT	DWG	DRAWING	MOV	MOTOR OPERATED VALVE	SPST	SINGLE POLE SINGLE THROW
ATS	AUTOMATIC TRANSFER SWITCH	E	EXISTING	N	NEUTRAL	STL	STEEL
AUX	AUXILIARY	FDR	FEEDER	NC	NORMALLY CLOSED	STP	SHIELDED TIWSTED PAIR
AUTO	AUTOMATIC	FIN	FINISHED	NEC	NATIOAL ELECTRIC CODE	SOV	SOLENOID VALVE
AWG	AMERICAN WIRE GAUGE	FLA	FULL LOAD AMPS	NO	NORMALLY OPEN	SW	SWITCH
BC	BARE COPPER	FLEX	FLEXIBLE	NTS	NOT TO SCALE	TB	TERMINAL BLOCK
BKR	BREAKER	GFI	GROUND FAULT INTERRUPT	NV	NEEDLE VALVE	TD	TIME DELAY
C	CONDUIT	GND	GROUND	OT	OVERTEMP	TEMP	TEMPERATURE
CB	CIRCUIT BREAKER	HOA	HAND-OFF-AUTO	PR	PRESSURE REGULATOR	TERM	TERMINAL
COND	CONDUCTOR	IN	INCHES	PLC	PROGRAMMABLE CONTROLLER	T	TEMPERATURE SWITCH
CONTD	CONTINUED	JB	JUNCTION BOX	PNL	PANEL	TYP	TYPICAL
CP	CONTROL PANEL	KVA	KILOVOLT-AMPERES	POS	POSITION	UG	UNDERGROUND
CT	CURRENT TRANSFORMER	KW	KILOWATT	RCP	RECEPTACLE	V	VOLTS
CR	CONTROL RELAY	LM	LIMIT	RTU	REMOTE TERMINAL UNIT	VFD	VARIABLE FREQUENCY DRIVE
CV	CHECK VALVE	MA	MILLIAMPERES	SEL	SELECTOR	W	WATTS
DC	DIRECT CURRENT	MCC	MOTOR CONTROL CENTER	SPEC	SPECIFICATION	W/	WITH
DPDT	DOUBLE POLE SINGLE THROW	MIN	MINUTES OR MINIMUM	SS	STAINLESS STEEL	W/O	WITHOUT

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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DESIGN	JD	07/14/16
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APPROVED	JD	07/14/16

FILE: 11765_1000-A.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE PILOT SYSTEM CONTROL PANEL
ELECTRICAL SYMBOLS AND ABBREVIATIONS

DRAWING NO. 1000-A | REV 1 | SHEET 2 OF 15

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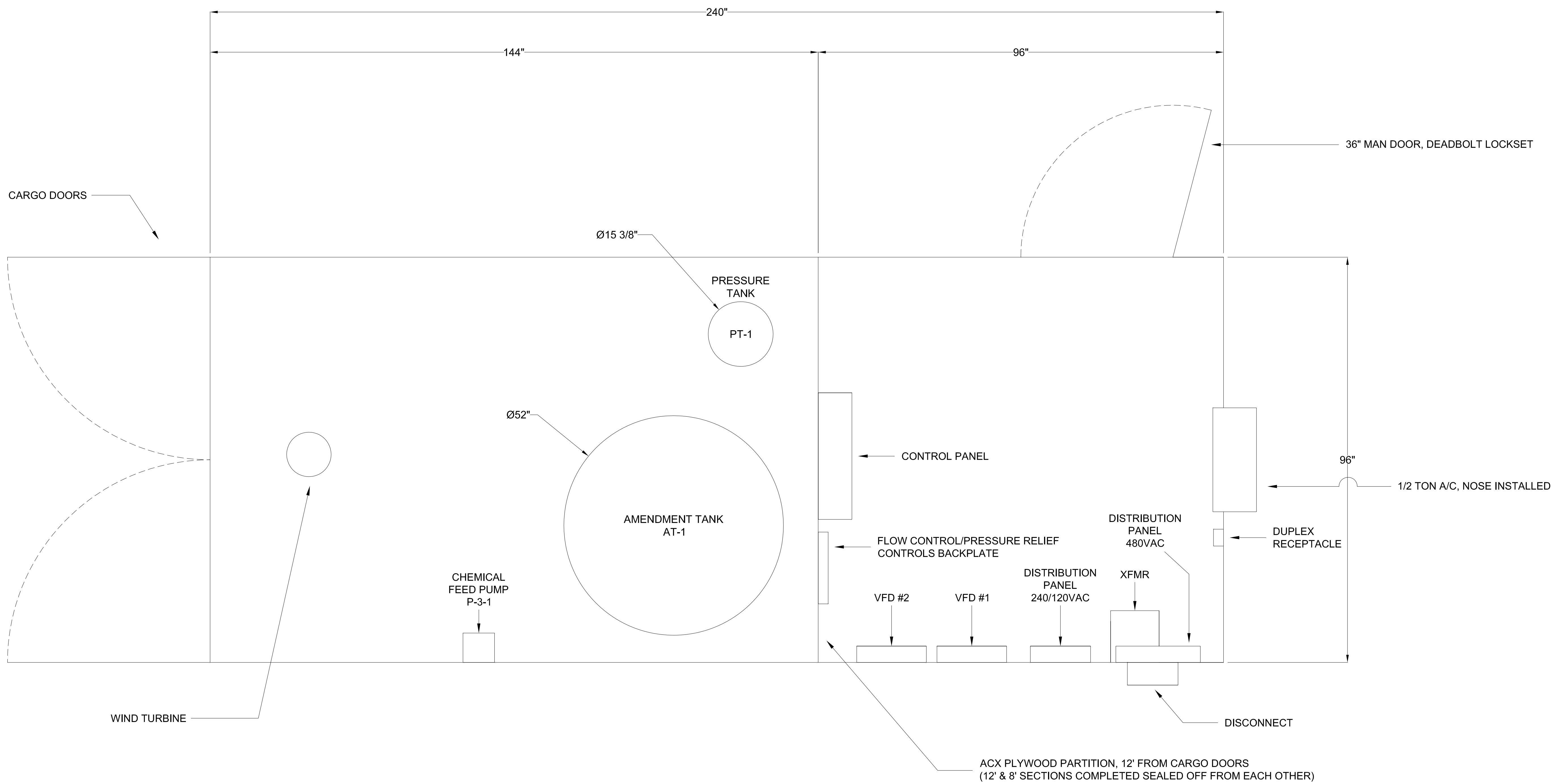
NOTE:

1. ENTIRE CONTAINER INSULATED: R13 UNDER ACX PLYWOOD.



CUSTOM-MODIFIED CONTAINER - AERIAL VIEW

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1	INITIAL RELEASE	07/14/16	JU

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APPROVED	JD	07/14/16

FILE: 11765_1001.DWG

CLIENT: KIRTLAND AFB

JOB: 11765

LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE PILOT SYSTEM CONTROL PANEL

CONTAINER LAYOUT

DRAWING NO. 1001 | REV 1 | SHEET 3 OF 15

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PLACE HOLDER

1	INITIAL RELEASE	07/14/16	JU
REV	DESCRIPTION	DATE	NAME

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DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1002.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
SINGLE LINE DIAGRAM

DRAWING NO. 1002 | REV 1 | SHEET 4 OF 15

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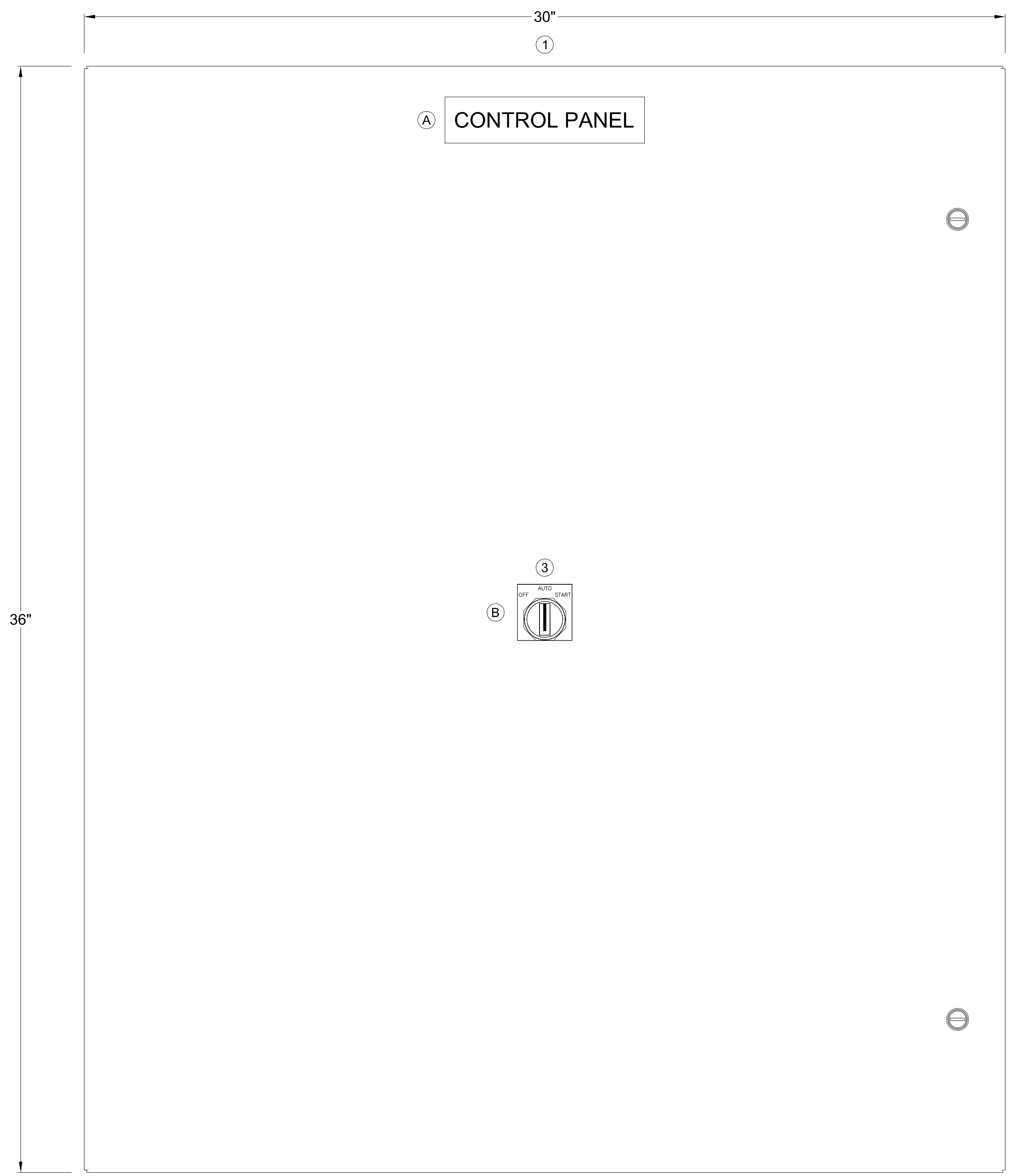
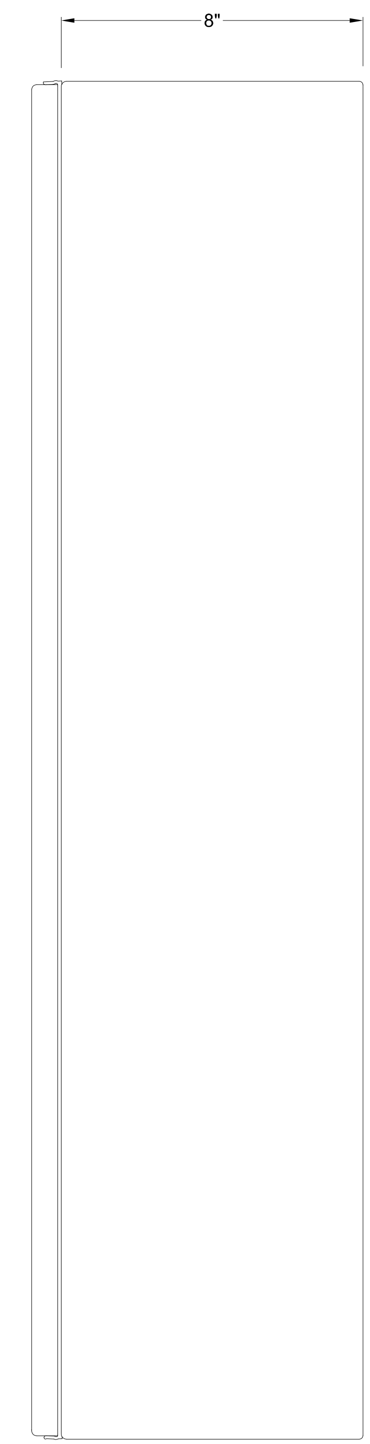


PILOT SYSTEM CONTROL PANEL ENCLOSURE ELEVATION - FRONT VIEW



PILOT SYSTEM CONTROL PANEL ENCLOSURE ELEVATION - SIDE VIEW

LEGEND PLATE LIST

P1 = 1.50" x 6.50" Plate
R = Ring Type Legend Plate
White Text w/ Black Background

Tag #	Qty	Type	Engraving	Letter Size
A	1	P1	CONTROL PANEL	1/4"
B	1	R	OFF-AUTO-START	3/16"

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1010.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
ENCLOSURE LAYOUT

DRAWING NO. 1010 | REV 1 | SHEET 5 OF 15

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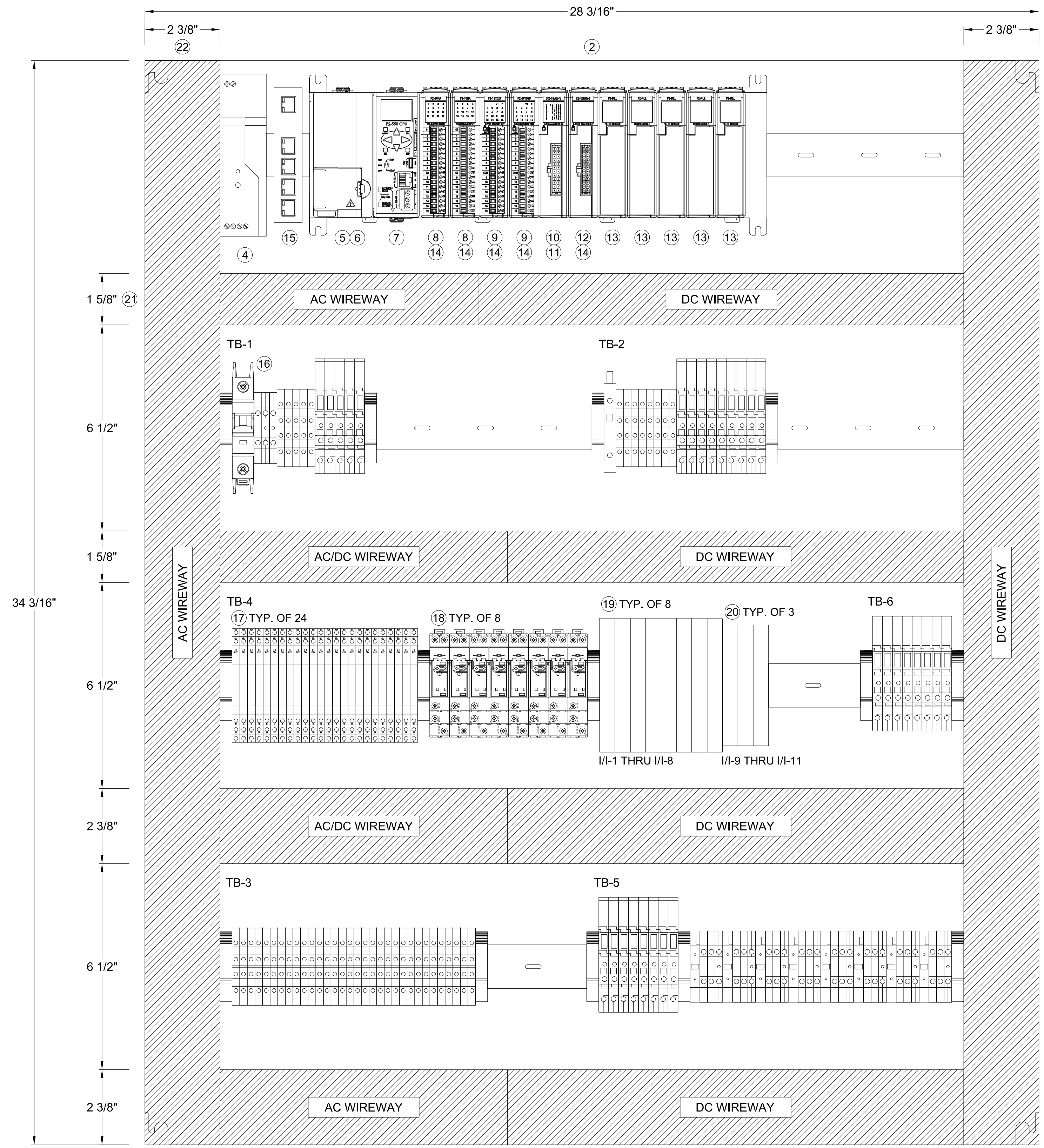

PILOT SYSTEM CONTROL PANEL BACKPLATE ELEVATION - FRONT VIEW

BILL OF MATERIALS

ITEM #	QTY	PART NO.	MANUFACTURER	DESCRIPTION	SHOWN ON DWG. #
1	1	CSD36308	HOFFMAN	ENCLOSURE, 36"(H) x 24.25"(W) x 10"(D), WALL MOUNT, QUICK-RELEASE LATCH, TYPE 4X	1010
2	1	CP3630	HOFFMAN	BACKPLATE, 34.2"(H) x 28.2" (W), WHITE	1011
3	1	800H-JR5A	ALLEN-BRADLEY	SELECTOR SWITCH, 3-POSITION, SPRING RTN FROM RIGHT	1010
4	1	2904376	PHOENIX CONTACT	24VDC POWER SUPPLY, 6.25A OUTPUT, 100-240VAC INPUT	1011
5	1	P2-11B	AUTOMATION DIRECT	PLC 11-SLOT BASE	1011
6	1	P2-01AC	AUTOMATION DIRECT	PLC POWER SUPPLY, 100-240VAC INPUT PWR	1011
7	1	P2-550	AUTOMATION DIRECT	PLC CPU, ETHERNET, USB, RS232	1011
8	2	P2-16ND3	AUTOMATION DIRECT	16 PT DC INPUT MODULE, 100-240VAC INPUTS	1011
9	2	P2-16TD2P	AUTOMATION DIRECT	16 PT 24VDC OUTPUT MODULE	1011
10	1	P2-16AD-1	AUTOMATION DIRECT	16-CH CURRENT ANALOG INPUT MODULE, 0-20mA, 16 BIT	1011
11	1	ZL-P2-CBL24-2P	AUTOMATION DIRECT	ZIPLINK I/O CABLE, 24 PIN TO PIGTAIL, 6.6FT	1011
12	1	P2-08DA-1	AUTOMATION DIRECT	8-CH CURRENT ANALOG OUTPUT MODULE, 0-20mA, 16 BIT	1011
13	5	P2-FILL	AUTOMATION DIRECT	FILLER MODULE	1011
14	5	P2-R2B	AUTOMATION DIRECT	MODULE CONNECTOR, 18-PIN, SCREW	1011
15	1	32025-8	COMTROL	ETHERNET SWITCH, 5-PORT, UNMANAGED, 24VDC INPUT PWR	1011
16	1	FAZ-D15-1-NA-SP	EATON	CIRCUIT BREAKER, 15A, 1-POLE, D-CURVE	1011
17	24	38.51.7.024.0050	FINDER	38 SERIES RELAY, 24VDC COIL, SPDT, 6A	1011
18	8	4C.01.9.024.0050	FINDER	4C SERIES RELAY, 24VDC COIL, SPDT, 15A	1011
19	8	KCD2-STC-EX1	PEPPERL+FUCHS	INTRINSICALLY SAFE BARRIER, ANALOG INPUT, 24VDC INPUT PWR	1011
20	3	2865434	PHOENIX CONTACT	INTRINSICALLY SAFE BARRIER, DIGITAL INPUT, 24VDC INPUT PWR	1011
21	LOT	T1E-1540W	IBOCO	WIREWAY, 1.5" (W) x 4.0" (D), WHITE	1011
22	LOT	T1E-2240W	IBOCO	WIREWAY, 2.25" (W) x 4.0" (D), WHITE	1011

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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WWW.CALCON.COM

DRAWN	JU	07/14/16
DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1010.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
BACKPLATE LAYOUT

DRAWING NO. 1011 | REV 1 | SHEET 6 OF 15

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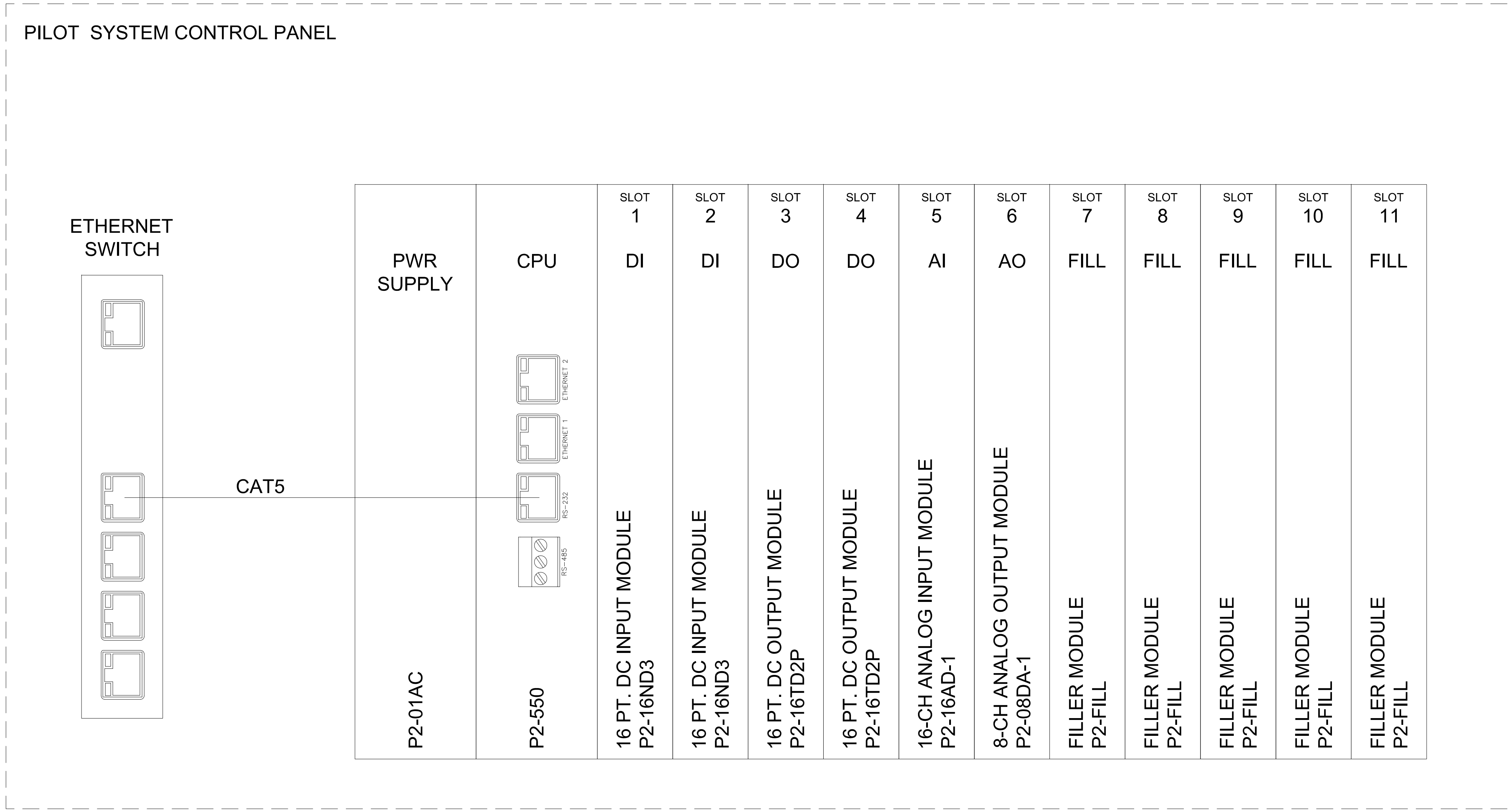

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

CALCON SYSTEMS
Automation & Process Control Specialists

CALCON SYSTEMS, INC.
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SAN RAMON, CA 94583
TEL: 925-277-0665
WWW.CALCON.COM

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DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1012.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
SYSTEM NETWORK DIAGRAM / PLC MODULE LAYOUT

DRAWING NO. 1012 | REV 1 | SHEET 7 OF 15

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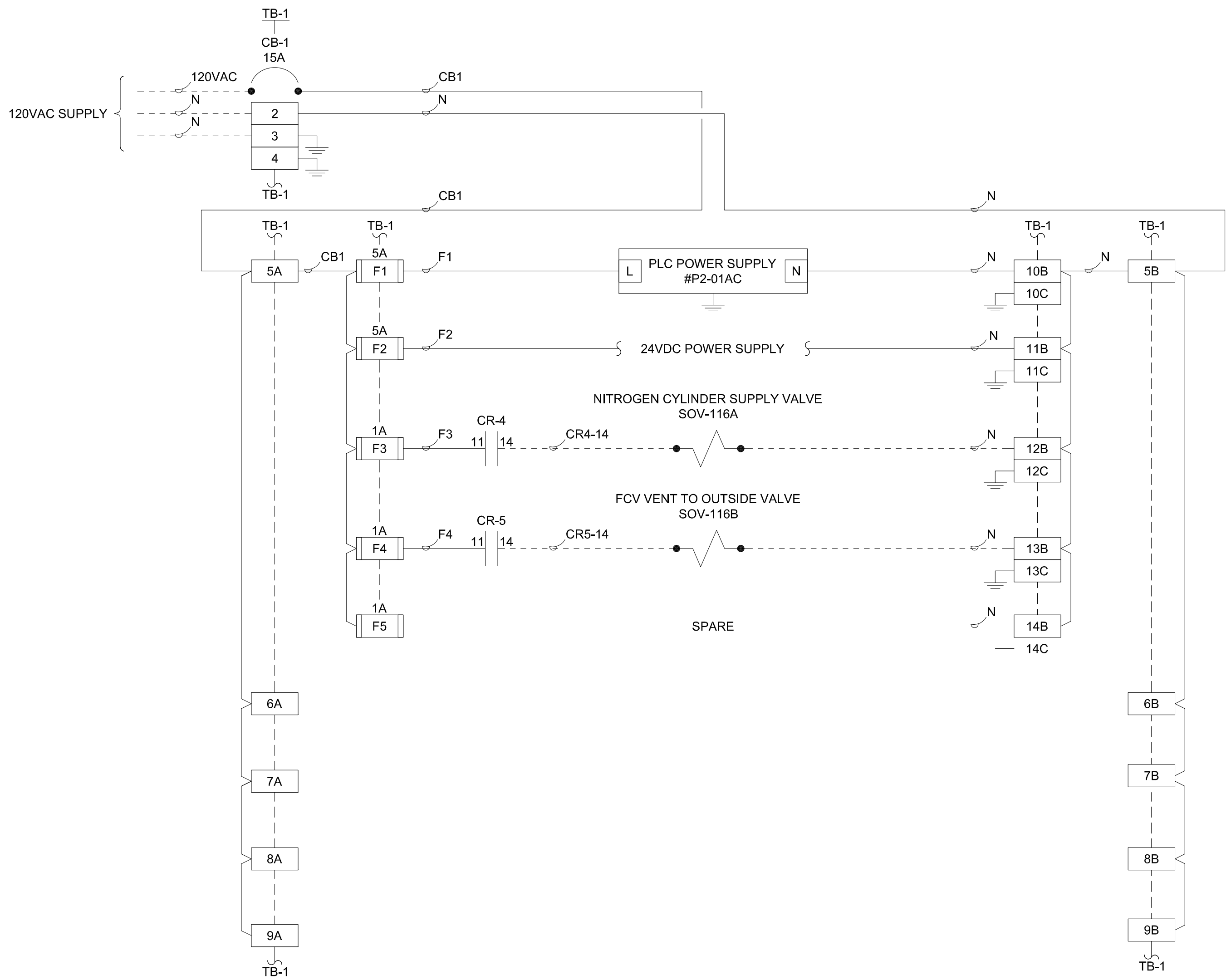

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1	INITIAL RELEASE	07/14/16	JU
REV	DESCRIPTION	DATE	NAME

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DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1020.DWG

CLIENT: KIRTLAND AFB

JOB: 11765

LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
120VAC POWER DISTRIBUTION

DRAWING NO.	REV	SHEET
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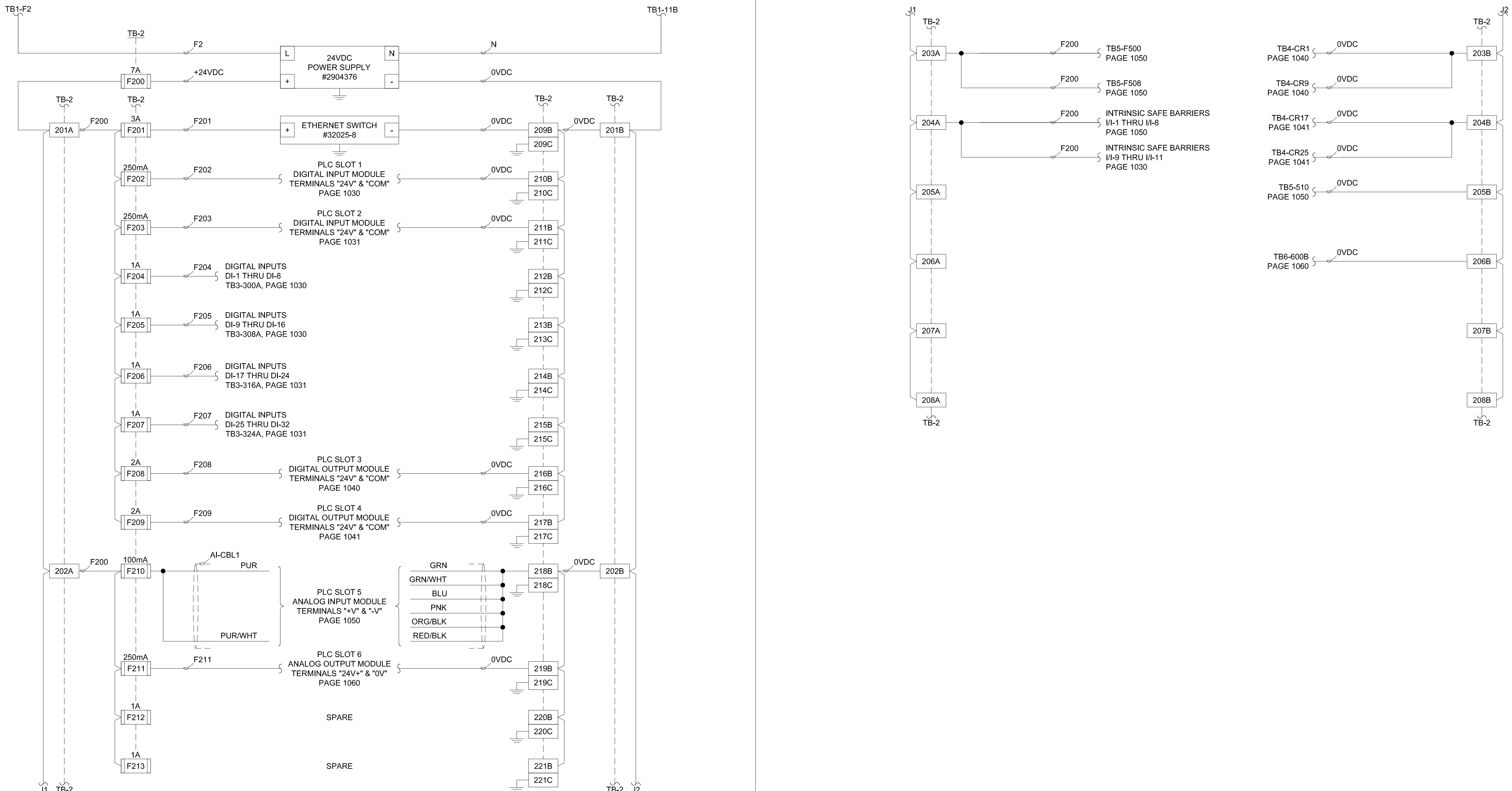

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

CALCON SYSTEMS

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DRAWN	JU	07/14/16
DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1020.DWG

CLIENT: KIRTLAND AFB

JOB: 11765

LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
24VDC POWER DISTRIBUTION

DRAWING NO. 1021 | REV 1 | SHEET 9 OF 15

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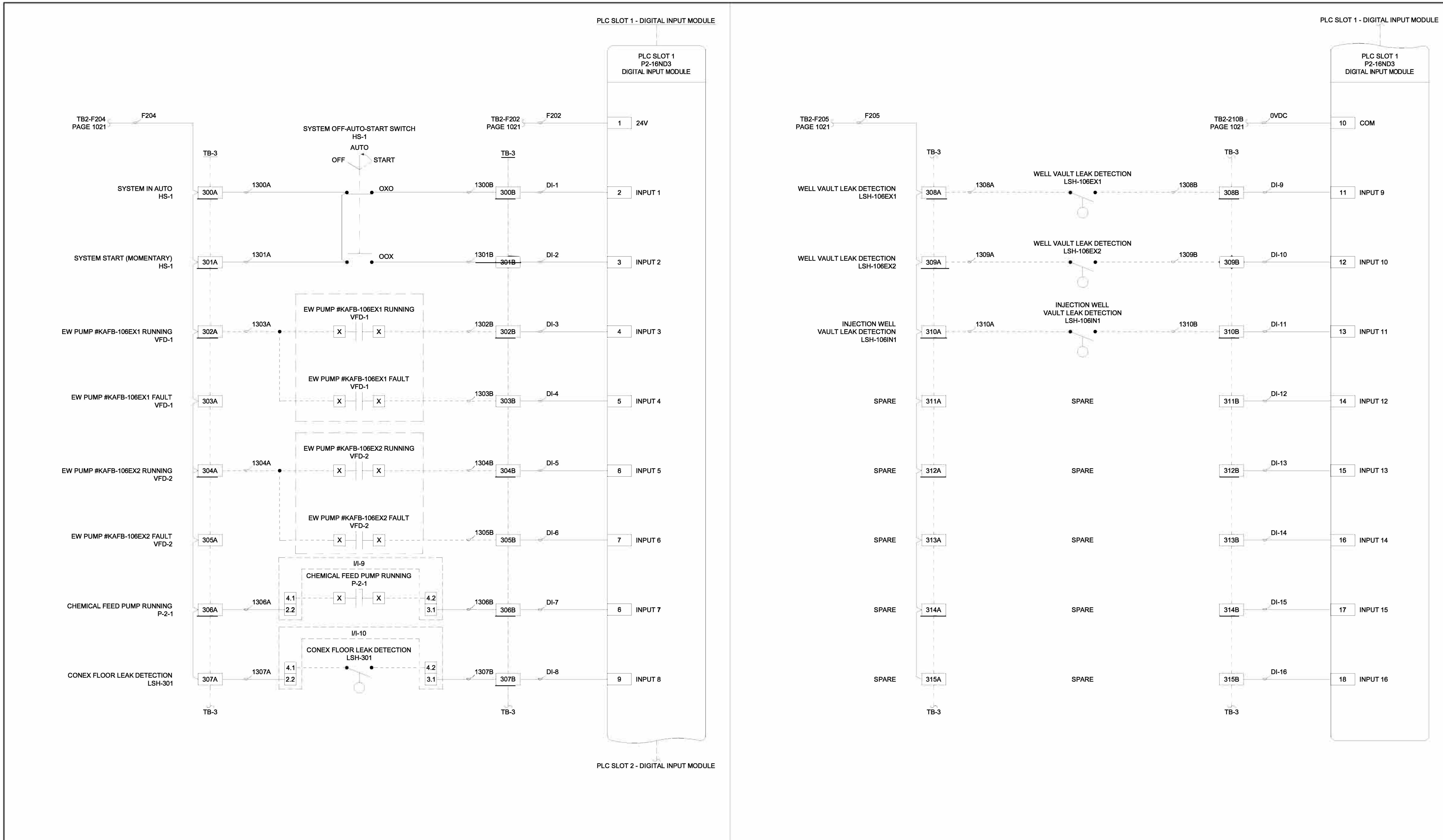

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1030.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
PLC SLOT 1 – 24VDC DIGITAL INPUT MODULE WIRING DIAGRAM

DRAWING NO. 1030 | REV 1 | SHEET 10 OF 15

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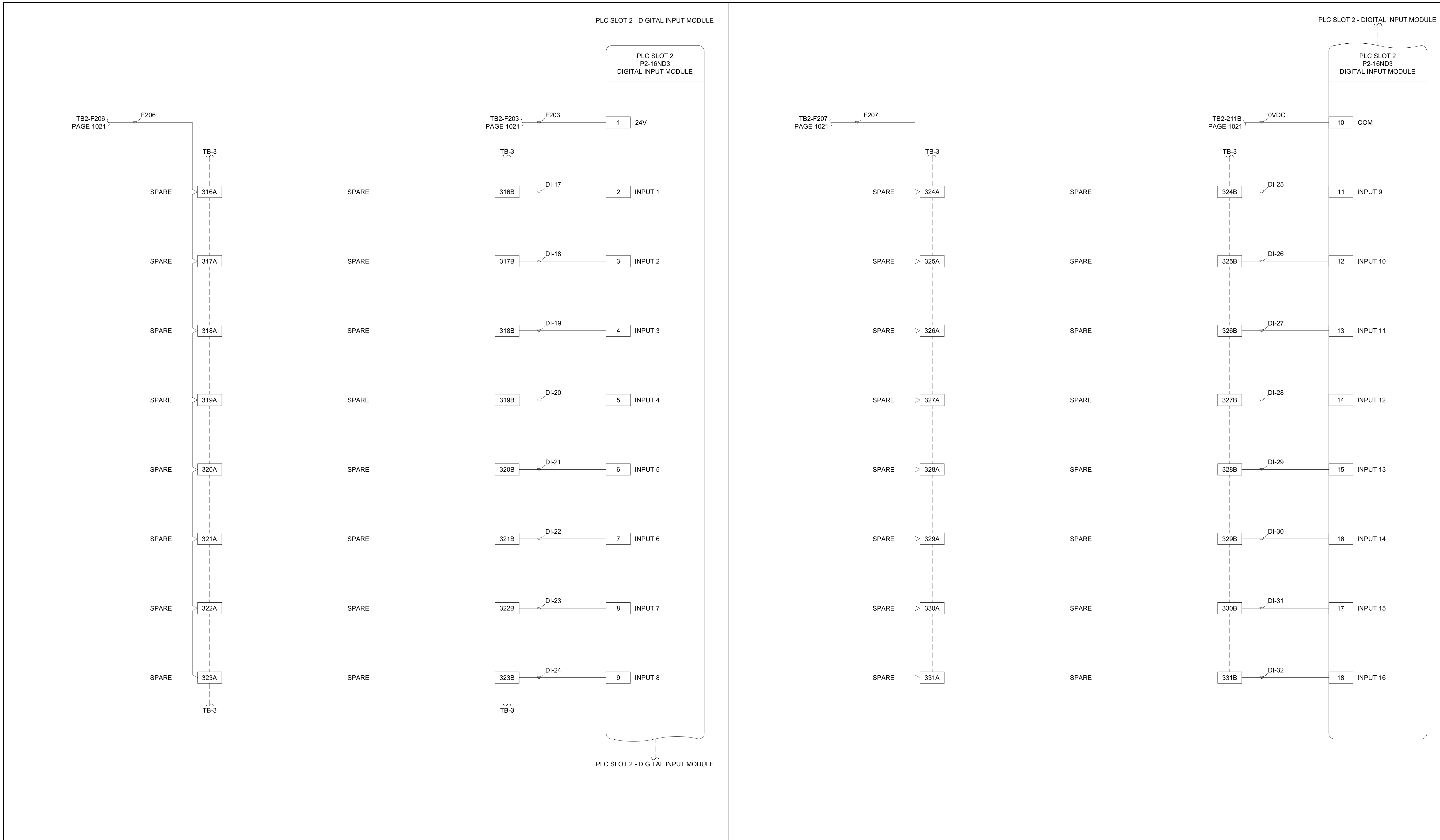

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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DRAWN	JU	07/14/16
DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1030.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
PLC SLOT 2 - 24VDC DIGITAL INPUT MODULE WIRING DIAGRAM

DRAWING NO. 1031 | REV 1 | SHEET 11 OF 15

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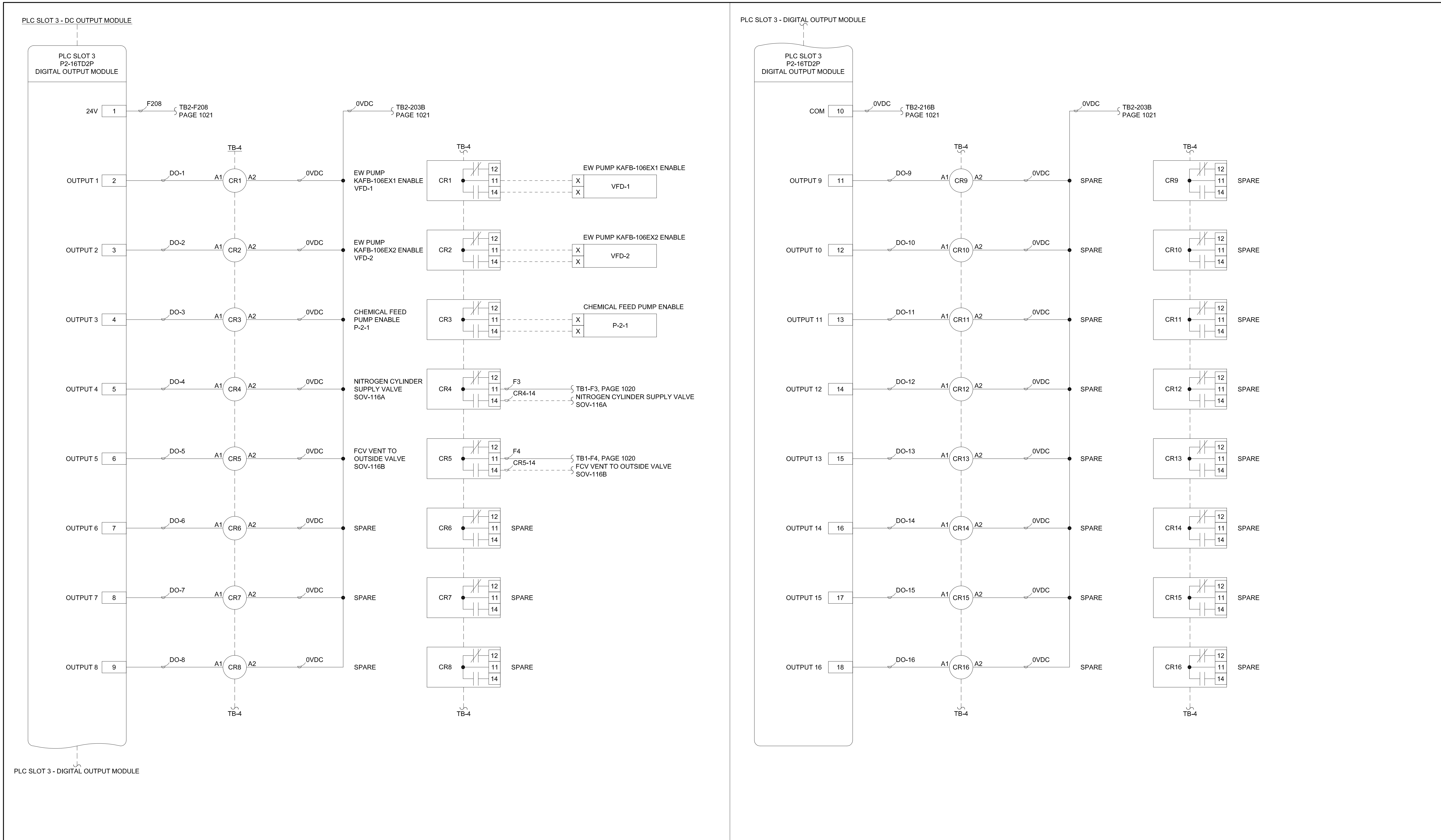

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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DRAWN	JU	07/14/16
DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1040.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
PLC SLOT 3 - DIGITAL OUTPUT MODULE WIRING DIAGRAM

DRAWING NO. 1040 | REV 1 | SHEET 12 OF 15

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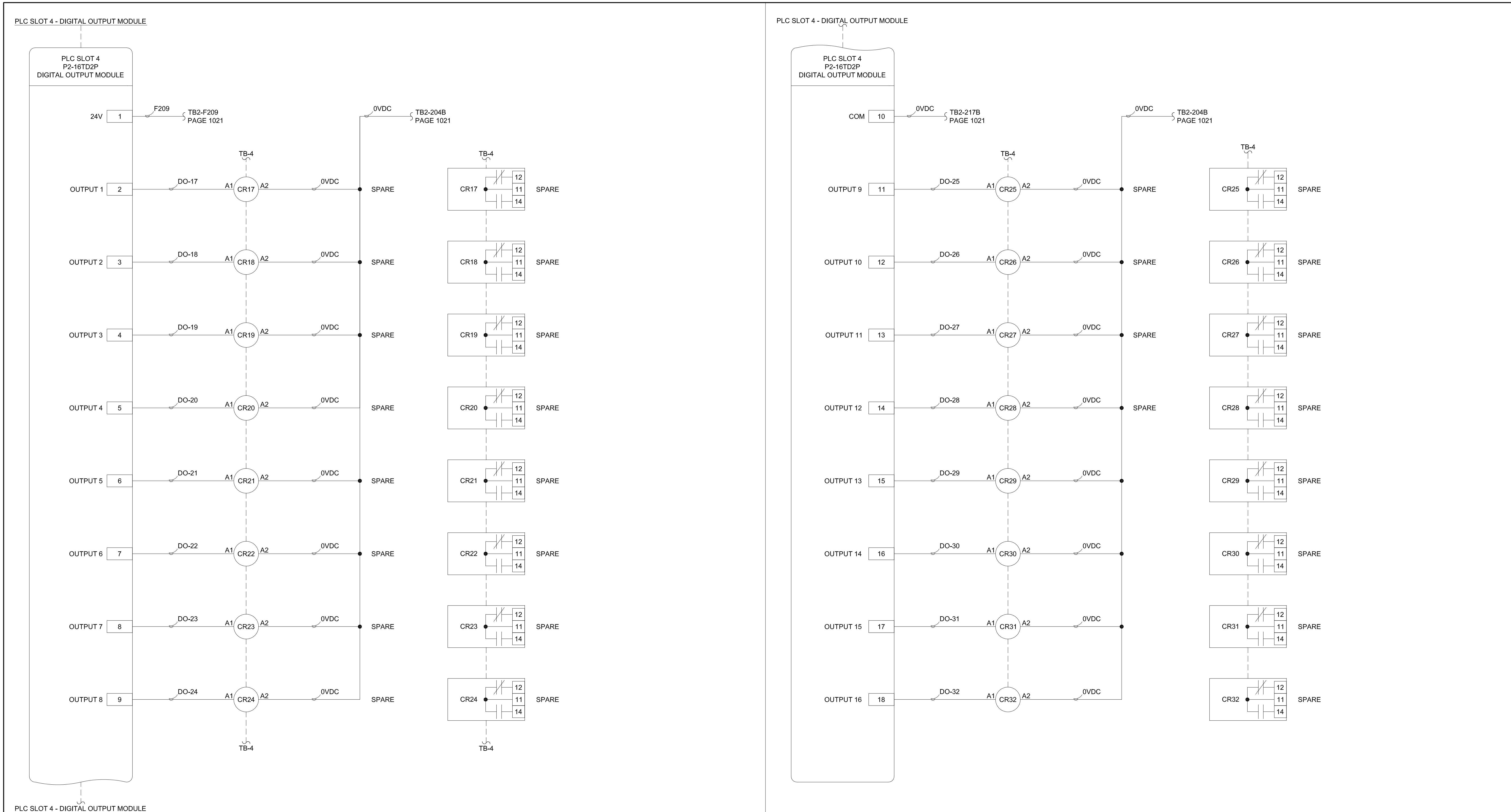

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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DRAWN	JU	07/14/16
DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1040.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
PLC SLOT 4 – DIGITAL OUTPUT MODULE WIRING DIAGRAM

DRAWING NO.	REV	SHEET
1041	1	13 OF 15

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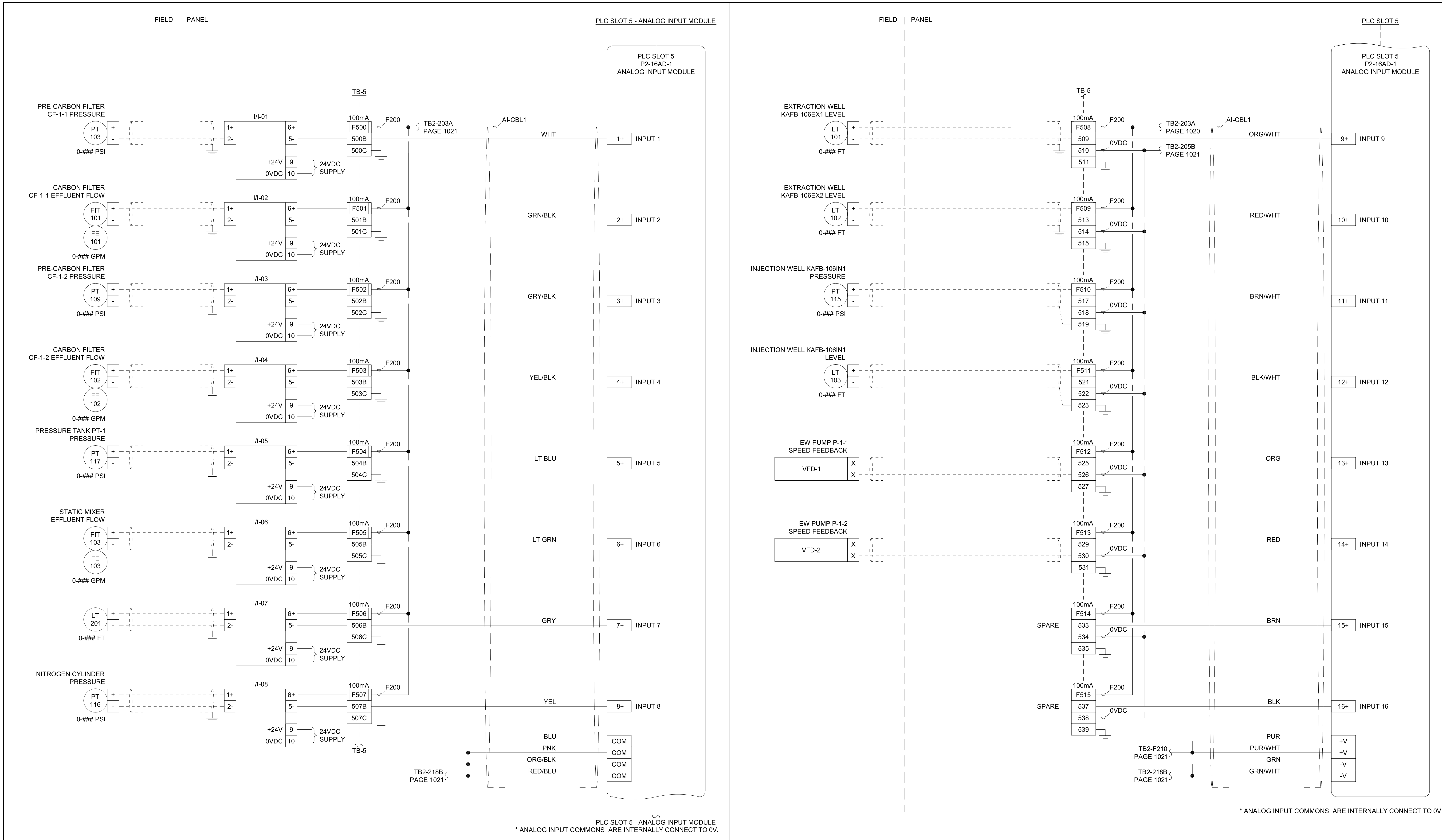

REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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DRAWN	JU	07/14/16
DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1050.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE PILOT SYSTEM CONTROL PANEL
PLC SLOT 5 – ANALOG INPUT MODULE WIRING DIAGRAM

DRAWING NO. 1050 | REV 1 | SHEET 14 OF 15

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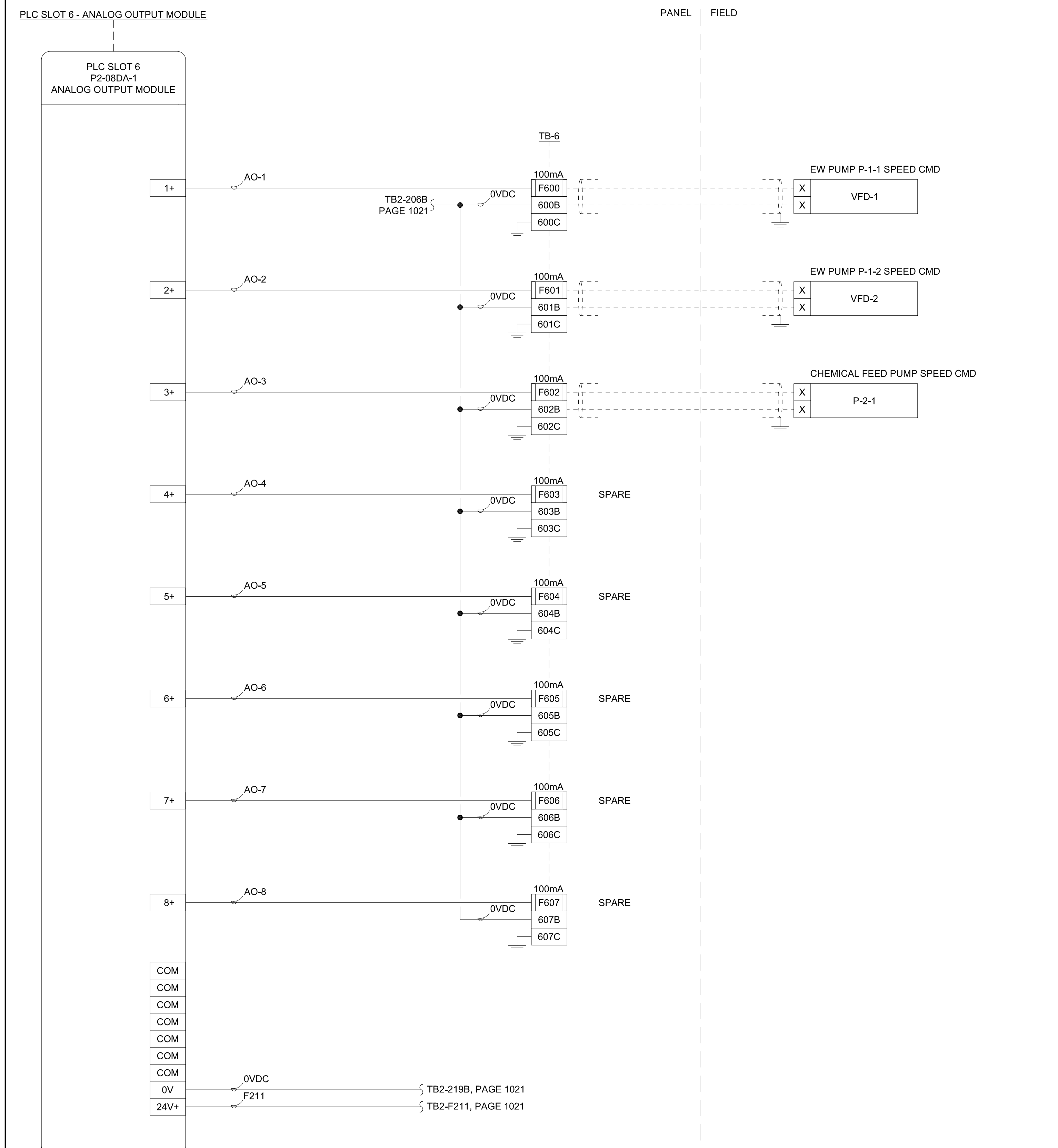

* ANALOG OUTPUT COMMONS ARE INTERNALLY CONNECT TO 0V.

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REV	DESCRIPTION	DATE	NAME
1	INITIAL RELEASE	07/14/16	JU

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SAN RAMON, CA 94583
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DRAWN	JU	07/14/16
DESIGN	JD	07/14/16
CHECKED	JD	07/14/16
APPROVED	JD	07/14/16

FILE: 11765_1060.DWG

CLIENT: KIRTLAND AFB
JOB: 11765
LOCATION: ALBUQUERQUE, NEW MEXICO

TITLE: KIRTLAND AIR FORCE BASE
PILOT SYSTEM CONTROL PANEL
PLC SLOT 6 – ANALOG OUTPUT MODULE WIRING DIAGRAM

DRAWING NO. 1060 | REV 1 | SHEET 15 OF 15

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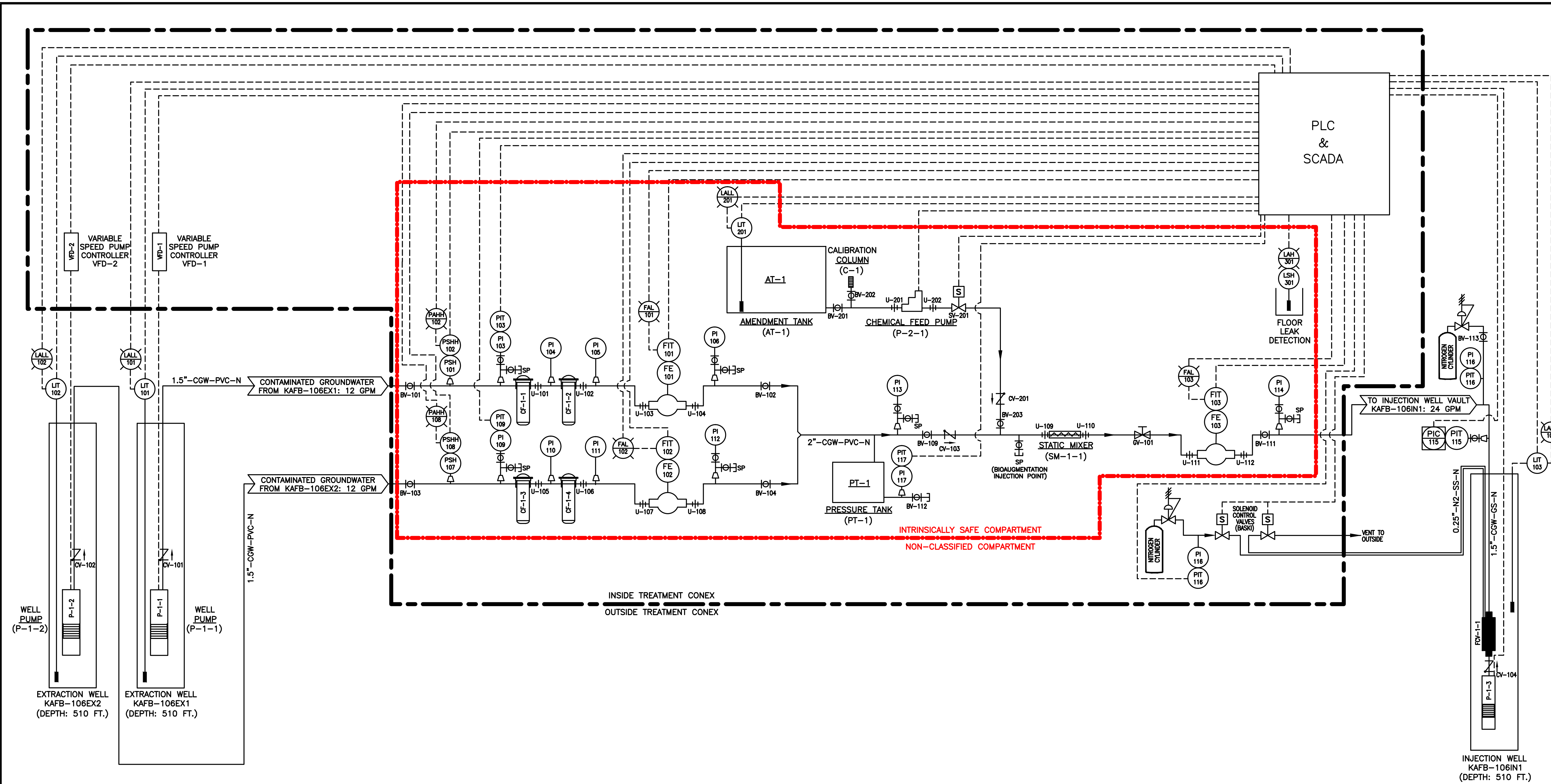

P-1-1, P-1-2 EXTRACTION WELL PUMP	VFD-1, VFD-2 PUMP CONTROLLER	FIQ-101, FIQ-102, FIQ-103 FLOW METER	PT-1 PRESSURE TANK	AT-1 AMENDMENT TANK	P-3-1 CHEMICAL FEED PUMP	PIT-111 PRESSURE TRANSMITTER	FCV-1-1 FLOW CONTROL VALVE	P-1-3 INJECTION WELL PUMP
TYPE: SUBMERSIBLE FLOW: 15GPM@575' MOTOR:FRANKLIN,5HP,460V,3PH MODEL: 25S50-26 (Teflon) MFR: GRUNDFOS	TYPE: 60HZ FREQ CONVERTER ENCLOSURE: IP55, A5 ELECTRIC: 3X440-500V MODEL: CUE (part#91136938) MFR: GRUNDFOS	TYPE: ELECTROMAGNETIC INLET PIPE SIZE: 1" FLANGE MODEL: M-3000 SERIES SERIAL: MFR: BADGER METER INC.	TYPE: DIAPHRAGM TANK VOLUME: 31.8 GAL PRE-CHARGE: 12 PSI INLET: 1" NPTF MODEL: V100 MFR: GOULDS	TYPE: VERTICAL POLY TANK DIMENSIONS: 52"x66",550GAL OUTLET: 2" BULKHEAD MODEL: NTO (VT0550-52) MFR: ACE ROTO-MOLD	TYPE: ELECTRONIC METERING CAPACITY: 2.5 GPH, 150 PSI VOLTAGE: 120 VAC MODEL: E71 MFR: LMI	TYPE: INTRINSICALLY SAFE RANGE: 1-30 PSI SETPOINT: 5-10 PSI MODEL: 2088 MFR: ROSEMOUNT	TYPE: PNEUMATIC SIZE: 4" OD MODEL: INFLEX FCV MFR: BASKI INCLUDES CONTROL PANEL WITH NITROGEN REGULATOR	TYPE: SUBMERSIBLE FLOW: 3GPM@550' MOTOR: 1HP,230V,8.1A MODEL: 5SQE10-410 (Teflon) MFR: GRUNDFOS

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Lawrenceville, NJ	9/7/16	G.Lavorgna	G.Lavorgna	S.Shealy	P.KostervanGroos	004□□-D1

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17 Princess Road
Lawrenceville, New Jersey 08648

U.S.□ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
OMAHA, NEBRASKA

APPENDIX A

RECIRCULATION AND AMENDMENT SYSTEM
PIPING AND INSTRUMENTATION DIAGRAM

IN-SITU EDB BIOREMEDIATION PILOT TEST
KIRTLAND AFB, NEW MEXICO

VALVE AND PIPING SYMBOLS

- GLOBE VALVE
- GATE VALVE
- BUTTERFLY VALVE
- SPRING CHECK VALVE
- CHECK VALVE
- PLUG VALVE
- 3–WAY VALVE
- ANGLE VALVE
- RELIEF OR SAFETY VALVE
- DIAPHRAGM VALVE
- BALL VALVE NC
- BALL VALVE NO
- GLOBE VALVE
- SELF–CONTAINED PRESSURE REGULATING VALVE W/RELIEF
- SELF–CONTAINED PRESSURE REGULATING VALVE AND FILTER W/RELIEF
- FILTER
- KNIFE GATE VALVE
- FLOAT VENT VALVE
- BP BACKFLOW PREVENTER
- SP SAMPLE PORT
- FLEXIBLE HOSE
- EXPANSION JOINT
- BASKET TYPE STRAINER
- Y–TYPE STRAINER
- T STEAM TRAP
- DUPLEX STRAINER
- SLEEVE COUPLING (SC)
- FLOOR DRAIN
- EQUIPMENT DRAIN
- CLEANOUT (CO)
- REMOVABLE PLUG
- REMOVABLE CAP
- BF BLIND FLANGE
- EXHAUST TO ATMOSPHERE (INSIDE)
- EXHAUST TO ATMOSPHERE (OUTSIDE)
- REDUCER
- UNION
- QUICK DISCONNECT COUPLING
- GAUGE SEAL
- DAMPER
- SILENCER

VALVE OPERATOR SYMBOLS

- S SOLENOID
- M MOTOR, ELECTRIC
- DIAPHRAGM WITH POSITIONER
- HANDWHEEL OR LEVER

PRIMARY ELEMENT SYMBOLS – FLOW

- ORIFICE PLATE
- PITOT TUBE
- AVERAGING PITOT TUBE
- SIGHT TUBE
- TOTALIZING FLOWMETER
- POSITIVE DISPLACEMENT FLOW METER
- WEIR
- TURBINE OR PROPELLER TYPE METER
- MAGNETIC FLOW METER
- ROTAMETER

GENERAL INSTRUMENT SYMBOLS

- FIELD MOUNTED
- PANEL MOUNTED
- REAR–OF–PANEL MOUNTED
- N INTERLOCK (WHERE N = INTERLOCK NUMBER)
- P PURGE
- TWO INSTRUMENTS PHYSICALLY CONNECTED
- INTERNAL PLC INSTRUMENT OR FUNCTION
- INDICATOR LIGHT
- PISTON ACTUATOR
- TI TIMER

LINE SYMBOLS

- PROCESS PIPES OR CHANNELS
- ELECTRICAL SIGNAL
- ELECTRICAL INTERCONNECTION
- PNEUMATIC SIGNAL

SERVICE ABBREVIATIONS

AIR	AIR, ATMOSPHERIC PRESSURE
ASP	AIR SPARGE
BW	BACKWASH
CA	COMPRESSED AIR
CGW	CONTAMINATED GROUNDWATER
CDS	CONDENSATE
D	DRAIN
EFF	EFFLUENT
EXH	EXHAUST
GW	GROUNDWATER
NPW	NON–POTABLE WATER
P	PRODUCT (LNAPL)
PW	POTABLE WATER
S	SANITARY
SC	SECONDARY CONTAINMENT
SL	SLUDGE
SMC	STEAM MIGRATION CONTROL
SP	SAMPLE PORT
SS	STORM SEWER
STM	STEAM
SVE	SOIL VAPOR EXTRACTION
TF	TOTAL FLUIDS
V	VENT
VAP	VAPOR

PIPING MATERIAL IDENTIFICATION

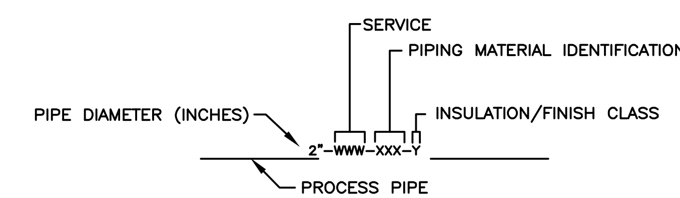
CPVC	CHLORINATED POLYVINYL CHLORIDE
CSP	CARBON STEEL PIPE
COP	COPPER
CMP	CORRUGATED METAL PIPE
CIP	CAST IRON PIPE
DIP	DUCTILE IRON PIPE
GAL	GALVANIZED STEEL PIPE
PE	POLYETHYLENE PIPE
PP	POLYPROPYLENE PIPE
PVC	POLYVINYL CHLORIDE PIPE
PVCH	POLYVINYL CHLORIDE HOSE
RCP	REINFORCED CONCRETE PIPE
RUB	RUBBER HOSE
SS	STAINLESS STEEL PIPE
VCP	VITRIFIED CLAY PIPE

INSULATION/FINISH CLASS

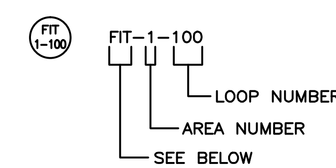
EQUIPMENT SYMBOLS

- SUBMERSIBLE PUMP
- PUMP
- PNEUMATIC DOUBLE DIAPHRAGM PUMP
- FCV (FLOW CONTROL VALVE)
- BLOWER
- COMPRESSOR AIR COMPRESSOR
- CHEMICAL FEED PUMP
- WELL PUMP

PROCESS PIPING IDENTIFICATION



INSTRUMENT IDENTIFICATION



F	FILTER
FAL	FLOW ALARM LOW
FE	FLOW ELEMENT
FI	FLOW INDICATOR
FIT	FLOW INDICATOR AND TRANSMITTER
FIQ	FLOW INDICATOR AND TOTALIZER
FN	FAN
FQ	FLOW TOTALIZER
FR	FILTER REGULATOR
FSL	FLOW SWITCH LOW
HOA	HAND–OFF–AUTOMATIC
HS	HAND SWITCH
KY	TIMER
LAH	LEVEL ALARM HIGH
LAHH	LEVEL ALARM HIGH–HIGH
LAL	LEVEL ALARM LOW
LALL	LEVEL ALARM LOW–LOW
LEL	LOWER EXPLOSIVE LIMIT
LI	LEVEL INDICATOR
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH–HIGH
LT	RUN LIGHT
MV	MOTORIZED VALVE
OCA	OPEN(MOMENTARY)–CLOSE–AUTO
PAH	PRESSURE ALARM HIGH
PCV	PRESSURE CONTROL VALVE
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATOR AND TRANSMITTER
PSH	PRESSURE SWITCH HIGH
RV	RELIEF VALVE
SV	SOLENOID VALVE
TA	TEMPERATURE ANALYZER
TE	TEMPERATURE ELEMENT
TI	TEMPERATURE INDICATOR
TSH	TEMPERATURE SWITCH HIGH
TT	TEMPERATURE TRANSMITTER

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OMAHA DISTRICT
OMAHA, NEBRASKA

APPENDIX A
RECIRCULATION AND AMENDMENT SYSTEM
PIPING AND INSTRUMENTATION
DIAGRAM LEGEND
IN-SITU EDB BIOREMEDIATION PILOT TEST
KIRTLAND AFB, NEW MEXICO

DRAWING NUMBER	□004□□-D1
APPROVED BY	P.KostervanGroos
CHECKED BY	S.Shealy
DRAWN BY	G.Lavorgna
DESIGNED BY	G.Lavorgna
DATE	9/7/16
OFFICE	Lawrenceville, NJ

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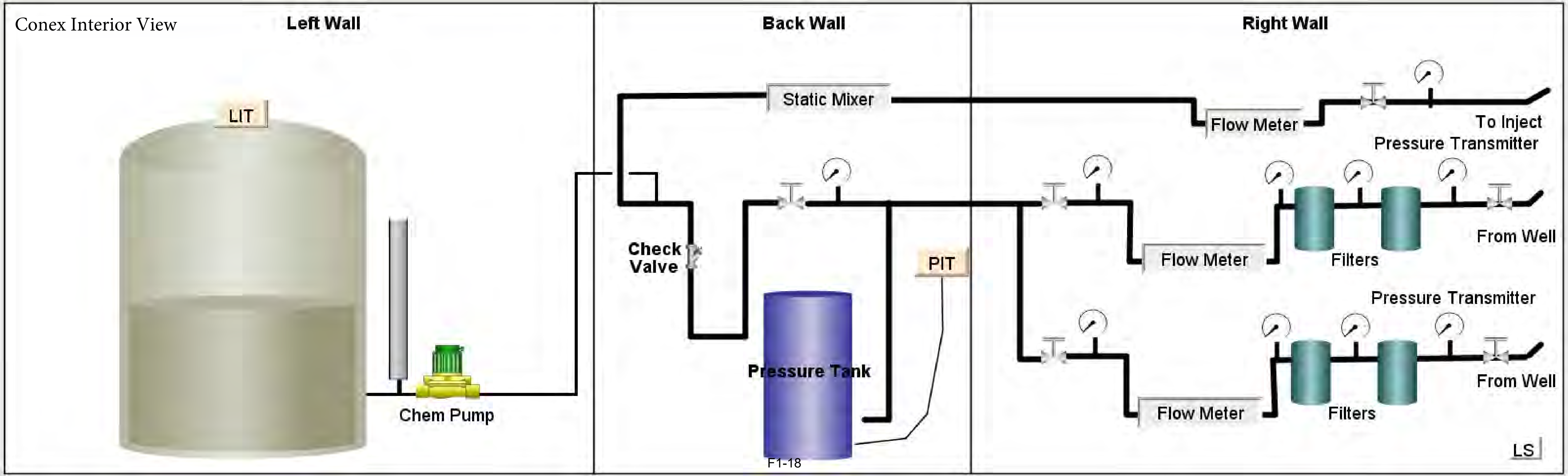
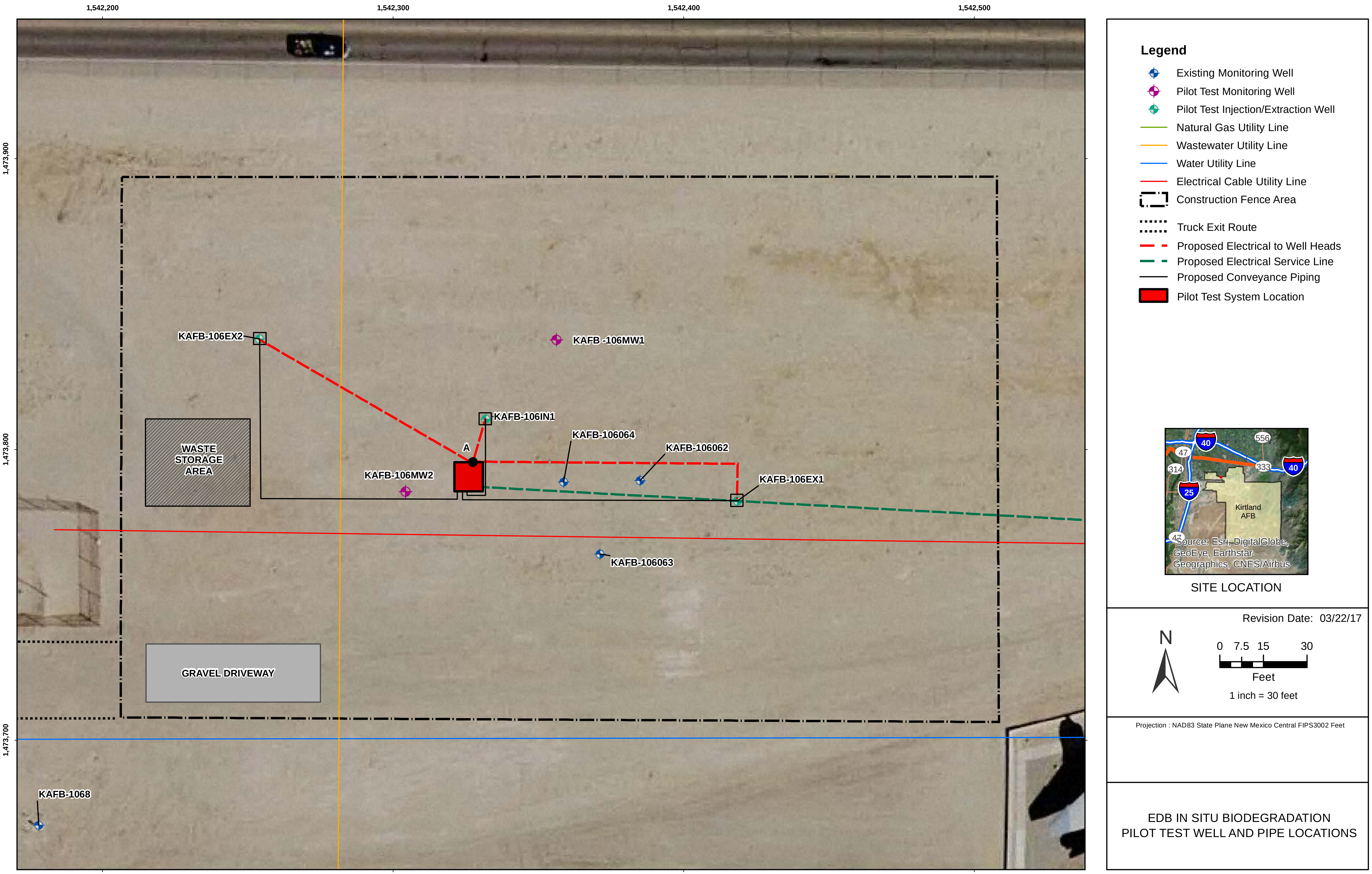
Plotted By: zeke.corpio



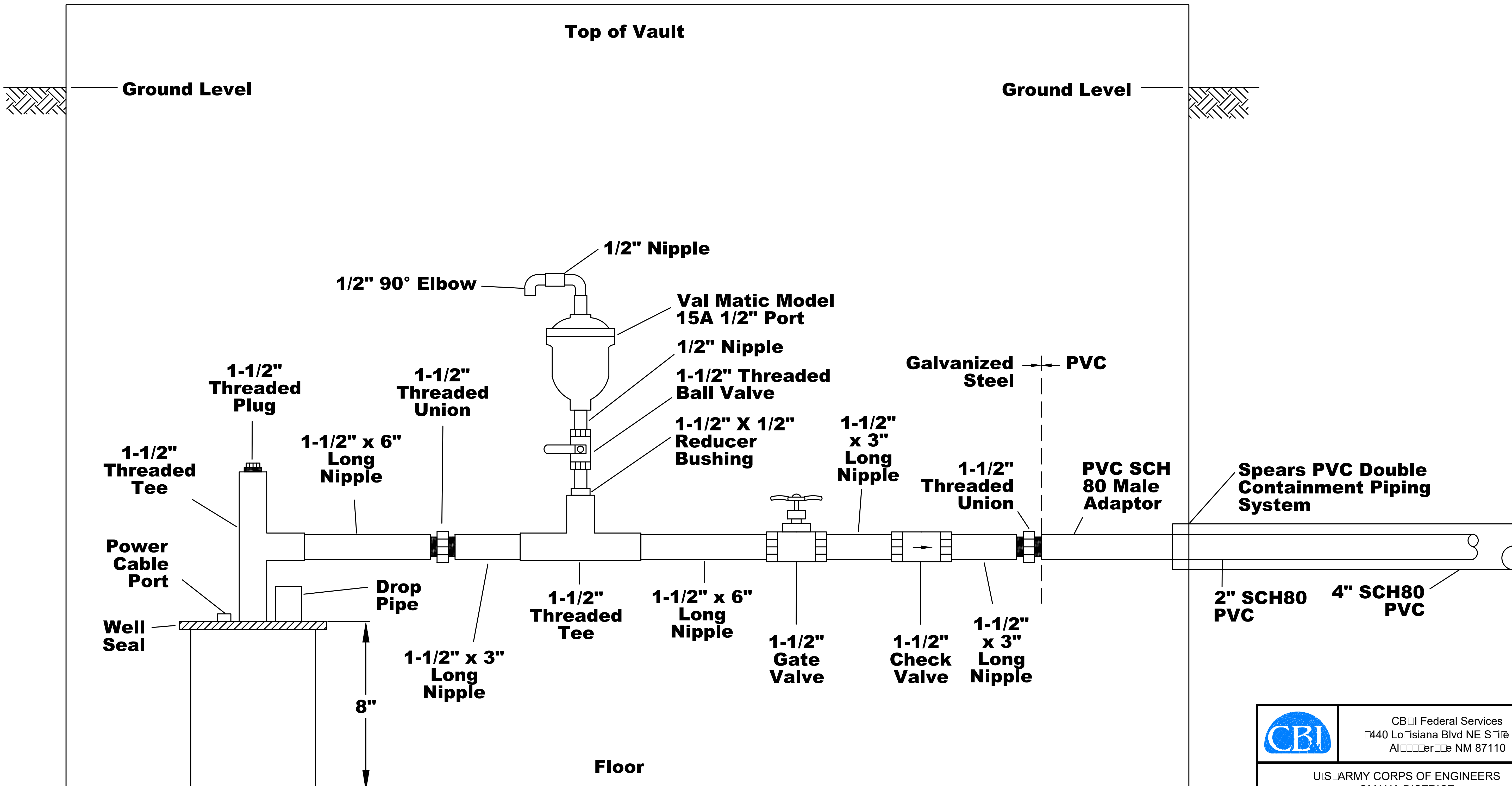
Conex Interior View
Left Wall
Back Wall
Right Wall
LIT
Chem Pump
Static Mixer
Check Valve
PIT
Pressure Tank
F1-18
Flow Meter
To Inject
Pressure Transmitter
From Well
Filters
Flow Meter
Pressure Transmitter
From Well
Filters
Flow Meter
LS



EDB IN SITU BIODEGRADATION
PILOT TEST WELL AND PIPE LOCATIONS

H:\Kirtland_AFB\GIS_Documents\Project_Maps\ESTCP\ECarpioESRI Data Solutions TeamKAFB_ESTCP011.mxd 03/22/17

EXTRACTION WELL HEAD AND VAULT PIPING FOR KAFB-106EX1 AND KAFB-106EX2



CB□I Federal Services
□440 Lo□isiana Blvd NE S□i□e □00
Al□□□□er□□e NM 87110

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OMAHA, NEBRASKA

EXTRACTION WELL VAULT DESIGN
AND WELL HEAD

IN-SITU EDB BIOREMEDIATION PILOT TEST
KIRTLAND AFB, NEW MEXICO

□004□□-EXTRACTION WELL PIPING

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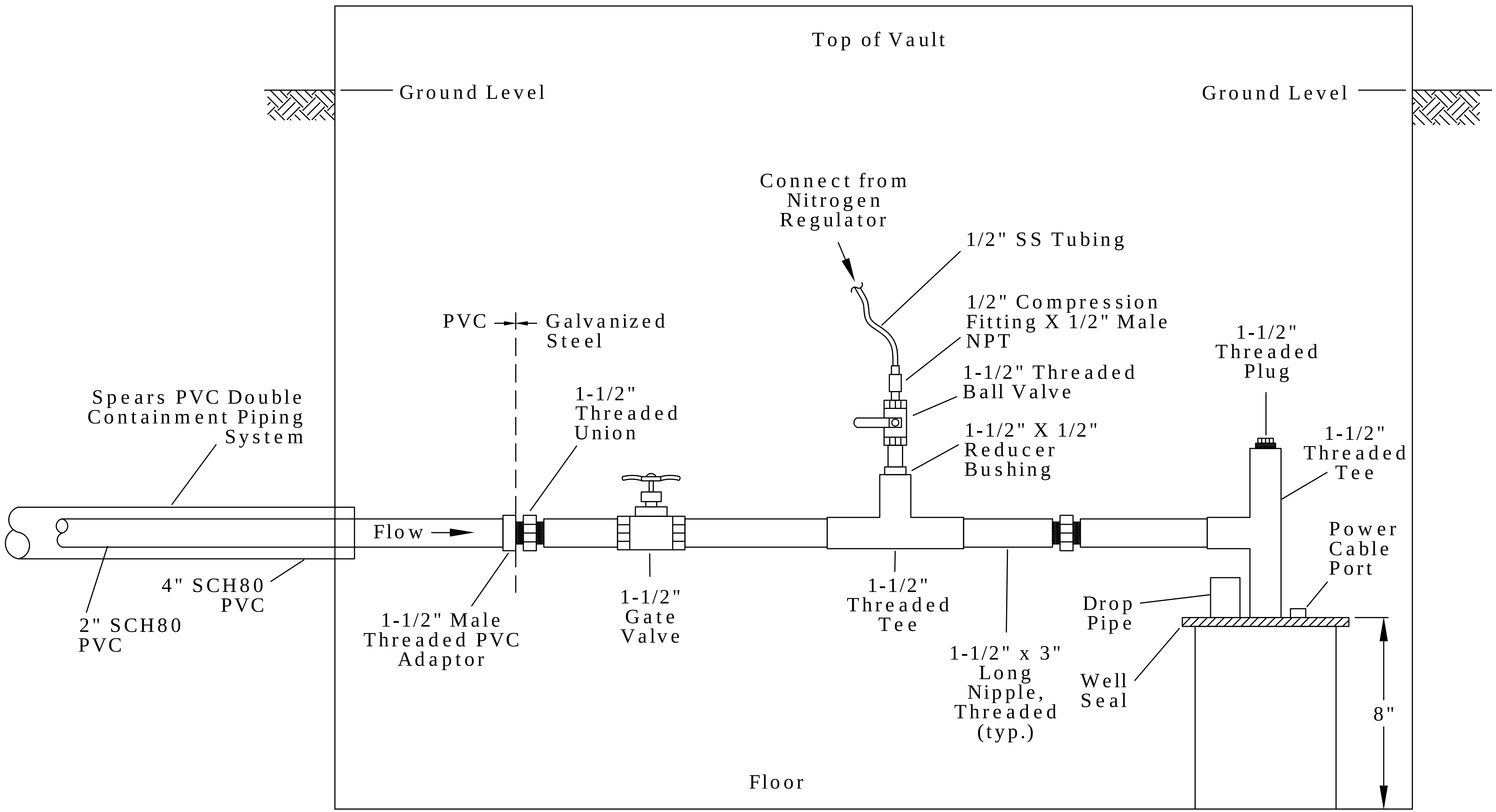
Plotted By: zeke.carpio

INJECTION WELL HEAD AND VAULT PIPING FOR KAFB-106EX1 AND KAFB-106EX2



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Al□□□□er□□e NM 87110

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OMAHA, NEBRASKA

INJECTION WELL VAULT DESIGN
AND WELL HEAD

IN-SITU EDB BIOREMEDIATION PILOT TEST
KIRTLAND AFB, NEW MEXICO

APPENDIX G
SAFETY DATA SHEETS

APPENDIX H
FIELD SAMPLING RECORDS

H-1. Groundwater Purge Logs

H-2. Sample Collection Logs

APPENDIX I
DATA QUALITY EVALUATION REPORT AND DATA PACKAGES

I-1. Data Quality Evaluation Report (June 2017 – January 2019)

I-2. Data Quality Evaluation Report (March 2020 – October 2020)

I-3. Data Packages

APPENDIX J
WASTE DISPOSAL DOCUMENTATION

J-1. Soil IDW Disposal Letters and Approvals

J-2. Corrective Action Report

J-3. Non-Hazardous Waste Manifests

J-4. Hazardous Waste Manifests

J-5. Waste Profiles

APPENDIX C TREATABILITY STUDY REPORT (CB&I, 2015)

NATURAL ATTENUATION AND BIOSTIMULATION FOR IN SITU TREATMENT OF 1,2-DIBROMOETHANE (EDB)

ESTCP PROJECT ER-201331
Treatability Study Report

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Table of Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

$\delta^{13}C$	Delta 13-Carbon (measure of carbon isotope composition)
ε	Isotope enrichment factor
AFB	Air Force Base
ATL	Analytical and Treatability Laboratory
AvGas	Aviation gasoline
BDAG	Biotechnology Development and Applications Group
BFF	Bulk Fuels Facility
Br	Bromine
BSM	Basal Salts Media
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
bgs	below ground surface
C	carbon
^{12}C, ^{13}C	stable carbon isotopes
CB&I	CB&I Federal Services, LLC
COC	Contaminant of concern
CSIA	Compound-specific stable isotope analysis
d	day
DAP	Diammonium phosphate
DCA	1,2-dichloroethane
DHC	*Dehalococcoides* spp.
DoD	Department of Defense
E_a	Energy of activation
EDB	Ethylene dibromide (1,2-dibromoethane)
EPA/USEPA	United States Environmental Protection Agency
ESTCP	Environmental Security Technology Certification Program
F	Fraction of initial quantity remaining
Fe	iron
$FeCO_3$	Ferrous carbonate (siderite)
Fe_2O_3	Hematite
Fe_3O_4	Magnetite
FeS	Ferrous sulfide (mackinawite)
FeS_2	Iron pyrite
$FeCl_2$	ferrous chloride
ft	feet
g	grams
GC	Gas Chromatography instrument
GC-IRMS	Gas Chromatography Isotope Ratio Mass Spectrometry
GC/MS	Gas Chromatography–Mass Spectrometry
H	hydrogen
HCl	hydrochloric acid
Hg	Mercury
$HgCl_2$	Mercuric chloride
hr	hour(s)
HS^-	Bisulfide
H_2S	hydrogen sulfide

KAFB	Kirtland Air Force Base well number
L	liter(s)
LNAPL	light non-aqueous phase liquid
µg	micrograms
m	meter
M	Molar
MCL	Maximum Contaminant Level
mg	milligram(s)
mM	millimolar
N	Nitrogen
NAPL	non-aqueous phase liquid
Na_2S	sodium sulfide
ng	nanogram(s)
nmol	nanomole(s)
O_2	oxygen
OD_{600}	Optical Density at 600 µm wavelength
OU	University of Oklahoma
P	Phosphorus
PCE	Tetrachloroethene
QA/QC	Quality Assurance / Quality Control
S^{2-}	Sulfide
SRB	Sulfate Reducing Bacteria
US	United States
VFAs	Volatile Fatty Acids
VOC	volatile organic compounds
yr	year

1.0 INTRODUCTION

1,2-Dibromoethane (EDB) is a suspected human carcinogen with a variety of historic uses and is emerging as a significant contaminant of concern (COC) for the Department of Defense (DoD). While EDB was used as a soil fumigant from the 1950s until the early 1980s, its use as a lead scavenging compound in fuels to prevent the build-up of lead oxide deposits in engines is the primary motivation for this work. Lead was largely removed from fuels in the US by the end of the 1980s, but its use continued in specific fuels such as aviation gasoline (AvGas). The total extent of EDB contamination at military and civilian sites remains unclear, as typical analytical methods for VOCs (e.g., EPA 8260B) have detection limits for EDB much greater than the promulgated MCL of 0.05 µg/L (Wilson et al., 2008). It is expected that many military sites with hydrocarbon contamination from AvGas via leaking pipelines, spills, or past fuel handling practices may have EDB in groundwater. A large effort is underway at Kirtland Air Force Base (AFB) to define and remediate an EDB plume associated with a past AvGas release, and the treatability studies described herein were supported by this ESTCP project (ER-201331), and other DoD supported remediation efforts at Kirtland AFB.

ESTCP project ER-201331 focuses on improving tools for quantifying natural attenuation of EDB and enhancing EDB degradation in situ thru the use of EDB degrading microorganisms. Treatability studies performed to support these efforts include: 1) an evaluation of biotic and abiotic EDB carbon isotope effects to assist with determining the extent of EDB degradation at the site; and 2) an evaluation of alternative aerobic and anaerobic biostimulation or bioaugmentation approaches for enhancing EDB degradation at Kirtland AFB.

2.0 EDB CARBON ISOTOPE FRACTIONATION DURING DEGRADATION

2.1 INTRODUCTION

Monitored natural attenuation is a widely accepted remedy for hydrocarbon and chlorinated solvent contamination when risks associated with a plume can be quantified and verified, and these risks are acceptable. To demonstrate the use of compound-specific isotope analysis (CSIA) to help quantify attenuation of EDB plumes, this ESTCP project will use CSIA to estimate the extent of EDB degradation in groundwater at Kirtland AFB under differing geochemical conditions, ranging from reducing to oxic. Data from this effort will provide insights into how EDB naturally degrades in situ via biological and abiotic pathways. Plume-wide isotope values, geochemical parameters, and concentration data will be used to inform a conceptual model of EDB attenuation at the site.

To appropriately quantify the extent of EDB degradation using isotope data, isotope enrichment factors (ε values) of important degradation mechanisms must be known, and these fractionation factors are determined under controlled settings. For example, Henderson and colleagues (2008) evaluated anaerobic EDB degradation in microcosms constructed from a South Carolina site using CSIA and measurements of EDB loss, and observed a carbon isotope enrichment factor, ε, of -5.7‰ in anaerobic microcosms simulating natural attenuation. Another recent study investigated EDB degradation by iron sulfide (FeS) and observed greater carbon isotope fractionation via this mechanism, with ε estimated to range from -20 ‰ to -30 ‰ (Kuder et al., 2012; Wilson et al., 2008). The laboratory studies performed by CB&I Federal Services, LLC (CB&I) and described herein complement these previous studies. The treatability studies described herein include the determination of isotope enrichment factors associated with biodegradation under both anaerobic and aerobic conditions, as well as degradation associated with abiotic processes, including interactions with commercially acquired iron sulfides (FeS and FeS_2), and hydrolysis. The determination of these enrichment factors helps establish the range of EDB isotope fractionation one may expect in the field related to EDB degradation, and provides, to some degree, information needed to utilize carbon isotope data for determining the extent of degradation.

2.2 MATERIALS AND METHODS

2.2.1 Isotopic Fractionation of Carbon in EDB by Bacterial Cultures

Several bacterial cultures that are known to degrade EDB were used to study the isotope fractionation of EDB during biological degradation. The cultures tested included the aerobic ethane-degrader *Mycobacterium sphagni* ENV482 (isolated by our group from Cape Cod, MA), the methanotroph *Methylocella palustris*, and the anaerobic dechlorinating cultures SDC-9, PJKS, and Hawaii-05, each of which was previously enriched by scientists in our laboratory.

M. sphagni ENV482 was grown aerobically in basal salts medium (BSM; Hareland et al., 1975) with 10% ethane in headspace. *M. palustris* was grown aerobically in ATCC Medium 2157 (Methylocella medium) with 10% methane in the headspace. Anaerobic cultures were grown in

RAMM media with lactate and PCE. Based on previous degradation results, the culture density was adjusted to allow for significant degradation of EDB over a 4-8 hour time period. Cultures were placed into Boston round bottles with Teflon-lined caps, and were spiked with EDB to 5-10 mg/L. Samples were collected at predetermined time points, preserved with hydrochloric acid (HCl), and analyzed for EDB concentrations via GC/MS in CB&I's Analytical and Treatability Laboratory (ATL; Lawrenceville, NJ) and EDB stable carbon isotopes at Tomasz Kuder's laboratory at the University of Oklahoma.

2.2.2 Hydrolysis of EDB in Water at Elevated Temperatures

A series of experiments was performed to evaluate carbon isotope fractionation associated with EDB degradation at elevated temperatures. This degradation was assumed to be due to hydrolysis of EDB, as previously investigated by Weintraub (1989) and others (Barbash and Reinhard, 1989; Reinhard and Vogel, 1988). In the treatability experiments described herein, 5-10 mg/L EDB was dissolved in a batch of purified water. This water was then dispensed into individual serum vials (total volume 8.5 mL) sealed with Teflon-lined butyl rubber stoppers and aluminum crimp seals. The vials were then placed in an incubator at elevated temperature (i.e., 60 °C, 75 °C, or 90 °C), and duplicate vials were removed periodically, cooled, and analyzed for EDB and bromide concentrations. Bromide analysis was performed via EPA Method 300 and was used to examine the release of bromide during degradation of EDB. Representative samples were analyzed for EDB stable carbon isotopes at Tomasz Kuder's laboratory at the University of Oklahoma.

2.2.3 Abiotic EDB Degradation by Iron Containing Solids

Abiotic EDB degradation facilitated by reduced iron minerals was investigated using chemically synthesized minerals purchased from commercial vendors. If sufficient degradation was noted, carbon isotope enrichment factors were determined. FeS (Sigma-Aldrich or Strem Chemicals, Inc.), FeS_2 (Strem Chemicals, Inc.), $FeCO_3$ (City Chemicals, LLC), Fe_3O_4 (Strem Chemicals, Inc.), and Fe_2O_3 (Strem Chemicals, Inc.) were purchased from the indicated vendors and added to 250 mL Boston round bottles with Teflon-lined caps in a Coy anaerobic chamber. Anaerobic synthetic groundwater (0.5 mg/L $MnSO_4$-H_20; 50 mg/L Na_2SO_4; 56 mg/L NaCl; 20 mg/L $NaHCO_3$) buffered at a pH value of approximately 7.3 with 0.04 M HEPES was then added, and spiked with EDB to 6-10 mg/L. Samples were collected periodically, preserved with HCl, and analyzed for EDB concentrations via GC/MS in CB&I's Analytical and Treatability Laboratory via GC/MS and EDB stable carbon isotopes at Tomasz Kuder's laboratory at the University of Oklahoma. To facilitate the evaluation of EDB degradation products, a second set of nearly identical samples was prepared in 160 mL serum bottles and used to evaluate reduced gases (i.e., methane, ethane, ethene, and propane) by headspace sampling.

2.3 RESULTS AND DISCUSSION

2.3.1 Isotopic Fractionation of Carbon in EDB by Bacterial Cultures

Initial EDB concentrations ranged from 0.025 to 0.05 mM in these experiments and degradation was noted with each culture tested. Figure 1 shows changes in EDB concentration observed during the experiments with time. Significant degradation was noted with all cultures within 24 hours, including greater than 99 % degradation for the anaerobic cultures SDC-9 and Hawaii-05 within 5 hours. Anaerobic culture PJKS was tested twice as its isotope fractionation was notably different from the other two anaerobic degrading cultures.

Figure 2 shows carbon isotope fractionation of EDB by the tested bacterial cultures. If one assumes that isotope fractionation can be described as a Rayleigh process, then the relevant enrichment factors, ε, can be determined from the following equation:

$$\delta^{13}C = \varepsilon \ln F + \delta^{13}C_0$$

Where $\delta^{13}C_0$ and $\delta^{13}C$ are the carbon delta value describing the relative $^{13}C/^{12}C$ ratios of EDB before and after degradation, F is the fraction of the initial quantity of EDB remaining, and ε is the enrichment factor. Figure 3 shows the linearized form used to determine ε values for the fractionation observed. Experimentally determined ε values for all treatability experiments are listed in Table 1. There were at least three general levels of isotope fractionation observable during biological degradation of EDB. The methanotrophic culture *M. palustris* appears to fractionate carbon isotopes the least, with ε = -2.7 ± 0.2 ‰. *M. sphagni* ENV482, SDC-9, and Hawaii-05 fractionate the EDB with ε values ranging from -5.7 ‰ to -8.7 ‰, which is consistent with experiments by Henderson et al. (2008) where an ε value of – 5.7 ‰ was determined for EDB degradation in anaerobic microcosms. It is interesting to note that the fractionation associated with the aerobic degradation by *M. spagni* ENV482 is similar to that of the anaerobic debrominating cultures SDC-9 and Hawaii-05. The isotope fractionation of EDB associated with the anaerobic PJKS culture is much greater with ε = -17.6 ‰ and -20.1 ‰ during duplicate experiments. The reason for this large fractionation is unknown, but it is similar to the greater fractionation associated with abiotic degradation processes as described below.

2.3.2 Hydrolysis of EDB in Water at Elevated Temperatures

Initial EDB concentrations in the hydrolysis experiments were 0.035 to 0.06 mM. Figure 4 shows changes in EDB concentration for the three hydrolysis experiments performed at 60 °C, 75 °C, and 90 °C. Assuming Arrhenius type behavior for changes in hydrolysis rates with temperature, an activation energy, E_a for EDB hydrolysis was determined to be 130 ± 60 kJ/mol, which is consistent with previous studies where E_a for hydrolysis was determined to range from 80 to 100 kJ/mol (Reinhard and Vogel, 1988; Weintraub, 1989). Bromide measured during these experiments indicate an approximate yield of two moles of bromide for each mole of EDB degraded, which is consistent a previous investigations of EDB hydrolysis, where ethylene glycol was the dominant degradation product (Weintraub, 1989).

Figure 5 shows carbon isotope fractionation of EDB by hydrolysis. As above, if a Rayleigh process is assumed, one can determine the relevant enrichment factor for hydrolysis. Figure 6 shows the linearized form used to determine ε values for the fractionation observed, and all ε values are listed in Table 1. While there is some variability in determined enrichment factors, ε values for hydrolysis ranged from -17 ‰ to -21 ‰ with an average of -19.4 ‰, and do not appear very sensitive to temperature. The isotope fractionation observed for the hydrolysis experiments is consistent with other observed cases of abiotic EDB degradation, as observed below, as well as degradation by the PJKS culture noted above.

2.3.3 Abiotic EDB Degradation by Iron Containing Solids

Initial EDB concentrations in the abiotic degradation experiments were approximately 0.035 mM. Figure 7 shows changes in EDB concentration with time for EDB reactions with $Fe_3O_{4(s)}$, $FeS_{2(s)}$, and $FeS_{(s)}$. Changes in EDB concentration with $FeCO_{3(s)}$ and $Fe_2O_{3(s)}$ were not significantly different than Fe_3O_4 or controls and are not included in Figure 7 for clarity. Accounting for the concentration of FeS, the second order rate constant of EDB degradation is $0.23 \pm 0.03\ M^{-1}d^{-1}$, which is consistent with previous study where the second order rate constant was determined to range from 0.19 to 0.32 $M^{-1}d^{-1}$ (Kuder et al., 2012). Because small changes in EDB were difficult to measure, the degradation rate by FeS_2 was estimated by measurement of its degradation product ethene, and was determined to occur with a second order rate constant of $0.020 \pm 0.001\ M^{-1}d^{-1}$, approximately an order of magnitude slower than the FeS solid. We have not identified previous kinetic data for FeS_2 catalyzed EDB degradation. Near complete stoichiometric conversion of EDB to ethene was observed for both FeS and FeS_2.

Figure 8 shows carbon isotope fractionation of EDB catalyzed by FeS and FeS_2. As earlier, if a Rayleigh process is assumed, one can determine the relevant enrichment factor for degradation by these reduced iron minerals. Figure 9 shows the linearized form used to determine ε values for the fractionation observed, and all ε values are listed in Table 1. The ε value for EDB degradation catalyzed by FeS was determined to be -20.0 ± 1.9 ‰, which is consistent with the range of previous observations (Kuder et al., 2012; Wilson et al., 2008). The ε value for EDB degradation catalyzed by FeS_2 was determined to be -34.6 ± 8.6 ‰, but there is much greater uncertainty associated with this value due to smaller amount of degradation that occurred during the experimental period. However, it should be noted that the enrichment factor for FeS_2 catalyzed degradation is not significantly different from the range of enrichment factors noted for FeS in previous investigations (Kuder et al., 2012). It would be worthwhile to run longer duration experiments to further investigate EDB degradation catalyzed by FeS_2. As no degradation was catalyzed by Fe_3O_4, $FeCO_3$, or Fe_2O_3 over the experimental period, enrichment factors for these minerals were not determined.

2.4 SUMMARY

Significant carbon isotope fractionation was observed during EDB degradation by biotic and abiotic means. The carbon isotope enrichment factors associated with these various degradation mechanisms are described in Table 1. Carbon isotope fractionation was greater during abiotic reactions with an enrichment factor, ε, of -20 ‰, with only degradation by FeS_2 being greater, but with large uncertainties. It is interesting that carbon isotope fractionation by the anaerobic PJKS culture was similar to abiotic reactions (Figure 10). Aside from the PJKS culture, carbon isotope fractionation associated with EDB biodegradation was smaller. This is noteworthy, as these reactions were also observed to be the fastest. The determination of these enrichment factors helps establish the range of EDB isotope fractionation one may expect in the field related to EDB degradation, and provides valuable information needed to utilize carbon isotope data for constraining EDB degradation rates and evaluating predominant mechanism(s).

3.0 KIRTLAND AFB SPECIFIC TREATABILITY TESTING

3.1 INTRODUCTION

CB&I conducted laboratory treatability studies to evaluate alternative EDB bioremediation approaches being considered for demonstration at the Kirtland AFB Bulk Fuels Facility (BFF). Because EDB is present at Kirtland AFB together with benzene, toluene, ethylbenzene, and xylenes (BTEX), the impacts of the bioremediation approaches on BTEX compounds was also investigated during treatability testing. These treatability studies were supported by this ESTCP project and other DoD supported remediation efforts at Kirtland AFB.

Treatability tests were performed to assess the degradation of EDB and BTEX compounds under aerobic and anaerobic conditions using batch microcosms filled with aquifer materials (solids and water) collected at two Kirtland AFB BFF locations. One location was in an area where fuel associated non-aqueous phase liquid (NAPL) was previously observed, and the other was crossgradient and much less impacted by EDB and BTEX compounds. Different amendments were used to determine their effects on the rates of biotic and/or abiotic degradation of EDB and BTEX in the aquifer samples. Oxygen and inorganic nutrients were added to samples from each location in order to investigate potential aerobic degradation of EDB and BTEX. Additionally, two aerobic bacterial cultures previously isolated at CB&I and known to degrade EDB were tested using the site specific materials. Anaerobic treatments included sulfate alone, sulfate in combination with ferrous iron, and sulfate in combination with ferrous iron, lactate and inorganic nutrients. These amendments were included to enhance the growth of sulfate-reducing bacteria (SRB) and produce sulfide minerals capable of abiotic EDB degradation. SRB may also degrade BTEX. An anaerobic dehalogenating culture that was previously observed to degrade EDB was also investigated using the site specific materials to determine whether anaerobic bioaugmentation could be used to promote rapid EDB biodegradation at Kirtland AFB.

The data presented herein provide information on alternative approaches for enhancing EDB and BTEX degradation at Kirtland AFB. The sections that follow describe the study materials, set-up and sampling methods, results, and conclusions.

3.2 MATERIALS AND METHODS

3.2.1 Sample Location and Collection

Aquifer core samples were collected from two locations at Kirtland AFB (Figure 11). Greater concentrations of BTEX and EDB were expected at the first site located ~ 11 meters (m) upgradient of existing well KAFB-106079 and in an area where fuel LNAPL was previously observed. The samples from this location are referred to as “Source Area.” A new groundwater monitoring well was installed at this location after coring was complete (KAFB-106210). The second core samples were collected during the replacement of well KAFB-10612, which is located at the edge of the plume and expected to have lower BTEX and EDB concentrations based on existing site data. A new well was installed in this location (KAFB-10612R). These samples are referred to as “Sidegradient.” Because NAPL was never observed in the area of this well, these latter samples were used to evaluate the effect of amendments on BTEX and EDB in an area of the plume with only dissolved phase contamination.

3.2.1.1 Groundwater

Groundwater used for the laboratory testing was collected from well KAFB-106210 for the Source Area microcosms and from well KAFB-106012R for the Sidegradient microcosms. The water was collected in sterile stainless steel soda kegs (18.5 L) with no headspace using a Bennett pump according to procedures established for monitoring well sampling at Kirtland AFB. CB&I routinely uses this type of soda keg for shipment and storage of anaerobic cultures. Collection of groundwater samples in these soda kegs enabled large quantities of groundwater to be obtained and stored under anoxic conditions. Soda kegs were filled to overflowing to eliminate headspace. One soda keg of groundwater was collected from each well. Upon collection, the soda kegs were placed in coolers with ice and shipped overnight to CB&I's Biotechnology Development and Applications Group (BDAG) laboratory in Lawrenceville, NJ. Upon receipt, the soda kegs were inspected and stored at 4 °C.

3.2.1.2 Aquifer Solids

Aquifer solids used for the laboratory microcosm testing were collected during construction of the new wells described above (KAFB-10612R and KAFB-106210). Aquifer solids were collected in acetate sleeves during coring. The core sleeves were sectioned in the field to fit into shipping coolers, the ends of each core were labeled and sealed to limit intrusion of air during sample shipment and storage, and core sleeves were sealed in nitrogen flushed bags. A minimum of 3.5 kg of soil (approximately 1.8 m of core, assuming a 3.8-cm diameter acetate sleeve) was requested for this work, allowing for losses during sieving, etc. Upon collection, the soil cores were placed in a cooler with ice and shipped overnight to CB&I's BDAG laboratory in Lawrenceville, NJ. Upon receipt, the soil cores were inspected and stored at 4 °C.

3.2.2 Source Area Microcosms

Aquifer solids from well KAFB-106210 (ten cores representing 487 – 501 ft below ground surface (bgs)) were received in acetate sleeves and stored at 4^{o}C until used in microcosm setup. At the time of microcosm setup, the acetate sleeves (all except for 489 ft bgs and 496 ft bgs, which were kept intact for NAPL analyses) were placed in an anaerobic chamber with a hydrogen-free nitrogen gas atmosphere. Soil was removed from the acetate sleeves, passed through a 0.635-cm sieve, and homogenized by hand using a modified cone-and-quarter technique. Homogenized soil (30 g) was immediately placed into sterile serum bottles (total volume = 160 mL).

Two initial microcosms were prepared to determine whether sufficient quantities of EDB and BTEX were present in site materials for the treatability testing. These two microcosms were prepared with 30 g of homogenized soil and groundwater from KAFB-106210. The headspace was <1 mL. These unamended microcosms were allowed to shake gently on their sides at 15 ^{o}C for 24 hours, after which time they were sampled. Aqueous samples were removed and analyzed (with expedited turnaround time) for BTEX and EDB. These initial microcosms yielded the following results (average of duplicate microcosm values): EDB 225 μg/L, benzene 2560 μg/L, toluene 6600 μg/L, ethylbenzene 735 μg/L, meta- and para-xylenes 1950 μg/L, and o-xylene 840 μg/L. These results indicated sufficient quantities of contaminants for the study, and as such, no contaminant spike was required.

3.2.2.1 Treatments and Amendments

Treatments were prepared in quintuplicate (5 replicate bottles) as follows:

Treatment 1. Killed Anaerobic Control: These bottles received mercuric chloride ($HgCl_2$; 1000 mg/L) to inhibit biological activity. This treatment was used to evaluate abiotic losses of BTEX and EDB under anaerobic conditions (e.g., evasion from bottles, adsorption/desorption from soil).

Treatment 2. Killed Aerobic Control: These bottles received mercuric chloride (1000 mg/L) to inhibit biological activity and 100 % oxygen gas in the headspace. This treatment was used to evaluate abiotic losses of BTEX and EDB under aerobic conditions (e.g., evasion from bottles, adsorption/desorption from soil).

Treatment 3. Unamended Live Control: These bottles received no amendments, consisting of aquifer solids and groundwater only. This treatment was used as a control to help evaluate the effectiveness of the other amendments in contrast to natural attenuation of the BTEX and EDB in the microcosms.

Treatment 4. Oxygen + Inorganic Nutrients: These treatments received inorganic nutrients in the form of diammonium phosphate (DAP; 50 mg/L), and 100 % oxygen gas in the headspace. These microcosms were used to evaluate oxygen as a terminal electron acceptor coupled to the degradation of BTEX and EDB, and also to evaluate whether the presence of oxygen inhibits any ongoing natural EDB degradation.

Treatment 5. Sodium Sulfate: These bottles received sodium sulfate (100 mg/L) to serve as a terminal electron acceptor for sulfate-reducing bacteria. These microcosms were used to evaluate whether sulfate stimulates degradation of BTEX and EDB in the microcosms.

Treatment 6. Sodium Sulfate and Ferrous Chloride: These bottles received sodium sulfate (100 mg/L) and ferrous chloride ($FeCl_2$; 100 mg/L). These microcosms were used to evaluate whether ferrous iron (Fe^{2+}) aids the degradation of BTEX and EDB, either by protecting microorganisms from potentially inhibitory concentrations of sulfide (S^{2-}), or by abiotic degradation reactions from either sulfide or iron sulfide species (e.g., FeS).

Treatment 7. Sodium Sulfate, Ferrous Chloride, and Sodium Lactate: These bottles received sodium sulfate (100 mg/L), ferrous chloride (100 mg/L), lactate (100 mg/L), and inorganic nutrients as DAP (50 mg/L). The addition of sodium lactate in this treatment was used to stimulate naturally-occurring microorganisms, such as *Dehalococcoides spp.* and sulfate reducers in site soils, thereby enhancing degradation of EDB and/or BTEX.

Treatment 8. Sodium Sulfate, Ferrous Chloride, Sodium Lactate, and SDC-9 Consortium: These bottles received sodium sulfate (100 mg/L), ferrous chloride (100 mg/L), lactate (100 mg/L), inorganic nutrients in the form of DAP (50 mg/L), and CB&I's SDC-9 bioaugmentation culture (mixed dehalogenating bacteria including *Dehalococcoides* (DHC) and *Dehalogenimonas*) at a final optical density of 0.1 (~3 X 10^7 DHC cells/mL).

Treatment 9. Inorganic Nutrients: These bottles received inorganic nutrients in the form of DAP (50 mg/L). This treatment was identical to Treatment 3 but with the addition of supplemental nitrogen (N) and phosphorus (P).

Treatment 10. Sulfate plus Nutrients: These bottles received sodium sulfate (100 mg/L) and inorganic nutrients in the form of DAP (50 mg/L). This treatment was identical to Treatment 5 but with the addition of supplemental N and P.

Treatment 11. Sodium Sulfate and Ferrous Chloride plus Nutrients: These bottle received sodium sulfate (100 mg/L), ferrous chloride (100 mg/L), and inorganic nutrients in the form of DAP (50 mg/L). This treatment was identical to Treatment 6 with the addition of supplemental N and P.

3.2.2.2 Microcosm Preparation

Homogenized aquifer solids (30 g) were initially added to each microcosm in a hydrogen-free nitrogen atmosphere Coy anaerobic chamber. The amendments listed in Section 2.2.1 were then added to the appropriate microcosms, and the microcosms were filled with site groundwater such that the headspace in each bottle was negligible (i.e., less than 1 mL headspace). Twenty mL of groundwater was removed from the aerobic treatments (i.e., Treatments 2 and 4), and the resulting headspace was replaced with 100 % oxygen gas. Microcosms were sealed using Teflon-lined butyl rubber stoppers and aluminum crimp caps. Bottles were incubated at 15 ^{o}C on their sides with gentle shaking. Photographs of microcosm setup are provided in Figure 12, and a photograph of the completed microcosms after some sampling is provided in Figure 13. Triplicate bottles from each treatment, designated A, B, and C, were used to monitor EDB, BTEX, and reduced gases. A single bottle, designated D, from each treatment was used to monitor pH, anions, volatile fatty acids (VFAs) and dissolved iron. A separate single bottle, designated E, was used to for split samples of BTEX compounds to be analyzed at CB&I's ATL and an outside laboratory. These split samples were analyzed from five of the anaerobic treatments per sampling event. For the aerobic treatments, this single bottle (i.e., bottle E) was used to monitor headspace oxygen levels. Split samples were requested by local regulators, but we did not observe problems with CB&I's analyses.

3.2.2.3 Microcosm Sampling and Analysis

All microcosm sampling (with the exception of headspace oxygen levels) was performed in a Coy anaerobic chamber containing a hydrogen-free nitrogen gas atmosphere. Aqueous samples were removed at time zero (T=24 hours; 5/23/14) and again at 1, 2, 3, and 5 months from replicates A, B, and C from each treatment to monitor EDB, BTEX, and reduced gases (i.e., methane, ethane, ethene, propane, and acetylene). The sampling dates were as follows: 1 month

(6/23/2014), 2 months (7/22/2014), 3 Months (8/19/2014), and 5 months (10/20/2014). After 5 months, there was insufficient groundwater volume remaining in the microcosms for further sampling and analysis. The analytical methods used and the laboratories performing the analysis are provided below and in Table 2. EDB samples (~9 mL) were preserved with HCl and shipped to Empirical Laboratories (Nashville, TN), where they were analyzed via EPA Method SW8011. BTEX samples (~9 mL) were preserved with HCl and analyzed in-house in CB&I's ATL via EPA Method SW8260B. Reduced gas samples (2 mL) were preserved with HCl and analyzed in CB&I's ATL via EPA Method 3810, RSK-175.

In addition to the samples listed previously, aliquots were removed from a single replicate (replicate D) from each treatment in order to monitor pH (2 mL analyzed via hand probe), anions and volatile fatty acids (one 5 mL filter-sterilized sample analyzed via EPA Method 300.0 for both parameters), and dissolved iron (3 mL removed and preserved with nitric acid and analyzed via Hach kit). VFAs were analyzed only for those treatments receiving lactate (i.e., Treatments 7 and 8). Additional anion sampling was performed more frequently, usually once every 2 weeks. The dates of additional anion sampling (in addition to the 1, 2, 3, and 5 month samples), for these microcosms were 6/4/2014, 7/8/2014, 8/5/2014, 9/3/2014, and 10/2/2014. Sterile glass beads were used to replace the volume of groundwater removed from each microcosm at each sampling time point. At the completion of each sampling event, the headspace of all aerobic microcosms (i.e., Treatments 2 and 4) was replaced with 20 mL oxygen gas via injection through the septa.

Immediately prior to each sampling event, headspace oxygen levels in one replicate of each aerobic treatment (i.e., Treatments 2 and 4) were measured via direct headspace injection on a GC using a standard curve to estimate headspace oxygen concentration. Additionally, headspace oxygen levels were measured weekly during the first three months of incubation and twice monthly during months 4 and 5 to ensure that the aerobic microcosms did not become limited in oxygen. If oxygen levels in the headspace were less than 20 %, the headspace gas was replaced with 100 % oxygen.

3.2.3 Sidegradient Microcosms

Aquifer solids from well KAFB-10612R (six cores representing 489 – 498 ft bgs) were received in acetate sleeves and stored refrigerated at 4 ^{o}C until used in microcosm setup. At the time of microcosm setup, the acetate sleeves were placed in a Coy anaerobic chamber with a hydrogen-free nitrogen gas atmosphere. Aquifer solids removed from the acetate sleeves, passed through a 0.635-cm sieve, and homogenized by hand using a modified cone-and-quarter technique. Soil (30 g) was immediately placed into serum bottles (total volume = 160 mL).

As described for the Source Area, two initial microcosms were prepared to determine whether sufficient quantities of EDB and BTEX were present in site materials for the treatability testing. These two microcosms were prepared with 30 g of homogenized aquifer solids and groundwater from KAFB-10612R. The headspace was <1 mL. These microcosms were allowed to shake gently on their sides at 15 ^{o}C for 24 hours, after which time the microcosms were sampled. Aqueous samples were removed and analyzed (with expedited turnaround time) for BTEX and EDB. These initial microcosms yielded the following results (average of duplicate microcosm values): EDB 0.20 μg/L, benzene 1.8 μg/L, toluene 14.6 μg/L, ethylbenzene <1.3 μg/L, m- and para-xylenes ≤1.2 μg/L, and o-xylene <0.85 μg/L. In the case of ethylbenzene and all xylenes, one microcosm had no detection of these compounds, and the replicate microcosm yielded estimated J values. The observed concentrations of EDB and the BTEX compounds were considered to be too low for the purposes of this study, so the concentration of each was increased when the study was set-up (See Section 2.3.2).

3.2.3.1 Treatments and Amendments

Treatments for the Sidegradient microcosms were prepared in quintuplicate (5 replicate bottles) as described for Source Area microcosms in Section 2.2.1.

3.2.3.2 Microcosm Preparation

The Site groundwater used in this study was prepared in one large (9 L) batch in a gastight Mylar bag 24 hours prior to being used in microcosm setup. Concentrated solutions of EDB, benzene, toluene, ethylbenzene, and xylenes dissolved in purified water were prepared and added to the Mylar bag in order to bring the level of these contaminants to desired concentrations. The Mylar bag containing the groundwater was then placed on a shaker and gently shaken for 24 hours at 15 ^{o}C to allow for equal distribution of the contaminants throughout the 9 L of groundwater. After 24 hours, the groundwater was immediately tested for BTEX concentrations, yielding the following: benzene (~400 μg/L), toluene (~300 μg/L), ethylbenzene (~200 μg/L), and xylenes (~150 μg/L). These concentrations were adequate for microcosm testing. As CB&I does not have EPA Method 8011 capabilities in-house, immediate EDB testing on the spiked groundwater was not possible, however, as the BTEX compounds were all within an acceptable range, we expected that EDB concentrations would be as well, thus microcosm setup was completed.

Microcosms were prepared essentially as described in Section 2.2.2. Homogenized aquifer solids (30 g) were initially added to each microcosm in the Coy anaerobic chamber, the amendments listed in Section 2.2.1 were then added to the appropriate microcosms, and the microcosms were filled with site groundwater such that the headspace in each bottle was negligible (i.e., less than 1 mL headspace). 20 mL of groundwater was then removed from the aerobic treatments (i.e., Treatments 2 and 4), and the resulting headspace was replaced with 100 % oxygen gas. Microcosms were sealed using Teflon-lined butyl rubber stoppers and aluminum crimp caps. Bottles were incubated at 15 ^{o}C on their sides with gentle shaking.

3.2.3.3 Microcosm Sampling and Analysis

Microcosms were sampled in an identical fashion to those prepared with Source Area site materials. Samples were obtained, preserved, and analyzed as described above (see Section 2.2.3). Microcosms were sampled at time zero (6/25/2014) and again at 1 (7/23/2014), 2 (8/20/2014), 4 (10/21/2014), and 7 (1/21/2015) months of incubation for BTEX, reduced gases, anions, VFAs, dissolved iron, pH, and percent oxygen. As with the Source Area microcosms, samples for anions, VFAs, and percent oxygen were obtained more frequently.

The time zero EDB data indicated that the initial EDB spike yielded a final concentration of EDB in most microcosms of ~0.06 μg/L, with six microcosms having time zero EDB values below detection (i.e., <0.04 μg/L). It is unclear why EDB was not higher in these samples as all bottles were presumably spiked to an estimated concentration of 5 μg/L. However, these low EDB concentrations were inadequate for microcosm testing purposes and, as such, all microcosms were re-spiked with additional EDB at the one month time point (7/23/2014). Each bottle was spiked using a small aliquot of concentrated EDB in purified water via a Gastight needle through the septum. The bottle was immediately shaken vigorously by hand for 1 minute and solids were allowed to settle for ~15 minutes, after which the bottle was sampled as per normal protocols. This additional EDB spike yielded concentrations of ~4.4 μg/L EDB per microcosm. The 1 month sample point was considered time zero for the purposes of reporting EDB concentration data. Thus, while EDB was sampled at the same time and sampling events as BTEX, the time points for EDB only were time zero, one, three, and six months.

At 56 and 152 days of incubation, Treatments 7, 8, 9, 10, and 11 received an additional amendment of DAP (50 mg/L). At 152 days of incubation, Treatment 4 received an additional amendment of DAP (50 mg/L).

3.2.4 Aerobic Biostimulation Test

The following microcosm study was performed to examine aerobic biostimulation substrates in the Sidegradient zone. Microcosms were prepared using the same Site materials in the same quantities (i.e., 30 g soil from 10612R in a 160-mL serum bottle) as detailed in Section 2.3 above. Microcosm treatments were prepared in a Coy anaerobic chamber as follows:

3.2.4.1 Treatments and Amendments

The following treatments were prepared for the aerobic biostimulation microcosms.

Treatment 1. Killed Control: These bottles received mercuric chloride (1000 mg/L) to inhibit biological activity, and were used to evaluate abiotic loss of EDB;

Treatment 2. Live Control: These bottles received no amendments (i.e., they consisted of Site soil and groundwater only) to evaluate natural degradation of EDB.

Treatment 3. Ethane Biostimulation: These bottles received inorganic nutrients in the form of DAP (50 mg/L), and ethane and oxygen gases in the headspace. The headspace volume in each bottle (20 mL) consisted of 3 % ethane / 97 % oxygen. These bottles were used to ascertain whether bacteria capable of ethane degradation were potentially present at the Site and capable of being stimulated to degrade EDB via co-metabolism following the addition of exogenous ethane;

Treatment 4. Methane Biostimulation: These bottles received inorganic nutrients in the form of DAP (50 mg/L), and methane and oxygen gases in the headspace. The headspace volume in each bottle (20 mL) consisted of 3 % methane / 97 % oxygen. These bottles were used to ascertain whether bacteria capable of methane degradation (i.e., methanotrophs) were potentially present at the Site and capable of being stimulated to degrade EDB via co-metabolism following the addition of exogenous methane;

Treatment 5. Propane Biostimulation: These bottles received inorganic nutrients in the form of DAP (50 mg/L), and propane and oxygen gases in the headspace. The headspace volume in each bottle (20 mL) consisted of 3 % propane / 97 % oxygen. These bottles were used to ascertain whether bacteria capable of propane degradation (i.e., propanotrophs) were potentially present at the Site and capable of being stimulated to degrade EDB via co-metabolism following the addition of exogenous propane.

3.2.4.2 Microcosm Preparation

All microcosms were filled with groundwater such that the headspace in each bottle was negligible (i.e., less than 1 mL headspace). Each microcosm was then spiked with EDB to a final aqueous concentration of ~4 mg/L. A higher concentration of EDB was used in these microcosms in order to perform CSIA on the EDB samples where degradation was observed, and so that EDB could be analyzed at CB&I ATL using EPA Method 8260B (see next section). 20 mL was then removed from each aerobic microcosm, and the resulting headspace was replaced with the indicated gas mixture. Microcosms were sealed using Teflon-lined butyl rubber stoppers and aluminum crimp caps and shaken gently at 15^{o}C.

3.2.4.3 Microcosm Sampling and Analysis

Aqueous samples were removed at time zero and again at 4, 9, 13, 20, and 27 weeks of incubation from all microcosms to monitor EDB concentrations. EDB samples for this study were analyzed at CB&I's ATL via EPA Method 8260B and consisted of 3 mL liquid placed in a 3 mL amber autosampler vial preserved with HCl and sealed using Teflon-lined butyl rubber septa and aluminum crimp seals. Samples of varying volumes were also removed to a 20 mL VOC vial, which was them brought to zero headspace using acidified distilled, deionized water (i.e., pH <2) for possible CSIA analysis (depending on extent of EDB degradation). Sterile glass beads were used to replace the volume of groundwater removed from each microcosm at each sampling time point.

3.2.5 Aerobic Bioaugmentation Test

To further explore aerobic options for EDB remediation, an additional aerobic microcosm study was prepared in which two aerobic bacterial strains isolated in CB&I's laboratories were tested for their ability to degrade EDB under conditions representative of those at Kirtland AFB. This study used the same site materials in the same amounts as those outlined in Section 2.4, however these microcosms were set up aerobically (i.e., not in an anaerobic chamber).

3.2.5.1 Treatments and Amendments

Treatment 1. ENV425 Bioaugmentation: These bottles received *Rhodococcus ruber* ENV425 to a final OD_{600} of 0.1. *R. ruber* ENV425 is a propanotroph isolated by CB&I's BDAG that has been demonstrated to degrade EDB in pure culture. These microcosms also received propane and oxygen gases in the headspace. The headspace volume in each bottle (20 mL) consisted of 3 % propane / 97 % oxygen;

Treatment 2. ENV482 Bioaugmentation: These bottles received *Mycobacterium sphagni* ENV482 to a final OD_{600} of 0.1. *M. sphagni* ENV482 is an ethane-degrading bacterium that was isolated by BDAG from an EDB-contaminated aquifer in MA (Joint Base Cape Cod), and has been demonstrated to rapidly degrade EDB in pure culture in laboratory studies. These microcosms also received ethane and oxygen gases in the headspace. The headspace volume in each bottle (20 mL) consisted of 3 % ethane / 97 % oxygen;

Treatment 3. Live Controls: These bottles received no amendments (i.e., they consisted of Site soil and groundwater only), and were used to evaluate aerobic degradation of EDB in the absence of added co-substrates.

Treatment 4. Killed Controls: These treatments received mercuric chloride (1000 mg/L) to inhibit biological activity.

3.2.5.2 Microcosm Preparation, Sampling, and Analysis

Microcosms were prepared as previously described, except that they were prepared in room air. All bottles received 30 g of homogenized site sediment and groundwater. A 20 mL headspace was left in the bottles for gas addition by removal of 20 mL of Site groundwater after bottles were prepared. All bottles were spiked with ~4 mg/L EDB at time 0. Aqueous samples were removed from all microcosms at time zero (immediately after EDB addition) and again at 4, 7, 11, 18, and 25 days to monitor EDB. EDB samples (3 mL) for this study were analyzed at CB&I's ATL via EPA Method 8260B.

3.3 RESULTS

Select results from microcosms are provided in the figures cited in the subsequent sections and all analytical results are provided in tabular format in Appendix A.

3.3.1 Source Area: Aerobic Treatments

3.3.1.1 EDB

The initial concentration of EDB in the Source Area aerobic microcosms was 213 ± 3 μg/L in the killed control (Treatment 2) and 239 ± 20 μg in the live bottles with nutrients added (Treatment 4). Over the course of the 5-month incubation, There was a loss of ~50 % of the original EDB in the live samples receiving oxygen and nutrients, while no comparative loss was observed in the killed control (Figure 14). After 5 months of incubation, 239 ± 5 μg/L of EDB was detected in the killed control samples and 123 ± 30 μg was detected in the aerobic bottle with nutrients (i.e., oxygen treatment). The most appreciable decline in EDB occurred from Month 2 to Month 3 of incubation, and the apparent rate of loss subsequently decreased from Month 3 to Month 5. The data suggest that aerobic biodegradation of EDB occurred in this treatment. However, the final concentration of EDB in Treatment 4 was greater than 100 μg/L after 5 months, and the rate of degradation appeared to decrease at later time points. As discussed further in Section 4, it is possible that this degradation was co-metabolic in nature (rather than growth-linked), and that the co-substrate was degraded with time, causing the rate of EDB biodegradation to decline.

3.3.1.2 BTEX

Concentrations of BTEX in the aerobic Source Area microcosms at time 0 were ~2,800 μg/L for benzene, 7,400 μg/L for toluene, 800 μg/L for ethylbenzene, and 3,200 μg/L for total xylenes (ortho-, meta- and para- combined). All of the BTEX compounds were rapidly degraded in the aerobic treatment microcosms with nutrients added (Treatment 4). Benzene concentrations were below detection (<12 μg/L) in the live aerobic treatment within the first three months of incubation (Figure 15). In the killed control, concentrations declined to ~1800 μg/L, presumably due primarily to volatile losses during sampling and exchange of headspace gas with oxygen. Similarly, toluene was degraded rapidly in the aerobic bottles, with ~44 μg/L remaining on average after 5 months, compared to ~4,500 μg/L in the killed control (Figure 16). Ethylbenzene degradation was similarly rapid in the live aerobic bottles, with all samples being below detection (<22 μg/L) after 2 months of incubation (Figure 17). Ortho-, meta-, and para-xylene degradation was also rapid, with greater than 97 % of the original para- and meta-xylene degraded within the first two months of incubation, and ortho-xylene below detection by Month 3 (total xylenes are presented in Figure 18). The data from this treatment indicate that BTEX compounds degrade when oxygen and nutrients are added to the aquifer materials.

3.3.1.3 Reduced Gases

Methane was detected in the aerobic bottles at very low concentrations (~10-35 μg/L) over the course of the study (with the exception of the 5-month sampling point, when all samples were < 2.2 μg/L). This low concentration of methane presumably was generated in the groundwater under anaerobic conditions in the aquifer, and persisted in the microcosms. Ethane, ethene, propane, and acetylene were below detection levels (i.e., <6 μg/L) in all aerobic microcosms over the course of the study. Methane data are provided in Appendix A.

3.3.1.4 Anions

Sulfate levels in the aerobic microcosms were ~30 mg/L at the start of the study and remained at this level (i.e., between 20 – 40 mg/L) throughout the time this study was performed (Figure 19), indicating that no sulfate reduction occurred. This is as expected, as sulfate reduction requires anaerobic incubation conditions.

Nitrate was present at a low concentration (~1.6 mg/L) in the microcosms at time zero and showed a general overall decline in both the live and killed samples, being below detection by 5 months. However, due to the small sample volume and dilution required due to comparatively high chloride in the samples, most values for nitrate over the course of the study were near the detection limit and were reported as estimated *J* values. Thus, no conclusions should be drawn concerning the fate of nitrate in the aerobic microcosm samples from the data. Nitrite was not detected in any anion samples over the course of the study. Nitrate and nitrite data are provided in Appendix A.

Phosphate was detected in the aerobic treatment that received DAP as a nutrient source, but not in the aerobic killed controls (which did not receive nutrients) over the course of this study. Dissolved phosphate concentrations in the live aerobic microcosms were ~ 6 mg/L at time zero, and varied between ~3 and 5 mg/L over the course of the study, indicating that enough phosphate was available for microbial growth and activity. A total of 36 mg/L of phosphate was added to the samples, which suggests that a large percentage formed insoluble precipitates, which is expected for this compound. Phosphate data are provided in Appendix A.

3.3.1.5 Oxygen

Headspace oxygen was monitored in the aerobic microcosms at least twice per month to ensure that the microcosms remained aerobic. Oxygen was replaced in the headspace after each sampling event and any time headspace testing revealed a headspace oxygen level of less than 20 %. The oxygen data are provided in Figure 20. Oxygen was steadily consumed in the live aerobic treatment during the first 2 months of incubation, indicating the presence of active aerobic bacteria. This is consistent with the biodegradation of BTEX that was observed during this period. The rate of oxygen consumption appeared to decline over time, which is also consistent with the much lower residual BTEX concentrations at later time points.

3.3.1.6 pH

The initial pH in the microcosms was neutral, with the killed controls having a starting pH of 6.6 and the live treatments having a pH of 7.4. Over the course of the study the pH increased to ~8 in both the live bottles (pH 7.9) and the killed control (pH 8.4) treatments (Figure 21). More significant increases were observed in the anaerobic microcosms (see Section 3.2). However, the pH in the microcosms was adjusted back to neutral (~7) on 8/22/2014 (3 months) using a small aliquot of HCl. Although a pH of 8 is most likely within an acceptable range for many organisms living at neutral pH, the pH was adjusted to prevent a potential increase to higher values. The pH in the aerobic microcosms again increased to ~8 by Month 5.

3.3.1.7 Dissolved iron

High levels of dissolved iron were detected in the killed control samples (>16 mg/L) during the course of this study. As high dissolved iron was noted in all of the killed controls (aerobic and anaerobic from both locations), this may be an effect of the addition of high concentrations of mercuric chloride to the samples as a killing agent, perhaps with Hg displacing Fe from aquifer particles. In the live aerobic treatment, dissolved iron was low throughout the study (<1.5 mg/L) with the exception of the Month 5 sample, where it increased to 6.7 mg/L. There was a similar increase of ~6 mg/L seen in both the control and the treatment bottled between the three and five month time points. We do not believe that this is an issue for concern, as oxygen levels in the bottles were high based on headspace analysis, so anoxic conditions were unlikely to have caused the increase in dissolved iron.

3.3.2 Source Area: Anaerobic Treatments

3.3.2.1 EDB

The initial average EDB concentrations in the different anaerobic treatments at time 0 ranged from 200 to 217 μg/L (Figure 22**)**. EDB degradation was observed in treatments that received the

SDC-9 dehalogenating culture (together with lactate, inorganic nutrients, ferrous iron and sulfate). In this treatment, the average EDB concentrations were below detection at month 1 (<0.09 μg/L), month 2 (<0.04 μg/L), and month 3 (<0.04 μg/L) sampling. An increase in EDB was observed in 2 of 3 replicate bottles at 5 months (to an average of 3.9 ± 1.7 μg/L). The reason for this increase is unclear but may represent desorption of residual EDB from the microcosm sediments (or partitioning from residual NAPL) or analytical error. It should be noted that, in this sample set only, Empirical Laboratories reported a 50-fold higher detection limit for these samples due to QA/QC non-conformance issues in the original analyses, so this increase may be the result of an analytical error rather than a real increase in EDB.

There was no decrease in EDB concentrations in any of the other anaerobic treatments, including the treatment that had lactate, inorganic nutrients, ferrous iron and sulfate, but no SDC-9 culture, showing that the bioaugmentation culture was responsible for the observed EDB biodegradation (Figure 22). This observation is consistent with other CB&I laboratory studies showing that SDC-9 culture rapidly biodegrades EDB **(**CB&I unpublished data; Figure 23**).** Treatments 6 and 7 (sodium sulfate only and sodium sulfate with ferrous chloride) are not shown in Figure 22 or any subsequent figures. The results from these treatments were not substantially different than their counterpart treatments that also received inorganic nutrients (i.e., Treatments 10 and 11, respectively). All data are provided in Appendix A.

3.3.2.2 BTEX

BTEX results from the anaerobic Source Area microcosms are presented in Figure 24 through Figure 27**,** for benzene, toluene, ethylbenzene and total xylenes, respectively. The results indicate that there was no significant reduction in BTEX concentrations in any of the anaerobic treatments compared to the killed anaerobic control samples. The moderate increases and decreases observed were nearly identical in all treatments and were observed for all BTEX compounds. None of the data provided evidence of BTEX degradation.

3.3.2.3 Reduced Gases

All Source Area microcosms started out with either trace or non-detectable levels of methane (i.e., 21 μg/L or less). Methane levels remained low in all microcosms with the exception of those receiving the SDC-9 bioaugmentation culture, in which methane increased to over 475 μg/L in all bottles within the first month of incubation, after which the levels steadily declined (Figure 28). Interestingly, ethene was also detected in the microcosms receiving SDC-9 after 2 months of incubation (26.7 ± 1.8 μg/L; Figure 29), but not in any other treatments. This ethene decreased slightly over time, but remained at 18.4 ± 2.1 μg/L after 5 months in these bottles. It is possible that the ethene detected was a degradation product from EDB by SDC-9. Stoichiometrically, 200 μg/L of EDB should produce ~30 μg/L of ethene upon degradation, which is very close to the quantity observed in these bottles at month 2. The primary degradation product of 1,2-dichloroethane by SDC-9 is ethene, so it is likely that this also is the primary product from EDB. Ethane, propane, and acetylene were not detected in any of the anaerobic microcosms over the course of this study.

3.3.2.4 Anions

Background chloride levels in the microcosms were ~100 mg/L chloride. As expected, baseline chloride levels were higher in microcosms amended with ferrous chloride and in the killed controls amended with mercuric chloride (~140 and 220 mg/L, respectively). There was little change in chloride values over the course of the study except for an expected increase in all treatments between 89 and 104 days due to pH adjustment with HCl. Chloride data are provided in Appendix A.

Baseline sulfate levels were ~30 mg/L sulfate in microcosms not receiving sodium sulfate as an amendment, and ~90 mg/L in microcosms receiving sodium sulfate (Figure 30). Sulfate reduction was observed in the SDC-9 bioaugmentation treatments over the first two months of incubation, however, sulfate reduction ceased thereafter, with ~25 mg/L sulfate persisting in these microcosms for the remainder of the study. The reduction of sulfate mirrored that of lactate in this treatment (see Section 3.5.7). There was no significant change in sulfate levels in any of the remaining microcosm treatments (i.e., biostimulation treatments or controls). Thus, over the course of the study, significant sulfate reduction only occurred in bottles with SDC-9, and that activity did not appear to be coupled to enhanced BTEX degradation.

As reported for the aerobic microcosms, nitrate was present at a low concentration (~1.6 mg/L) in the microcosms at time zero and showed a general overall decline in both the live and killed samples during 5 months. However, due to the small sample volume and dilution required due to comparatively high chloride in the samples, most values for nitrate over the course of the study were near the detection limit and were reported as *J* values. Despite the analytical limitations, there did not appear to be rapid degradation of nitrate in the bottles, as expected under strong reducing conditions. Nitrite was not detected in any samples over the course of the study. Nitrate and nitrite data are provided in Appendix A.

At time 0, phosphate was detected only in treatments receiving DAP as a nutrient source at ~5 mg/L, and only in those treatments that did not receive additional iron. It is likely that an iron-phosphate precipitate occurred in the bottles with extra iron added. Phosphate was observed at low concentration in many of the different treatments over the course of the study, including some of those with added iron, presumably due to shifting geochemistry in the bottles with time. At the conclusion of the study, iron was below detection in all treatments. Phosphate data are provided in Appendix A.

3.3.2.5 Dissolved Iron

In the treatments that did not receive ferrous chloride, dissolved iron concentrations started at <1 mg/L and remained as such throughout the duration of the study (Figure 31). Initial dissolved iron concentrations in treatments receiving ferrous chloride ranged from ~6 to 18 mg/L, with the highest being in the killed control sample, as previously noted and discussed for the aerobic microcosms. We believe that the addition of mercuric chloride as a killing agent resulted in the elevated iron concentrations in this treatment. Within 3 months, iron concentrations in the anaerobic live bottles were all reduced to 0.5 mg/L or less while the killed control increased to >

25 mg/L. At the last sampling event (5 months), dissolved iron was again detected in several of the treatments at 1-5 mg/L.

3.3.2.6 pH

The initial pH in the microcosms ranged from 6.6 to 7.4 (Figure 32). Over the course of the study, pH values in all of the treatments rose, eventually exceeding 8.5 in every treatment except the killed control. The pH in the microcosms was adjusted back to neutral (~7) at 92 days of incubation using a small aliquot of HCl. Continued pH monitoring indicated that, despite the addition of HCl, the microcosms returned to pH $\geq$ 8.5 by Month 5. The reason for this rise in pH in unclear, but it may be an effect of the static microcosm conditions (i.e., no opportunity for dispersal of breakdown products or influx of fresh groundwater). The rise in pH may also have been caused by the addition of glass beads to the bottles after each sampling event (potentially due to leaching from the soda lime glass), although it is unclear why the rise in the aerobic bottles was less if this were the primary cause. The rise in pH was not as apparent in microcosms that had not had liquid samples removed (i.e., “E” bottles that were not sampled for split BTEX samples; see Section 3.2.8). It is uncertain if the increase in pH was sufficient to have inhibited some microbial activity (See Section 4).

3.3.2.7 Volatile Fatty Acids

VFAs were monitored only in treatments that received lactate as an amendment (i.e., Treatment 7, lactate biostimulation, and Treatment 8, SDC-9 bioaugmentation; Figure 33). The data indicate that all lactate (~100 mg/L) added to the bioaugmentation microcosms was converted to acetate within 2 months of incubation, with the majority of the lactate degradation occurring during the second month of incubation. In contrast, lactate in the lactate biostimulation treatments was degraded at a steady but slower rate during the second and third months of incubation, after which lactate utilization and acetate production ceased. There was no degradation of acetate in any of these microcosms.

3.3.3 Sidegradient Area: Aerobic Treatments

3.3.3.1 EDB

As described in the Materials and Methods Section (Section 2.3.3), EDB was spiked into the Sidegradient microcosms to achieve an expected concentration of 5 µg/L just prior to the 1 month sampling event. In the aerobic microcosms the initial spike of EDB resulted in 1 month concentrations of 4.7 ± 0.1 µg/L in the killed control and 4.3 ± 0.1 µg/L in the live aerobic bottles with nutrients (Figure 34). EDB concentrations steadily decreased in the aerobic nutrient-amended bottles over the course of the study. By month 7 (i.e., 6 months after the EDB was added), the concentration of EDB in the microcosms was < 0.04 µg/L, 0.06 µg/L, and 0.09 µg/L in the three replicates, giving an conservative average of 0.06 ± 0.03 µg/L (averaging the non-detect value at 0.04 µg/L). In contrast, 3.5 ± 0.1 µg/L of EDB remained in the aerobic killed controls at the conclusion of the study. Thus, as with the Source Area microcosms, the data indicate aerobic biodegradation of EDB in the Sidegradient microcosms in the presence of nutrients and oxygen.

3.3.3.2 BTEX

BTEX results for the Sidegradient aerobic microcosms are provided in Figure 35 through Figure 38 for benzene, toluene, ethylbenzene and total xylenes, respectively. As observed with the Source Area microcosms, the BTEX compounds were rapidly degraded in the microcosms receiving oxygen and inorganic nutrients. From starting concentrations ranging from ~350 µg/L for benzene to ~150 µg/L for total xylenes, all BTEX compounds were below detection within one month of incubation in the live aerobic treatment, while nearly all of the BTEX (>90 %) remained for each compound in the killed aerobic controls after 1 month. Slow volatile losses were observed for BTEX in the killed controls during the seven month period, but the losses in the live samples clearly represent rapid biodegradation.

3.3.3.3 Reduced Gases

The aerobic Sidegradient microcosms started out with trace levels of methane (~25 µg/L) at time 0. Methane levels remained low in the microcosms and, with the exception of one killed control sample (which had 20 µg/L methane), methane was below detection (< 2.2 µg/L) in all aerobic samples after 7 months of incubation. The methane most likely was present in the site groundwater and was slowly lost with time as headspace gas was replaced with oxygen. Ethane, ethane, propane, and acetylene were never detected in any of the microcosms over the course of this study. Reduced gas data are provided in Appendix A.

3.3.3.4 Anions

Sulfate levels in the aerobic microcosms were ~125 mg/L at the start of the study and remained at this level throughout the time this study was performed, indicating that no sulfate reduction occurred (Figure 39). This is as expected, as sulfate reduction requires anaerobic incubation conditions.

Nitrate was present at ~2.9 mg/L in the microcosms at time zero. Within the first month of incubation, nitrate concentrations in all microcosms (including killed controls) declined marginally to ~1.8 mg/L, where they remained for the duration of the study (Figure 40). Thus, there was no evidence that nitrate was reduced in the aerobic treatments, as expected. Nitrite was not detected in any anion samples over the course of the study.

Phosphate concentrations in the live aerobic microcosms were ~5.3 mg/L at time zero, and declined steadily to below detection (i.e., <0.14 mg/L) within 70 days of incubation. Additional DAP was added on Day 152, but phosphate levels at Day 167 and thereafter remained below detection, indicating that the additional phosphate had been consumed or that it precipitated from solution. Phosphate data are provided in Appendix A.

3.3.3.5 Oxygen

Headspace oxygen was monitored in the aerobic microcosms at least twice per month to ensure that the microcosms remained aerobic. Oxygen was replaced in the headspace after each sampling event. Oxygen levels in the live aerobic treatment remained above 42 % oxygen in the headspace over the course of the study, indicating that the microcosms did not become limited in oxygen at any point (Figure 41).

3.3.3.6 pH

The initial pH in the microcosms was neutral to slightly basic, with the killed control having a starting pH of 7.2 and the live aerobic treatment having an initial pH of 8.1. Over the course of the study, and as observed with aquifer materials from the Source Area, the pH increased in both the live and the killed control bottles with time (Figure 42). The pH in the killed controls never exceeded 8.2, while that in the live aerobic treatment reached a high 9.3. The pH in all of the aerobic microcosms was reduced to neutral (~7) using a small aliquot of HCl at Days 58 and 119. However, continued pH monitoring indicated that the pH increased after each addition of acid to >8.5 in the live aerobic samples, and much less significantly in the killed controls. Despite the increase in pH, complete or nearly complete EDB and BTEX degradation occurred in the live aerobic treatment.

3.3.3.7 Dissolved iron

High levels of dissolved iron were detected in the killed controls (>30 mg/L) during the course of this study. As discussed previously, this trend was noted in all of the killed controls, aerobic and anaerobic, and likely represents ion exchange or another effect of the mercuric chloride used as a microbial killing agent. In the live treatment, dissolved iron concentrations remained at or below 4 mg/L over the course of the study. Iron data are provided in Appendix A.

3.3.4 Sidegradient Area: Anaerobic Treatments

3.3.4.1 EDB

In the Sidegradient anaerobic microcosms, EDB degradation was only observed in the microcosms that received the SDC-9 bioaugmentation culture (Figure 43**)**. In this treatment, EDB was degraded to below detection (i.e., <0.04 µg/L) within one month of incubation, and remained below detection for the remainder of the study. During month 3 the reported detection limit for EDB was slightly higher at 0.19 µg /L. Although slight losses of EDB were observed over time in all treatments, there was no significant loss of EDB in any of the live anaerobic treatments compared to the killed control treatment over the course of this study. In order to improve the clarity of the figure, Treatments 6 and 7 (sodium sulfate only and sodium sulfate plus ferrous chloride) are not shown; the results of these treatments were not different than their counterpart treatments that also received inorganic nutrients (i.e., Treatments 10 and 11, respectively). The data for all treatments are provided in Appendix A.

3.3.4.2 BTEX

The initial concentration of benzene in the microcosms after spiking was ~400 µg/L (Figure 44). Over the course of 7 months, the concentrations in the killed control declined to ~299 ± 13 µg/L. The final concentration in the various live treatments ranged from 172 ± 149 µg/L (with one sample being non-detect accounting for the high standard deviation) in samples that received nutrients only to 295 ± 18 µg/L in bottles that received sulfate, iron and lactate. The concentration of benzene was lower in the treatments with sulfate only, sulfate with nutrients, and sulfate, nutrients, iron and SDC-9, than it was in the killed controls. Thus, more benzene degradation occurred in these samples compared to the killed control, but the results were not particularly dramatic over the 7 month incubation period.

Toluene concentrations averaged ~300 µg/L in the various anaerobic microcosms after spiking (Figure 45). Over the first few months of incubation, greater losses of toluene were observed in some of the live treatments, including especially those with nutrients only, no addition (live control) and sulfate plus nutrients compared to the killed control. This toluene degradation generally slowed with time. After 7 months of incubation, however, the concentration of toluene was significantly lower in the live treatments with no addition, nutrients only, sulfate plus nutrients, and sulfate, nutrients, iron and SDC-9, compared to the killed controls. Thus, anaerobic degradation of toluene was apparent in several of the anaerobic treatments. A similar trend was not observed in the Source Area microcosms.

The concentration of ethylbenzene at time 0 was ~225 µg/L (Figure 46**).** Over the course of 7 months, concentrations of ethylbenzene in all treatments declined gradually, but there was no significant difference between the killed control and any of the live treatments. The results were similar for ortho-xylene, which was initially present in microcosms at a concentration of ~30 µg/L (Figure 47). There was no evidence of enhanced degradation of ortho-xylene in the live versus the killed treatment. Meta- and para-xylene were rapidly degraded from an initial concentration of ~130 µg/L to <14 µg/L in the live microcosms receiving no amendment, nutrients, sulfate and nutrients, or sulfate, iron, and nutrients (Figure 48). The meta- and para-xylene were also degraded to below detection in the treatments with sulfate only, and sulfate with iron (data not shown). Degradation in the remaining treatments, each of which had lactate added along with other amendments, was similar to the killed control. The data suggest that degradation of meta- and para-xylene is naturally occurring under anaerobic conditions in these samples, and that lactate may inhibit this process. Similar results were not observed in the source Area, where no appreciable degradation of BTEX was observed.

3.3.4.3 Reduced Gases

As previously observed for the aerobic microcosms, the anaerobic Sidegradient microcosms had trace levels of methane (~25 µg/L) at time 0 (Figure 49). In bottles that received the SDC-9 culture, methane increased to a concentration of ~380 µg/L by month 1, and gradually declined thereafter. There was no evidence of appreciable methane generation in any of the other bottles, rather the concentrations gradually declined with time. Ethane, ethene, propane, and acetylene were never detected in any of the microcosms over the course of this study. Reduced gas data are provided in Appendix A.

3.3.4.4 Anions

Baseline sulfate levels in the Sidegradient microcosms were ~124 mg/L (Figure 50). This concentration was increased to ~180 mg/L in microcosms that received sodium sulfate as an amendment. Sulfate losses were observed in the treatment receiving lactate, sulfate, iron and nutrients as amendments (Treatment 7) and in the treatment with each of these amendments plus the SDC-9 culture (Treatments 8) over the first two months of incubation, however, sulfate remained reasonably constant thereafter, with ~140 - 160 mg/L persisting with time. There was no significant change in sulfate levels in any of the remaining microcosm treatments. The declining sulfate coincided with lactate degradation in these treatments (See Section 3.4.6).

Nitrate averaged ~2.8 mg/L in the anaerobic microcosms at time 0 (Figure 51**)**. Nitrate was near or below detection (<0.2 mg/L) in all microcosms except for the Killed Controls (i.e., Treatment 1) by the one month sampling point and thereafter. Nitrite was not detected in any microcosm samples over the course of the study. The data clearly indicate nitrate reduction in the microcosms.

Phosphate was detected at ~5 mg/L in the treatments that received nutrients only (Treatment 9) or sodium sulfate plus nutrients (Treatment 10) at time zero and generally declined in these treatments during the first 6 weeks of incubation. Phosphate was not initially detected in any of the other anaerobic treatments to which it was added, probably due to precipitation with iron, which was added to each of these treatments. DAP was re-added to all appropriate treatments 56 days of incubation, and phosphate was detected in all treatments at this time. However, phosphate was below detection in all treatments thereafter. As previously noted, phosphate commonly forms insoluble precipitates, so it is not surprising that it is below detection in the aqueous phase in these microcosms. The phosphate data for all treatments are provided in Appendix A.

3.3.4.5 pH

The initial pH in the microcosms ranged from 7.2 to 8.1 (Figure 52). As observed in the Source Area microcosms, the pH in all of the treatments rose, eventually reaching values $\geq$ 9. The pH in the microcosms was adjusted back to ~7 at 58 days of incubation using a small aliquot of HCl. The pH in the microcosms returned to $\geq$9 by the next sampling point and was once again adjusted to neutral with HCl at Day 119.

3.3.4.6 Fatty Acids

VFAs were monitored only in treatments that received lactate as an amendment (i.e., Treatment 7, lactate biostimulation, and Treatment 8, SDC-9 bioaugmentation). All of the added lactate (~92 mg/L) was degraded within the first month in the microcosms receiving SDC-9 and within 2 months in the microcosms receiving lactate without the bioaugmentation culture (Figure 53). Acetate, a common fermentation product of lactate, was observed to concurrently increase with lactate biodegradation in each case, reaching ~88 mg/L in samples with SDC-9 and 48 mg/L in those without added bacteria culture. The acetate decreased slowly over time in the treatment with SDC-9, reaching 73 mg/L by month 7, but did not decrease further in the treatment without added bacteria culture.

3.3.4.7 Dissolved Iron

Starting dissolved iron concentrations in all the live samples were low, ranging from below detection (i.e., <0.1 mg/L) to 1.2 mg/L (Figure 54). After one month, dissolved iron had increased in all live treatments to an average of 4.6 mg/L. However, thereafter, aqueous concentrations decreased appreciably, and generally remained at < 1 mg/L. The killed controls had >30 mg/L of dissolved iron at time 0, which was reduced to ~17 mg/L by the conclusion of the study. As noted previously, high dissolved iron levels were observed in all of the killed controls, presumably due to the addition of high levels of mercuric chloride to the samples.

3.3.5 Aerobic Biostimulation and Bioaugmentation Tests

For these aerobic microcosm studies, EDB concentrations were increased to ~4 mg/L so that analysis could be done at CB&I by EPA Method 8260, and so that samples could be analyzed for carbon stable isotopes during biodegradation if desired. Aerobic biostimulation with ethane, methane, and propane did not result in enhanced degradation of EDB in microcosms over the six month incubation period (Figure 55).

When aerobic biostimulation failed to yield any appreciable EDB degradation after 2 months, a second set of aerobic microcosms was constructed in which two different aerobic pure cultures, a propane-degrading culture (*Rhodococcus ruber* ENV425) and an ethane-degrading culture (*Mycobacterium sphagni* ENV482), were tested for the ability to biodegrade EDB under Site conditions. Both cultures have been previously shown to degrade EDB in laboratory tests. While both cultures degraded EDB in the microcosms, the ethane-degrading bacterium ENV482 was able to degrade 4.5 mg/L EDB to non-detectable levels (i.e., less than 21 µg/L) within 11 days of incubation (method MDL reduced to 8.5 µg/L at subsequent time points) (Figure 56). In contrast, the propanotroph ENV425 degraded greater than 80 % of the original EDB (i.e., EDB concentrations reduced from 4.4 mg/L to 800 µg/L) before degradation ceased. It is likely that this culture would have degraded EDB to a lower level if additional propane was added to the microcosms. In either case, both cultures were shown to be capable of EDB biodegradation in site samples.

3.4 DISCUSSION AND SUMMARY

3.4.1 Background on Amendments

This laboratory study evaluated the potential for enhanced aerobic and anaerobic degradation of EDB and BTEX at two locations associated with the Kirtland AFB BFF plume. Aquifer samples were collected from a central area where NAPL was previously observed and a sidegradient area expected to have low concentrations of dissolved phase EDB and BTEX components. A series of different amendments were then added to the samples to evaluate their effect on EDB and BTEX degradation. The amendments added and the rationale for each is provided in the following section:

(1) **Oxygen, alkane gases, and nutrients** were added to evaluate EDB and BTEX degradation under aerobic conditions. The aerobic degradation of BTEX is well established, and oxygen biosparging is a common procedure used to remediate BTEX in shallow groundwater, as many different aerobic bacteria can use these compounds as growth substrates. The aerobic degradation of EDB has been reported both through co-metabolism and through growth-linked metabolism. Co-metabolic degradation of a contaminant generally occurs under aerobic conditions through the activity of one of several broad-specificity oxygenase enzymes. These enzymes are synthesized by the cells to degrade a primary substrate (such as methane, propane, toluene, ammonia or others) but also may have activity toward secondary compounds, such as EDB. In previous studies, EDB was observed to be susceptible to aerobic co-metabolism by methanotrophs (Hartzell et al., 2001; McKeever et al., 2012), propanotrophs (Hartzell et al., 2001; Hatzinger et al., 2015), ethane-oxidizing bacteria (Hatzinger et al., 2015), ammonia-oxidizing bacteria (Vannelli et al., 1990) and pentane-oxidizing bacteria (Danko et al., 2012). Enhanced co-metabolic degradation of EDB in aquifer microcosms with phenol as a substrate was also was recently reported (Baek et al., 2013).

In addition to co-metabolism, the aerobic degradation of EDB via growth-linked metabolism has also been reported. Early studies described the aerobic degradation of EDB in surface soils (Pignatello, 1986; Swindoll et al., 1988), but the organisms involved and degradation pathways were not established. Subsequently, *Mycobacterium* sp. strain GP1 was isolated from a soil enrichment and observed to grow on EDB under aerobic conditions in the absence of any co-metabolic substrate (Poelarends et al., 1999). Other strains, including *Xanthobacter autotrophicus* GJ10 (Janssen et al., 1985; Keuning et al., 1985) and *Acinetobacter* sp. strain GJ70 (Janssen et al., 1987), partially debrominate EDB under aerobic conditions using a haloalkane dehalogenase, but do not possess the enzymes to completely degrade or grow on it. Bromoacetaldehyde, a likely end product in these strains, can be toxic to the cells if not further metabolized (i.e., it is a “suicide substrate”). The extent to which aerobic, growth-lined metabolism of EDB occurs in groundwater aquifers including Kirtland AFB is unknown, but it would most likely occur in the aerobic downgradient area. Low EDB concentrations and/or absence of organisms with this metabolic ability may limit this process.

(2) **Sulfate and iron** were added together and in combination with inorganic nutrients. These amendments were added to stimulate the growth of sulfate-reducing bacteria and to promote the subsequent production of hydrogen sulfide and/or iron sulfide by these organisms in situ. Some sulfate-reducing bacteria have been reported to biodegrade BTEX (e.g., Anderson and Lovley, 2000; Edwards et al., 1992), and the addition of sulfate is currently accepted as one potential approach to enhance remediation of petroleum impacted groundwater (e.g., Cuthbertson and Schumacher, 2010). In addition, sulfate-reducing bacteria produce bisulfide (HS^-) during biodegradative reactions, which can subsequently react with Fe in solution or in the soil matrix to form mackinawite (FeS) and other iron sulfide minerals. Both FeS and HS^- have been observed to promote the abiotic reduction of EDB to ethene (Kuder et al., 2012; Wilson et al., 2008, and references therein).

(3) **Lactate with or without the SDC-9 dehalogenating culture** was added to promote enhanced anaerobic degradation of EDB. Besides aerobic degradation, EDB has been observed to be subject to anaerobic degradation via reductive debromination by *Dehalococcoides* spp. (DHC; Peethambaram, 2010; Yu et al., 2012), and possibly other dehalogenating bacteria such as *Dehalogenimonas, Dehalobacter,* and *Desulfitobacterium*. These dehalogenating organisms utilize molecular hydrogen (H_2) as an electron donor and various halogenated compounds, including EDB, as electron acceptors. During reaction with

DHC, EDB has been observed to be completely debrominated to form 2 Br^- and ethene (C_2H_4) by dihaloelimination (Yu et al., 2013). The CB&I culture SDC-9, which contains *Dehalococcoides* and *Dehalogenimonas* among other organisms, is capable of rapidly degrading EDB, so this culture was tested as a potential bioaugmentation culture in some treatments.

Lactate was added in order to supply H_2 necessary for native or bioaugmented dehalogenating bacteria to degrade EDB. Previous microcosm studies from a fuel-contaminated aquifer in South Carolina demonstrated enhanced EDB debromination to ethene with lactate addition (Henderson et al., 2008). Lactate is typically fermented by indigenous bacteria, a process which generates H_2 and acetate. In an aquifer contaminated with fuel, such as that at the Kirtland AFB BFF site, fuel components such as BTEX also can be anaerobically degraded to produce hydrogen (Vogt et al., 2011). Sewell and Gibson (1991), for example, demonstrated that the addition of toluene to aquifer microcosms could stimulate reductive dechlorination of tetrachloroethene under anaerobic conditions. Thus, in this case, degradation of petroleum hydrocarbons, including benzene and EDB may occur concurrently and be interdependent.

3.4.2 Anaerobic EDB Degradation in Microcosms

Under anaerobic conditions, the biodegradation of EDB was only enhanced in samples that were amended with the SDC-9 dehalogenating culture (along with lactate, inorganic nutrients, sulfate, and iron). None of the other amendments, whether added individually or in combination, were observed to promote EDB degradation within the observed time period. Moreover, in both the Sidegradient and Source Area microcosms, EDB was degraded to <0.04 µg/L in these treatments, and, in the Source Area, nearly stoichiometric production of ethene was observed after EDB biodegradation. These results strongly suggest that bioaugmentation (with addition of lactate and inorganic nutrients) can be a viable strategy for enhancing EDB biodegradation in the Kirtland AFB BFF aquifer in the NAPL and non-NAPL areas.

The addition of sulfate, with or without inorganic nutrients and iron, was not successful for enhancing anaerobic EDB biodegradation in either location. There was little evidence for the enhanced growth of sulfate reducing bacteria (e.g., no loss of sulfate with time) or the production of iron sulfide minerals (e.g., observation of black FeS in bottles), except in the treatment with SDC-9, in which sulfate reduction and iron sulfide formation were evident. There was also some evidence of initial sulfate degradation in Sidegradient samples that received lactate and nutrients without SDC-9. However, even in these cases, sulfate was not completely consumed in the bottles. It is unclear why sulfate reduction could not be stimulated in most treatments, even with addition of inorganic nutrients, which are likely to be limiting at this site with all of the available petroleum. A recent microbial gene analysis (Microbial Insights; Quantarray-Chlor; http://www.microbe.com/quantarray-chlor/) conducted separately with groundwater from several wells within the plume (Figure 57) suggests that sulfate-reducing bacteria are present in the aquifer, but clearly their activity was minimal in the microcosms (Figure 58). It is possible that the elevated pH in the microcosms played a role in limiting sulfate reduction, but given that sulfate was present in each of the different groundwaters collected for the microcosms at

~30 mg/L (Source Area) to 130 mg/L (Sidegradient), other unknown factors may also play a role in limiting this process in situ.

The microbial gene analysis conducted across the Kirtland AFB BFF plume also showed that many different dehalogenating bacteria are present in the contaminated region of the aquifer at reasonable densities (i.e., $>10^4$ cells/ml in some locations), including *Dehalogenimonas*, *Dehalobacter* and *Desulfitobacterium* (Figure 59). Interestingly, *Dehalococcoides* spp., which are the most prevalent dehalogenating bacteria in the SDC-9 culture, were not present at a significant density in the samples (i.e., $\leq 10^1$ cells/ml in most locations) (Figure 59). It is possible that the native dehalogenating strains are (1) not capable of EDB biodegradation; (2) capable of degrading EDB, but are not active in the locations where the samples were taken; (3) are actively degrading EDB at a very slow rate in situ, or (3) are actively degrading in situ, but were inhibited in the microcosm testing due to the slowly rising pH or another factor associated with sample collection and preparation. Further studies would be necessary to evaluate these options. However, the microcosm results clearly show that the SDC-9 culture was capable of rapid degradation under simulated site conditions.

3.4.3 Aerobic EDB Biodegradation in Microcosms

There was evidence of aerobic EDB biodegradation in both the Source Area and the Sidegradient microcosms. In the Source Area, EDB degraded from ~240 µg/L to ~123 µg/L over the 5 month study, with most of the degradation occurring between month 2 and month 3, and very little thereafter. This degradation pattern may indicate a co-metabolic process in which the primary substrate (i.e., an alkane or other compound present in groundwater) was degraded within the first few months of oxygen addition, resulting in initial EDB degradation by the growing cells, and then a stall in EDB degradation when the primary substrate was consumed. It is also possible, but less likely, that this was a growth-linked process given the low initial EDB concentrations and the lack of degradation after a few months with ~50 % residual EDB.

In Sidegradient microcosms, EDB was concentrations decreased from ~4.3 µg/L to < 0.06 µg/L over 6 months of incubation, and degradation was apparent throughout the entire incubation period (even with elevated pH). Because of the low EDB concentrations, it is likely that this degradation also represents a co-metabolic process. The initial concentration of EDB is likely to be too low to support significant growth-linked metabolism of EDB, although this is also not impossible depending on the characteristics of the native organisms degrading EDB. Overall, the laboratory study clearly showed potential for aerobic degradation of EDB in the aquifer samples, but the nature of this process (i.e., growth-linked vs co-metabolic) and its potential to treat Source Area EDB concentrations to low levels cannot be determined from the results.

Aerobic biostimulation with alkane gases failed to yield any appreciable EDB degradation after 2 months, however the elevated EDB concentrations (>4 mg/L) used in this specific set of microcosms may have had an inhibitory effect on indigenous bacteria. Two different aerobic pure cultures, a propane-degrading culture (*Rhodococcus ruber* ENV425) and an ethane-degrading culture (*Mycobacterium sphagni* ENV482), were capable of degrading >4 mg/L EDB in Site soil and groundwater. The ethane-degrading bacterium ENV482 was able to degrade 4.5 mg/L EDB to non-detectable levels within 11 days (Figure 56). The propanotroph ENV425 degraded greater than 80 % of the original EDB before degradation ceased. It is likely that this culture would have degraded EDB to a lower level if additional propane had been added to the microcosms. In either case, both cultures were shown to be capable of EDB biodegradation in Site samples.

3.4.4 Anaerobic BTEX Biodegradation in Microcosms

In the Source Area microcosms, there was no evidence of anaerobic BTEX degradation in the presence or absence of sulfate, nutrients or other amendments. This is consistent with the lack of apparent sulfate reduction in these microcosms as well (which would likely be linked to BTEX degradation). Conversely, in the Sidegradient microcosms, anaerobic degradation of some of the BTEX compounds was indicated in specific treatments. In particular, there was evidence of toluene, meta- and para-xylene degradation, and to a lesser extent, benzene degradation in various microcosms, with the meta- and para-xylene reaching non-detect in some treatments. In the case of toluene and the two xylenes, good degradation was observed even in the absence of added amendments, suggesting current natural attenuation of the compounds. Degradation was not apparent for ethylbenzene or o-xylene, and benzene losses, while statistically significant compared to the killed control, were rather marginal.

3.4.5 Aerobic BTEX Biodegradation in Microcosms

BTEX compounds are known to be readily degradable under aerobic conditions unless nutrients or other factors (e.g., bioavailability, pH) limit their degradation. In both the Source Area and the Sidegradient microcosms BTEX was rapidly degraded under aerobic conditions with nutrients added, generally to near or below the MDL for the study.

3.4.6 Summary

The general conclusions from this study are as follows:

1. Enhanced anaerobic bioremediation of EDB was most rapid and extensive using bioaugmentation with a dehalogenating culture along with lactate and nutrient addition. EDB concentrations <0.04 µg/L were achieved in both the Source Area and Sidegradient microcosms;
2. Significant sulfate reduction (and subsequent production of HS^- and FeS, each of which react abiotically with EDB) was not apparent in the Source Area or Sidegradient microcosms, except in the bottle with SDC-9 added;
3. Enhanced aerobic bioremediation of EDB was most rapid and extensive using bioaugmentation with an ethane-degrading culture. EDB concentrations were lowered to non-detectable levels (i.e., <8.5 µg/L) in these aerobic Sidegradient microcosms. A propane-degrading culture was also capable of degrading EDB in Site soil and groundwater;
4. Aerobic degradation of EDB was clearly observed, and EDB concentrations of <0.06 µg/L were achieved in the Sidegradent microcosms. However, EDB degradation stalled in the Source Area, with residual concentrations above 120 µg/L after 5 months of incubation. The nature of this biodegradative process is unclear, but may be aerobic co-

metabolism supported by another component of the fuel contamination (e.g., alkanes) that also biodegraded aerobically with time, so once the fuel source was degraded, the EDB degradation ceased.

5. Anaerobic BTEX degradation was not observed in the Source Area with any amendments, but was observed for specific compounds (benzene, toluene, meta- and para-xylene) in the Sidegradient Area. In the latter case, toluene and the two xylenes appeared to be degrading even in the absence of added amendments;
6. Aerobic BTEX degradation was extensive for all compounds and in both sets of microcosms;
7. Elevated pH was observed in both sets of microcosms over time, and the pH was adjusted back to neutrality on one or more occasions only to again increase. This pH increase is most likely an unexpected artifact of the treatability study design (e.g., due to sealed bottles or addition of glass beads to fill void space after sampling). Degradation of EDB and BTEX occurred in many instances irrespective of the pH increase in the bottles, but it is possible that this increase had an inhibitory effect on some processes (e.g., sulfate reduction).

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5.0 TABLES

Table 1. Isotope enrichment factors (ε) associated with the degradation mechanisms tested.

Degradation Experiment	ε (‰)
Biological Degradation	
Methylocella palustris	-2.7 ± 0.2
Mycobacterium sphagni ENV482	-5.7 ± 1.0
SDC-9	-8.7 ± 0.4
Hawaii-05	-7.4 ± 0.5
PJKS 1	-17.6 ± 1.6
PJKS 2	-20.1 ± 2.9
Abiotic Degradation	
Hydrolysis 60 °C	-17.1 ± 0.6
Hydrolysis 75 °C	-21.4 ± 3.4
Hydrolysis 90 °C	-19.7 ± 2.8
$FeS_{(s)}$	-20.0 ± 1.8
$FeS_{2(s)}$	-34.6 ± 8.6

Table 2. Analytical Methods.

Analysis	Method	Matrix	Approx. Sample Volume	Lab
VOCs	EPA Method 8260	Aqueous	8 mL	CB&I
EDB	EPA Method 8011	Aqueous	8 mL	Empirical Laboratories, LLC
Oxygen	TCD	Headspace	10 – 200 µL	CB&I
VFAs	EPA Method 3810, RSK-175	Aqueous	2 mL	CB&I
Anions	EPA Method 300	Aqueous	2 mL	CB&I
Dissolved iron	Hach Kit	Aqueous	2 mL	CB&I

GC – Gas Chromatograph
MS – Mass Spectrometer
TCD – Thermal Conductivity Detector
IC – Ion Chromatography

6.0 FIGURES

Figure 1. EDB degradation by bacterial cultures *Methylocella palustris*, *Mycobacterium sphagni* ENV482, SDC-9, PJKS, and Hawaii-05.

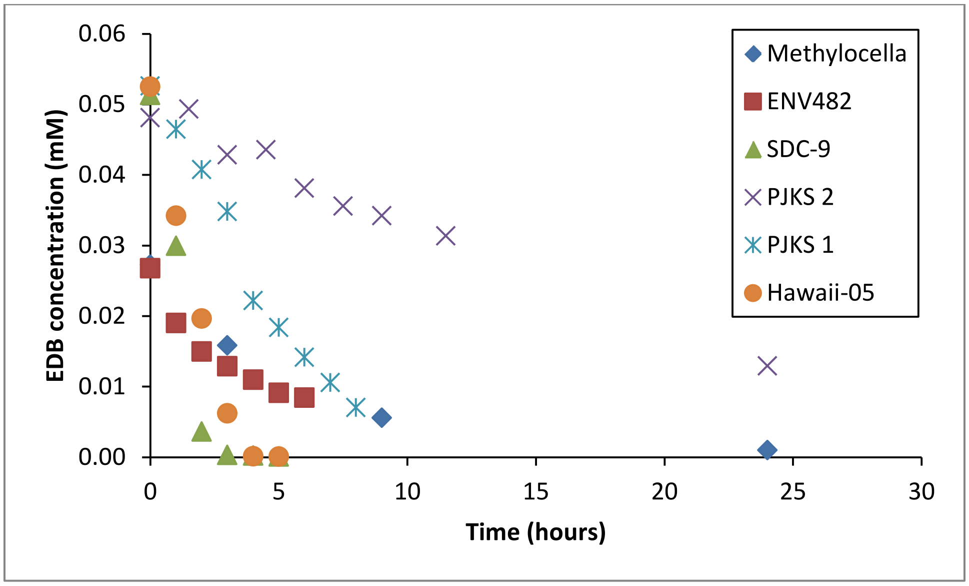


Figure 2. Carbon isotope composition of EDB undergoing degradation by bacterial cultures.

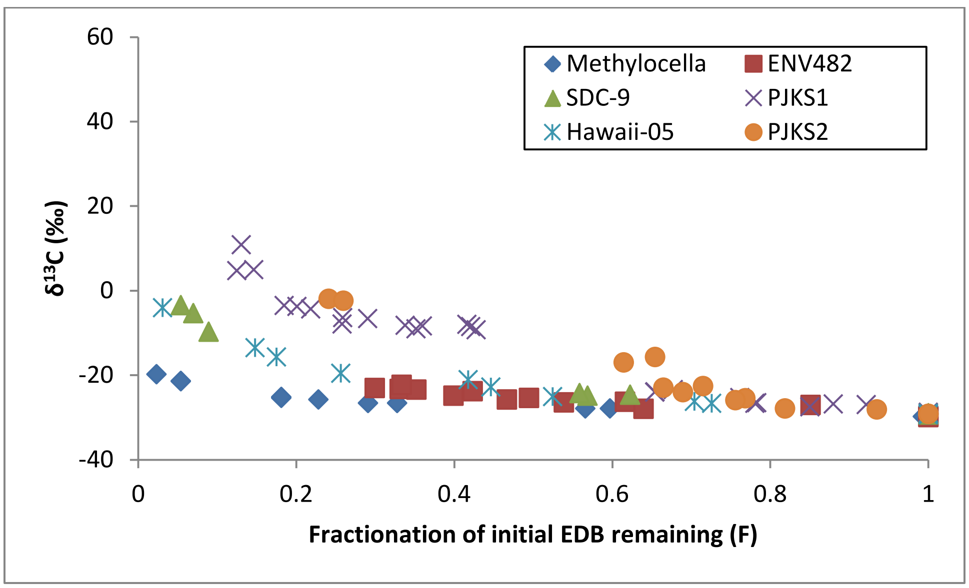


Figure 3.Carbon isotope fractionation associated with degradation by bacterial cultures. At least three differing degrees of fractionation are apparent. $\varepsilon_{Methylocella\ Palustris} \approx -2.7$ ‰, $\varepsilon_{SDC\text{-}9,ENV482,Hawaii\text{-}05} \approx -7.3$ ‰, and $\varepsilon_{PJKS} \approx -18.9$ ‰.

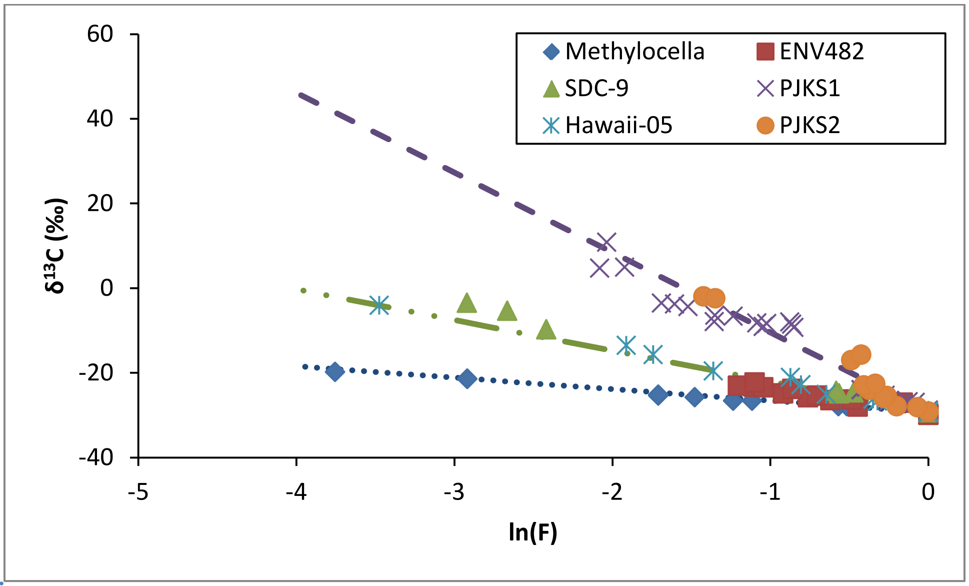


Figure 4. EDB degradation by hydrolysis at indicated temperatures.

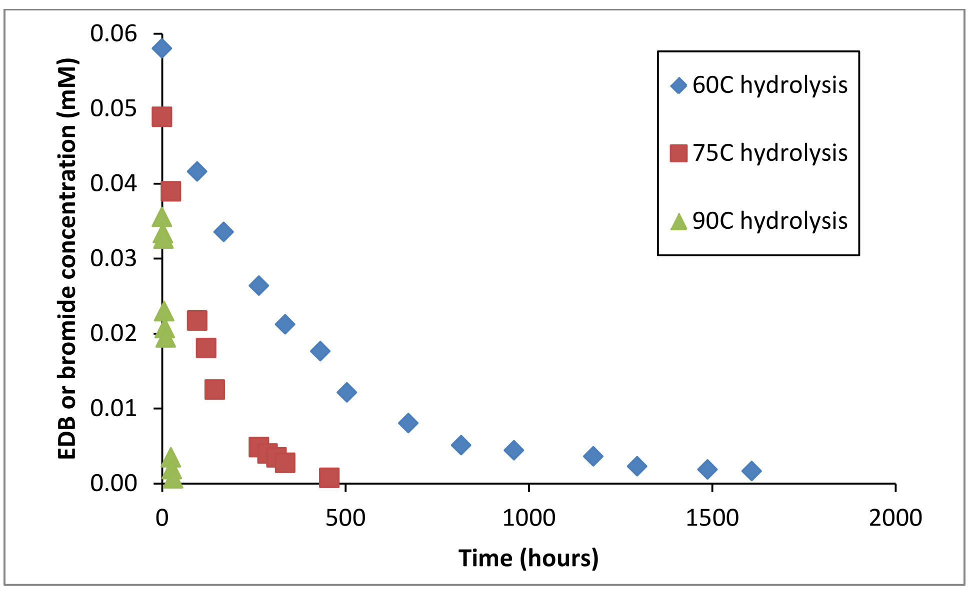


Figure 5. Carbon isotope composition of EDB undergoing degradation by hydrolysis.

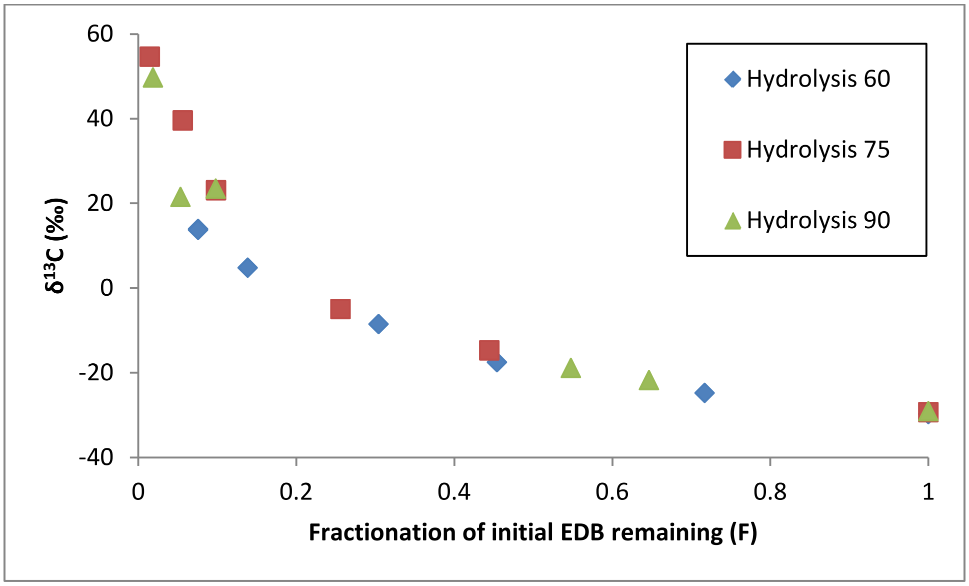


Figure 6. Carbon isotope fractionation associated with degradation by hydrolysis. The average enrichment factor, $\varepsilon_{hydrolysis}$, for the three experiments is – 19.4 ‰.

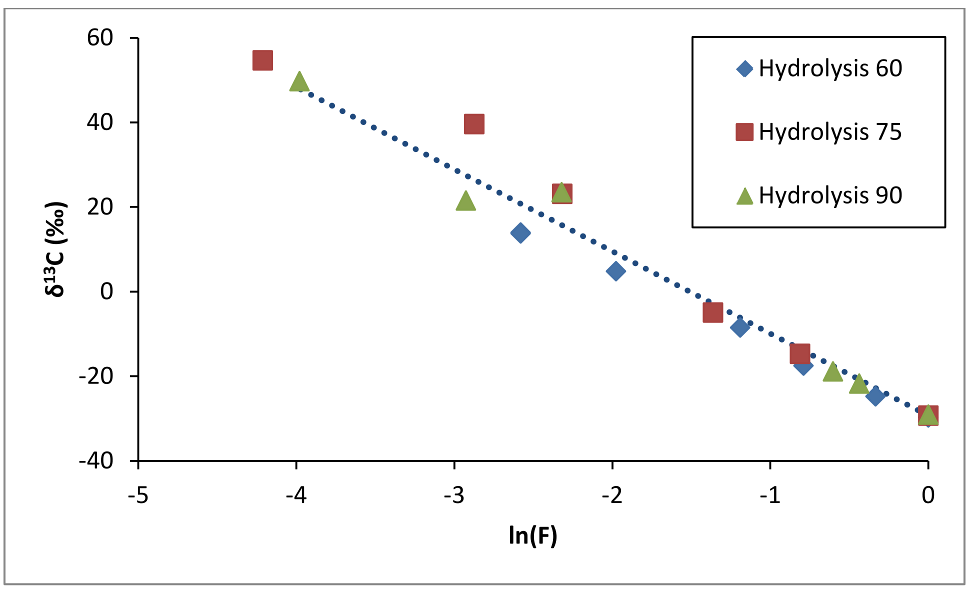


Figure 7. EDB degradation catalyzed by iron minerals. No degradation was apparent with Fe_3O_4. Degradation was observed by FeS and FeS_2.

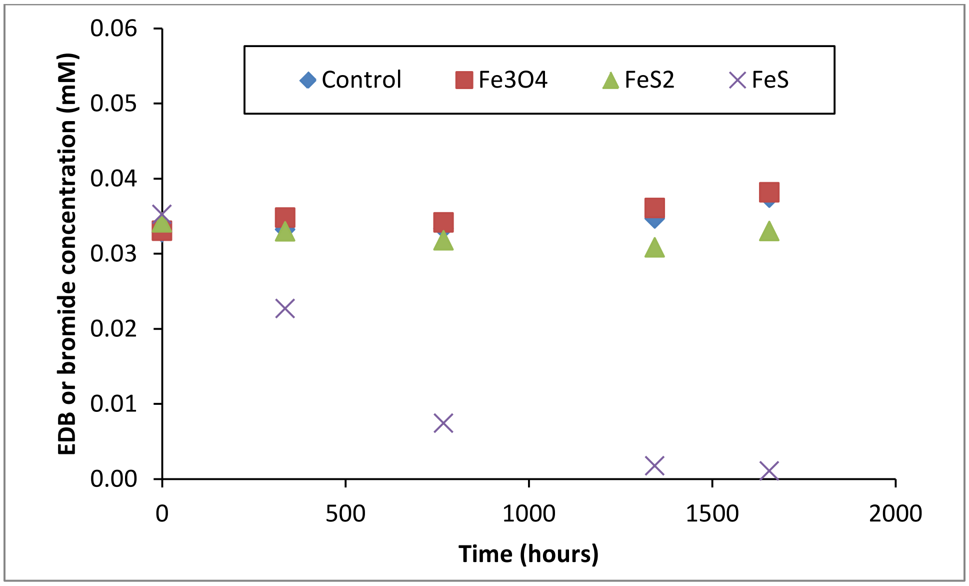


Figure 8. Carbon isotope composition of EDB after degradation catalyzed by FeS and FeS_2.

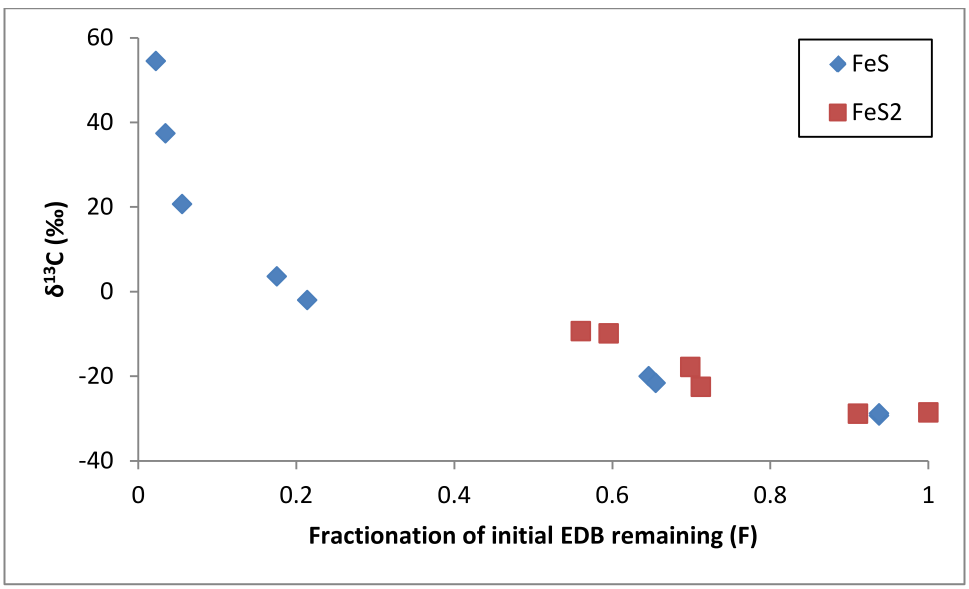


Figure 9. Carbon isotope fractionation associated with degradation catalyzed by FeS and FeS_2. The enrichment factors observed were ε_{FeS} = -20.0 ± 1.8 ‰ and ε_{FeS2} = -34.6 ± 8.6‰.

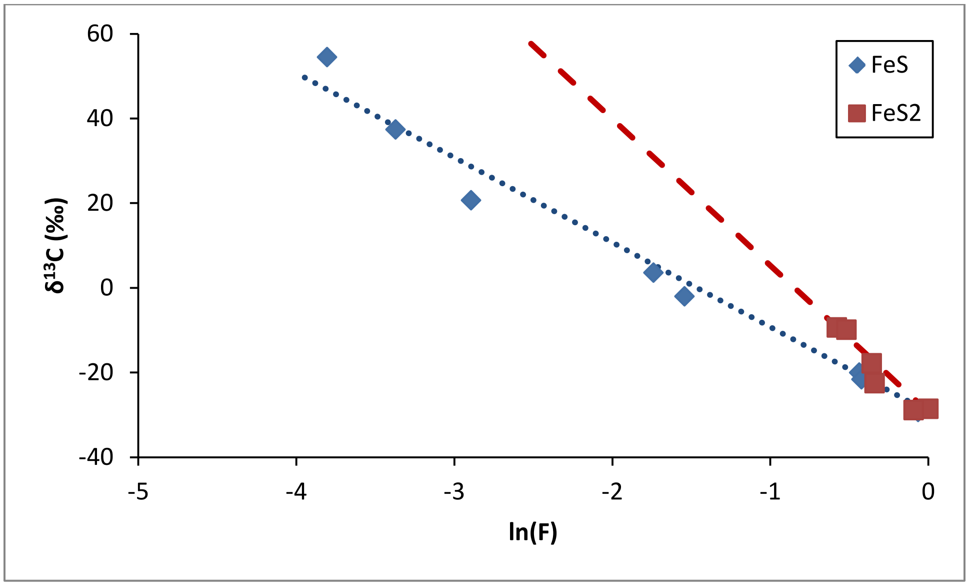


Figure 10. Carbon isotope composition of EDB after degradation by various abiotic mechanisms and biodegradation by anaerobic PJKS culture.

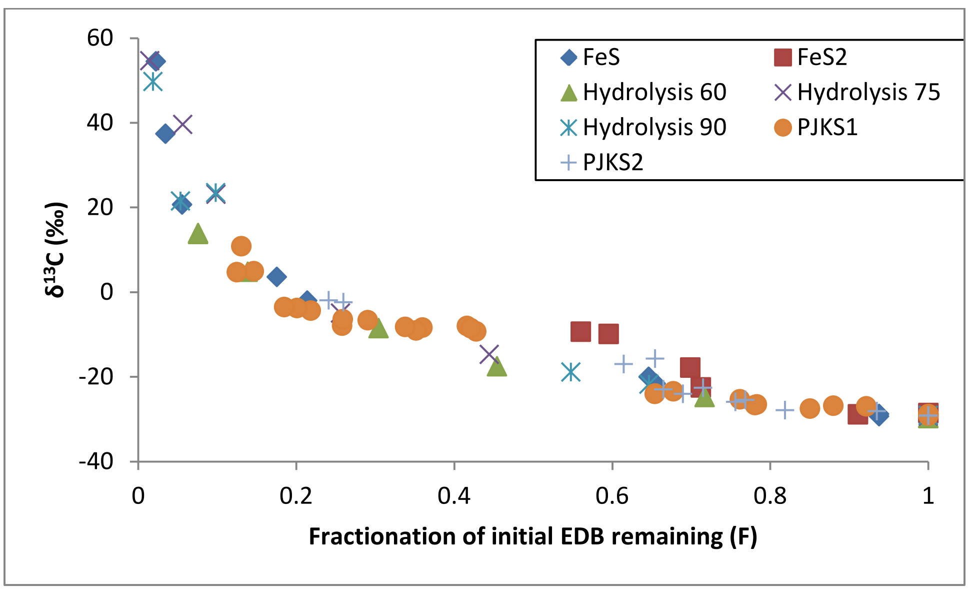


Figure 11. Locations of sample collection for microcosm study.

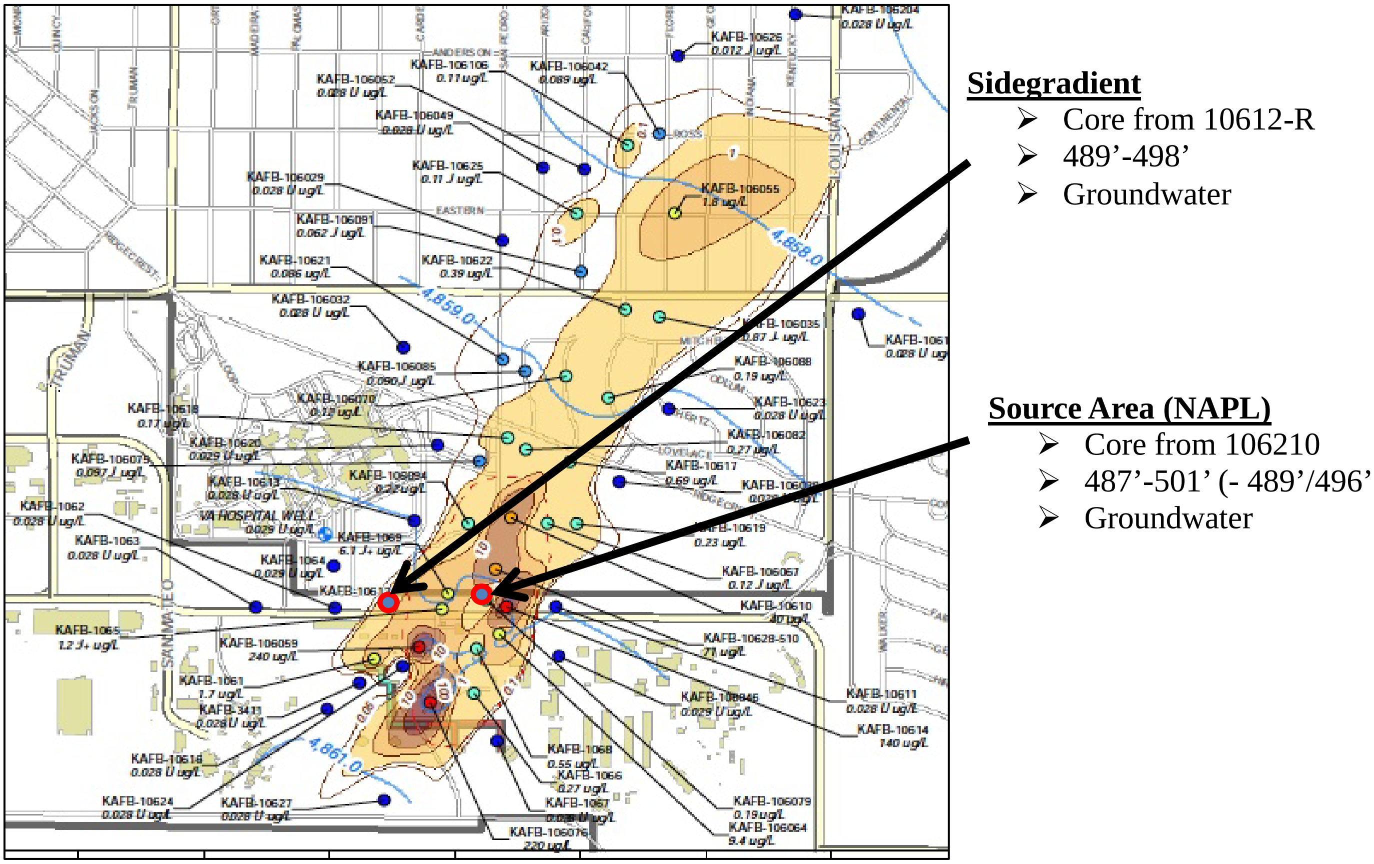


Figure 12. Photographs of microcosm set-up and sampling.

Figure 13. Photograph of microcosm bottles and schematic showing aerobic (A) and anaerobic (B) treatments. The small spheres in panel B represent glass beads which were added to fill void space after each sampling event.

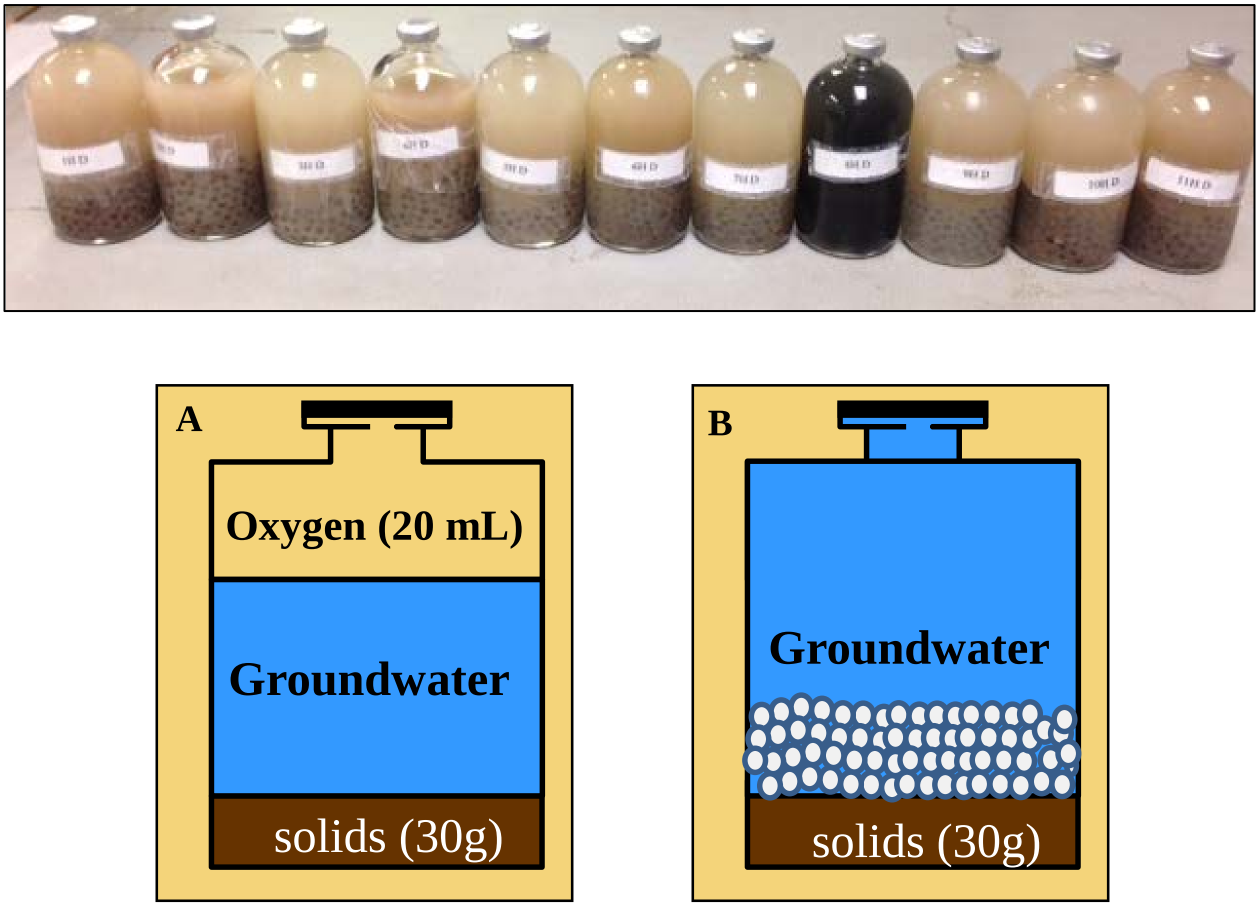


Figure 14. Concentration of EDB in aerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

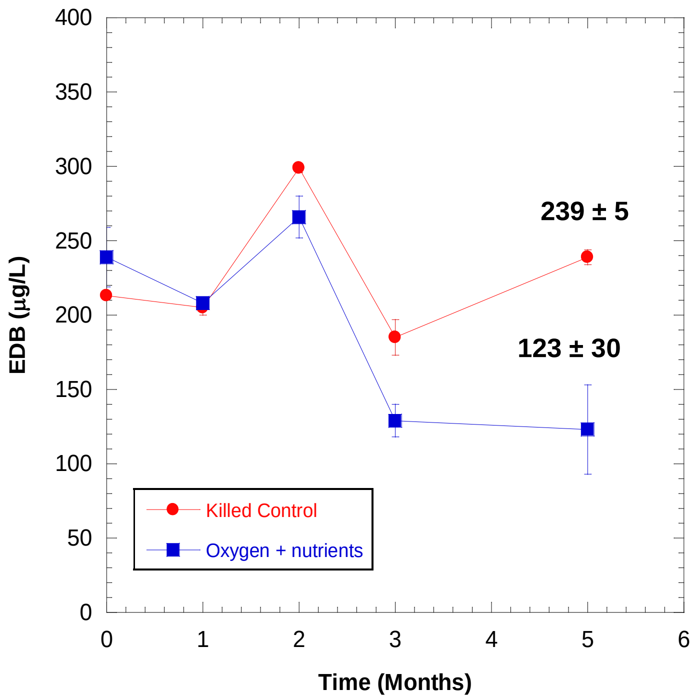


Figure 15. Concentration of benzene in aerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

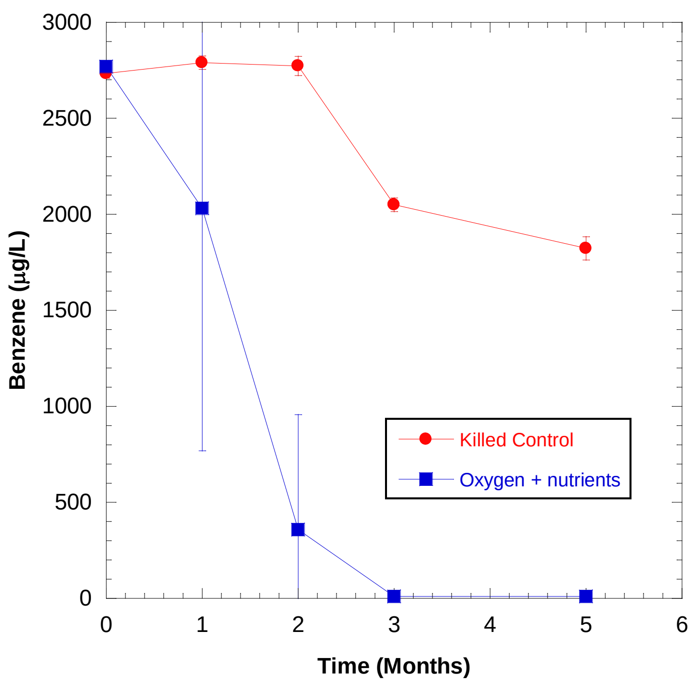


Figure 16. Concentration of toluene in aerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

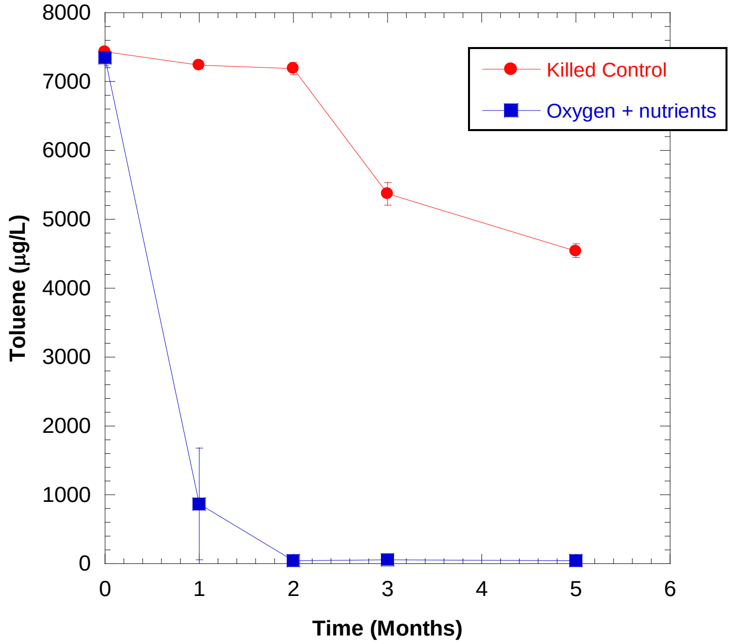


Figure 17. Concentration of ethylbenzene in aerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

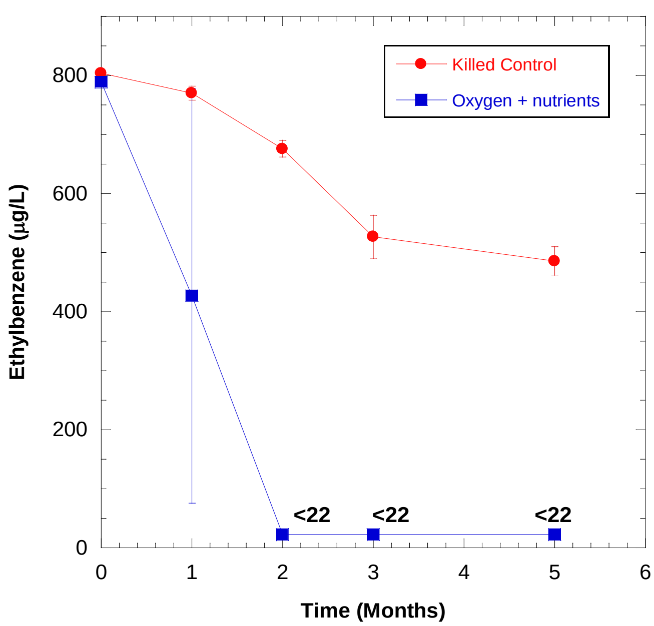


Figure 18. Concentration of total xylenes in the aerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

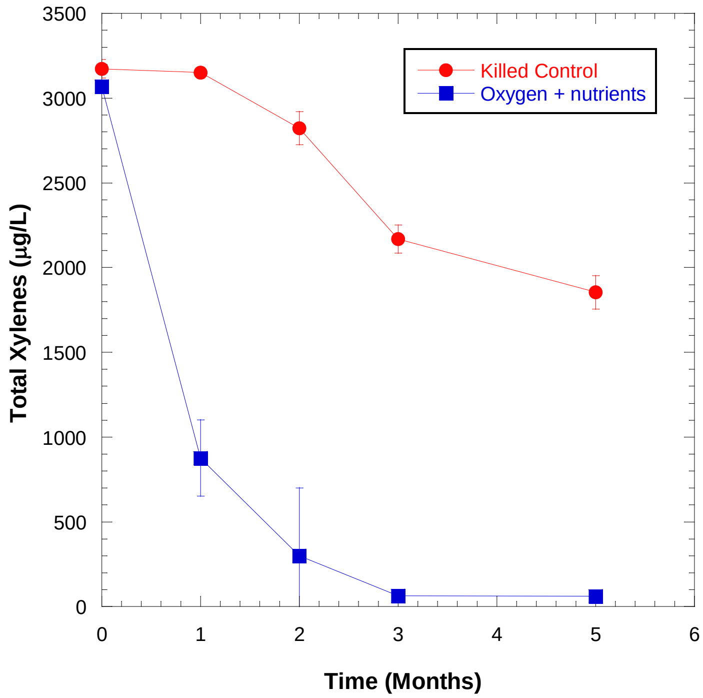


Figure 19. Concentration of sulfate in the aerobic Source Area microcosms over time. Values are from an individual bottle.

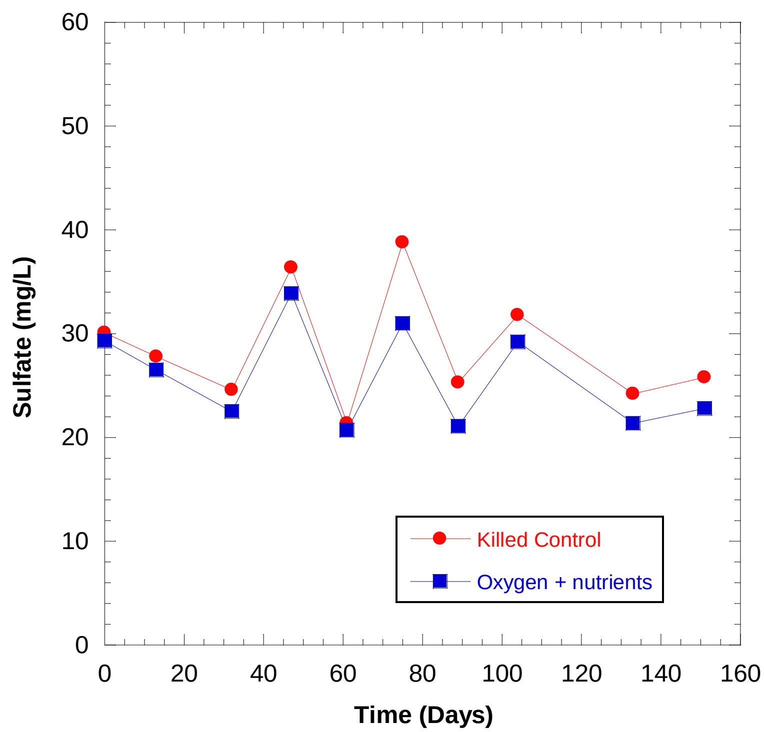


Figure 20. Headspace oxygen in the aerobic Source area microcosms. Values are from an individual bottle.

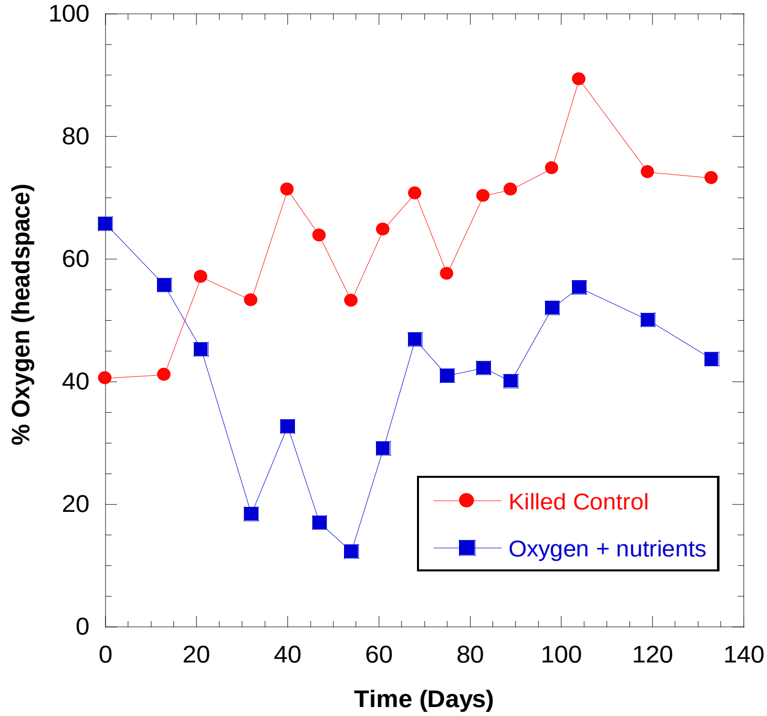


Figure 21. pH in aerobic Source Area microcosms. Values are from an individual bottle.

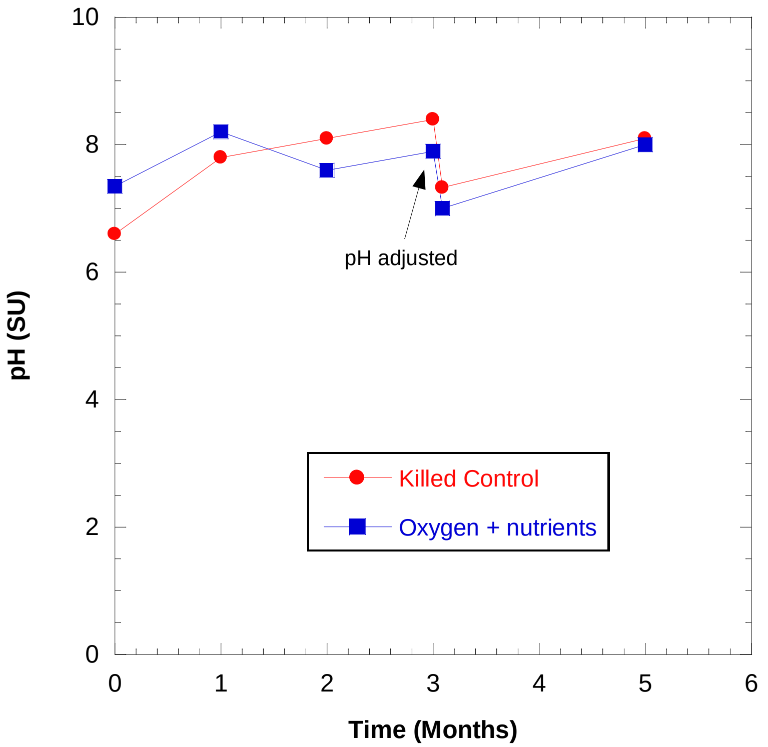


Figure 22. Concentration of EDB in anaerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

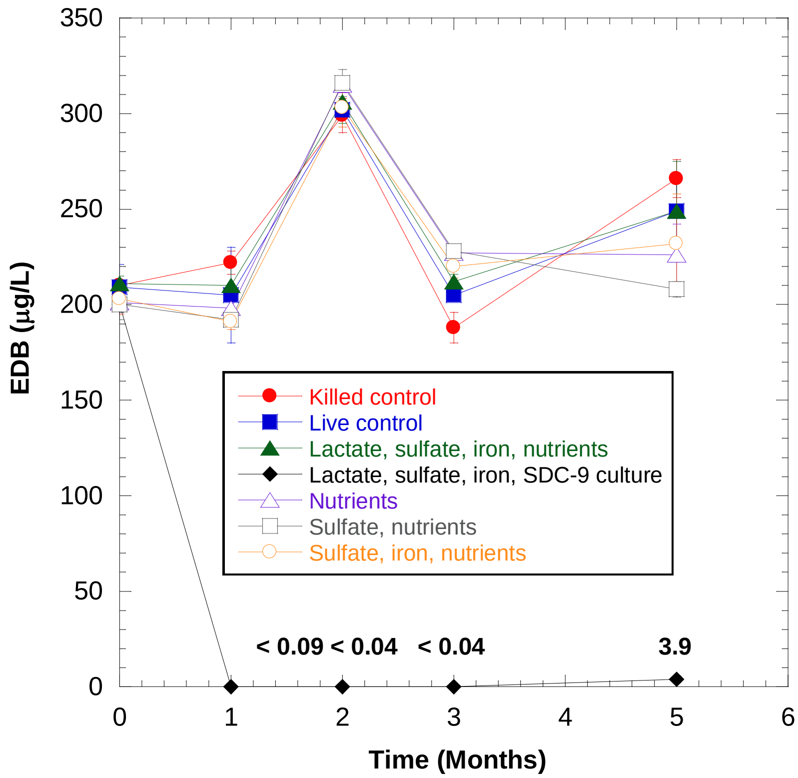


Figure 23. Degradation of EDB by the SDC-9 dehalogenating consortium. Values are mean ± standard deviation from duplicate samples.

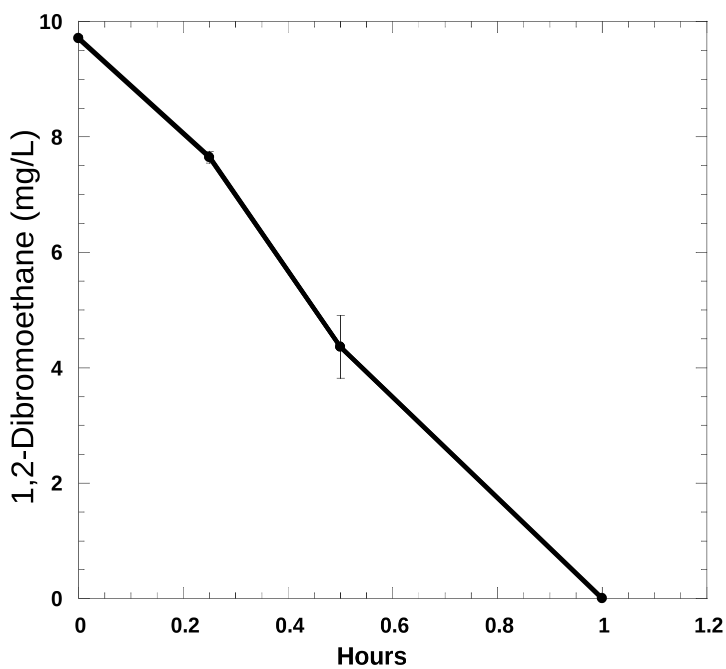


Figure 24. Concentration of benzene in anaerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

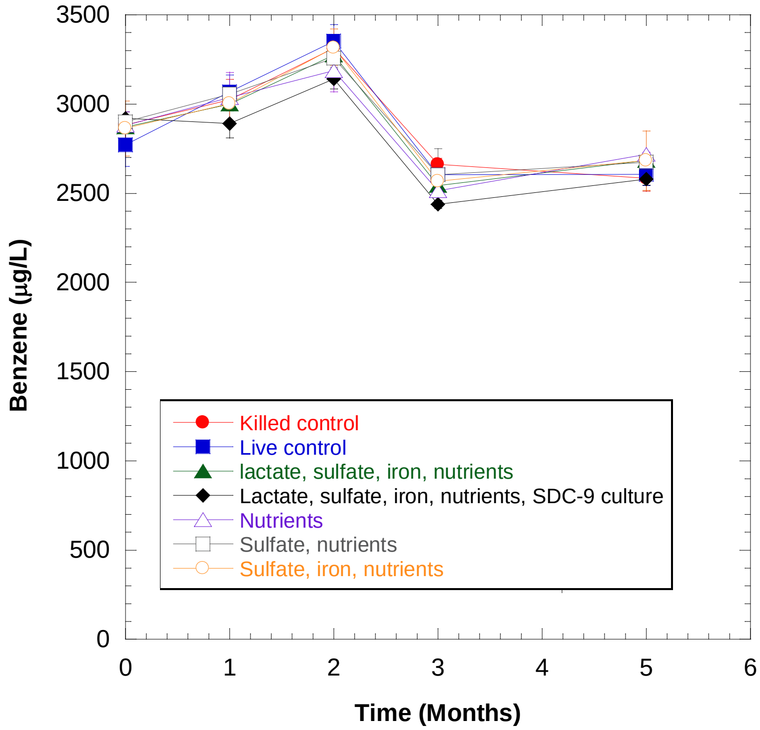


Figure 25. Concentration of toluene in anaerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

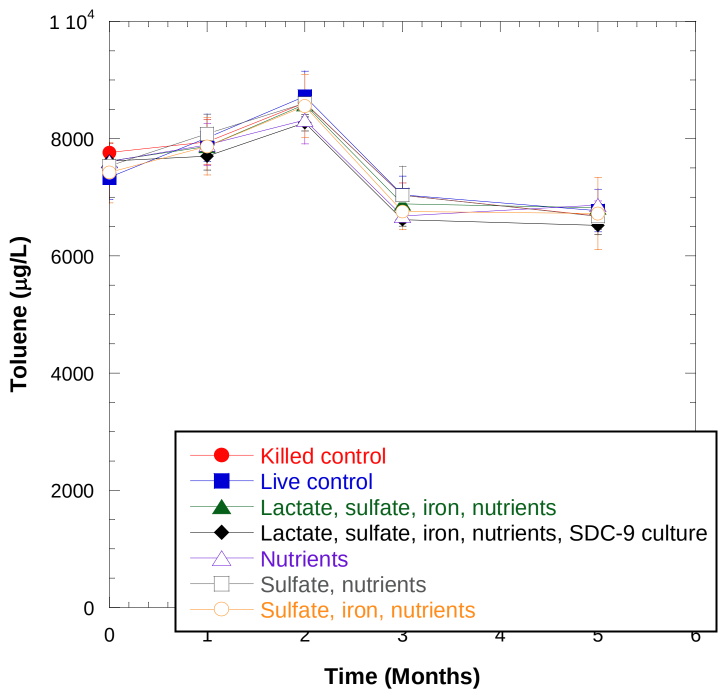


Figure 26. Concentration of ethylbenzene in anaerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

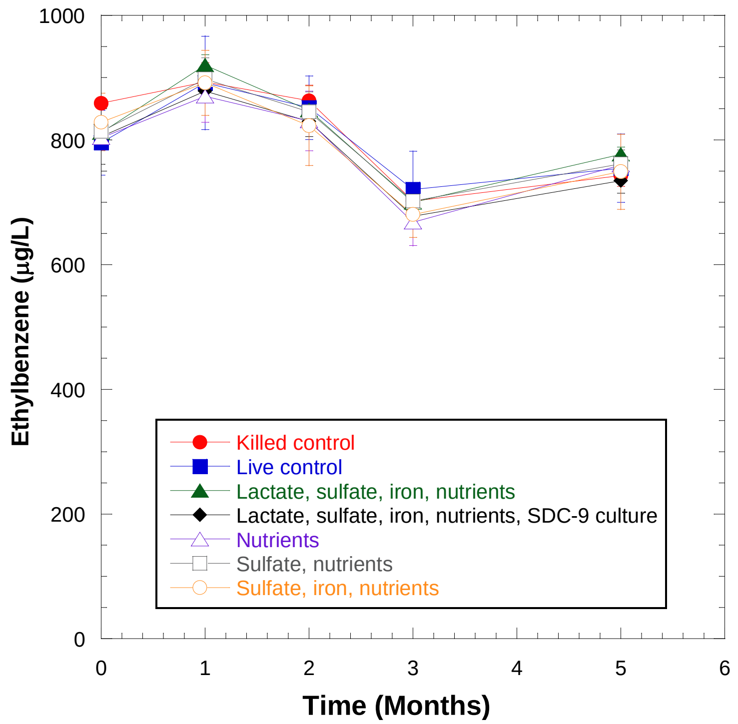


Figure 27. Concentration of xylenes in anaerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles**.**

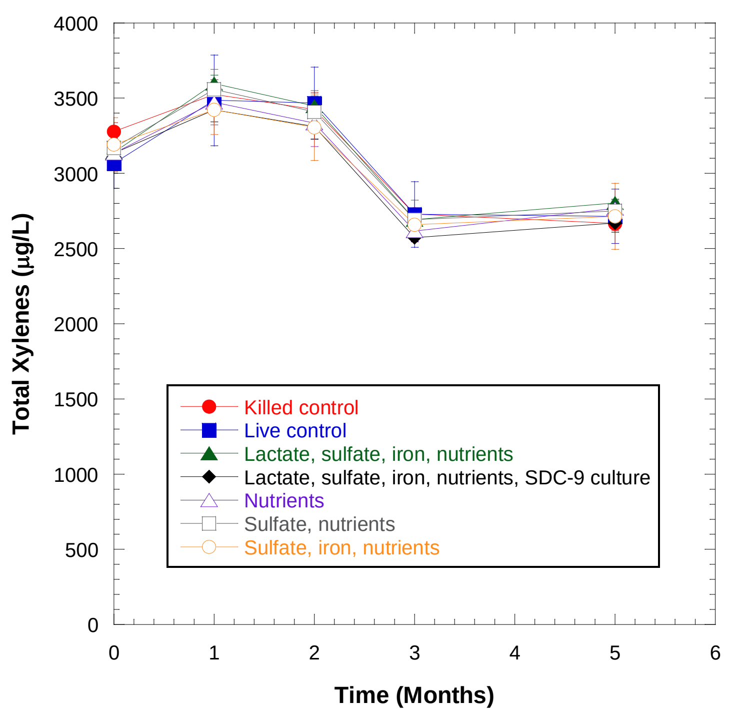


Figure 28. Concentration of methane in anaerobic Source Area microcosms over time. Values are mean ± standard deviation from triplicate bottles.

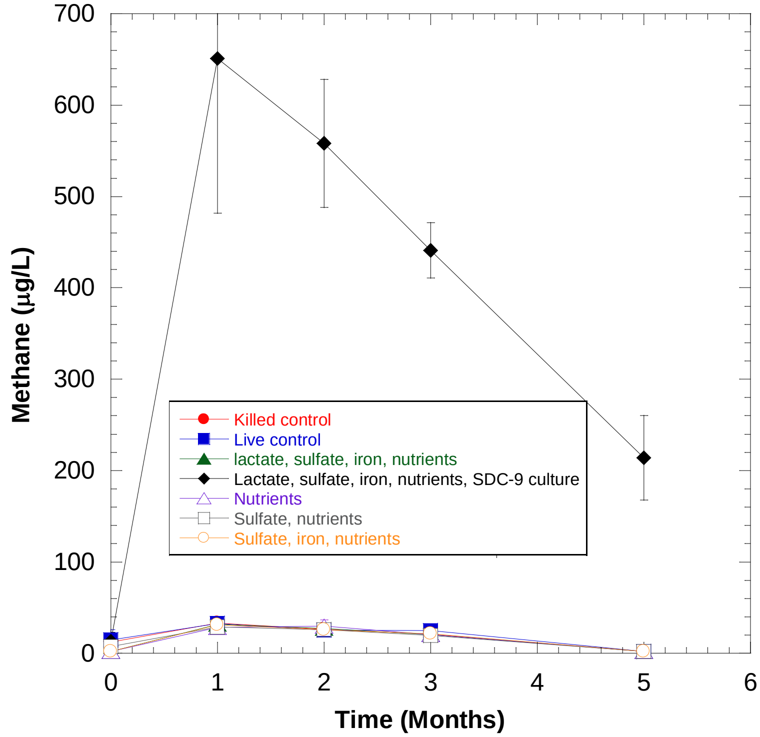


Figure 29. Concentration of EDB and ethene in anaerobic Source Area microcosms receiving the SDC-9 dehalogenating culture over time. Values are means from triplicate bottles in µmol/L.

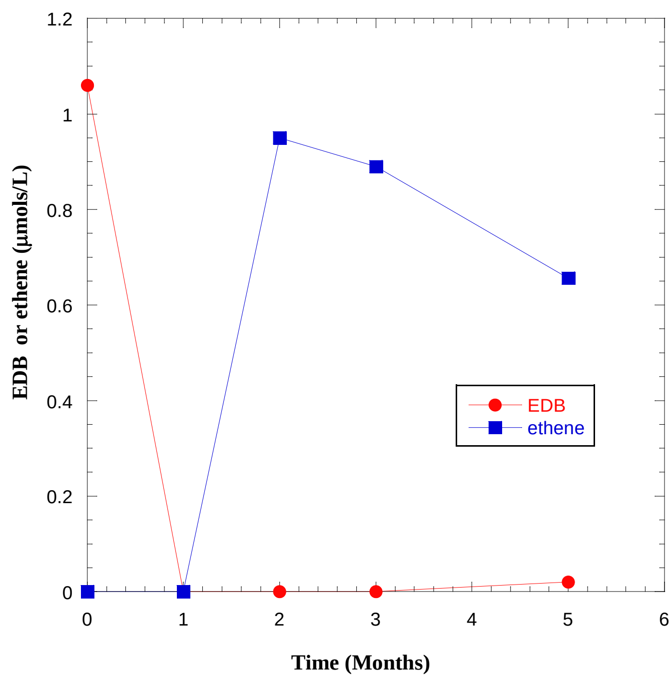


Figure 30. Concentration of sulfate in the anaerobic Source Area microcosms over time. Values are from an individual bottle.

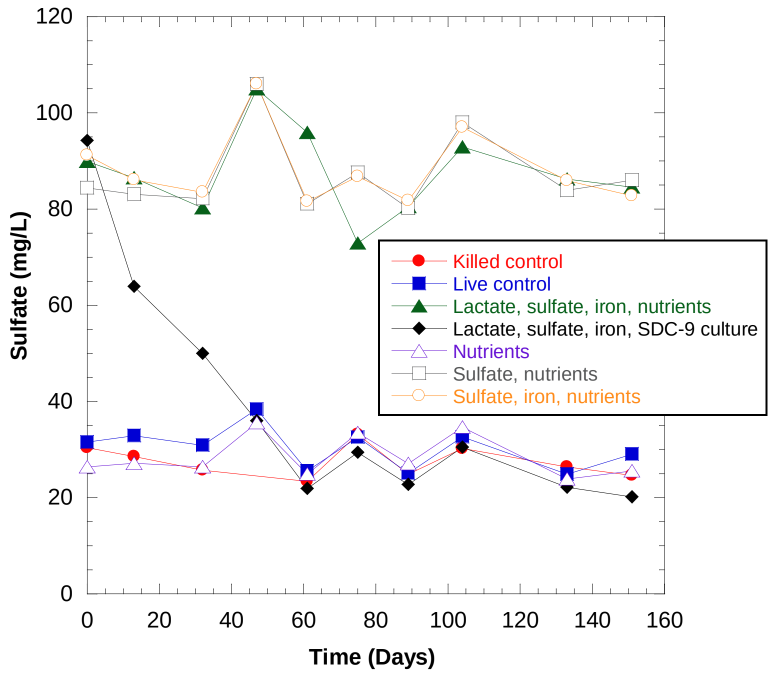


Figure 31. Concentration of dissolved iron in the anaerobic Source Area microcosms over time. Values are from an individual bottle.

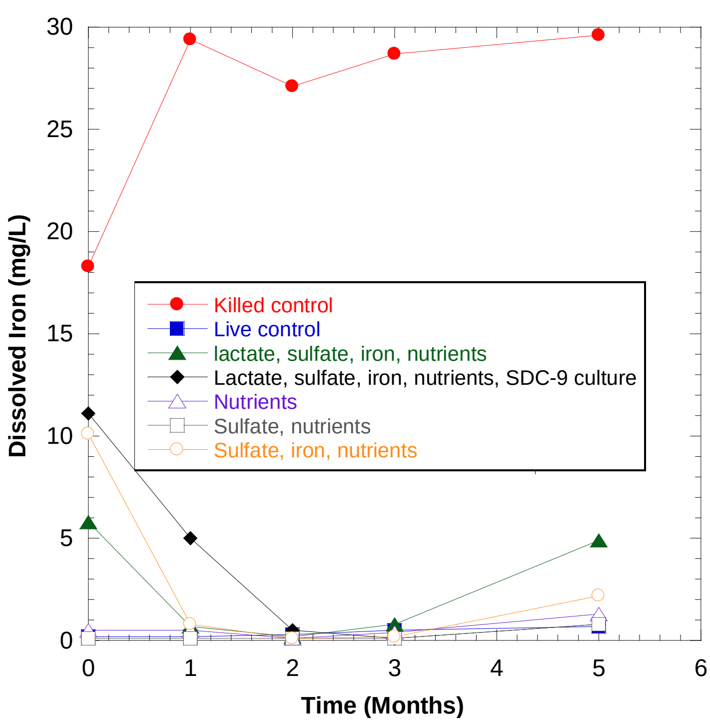


Figure 32. pH in anaerobic Source Area microcosms. Values are from an individual bottle.

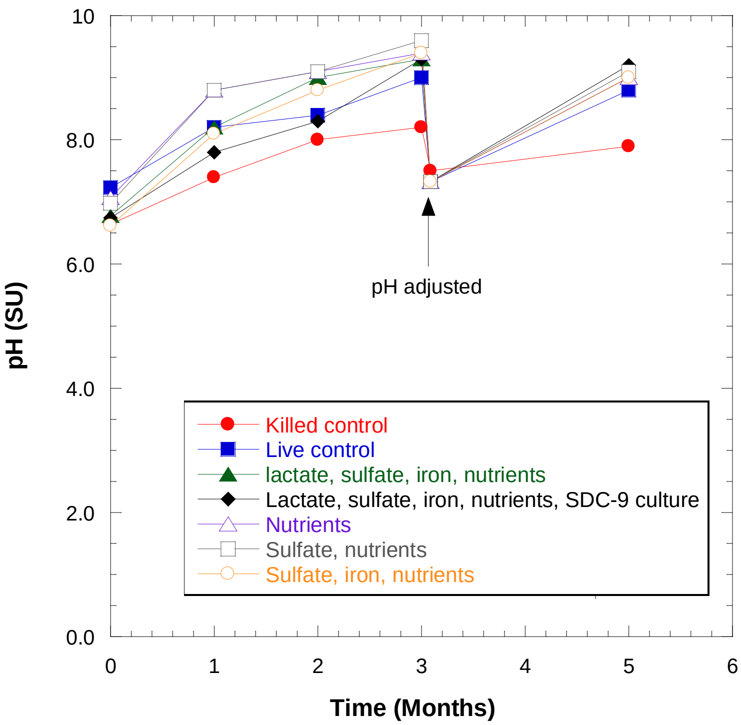


Figure 33. Lactate and acetate concentrations in anaerobic Source Area microcosms that received lactate initially as an electron donor. Values are from an individual bottle.

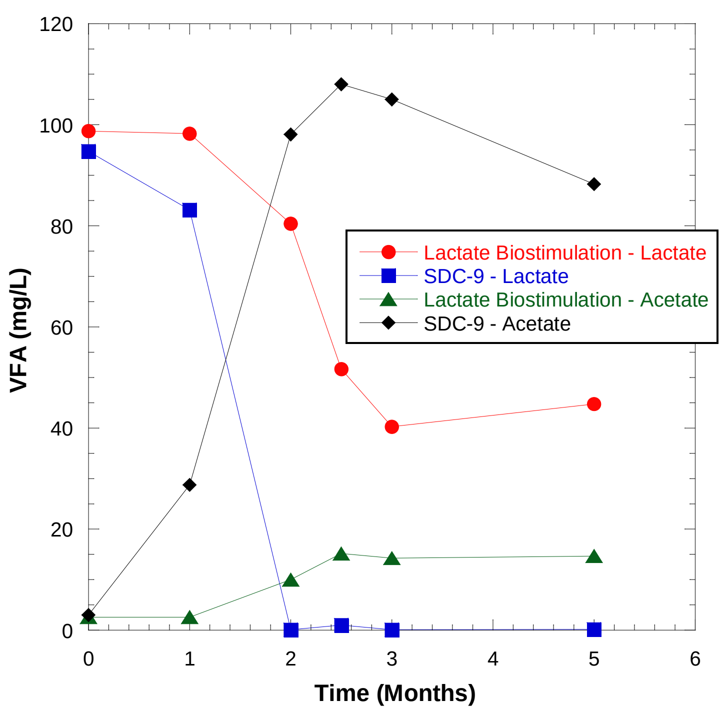


Figure 34. Concentration of EDB in aerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

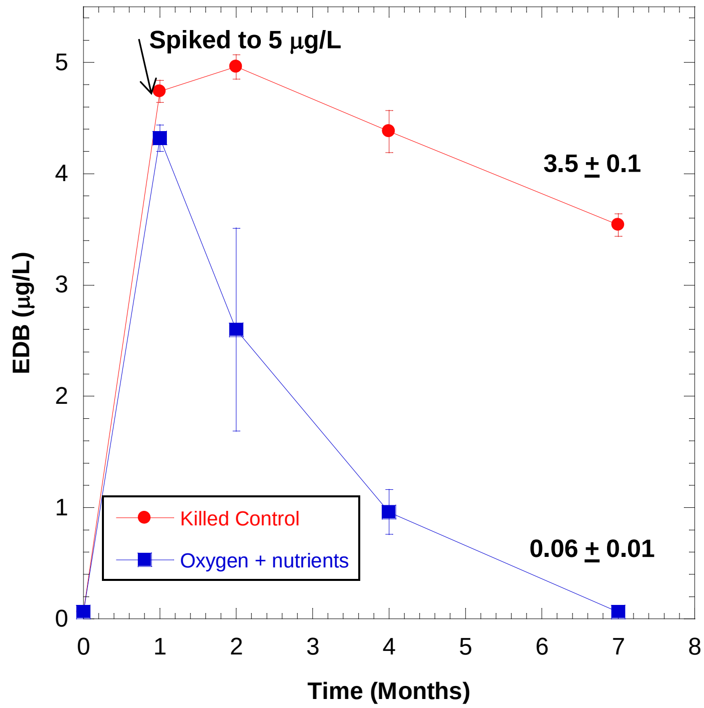


Figure 35. Figure 25. Concentration of benzene in aerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

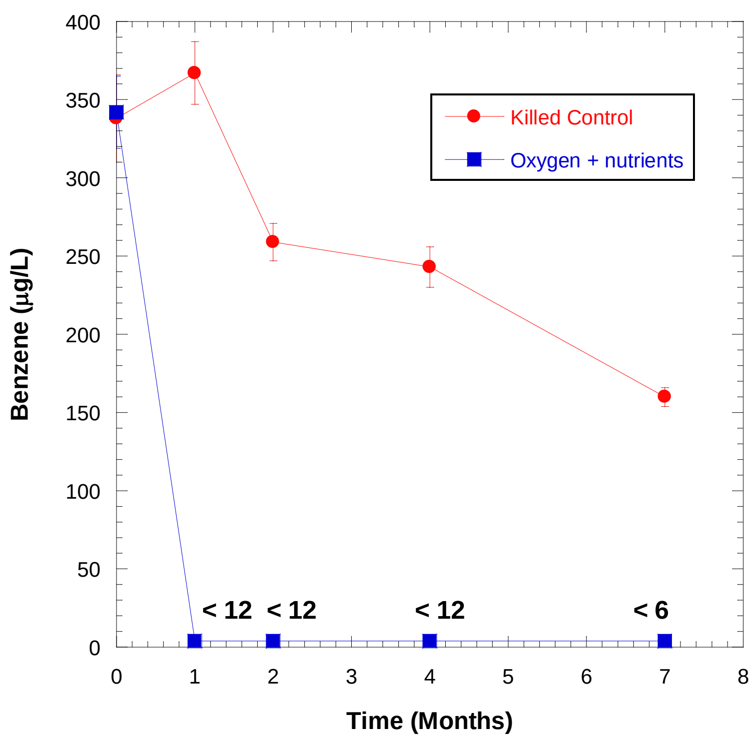


Figure 36. Concentration of toluene in aerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

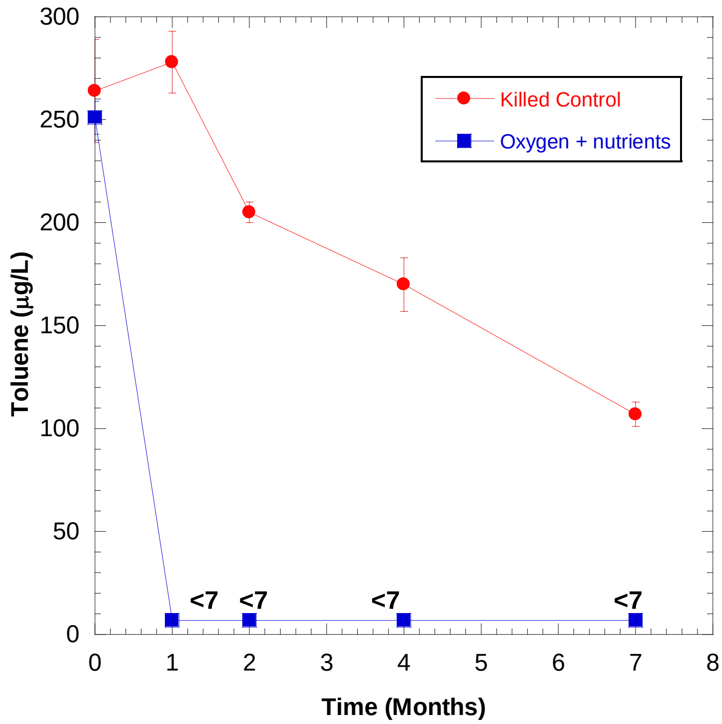


Figure 37. Concentration of ethylbenzene in aerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

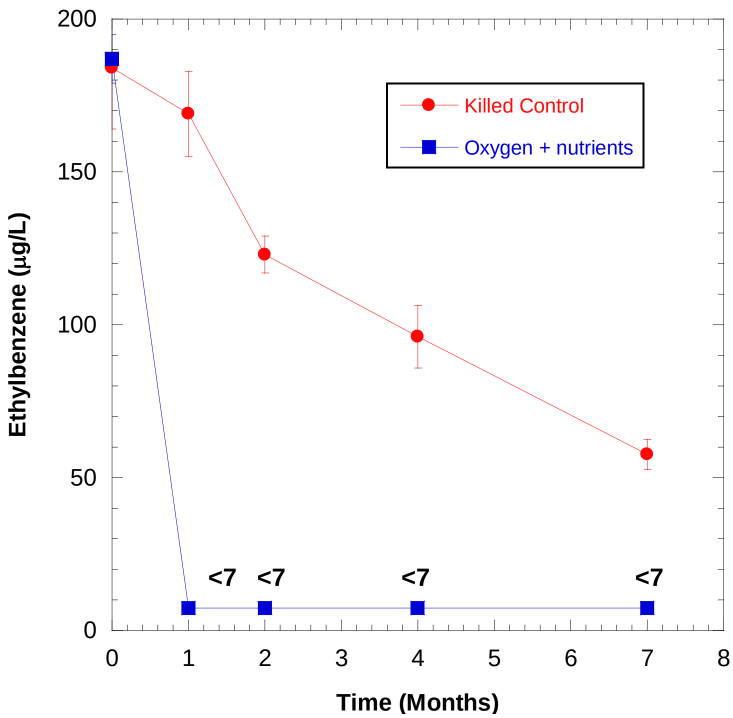


Figure 38. Concentration of total xylenes in the aerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

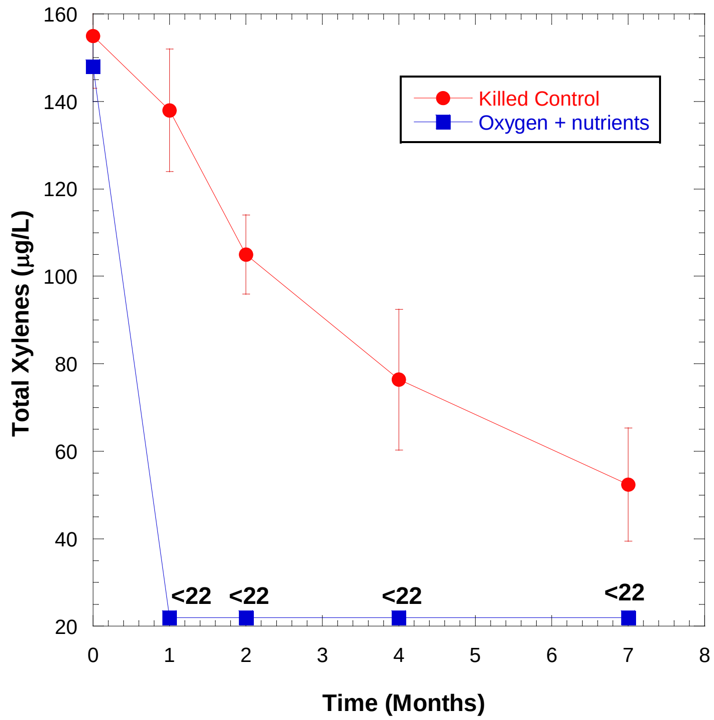


Figure 39. Concentration of sulfate in the aerobic Sidegradient microcosms over time. Values are from an individual bottle.

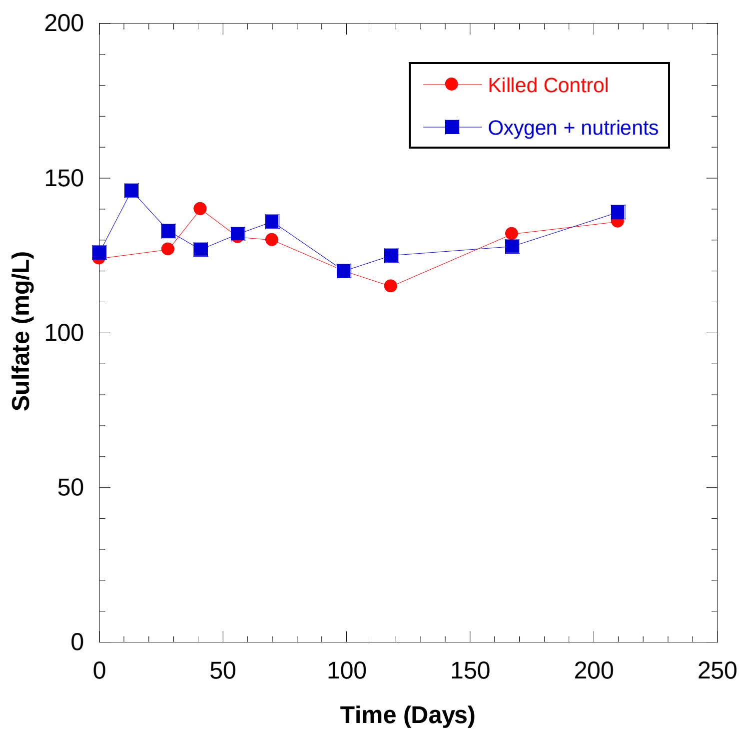


Figure 40. Nitrate in the aerobic Sidegradient microcosms. Values are from an individual bottle.

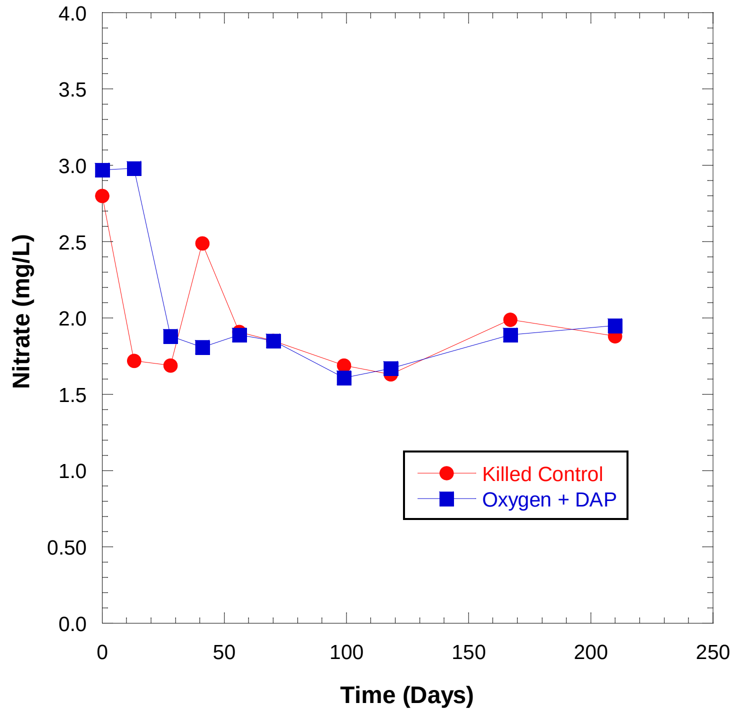


Figure 41. Headspace oxygen in the aerobic Sidegradient microcosms. Values are from an individual bottle.

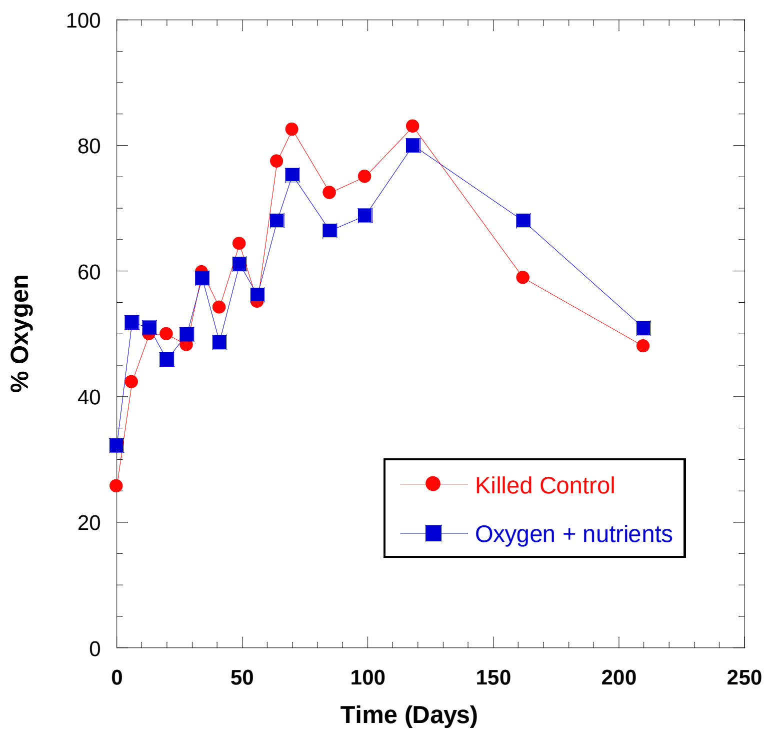


Figure 42. pH in aerobic Sidegradient microcosms. Values are from an individual bottle.

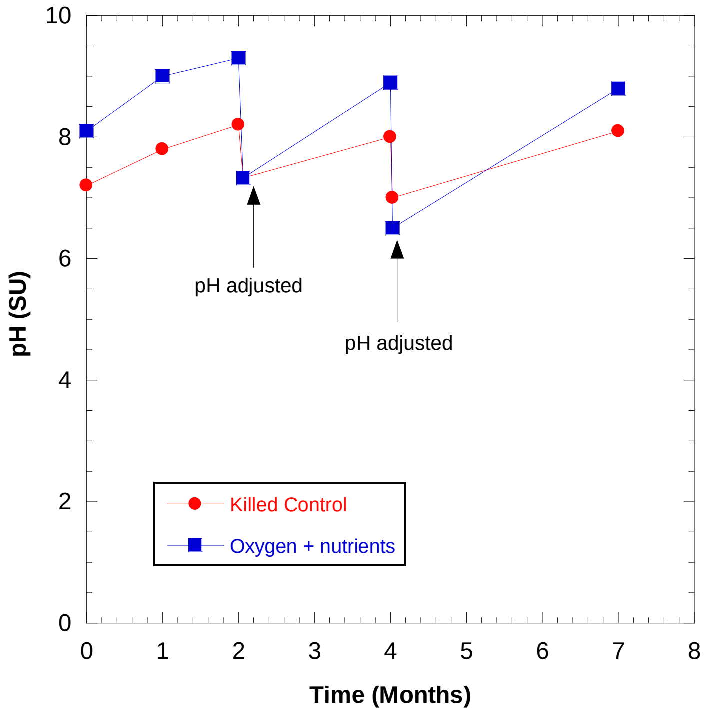


Figure 43. Concentration of EDB in anaerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

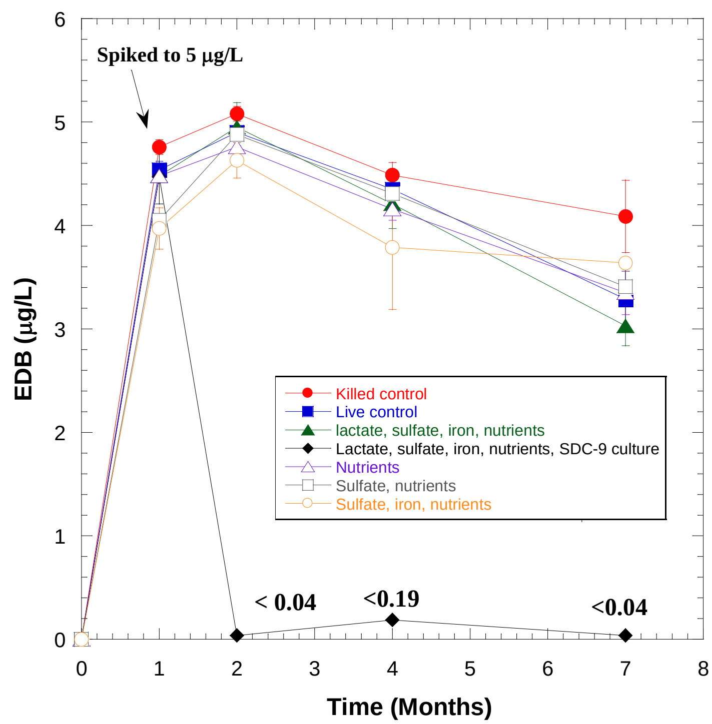


Figure 44. Concentration of benzene in anaerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottle.

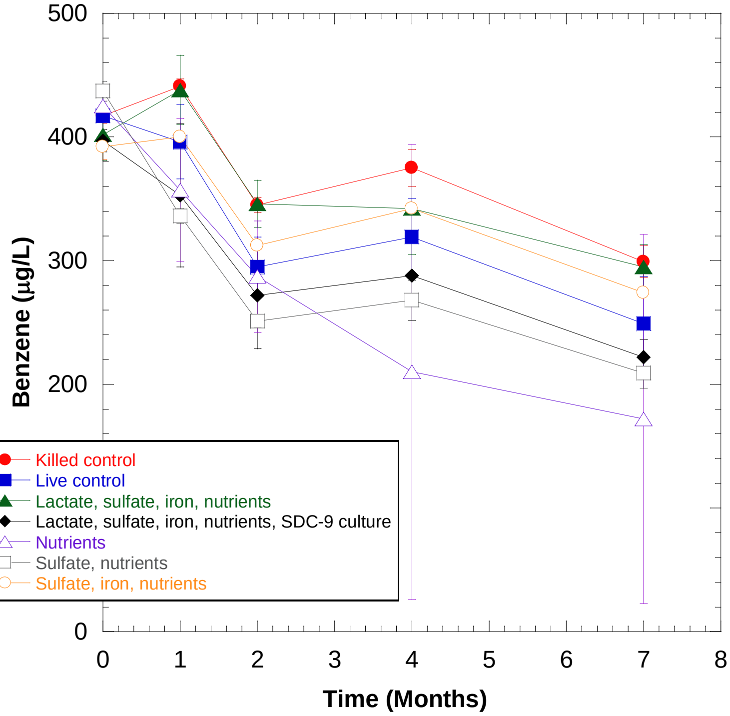


Figure 45. Concentration of toluene in anaerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles

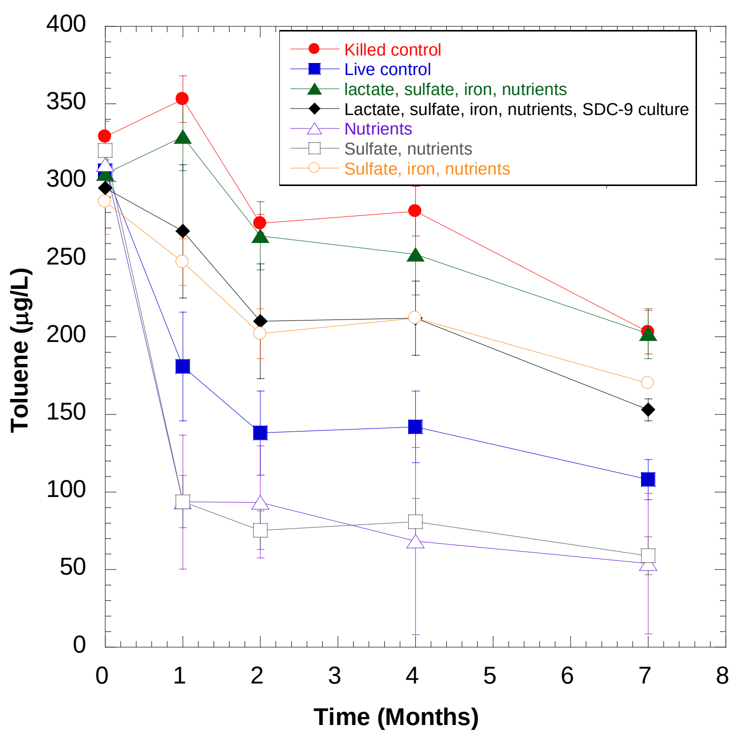


Figure 46. Concentration of ethylbenzene in anaerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

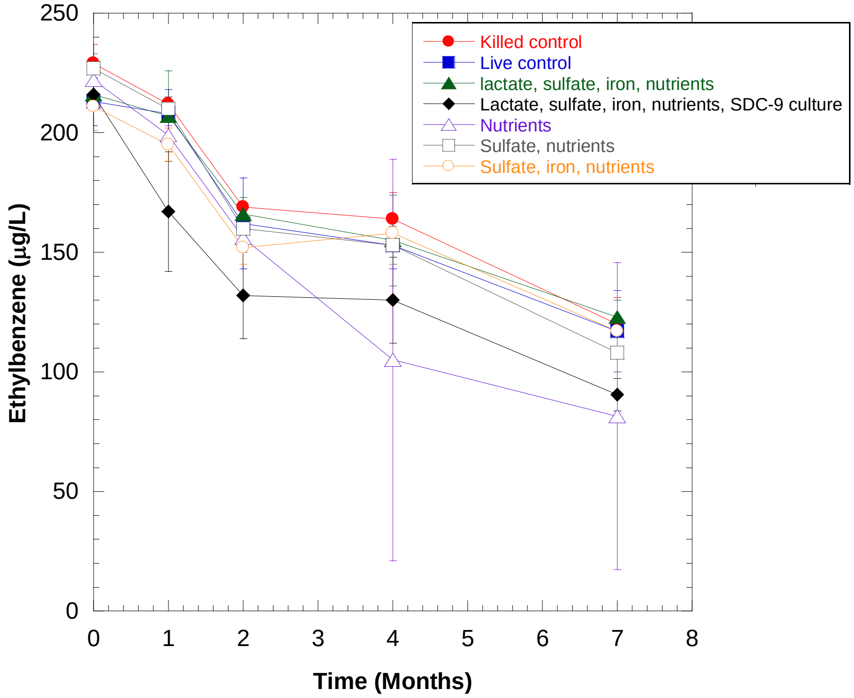


Figure 47. Concentration of o- xylene in anaerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

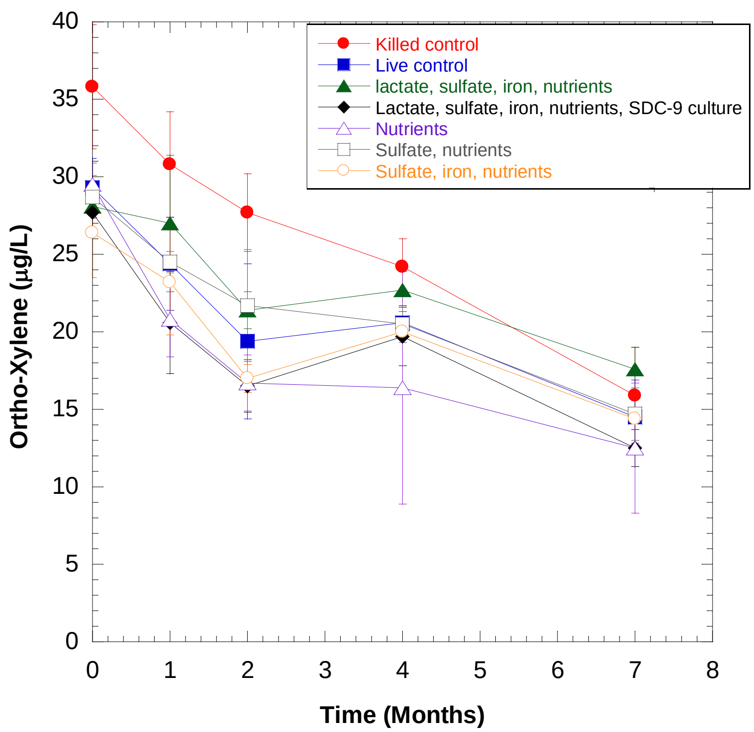


Figure 48. Concentration of m- and p-xylene in anaerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

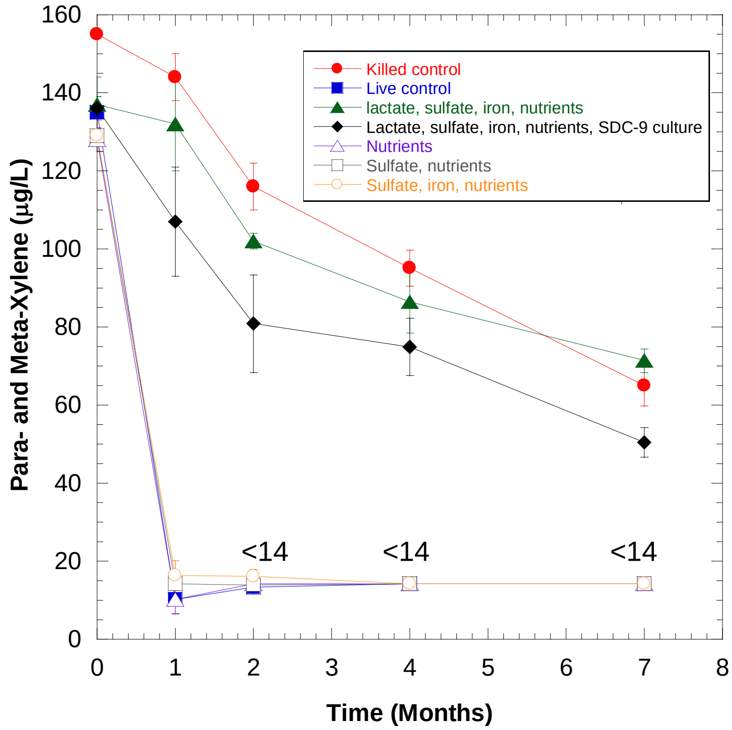


Figure 49. Concentration of methane in the anaerobic Sidegradient microcosms over time. Values are mean ± standard deviation from triplicate bottles.

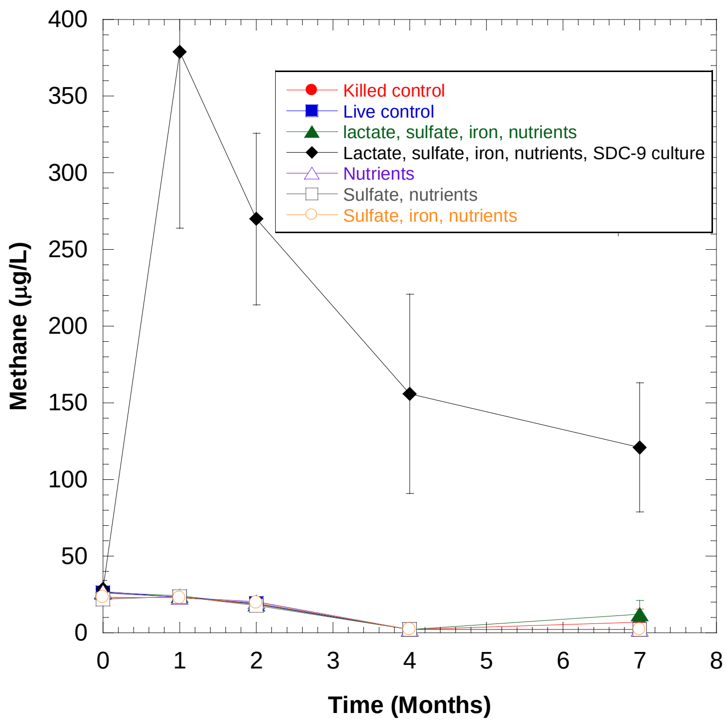


Figure 50. Concentration of sulfate in the anaerobic Sidegradient microcosms over time. Values are from an individual bottle.

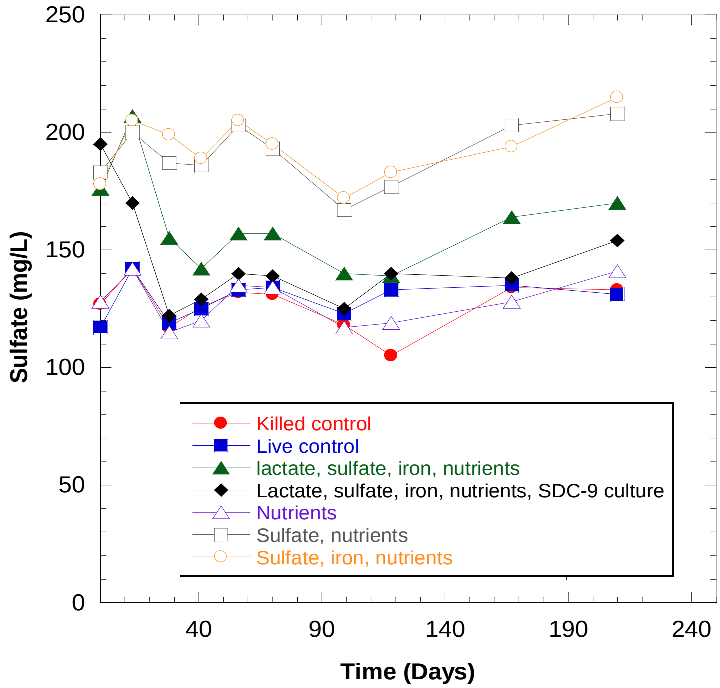


Figure 51. Concentration of nitrate in anaerobic Sidegradient microcosms. Values are from an individual bottle.

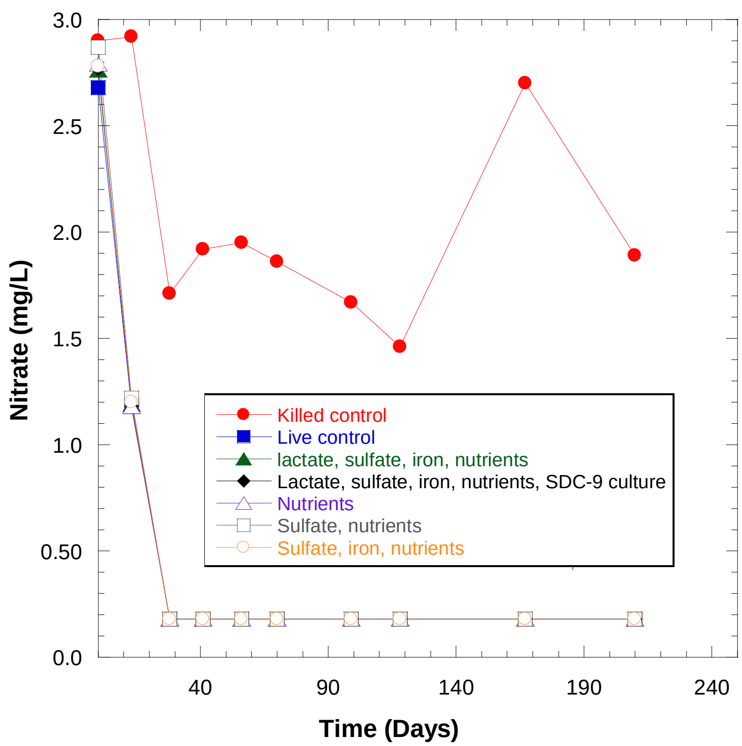


Figure 52. pH in anaerobic Sidegradient microcosms. Values are from an individual bottle.

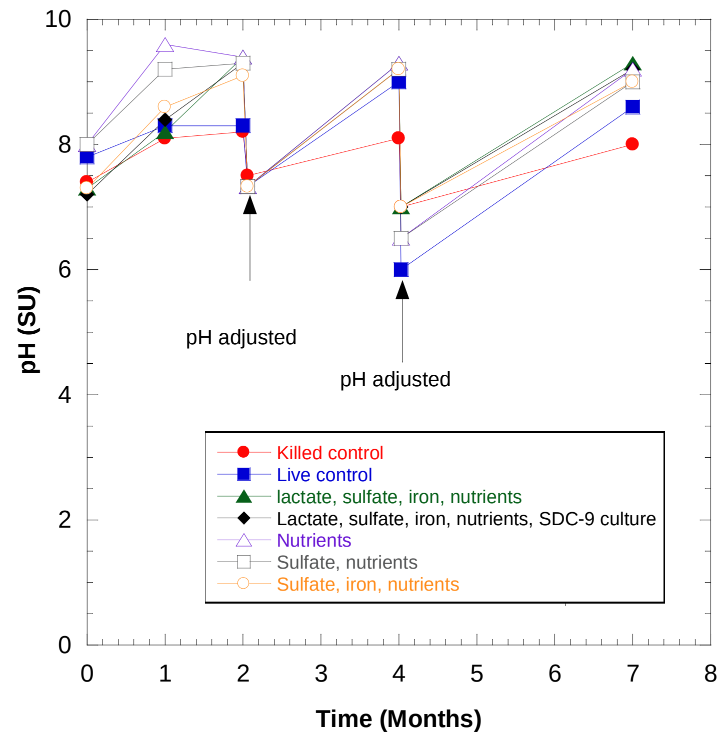


Figure 53. Lactate and acetate concentrations in anaerobic Sidegradient microcosms that received lactate initially as an electron donor. Values are from an individual bottle.

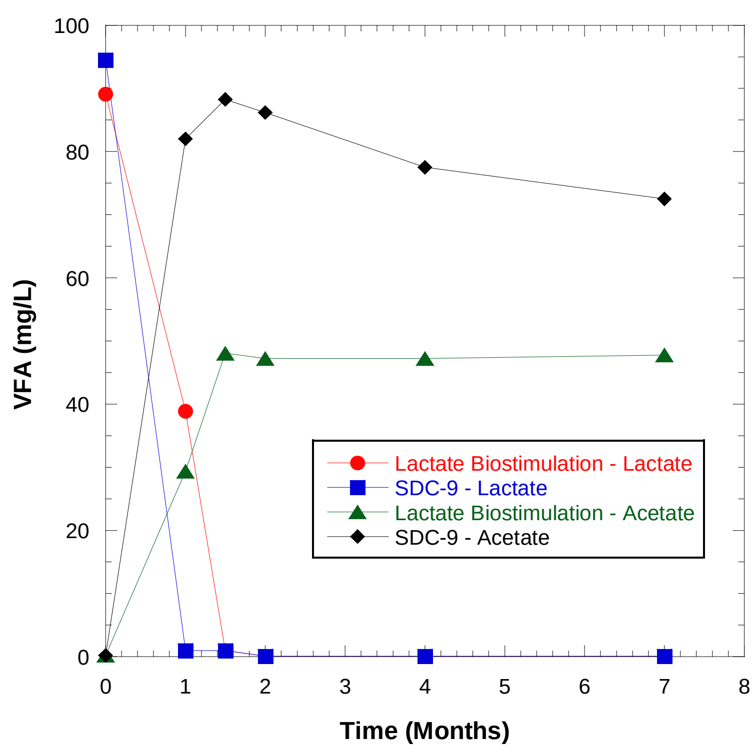


Figure 54. Concentration of dissolved iron in the anaerobic Sidegradient microcosms over time. Values are from an individual bottle.

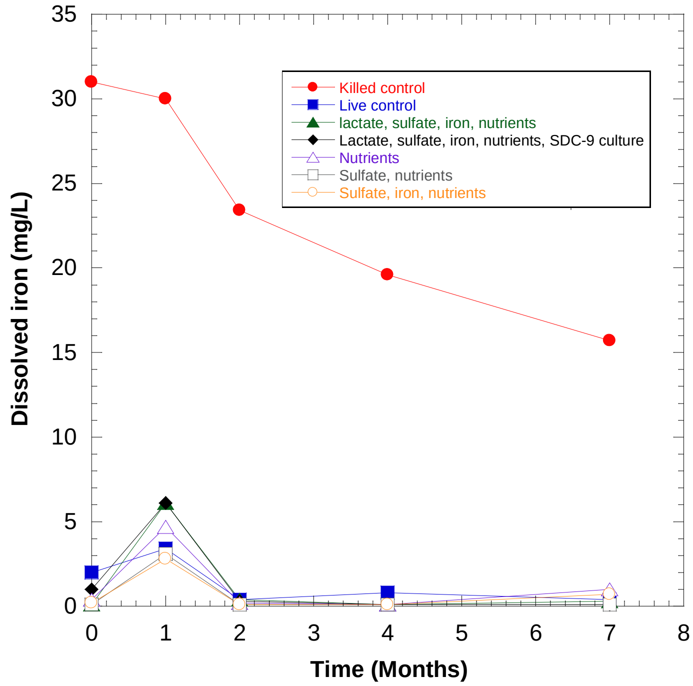


Figure 55. Concentration of EDB in aerobic biostimulation microcosms receiving methane, ethane, or propane as cometabolic substrates. Values are mean ± standard deviation from triplicate bottles.

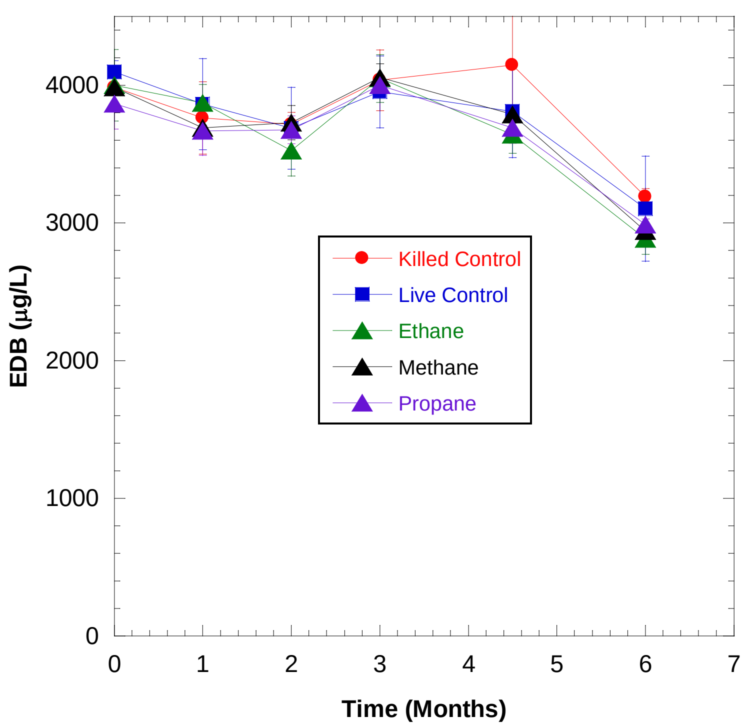


Figure 56. Concentration of EDB in aerobic bioaugmentation microcosms receiving bioaugmentation cultures (1) Rhodococcus ruber ENV425 with propane as a cosubstrate or Mycobacterium sphagni ENV482 with ethane as a cosubstrate. Values are mean ± standard deviation

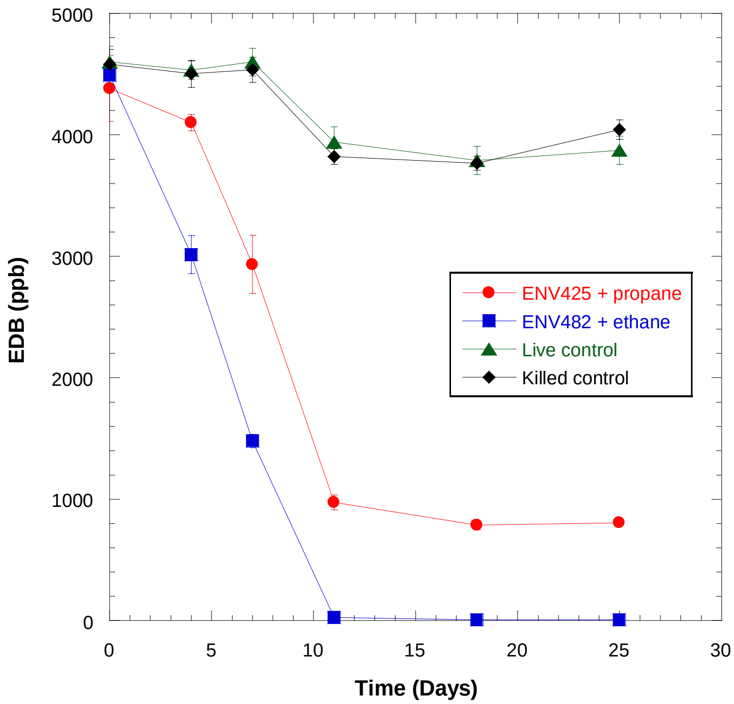


Figure 57. Wells in the KAFB BFF plume sampled for microbial gene analysis in first quarter, 2015.

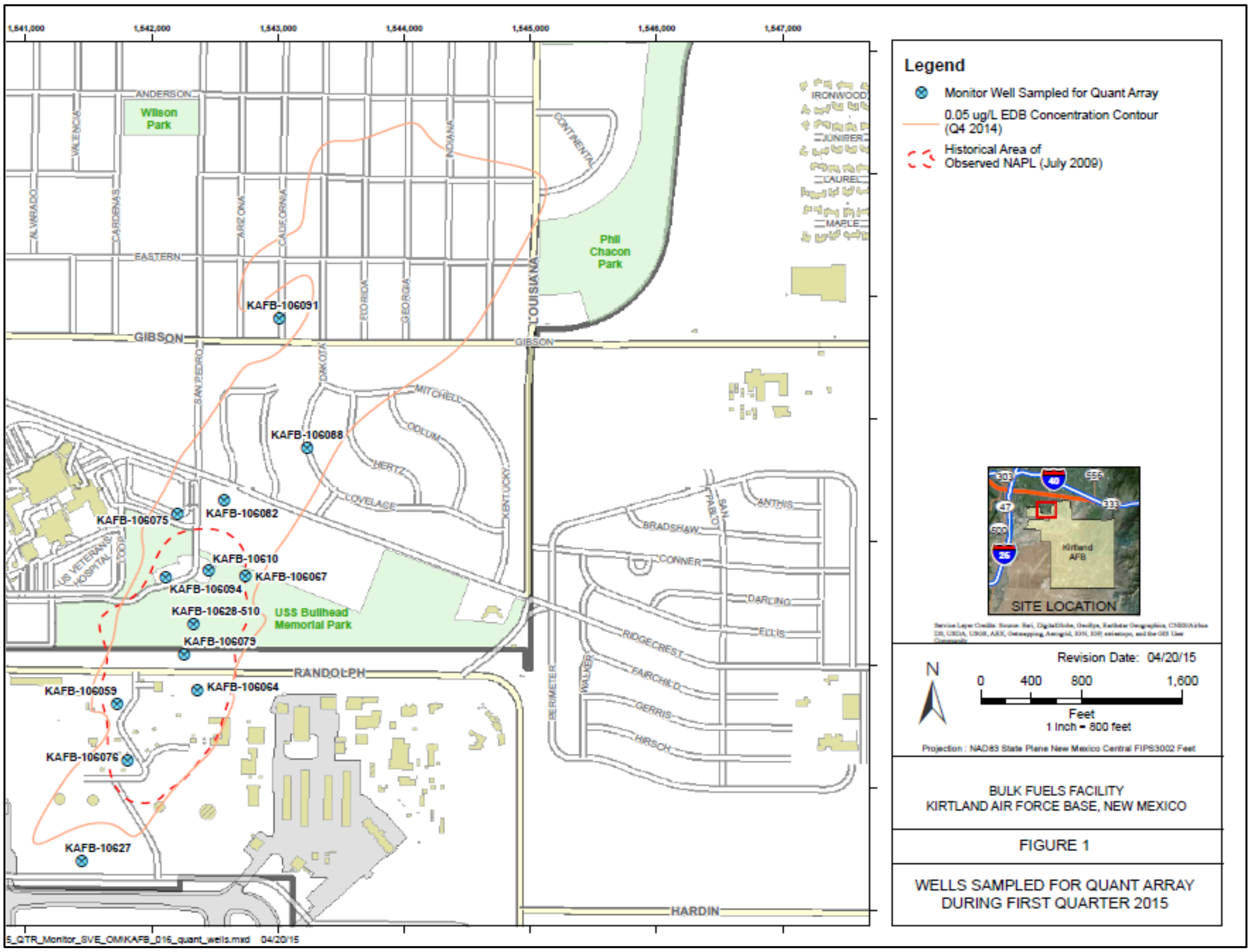


Figure 58. Numbers of sulfate reducing bacteria (cells/mL) in groundwater samples from the KAFB BFF plume in first quarter, 2015. Moving left to right, the red line represents the beginning of the suspected NAPL area (with well 106027 being upgradient of any contamination) and the green line represents the approximate downgradient edge of the proposed NAPL area with direction of groundwater flow.

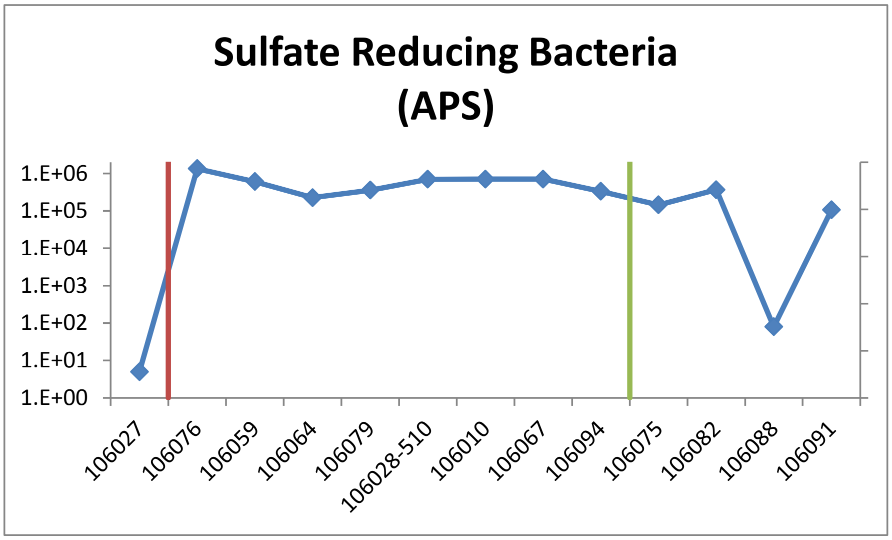
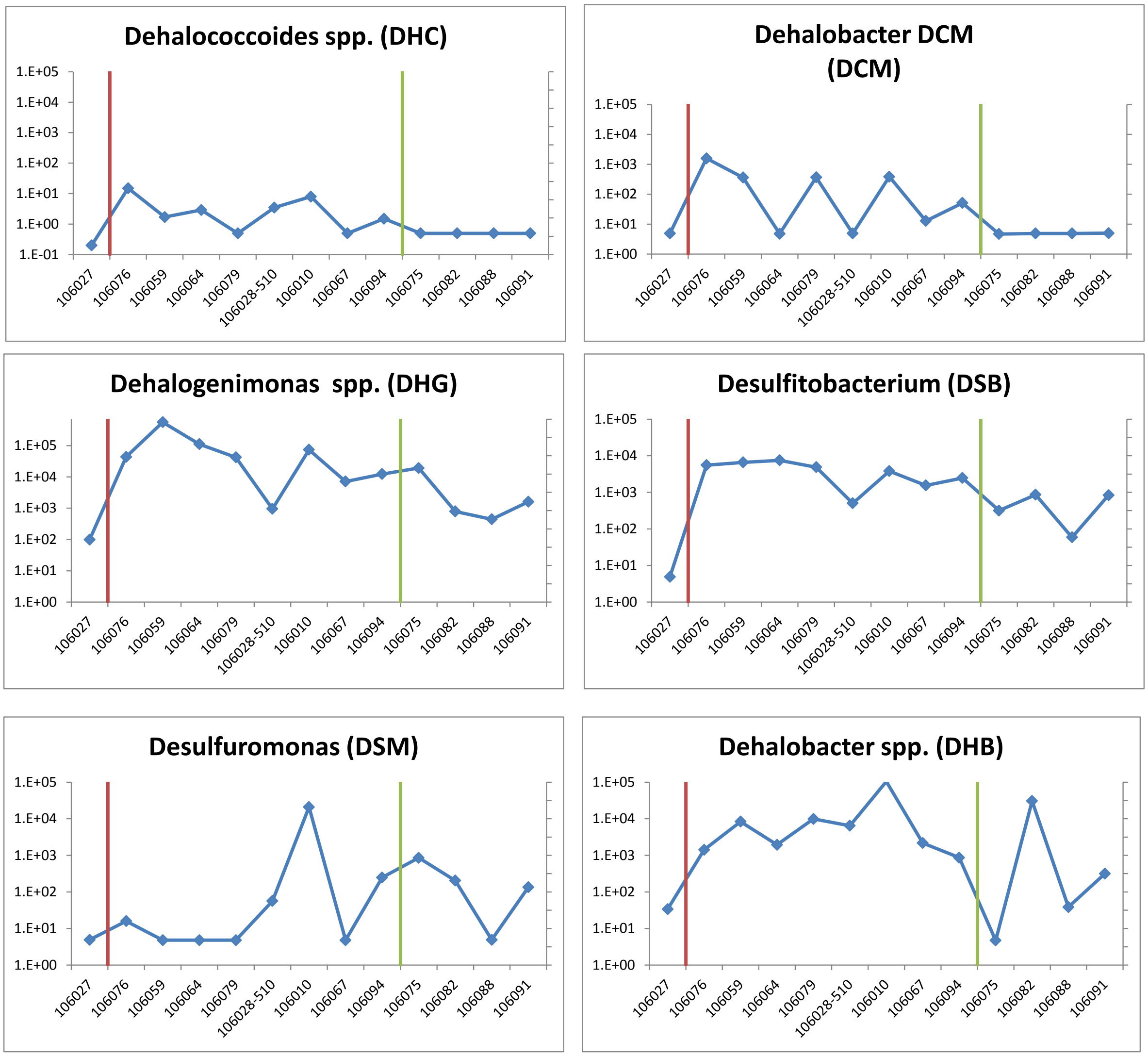


Figure 59. Numbers of different dehalogenating bacteria (cells/mL) in groundwater samples from the KAFB BFF plume in first quarter, 2015. Moving left to right, the red line represents the beginning of the suspected NAPL area (with well 106027 being upgradient of any contamination) and the green line represents the approximate downgradient edge of the proposed NAPL area with direction of groundwater flow.



7.0 APPENDIX A: ANALYTICAL DATA

Table A1. EDB Concentrations in Kirtland Air Force Base Source Area Microcosms (106210)

	Treatment	Time (days)	Date	EDB (µg/L)							
	106210			Q	1	Q	2	Q	3	Average	SD
1	Killed Anaerobic Control	0	5/22/2014		214		208		208	210	3
2	Killed Aerobic Control				211		217		211	213	3
3	Unamended Anaerobic Live Control				207		198		221	209	12
4	Oxygen + Nutrients				219		259		240	239	20
5	Sodium Sulfate				236		239		232	236	4
6	Sodium Sulfate + Ferrous Chloride				218		229		205	217	12
7	Sodium Sulfate + Ferrous Chloride + Lactate				215		209		208	211	4
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				204		197		199	200	4
9	Anaerobic + Nutrients				194		205		203	201	6
10	Sodium Sulfate + Nutrients				192		199		208	200	8
11	Sodium Sulfate + Ferrous Chloride + Nutrients				211^		202^		194^	202	9
1	Killed Anaerobic Control	32	6/23/2014		218		229		219	222	6
2	Killed Aerobic Control		1 month		213		213		205	210	5
3	Unamended Anaerobic Live Control				222		176		217	205	25
4	Oxygen + Nutrients				207		204		212	208	4
5	Sodium Sulfate				219		220		216	218	2
6	Sodium Sulfate + Ferrous Chloride				220		224		208	217	8
7	Sodium Sulfate + Ferrous Chloride + Lactate				226		202		203	210	14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.04	U	0.04	U	0.19	0.09	0.09
9	Anaerobic + Nutrients				204		201		190	198	7
10	Sodium Sulfate + Nutrients				194		189		194	192	3
11	Sodium Sulfate + Ferrous Chloride + Nutrients				188		195		190	191	4
1	Killed Anaerobic Control	61	7/22/2014		289		301		306	299	9
2	Killed Aerobic Control		2 months		302		297		298	299	3
3	Unamended Anaerobic Live Control				301		300		306	302	3
4	Oxygen + Nutrients				251		267		279	266	14
5	Sodium Sulfate				292		290		293	292	2
6	Sodium Sulfate + Ferrous Chloride				290		296		280	289	8
7	Sodium Sulfate + Ferrous Chloride + Lactate				304		297		318	306	11
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.04	U	0.04	U	0.04	0.04	0.00
9	Anaerobic + Nutrients				319		314		311	315	4
10	Sodium Sulfate + Nutrients				320		308		319	316	7
11	Sodium Sulfate + Ferrous Chloride + Nutrients				313		302		294	303	10
1	Killed Anaerobic Control	89	8/19/2014		196		186		181	188	8
2	Killed Aerobic Control		3 months		179		178		199	185	12
3	Unamended Anaerobic Live Control				205		205		206	205	1
4	Oxygen + Nutrients				128		118		140	129	11
5	Sodium Sulfate				209		195		209	204	8
6	Sodium Sulfate + Ferrous Chloride				209		200		211	207	6
7	Sodium Sulfate + Ferrous Chloride + Lactate				208		212		215	212	4
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.04	U	0.04	U	0.04	0.04	0.00
9	Anaerobic + Nutrients				228		223		231	227	4
10	Sodium Sulfate + Nutrients				227		227		230	228	2
11	Sodium Sulfate + Ferrous Chloride + Nutrients				223		225		213	220	6
1	Killed Anaerobic Control	151	10/20/2014		264		277		257	266	10
2	Killed Aerobic Control		5 months		234		239		244	239	5
3	Unamended Anaerobic Live Control				232		244		270	249	19
4	Oxygen + Nutrients				151		91.5		125	123	30
5	Sodium Sulfate				264		209		258	244	30
6	Sodium Sulfate + Ferrous Chloride				258		250		227	245	16
7	Sodium Sulfate + Ferrous Chloride + Lactate				275		248		223	249	26
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	1.91		4.92		4.89	3.91	1.73
9	Anaerobic + Nutrients				213		244		221	226	16
10	Sodium Sulfate + Nutrients				205		213		207	208	4
11	Sodium Sulfate + Ferrous Chloride + Nutrients				255		204		236	232	26

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL

U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

When triplicates consisted of a combination of detected and non-detected values, the calculated MDL was used to represent the non-detected (U) values in calculations

^Data reported is via SW8260 performed by CB&I due to loss or breakage of the EDB sample vials

Table A2. BTEX Concentrations in Kirtland Air Force Base Source Area Microcosms (106210)

	Treatment	Time (days)	Date	Benzene (μg/L)								Toluene (μg/L)								Ethylbenzene (μg/L)								Xylene (para and meta; μg/L)								Xylene (ortho; μg/L)							
	106210			Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD
1	Killed Anaerobic Control	0	5/22/2014		2900		2900		2850	2883	29		7810		7890		7590	7763	155		858		868		851	859	9		2320		2300		2240	2287	42		1010		990		970	990	20
2	Killed Aerobic Control				2710		2760		2730	2733	25		7390		7480		7430	7433	45		810		802		801	804	5		2160		2220		2200	2193	31		960		1010		970	980	26
3	Unamended Anaerobic Live Control				2890		2650		2770	2770	120		7660		6930		7440	7343	374		832		736		819	796	52		2220		2000		2180	2133	117		980		880		940	933	50
4	Oxygen + Nutrients				2790		2750		2770	2770	20		7450		7220		7370	7347	117		790		794		783	789	6		2100		2140		2140	2127	23		930		950		940	940	10
5	Sodium Sulfate				2920		2830		2940	2897	59		7870		7300		7880	7683	332		854		764		860	826	54		2340		2100		2300	2247	129		1020		910		1010	980	61
6	Sodium Sulfate + Ferrous Chloride				2850		2860		2720	2810	78		7610		7590		7200	7467	231		822		847		789	819	29		2200		2260		2120	2193	70		960		990		910	953	40
7	Sodium Sulfate + Ferrous Chloride + Lactate				2910		2860		2840	2870	36		7710		7730		7430	7623	168		811		812		812	812	1		2220		2140		2180	2180	40		970		940		970	960	17
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				2960		2900		2900	2920	35		7400		7670		7790	7620	200		764		801		854	806	45		2100		2140		2280	2173	95		920		960		1000	960	40
9	Anaerobic + Nutrients				2960		2810		2870	2880	75		7860		7400		7570	7610	233		815		792		804	804	12		2220		2160		2160	2180	35		980		940		940	953	23
10	Sodium Sulfate + Nutrients				2870		2930		2900	2900	30		7570		7610		7420	7533	100		804		827		812	814	12		2080		2260		2260	2200	104		940		980		990	970	26
11	Sodium Sulfate + Ferrous Chloride + Nutrients				2990		2910		2690	2863	155		7780		7660		6830	7423	517		864		846		776	829	46		2260		2280		2070	2203	116		1030		1020		914	988	64
1	Killed Anaerobic Control	32	6/23/2014		2890		3090		3090	3023	115		7500		8130		8200	7943	386		858		906		916	893	31		2380		2470		2500	2450	62		1040		1080		1110	1077	35
2	Killed Aerobic Control		1 month		2810		2750		2810	2790	35		7210		7300		7210	7240	52		764		783		762	770	12		2160		2200		2140	2167	31		988		984		979	984	5
3	Unamended Anaerobic Live Control				3070		2970		3160	3067	95		8110		7570		8360	8013	404		921		807		949	892	75		2520		2180		2600	2433	223		1070		964		1120	1051	80
4	Oxygen				575		2800		2720	2032	1262		328		1800		475	868	811	J	61.7		762		457	427	351	J	69.7	U	42.8	J	35.7	49.4	17.9		548		943		989	827	242
5	Sodium Sulfate				3130		3010		3150	3097	76		8170		7740		8320	8077	301		942		861		948	917	49		2530		2320		2620	2490	154		1120		1030		1120	1090	52
6	Sodium Sulfate + Ferrous Chloride				3140		3130		2850	3040	165		8250		8320		7360	7977	535		923		962		835	907	65		2520		2640		2250	2470	200		1120		1160		1020	1100	72
7	Sodium Sulfate + Ferrous Chloride + Lactate				3000		3040		2960	3000	40		7850		8040		7730	7873	156		906		939		915	920	17		2520		2520		2450	2497	40		1080		1130		1090	1100	26
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				2970		2890		2810	2890	80		7950		7680		7480	7703	236		890		886		861	879	16		2440		2380		2310	2377	65		1060		1050		1030	1047	15
9	Anaerobic + Nutrients				3180		3030		2900	3037	140		8230		7950		7520	7900	358		880		904		825	870	41		2470		2490		2280	2413	116		1080		1080		1020	1060	35
10	Sodium Sulfate + Nutrients				3020		3090		3060	3057	35		7740		8410		8100	8083	335		861		929		903	898	34		2360		2540		2520	2473	99		1050		1110		1100	1087	32
11	Sodium Sulfate + Ferrous Chloride + Nutrients				3080		3040		2890	3003	100		8240		8060		7320	7873	488		936		905		834	892	52		2480		2430		2250	2387	121		1080		1040		990	1037	45
1	Killed Anaerobic Control	61	7/22/2014		3320		3350		3270	3313	40		8740		8520		8580	8613	114		891		857		842	863	25		2450		2390		2290	2377	81		1080		1050		1020	1050	30
2	Killed Aerobic Control		2 months		2720		2780		2820	2773	50		7150		7290		7130	7190	87		688		680		661	676	14		1910		2000		1860	1923	71		890		930		880	900	26
3	Unamended Anaerobic Live Control				3430		3250		3380	3353	93		8970		8220		8970	8720	433		869		795		893	852	51		2440		2220		2560	2407	172		1100		980		1100	1060	69
4	Oxygen + Nutrients			U	11.8	U	11.8		1050	358	599	J	92.8	U	21.0	U	21.0	44.9	41.5	U	22.3	U	22.3	U	22.3	22.3	0.0	J	54.2	J	31.5	U	42.8	42.8	11.4	U	23.1	U	23.1		720	255	402
5	Sodium Sulfate				3350		3290		3420	3353	65		8760		8450		9020	8743	285		900		851		924	892	37		2470		2330		2510	2437	95		1080		1040		1100	1073	31
6	Sodium Sulfate + Ferrous Chloride				3310		3280		3010	3200	165		8760		8800		7610	8390	676		903		868		744	838	84		2480		2450		2060	2330	234		1100		1070		920	1030	96
7	Sodium Sulfate + Ferrous Chloride + Lactate				3360		3290		3170	3273	96		8670		8750		8340	8587	217		839		862		843	848	12		2420		2410		2330	2387	49		1080		1060		1040	1060	20
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				3190		3080		3150	3140	56		8420		8140		8250	8270	141		848		840		803	830	24		2340		2290		2230	2287	55		1060		1020		1000	1027	31
9	Anaerobic + Nutrients				3320		3150		3090	3187	119		8740		8310		7920	8323	410		882		825		786	831	48		2430		2290		2220	2313	107		1070		1020		970	1020	50
10	Sodium Sulfate + Nutrients				3210		3250		3310	3257	50		8350		8770		8700	8607	225		810		855		871	845	32		2250		2410		2440	2367	102		1000		1060		1070	1043	38
11	Sodium Sulfate + Ferrous Chloride + Nutrients				3390		3360		3200	3317	102		9050		8650		7980	8560	541		891		814		765	823	64		2450		2270		2140	2287	156		1090		1010		960	1020	66
1	Killed Anaerobic Control	89	8/19/2014		2650		2700		2640	2663	32		7110		7200		6810	7040	204		705		719		683	702	18		1900		1910		1870	1893	21		848		838		818	835	15
2	Killed Aerobic Control		3 months		2020		2040		2090	2050	36		5180		5470		5460	5370	165		487		556		537	527	36		1400		1510		1480	1463	57		678		730		707	705	26
3	Unamended Anaerobic Live Control				2650		2540		2620	2603	57		7280		6680		7170	7043	319		765		652		747	721	61		2000		1730		1970	1900	148		882		748		853	828	71
4	Oxygen + Nutrients			U	11.8	U	11.8	U	11.8	11.8	0.0	J	77.3	J	71.8	U	21.0	56.7	31.0	U	22.3	U	22.3	U	22.3	22.3	0.0	J	37.0	J	39.9	U	42.8	39.9	2.9	U	23.1	U	23.1	U	23.1	23.1	0.0
5	Sodium Sulfate				2690		2500		2640	2610	98		7220		6600		7300	7040	383		734		648		705	696	44		1980		1750		1830	1853	117		886		793		797	825	53
6	Sodium Sulfate + Ferrous Chloride				2580		2530		2340	2483	127		6910		6870		6310	6697	335		626		682		631	646	31		1750		1820		1710	1760	56		768		818		756	781	33
7	Sodium Sulfate + Ferrous Chloride + Lactate				2540		2560		2530	2543	15		6920		6880		6880	6893	23		702		699		698	700	2		1860		1880		1840	1860	20		843		837		813	831	16
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				2450		2450		2410	2437	23		6730		6620		6510	6620	110		689		683		661	678	15		1780		1780		1740	1767	23		804		811		801	805	5
9	Anaerobic + Nutrients				2570		2510		2460	2513	55		6700		6780		6570	6683	106		630		704		669	668	37		1770		1860		1790	1807	47		785		831		816	811	23
10	Sodium Sulfate + Nutrients				2450		2620		2740	2603	146		6520		7110		7490	7040	489		678		701		727	702	25		1780		1850		1970	1867	96		793		819		862	825	35
11	Sodium Sulfate + Ferrous Chloride + Nutrients				2600		2600		2500	2567	58		6840		7020		6420	6760	308		704		701		639	681	37		1840		1900		1770	1837	65		844		846		781	824	37
1	Killed Anaerobic Control	151	10/20/2014		2520		2570		2660	2583	71		6440		6780		6830	6683	212		725		745		759	743	17		1800		1870		1860	1843	38		813		824		833	823	10
2	Killed Aerobic Control		5 months		1760		1830		1880	1823	60		4430		4580		4620	4543	100		462		510		487	486	24		1170		1310		1230	1237	70		586		641		625	617	28
3	Unamended Anaerobic Live Control				2680		2570		2570	2607	64		6790		6400		7130	6773	365		770		694		802	755	55		1960		1730		1930	1873	125		859		776		887	841	58
4	Oxygen + Nutrients			U	11.8	U	11.8	U	11.8	11.8	0.0	J	73.5	J	33.2	J	23.9	43.5	26.4	U	22.3	U	22.3	U	22.3	22.3	0.0	J	31.1	U	42.8	U	42.8	38.9	6.8	U	23.1	U	23.1	U	23.1	23.1	0.0
5	Sodium Sulfate				2770		2540		2750	2687	127		7120		6010		7120	6750	641		799		627		798	741	99		1990		1580		1980	1850	234		889		719		885	831	97
6	Sodium Sulfate + Ferrous Chloride				2660		2630		2380	2557	154		6660		6790		6100	6517	367		766		750		679	732	46		1910		1890		1730	1843	99		862		843		757	821	56
7	Sodium Sulfate + Ferrous Chloride + Lactate				2670		2680		2700	2683	15		6840		6770		6860	6823	47		769		772		791	777	12		1930		1920		1950	1933	15		865		865		879	870	8
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				2540		2590		2610	2580	36		6390		6480		6690	6520	154		717		733		756	735	20		1790		1840		1880	1837	45		814		842		849	835	
9	Anaerobic + Nutrients				2710		2710		2730	2717	12		6790		6880		6930	6867	71		751		762		766	760	8		1890		1880		1950	1907	38		839		867		873	860	
10	Sodium Sulfate + Nutrients				2660		2670		2690	2673	15		6420		6820		6790	6677	223		737		777		771	762	22		1840		1940		1910	1897	51		824		877		860	854	
11	Sodium Sulfate + Ferrous Chloride + Nutrients				2860		2660		2530	2683	166		7370		6650		6150	6723	613		811		743		692	749	60		2040		1850		1730	1873	156		905		838		780	841	

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL).

U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

When triplicates consisted of a combination of detected and non-detected values, the calculated MDL was used to represent the non-detected (U) values in calculations

Table A3. Reduced Gas Concentrations in Kirtland Air Force Base Source Area Microcosms (106210)

	Treatment	Time (days)	Date	Methane (µg/L)								Ethane (µg/L)								Ethene (µg/L)							
	106210			Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD
1	Killed Anaerobic Control	0	5/22/2014		16.9		18.2	U	2.0	12.4	9.0	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
2	Killed Aerobic Control			U	2.0	U	2.0	U	2.0	2.0	0.0	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
3	Unamended Anaerobic Live Control				21.1	U	2.0		21.2	14.8	11.1	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
4	Oxygen + Nutrients				17.7		19.6	U	2.0	13.1	9.7	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
5	Sodium Sulfate			U	2.0		19.3		17.7	13.0	9.6	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
6	Sodium Sulfate + Ferrous Chloride			U	2.0		19.2	U	2.0	7.7	9.9	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate			U	2.0	U	2.0	U	2.0	2.0	0.0	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				16.1		21.0	U	2.0	13.0	9.9	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
9	Anaerobic + Nutrients			U	2.0	U	2.0	U	2.0	2.0	0.0	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
10	Sodium Sulfate + Nutrients			U	2.0	U	2.0		18.5	7.5	9.5	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients			U	2.0	U	2.0	U	2.0	2.0	0.0	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
1	Killed Anaerobic Control	32	6/23/2014		34.7		34.2		30.3	33.1	2.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
2	Killed Aerobic Control		1 month		32.8		34.9		30.0	32.6	2.5	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
3	Unamended Anaerobic Live Control				32.3		31.5		34.3	32.7	1.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
4	Oxygen + Nutrients				32.6		34.6		32.5	33.2	1.2	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
5	Sodium Sulfate				34.3		34.8	U	0.2	23.1	19.8	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
6	Sodium Sulfate + Ferrous Chloride				23.2		31.2		25.5	26.6	4.1	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate				30.5		37.7		26.7	31.6	5.6	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				484		821		647	651	169	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
9	Anaerobic + Nutrients				27.8		28.2		28.5	28.2	0.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
10	Sodium Sulfate + Nutrients				24.3		30.6		31.1	28.7	3.8	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients				33.5		32.4		28.4	31.4	2.7	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
1	Killed Anaerobic Control	61	7/22/2014		27.0		27.7		24.0	26.2	2.0	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
2	Killed Aerobic Control		2 months		24.5		23.9		23.3	23.9	0.6	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
3	Unamended Anaerobic Live Control				23.9		25.5		26.8	25.4	1.5	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
4	Oxygen + Nutrients				22.0		21.5		23.7	22.4	1.2	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
5	Sodium Sulfate				32.9		24.1		26.2	27.7	4.6	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
6	Sodium Sulfate + Ferrous Chloride				24.2		25.9		24.5	24.9	0.9	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate				28.5		25.0		27.8	27.1	1.9	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				478		588		608	558	70	U	4.0	U	4.0	U	4.0	4.0	0.0		25.3		26.0		28.7	26.7	1.8
9	Anaerobic + Nutrients				27.5		25.2		37.2	30.0	6.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
10	Sodium Sulfate + Nutrients				29.5		24.5		23.3	25.8	3.3	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients				25.2		24.9		27.7	25.9	1.5	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
1	Killed Anaerobic Control	89	8/19/2014		19.5		20.1		24.1	21.2	2.5	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
2	Killed Aerobic Control		3 months		18.4		18.3		19.3	18.7	0.6	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
3	Unamended Anaerobic Live Control				20.8		25.1		28.4	24.8	3.8	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
4	Oxygen + Nutrients				18.3		22.8		26.2	22.4	4.0	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
5	Sodium Sulfate				22.3		21.8		20.9	21.7	0.7	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
6	Sodium Sulfate + Ferrous Chloride				20.9		19.7		25.9	22.2	3.3	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate				21.0		19.2		21.6	20.6	1.2	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				410		444		469	441	30	U	4.0	U	4.0	U	4.0	4.0	0.0		24.6		23.9		26.4	25.0	1.3
9	Anaerobic + Nutrients				19.1		21.4		20.6	20.4	1.2	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
10	Sodium Sulfate + Nutrients				20.5		18.9		18.8	19.4	1.0	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients				20.2		24.5		20.5	21.7	2.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
1	Killed Anaerobic Control	151	10/20/2014	U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
2	Killed Aerobic Control		5 months	U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
3	Unamended Anaerobic Live Control			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
4	Oxygen + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
5	Sodium Sulfate				15.1	U	2.2	U	2.2	6.5	7.5	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
6	Sodium Sulfate + Ferrous Chloride			U	2.2	U	2.2		17.4	7.2	8.8	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				236		161	U	244	214	46	U	4.1	U	4.1	U	4.1	4.1	0.0		18.7		16.2		20.3	18.4	2.1
9	Anaerobic + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
10	Sodium Sulfate + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL).

U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

When triplicates consisted of a combination of detected and non-detected values, the calculated MDL was used to represent the non-detected (U) values in calculations

Table A4. Anion Concentrations in Kirtland Air Force Base Source Area Microcosms (106210)

	Treatment	Time (days)	Date	Chloride (mg/L)		Nitrite (mg/L)		Sulfate (mg/L)		Nitrate (mg/L)		Phosphate (mg/L)	
	106210			Q		Q		Q		Q		Q	
1	Killed Anaerobic Control	0	5/22/2014		219	U	0.1		30.4	J	1.67	U	0.14
2	Killed Aerobic Control				228	U	0.1		30.1	J	1.59	U	0.14
3	Unamended Anaerobic Live Control				108	U	0.1		31.6	J	1.59	U	0.14
4	Oxygen + Nutrients				100	U	0.1		29.3	J	1.59		5.90
5	Sodium Sulfate				101	U	0.1		93.3	J	1.59	U	0.14
6	Sodium Sulfate + Ferrous Chloride				135	U	0.1		74.5	J	1.74	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				141	U	0.1		89.9	J	1.82	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				144	U	0.1		94.3	J	1.57	U	0.14
9	Anaerobic + Nutrients				90	U	0.1		26.4	J	1.59		5.40
10	Sodium Sulfate + Nutrients				90	U	0.1		84.4	J	1.62		4.69
11	Sodium Sulfate + Ferrous Chloride + Nutrients				145	U	0.1		91.2	J	1.64	U	0.14
1	Killed Anaerobic Control	13	6/4/2014		256	U	0.1		28.6	J	1.69	U	0.14
2	Killed Aerobic Control				289	U	0.1		27.8	J	1.64	U	0.14
3	Unamended Anaerobic Live Control				114	U	0.1		32.9	J	1.74	U	0.14
4	Oxygen + Nutrients				88.7	U	0.1		26.5	J	1.74		4.42
5	Sodium Sulfate				94.1	U	0.1		89.3	J	1.74	U	0.14
6	Sodium Sulfate + Ferrous Chloride				132	U	0.1		84.6	J	1.68	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				136	U	0.1		86.5	J	1.71	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				169	U	0.1		63.9	J	1.73		5.39
9	Anaerobic + Nutrients				85.6	U	0.1		27.2	J	1.69		5.03
10	Sodium Sulfate + Nutrients				85.0	U	0.1		83.1	J	1.70		5.07
11	Sodium Sulfate + Ferrous Chloride + Nutrients				131	U	0.1		86.1	J	1.71	U	0.14
1	Killed Anaerobic Control	32	6/23/2014		289	U	0.1		25.8	J	1.67	U	0.14
2	Killed Aerobic Control		1 month		308	U	0.1		24.6	J	1.95	U	0.14
3	Unamended Anaerobic Live Control				97.9	U	0.1		30.9		2.14	U	0.14
4	Oxygen + Nutrients				72.7	U	0.1		22.5		2.04		3.77
5	Sodium Sulfate				83.9	U	0.1		79.9	J	1.71	U	0.14
6	Sodium Sulfate + Ferrous Chloride				127	U	0.1		80.7	J	1.98	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				129	U	0.1		80.3		2.02	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				154	U	0.1		50.0		2.07	U	0.14
9	Anaerobic + Nutrients				81.7	U	0.1		26.4	J	1.85		3.01
10	Sodium Sulfate + Nutrients				83.4	U	0.1		82.2	J	1.89		3.32
11	Sodium Sulfate + Ferrous Chloride + Nutrients				127	U	0.1		83.5	J	1.90	U	0.14
1	Killed Anaerobic Control	47	7/8/2014		407	U	0.1		148*		3.09	U	0.14
2	Killed Aerobic Control				395	U	0.1		36.4	J	1.71	U	0.14
3	Unamended Anaerobic Live Control				111	U	0.1		38.4	J	1.72	U	0.14
4	Oxygen + Nutrients				100	U	0.1		33.9	J	1.29		4.94
5	Sodium Sulfate				107	U	0.1		107	J	1.72	U	0.14
6	Sodium Sulfate + Ferrous Chloride				155	U	0.1		104	J	1.67	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				158	U	0.1		105	J	1.81	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				178	U	0.1		36.0	J	1.64	U	0.14
9	Anaerobic + Nutrients				102	U	0.1		35.6	J	1.68	J	1.19
10	Sodium Sulfate + Nutrients				109	U	0.1		106		2.61	J	1.19
11	Sodium Sulfate + Ferrous Chloride + Nutrients				154	U	0.1		106	J	1.72	U	0.14
1	Killed Anaerobic Control	61	7/22/2014		290	U	0.1		23.4	J	0.61	U	0.14
2	Killed Aerobic Control		2 months		270	U	0.1		21.4	J	0.55	U	0.14
3	Unamended Anaerobic Live Control				94.3	U	0.1		25.6	J	0.68	U	0.14
4	Oxygen + Nutrients				83.6	U	0.1		20.7	U	0.18		3.91
5	Sodium Sulfate				98.5	U	0.1		88.9	J	0.67	U	0.14
6	Sodium Sulfate + Ferrous Chloride				147	U	0.1		87.4	J	0.62	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				161	U	0.1		95.9	J	0.68	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				156	U	0.1		21.9	J	0.59	U	0.14
9	Anaerobic + Nutrients				77.9	U	0.1		24.9	J	0.60	J	1.12
10	Sodium Sulfate + Nutrients				88.9	U	0.1		81.1	J	0.55	J	0.77
11	Sodium Sulfate + Ferrous Chloride + Nutrients				136	U	0.1		81.6	J	0.54	U	0.14
1	Killed Anaerobic Control	75	8/5/2014	E	373	U	0.1		33.2	J	0.68	U	0.14
2	Killed Aerobic Control			E	405	U	0.1		38.8	J	0.78	U	0.14
3	Unamended Anaerobic Live Control				95.3	U	0.1		32.6	J	0.55	U	0.14
4	Oxygen + Nutrients				89.1	U	0.1		31.0	U	0.18		4.82
5	Sodium Sulfate				93.7	U	0.1		85.9	J	0.52	U	0.14
6	Sodium Sulfate + Ferrous Chloride				115	U	0.1		71.0	J	0.40	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				121	U	0.1		72.9	J	0.43	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				162	U	0.1		29.4	J	0.49	J	1.18
9	Anaerobic + Nutrients				96.9	U	0.1		33.5	J	0.51	J	0.82
10	Sodium Sulfate + Nutrients				92.6	U	0.1		87.6	J	0.49	J	0.90
11	Sodium Sulfate + Ferrous Chloride + Nutrients				138	U	0.1		86.8	J	0.47	J	0.84
1	Killed Anaerobic Control	89	8/19/2014		378	U	0.1		24.9	U	0.18	U	0.14
2	Killed Aerobic Control		3 months		373	U	0.1		25.3	U	0.18	U	0.14
3	Unamended Anaerobic Live Control				92.5	U	0.1		25.1	U	0.18	U	0.14
4	Oxygen + Nutrients				82.3	U	0.1		21.1	U	0.18		4.07
5	Sodium Sulfate				91.6	U	0.1		82.5	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride				137	U	0.1		81.8	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				138	U	0.1		80.5	U	0.18	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				164	U	0.1		22.8	U	0.18	U	0.14
9	Anaerobic + Nutrients				93.8	U	0.1		27.1	U	0.18	J	1.09
10	Sodium Sulfate + Nutrients				90.5	U	0.1		80.2	U	0.18	U	0.14
11	Sodium Sulfate + Ferrous Chloride + Nutrients				136	U	0.1		81.8	U	0.18	U	0.14
1	Killed Anaerobic Control	104	9/3/2014	E	465	U	0.1		30.3	J	0.41	U	0.14
2	Killed Aerobic Control			E	469	U	0.1		31.8	J	0.51	U	0.14
3	Unamended Anaerobic Live Control				223	U	0.1		32.7	J	0.54	U	0.14
4	Oxygen + Nutrients				173	U	0.1		29.2	U	0.18		2.88
5	Sodium Sulfate				158	U	0.1		95.6	J	0.54	U	0.14
6	Sodium Sulfate + Ferrous Chloride				210	U	0.1		94.7	J	0.53	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				213	U	0.1		92.9	J	0.53		1.55
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				234	U	0.1		30.5	J	0.49		2.13
9	Anaerobic + Nutrients				160	U	0.1		34.7	J	0.53	J	1.22
10	Sodium Sulfate + Nutrients				167	U	0.1		98.0	J	0.52	J	1.27
11	Sodium Sulfate + Ferrous Chloride + Nutrients				210	U	0.1		97.0	J	0.52	J	1.68
1	Killed Anaerobic Control	133	10/2/2014	E	434	U	0.1		26.4	J	0.46	U	0.14
2	Killed Aerobic Control			E	443	U	0.1		24.2	J	0.49	U	0.14
3	Unamended Anaerobic Live Control				228	U	0.1		24.9	J	0.50	U	0.14
4	Oxygen + Nutrients				166	U	0.1		21.4	U	0.18		3.21
5	Sodium Sulfate				140	U	0.1		75.4	J	0.46	U	0.14
6	Sodium Sulfate + Ferrous Chloride				195	U	0.1		79.8	J	0.46	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				211	U	0.1		86.3	J	0.47	J	0.45
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				234	U	0.1		22.2	J	0.48	J	0.64
9	Anaerobic + Nutrients				151	U	0.1		23.9	J	0.45	J	0.72
10	Sodium Sulfate + Nutrients				160	U	0.1		83.9	J	0.45	J	0.44
11	Sodium Sulfate + Ferrous Chloride + Nutrients				202	U	0.1		85.9	J	0.43	U	0.14
1	Killed Anaerobic Control	151	10/20/2014		383	U	0.1		24.7	U	0.18	U	0.14
2	Killed Aerobic Control		5 months		410	U	0.1		25.8	U	0.18	U	0.14
3	Unamended Anaerobic Live Control				227	U	0.1		29.1	U	0.18	U	0.14
4	Oxygen + Nutrients				161	U	0.1		22.8	U	0.18		4.17
5	Sodium Sulfate				151	U	0.1		85.0	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride				182	U	0.1		78.7	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				193	U	0.1		84.6	U	0.18	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				213	U	0.1		20.2	U	0.18	U	0.14
9	Anaerobic + Nutrients				147	U	0.1		25.6	U	0.18	U	0.14
10	Sodium Sulfate + Nutrients				156	U	0.1		86.0	U	0.18	U	0.14
11	Sodium Sulfate + Ferrous Chloride + Nutrients				187	U	0.1		82.8	U	0.18	U	0.14

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL).

U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

E - Estimated value beyond linear range

*Outlier; removed from data analysis and graphs

Table A5. Volatile Fatty Acid Concentrations in Kirtland Air Force Base Source Area Microcosms (106210)

	Treatment	Time (days)	Date	Lactate (mg/L)		Acetate (mg/L)		Propionate (mg/L)		Formate (mg/L)		Butyrate (mg/L)		Pyruvate (mg/L)		Valeric Acid (mg/L)	
	106210			Q		Q		Q		Q		Q		Q		Q	
7	Sodium Sulfate + Ferrous Chloride + Lactate	0	5/22/2014		98.8		2.56	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				94.8		3.06	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	32	6/23/2014		98.3		2.59	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		1 month		83.2		28.8	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	61	7/22/2014		80.4		10.0		14.8	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		2 months	U	0.1		98.1	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	75	8/5/2014		51.7		15.2		26.7	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	1.0		108	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	89	8/19/2014		40.3		14.3		28.4	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		3 months	U	0.1		105	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	151	10/20/2014		44.8		14.7		30.9	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		5 months	U	0.2		88.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3

U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

Table A6. pH and Dissolved Iron Concentration in Kirtland Air Force Base Source Area Microcosms (106210)

	Treatment	Time (days)	Date	Dissolved Fe (mg/L)		pH
	106210			Q		
1	Killed Anaerobic Control	0	5/22/2014		18.3	6.64
2	Killed Aerobic Control				16.5	6.60
3	Unamended Anaerobic Live Control			J	0.2	7.23
4	Oxygen + Nutrients			J	0.4	7.35
5	Sodium Sulfate			J	0.4	7.21
6	Sodium Sulfate + Ferrous Chloride			J	2.0	6.80
7	Sodium Sulfate + Ferrous Chloride + Lactate				5.8	6.78
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				11.1	6.74
9	Anaerobic + Nutrients				0.5	7.07
10	Sodium Sulfate + Nutrients			J	0.1	6.98
11	Sodium Sulfate + Ferrous Chloride + Nutrients				10.1	6.62
1	Killed Anaerobic Control	32	6/23/2014		29.4	7.4
2	Killed Aerobic Control		1 month		29.7	7.8
3	Unamended Anaerobic Live Control			J	0.2	8.2
4	Oxygen + Nutrients			J	0.3	8.2
5	Sodium Sulfate			U	0.1	8.3
6	Sodium Sulfate + Ferrous Chloride			J	0.3	8.2
7	Sodium Sulfate + Ferrous Chloride + Lactate				0.7	8.2
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				5.0	7.8
9	Anaerobic + Nutrients				0.5	8.8
10	Sodium Sulfate + Nutrients			U	0.1	8.8
11	Sodium Sulfate + Ferrous Chloride + Nutrients				0.8	8.1
1	Killed Anaerobic Control	61	7/22/2014		27.1	8.0
2	Killed Aerobic Control		2 months		28.8	8.1
3	Unamended Anaerobic Live Control			J	0.3	8.4
4	Oxygen + Nutrients				0.9	7.6
5	Sodium Sulfate			U	0.1	8.5
6	Sodium Sulfate + Ferrous Chloride			J	0.4	8.4
7	Sodium Sulfate + Ferrous Chloride + Lactate			J	0.2	9.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			J	0.5	8.3
9	Anaerobic + Nutrients			U	0.1	9.1
10	Sodium Sulfate + Nutrients			U	0.1	9.1
11	Sodium Sulfate + Ferrous Chloride + Nutrients			U	0.1	8.8
1	Killed Anaerobic Control	89	8/19/2014		28.7	8.2
2	Killed Aerobic Control		3 months		21.5	8.4
3	Unamended Anaerobic Live Control				0.5	9.0
4	Oxygen + Nutrients				1.1	7.9
5	Sodium Sulfate			U	0.1	8.8
6	Sodium Sulfate + Ferrous Chloride			J	0.4	8.8
7	Sodium Sulfate + Ferrous Chloride + Lactate				0.8	9.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.1	9.3
9	Anaerobic + Nutrients			J	0.4	9.4
10	Sodium Sulfate + Nutrients			U	0.1	9.6
11	Sodium Sulfate + Ferrous Chloride + Nutrients			J	0.2	9.4
1	Killed Anaerobic Control	151	10/20/2014		29.6	7.9
2	Killed Aerobic Control		5 months		27.9	8.1
3	Unamended Anaerobic Live Control				0.7	8.8
4	Oxygen + Nutrients				6.7	8.0
5	Sodium Sulfate			J	0.5	8.9
6	Sodium Sulfate + Ferrous Chloride			J	0.7	9.1
7	Sodium Sulfate + Ferrous Chloride + Lactate				4.9	9.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				0.8	9.2
9	Anaerobic + Nutrients				1.3	9.0
10	Sodium Sulfate + Nutrients				0.8	9.1
11	Sodium Sulfate + Ferrous Chloride + Nutrients				2.2	9.0

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantita
U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

Table A7. Oxygen Concentrations in Kirtland Air Force Base Source Area Microcosms (106210)

	Treatment	Time (days)	Date	**% O2**
	106210			
2	Killed Aerobic Control	0	5/22/2014	40.6
4	Oxygen + Nutrients			65.8
2	Killed Aerobic Control	13	6/4/2014	41.1
4	Oxygen + Nutrients			55.8
2	Killed Aerobic Control	21	6/12/2014	57.1
4	Oxygen + Nutrients			45.3
2	Killed Aerobic Control	32	6/23/2014	53.3
4	Oxygen + Nutrients		1 month	18.4
2	Killed Aerobic Control	40	7/1/2014	71.3
4	Oxygen + Nutrients			32.7
2	Killed Aerobic Control	47	7/8/2014	63.8
4	Oxygen + Nutrients			17.0
2	Killed Aerobic Control	54	7/15/2014	53.2
4	Oxygen + Nutrients			12.3
2	Killed Aerobic Control	61	7/22/2014	64.8
4	Oxygen + Nutrients		2 months	29.1
2	Killed Aerobic Control	68	7/29/2014	70.7
4	Oxygen + Nutrients			46.9
2	Killed Aerobic Control	75	8/5/2014	57.6
4	Oxygen + Nutrients			41.0
2	Killed Aerobic Control	83	8/13/2014	70.3
4	Oxygen + Nutrients			42.2
2	Killed Aerobic Control	89	8/19/2014	71.3
4	Oxygen + Nutrients		3 months	40.1
2	Killed Aerobic Control	98	8/28/2014	74.8
4	Oxygen + Nutrients			52.0
2	Killed Aerobic Control	104	9/3/2014	89.3
4	Oxygen + Nutrients			55.4
2	Killed Aerobic Control	119	9/18/2014	74.2
4	Oxygen + Nutrients			50.1
2	Killed Aerobic Control	133	10/2/2014	73.2
4	Oxygen + Nutrients			43.7

Values are reported as percent oxygen gas detected in the microcosm headspace.

Table A8. EDB Concentrations in Kirtland Air Force Base Side gradient Area Microcosms (10612R)

	Treatment	Time (days)	Date	EDB (μg/L)							
	10612R			Q	1	Q	2	Q	3	Average	SD
1	Killed Anaerobic Control	-28	6/25/2014		0.0589		0.0599		0.0611	0.0600	0.0011
2	Killed Aerobic Control				0.0726		0.0704		0.0685	0.0705	0.0021
3	Unamended Anaerobic Live Control				0.0663		0.0625		0.0669	0.0652	0.0024
4	Oxygen + Nutrients				0.0691		0.0724		0.0681	0.0699	0.0023
5	Sodium Sulfate				0.0652		0.0598		0.0661	0.0637	0.0034
6	Sodium Sulfate + Ferrous Chloride				0.0522		0.0593		0.0593	0.0569	0.0041
7	Sodium Sulfate + Ferrous Chloride + Lactate				0.0533	U	0.0382	U	0.0377	0.0431	0.0089
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.0377	U	0.0376	U	0.0376	0.0376	0.0001
9	Anaerobic + Nutrients				0.0524		0.0495		0.0587	0.0535	0.0047
10	Sodium Sulfate + Nutrients				0.0548		0.0524	U	0.0376	0.0483	0.0093
11	Sodium Sulfate + Ferrous Chloride + Nutrients				0.0594		0.0484		0.0676	0.0585	0.0096
1	Killed Anaerobic Control	0	7/23/2014		4.74		4.83		4.70	4.76	0.07
2	Killed Aerobic Control	EDB	time zero		4.69		4.85		4.68	4.74	0.10
3	Unamended Anaerobic Live Control				4.61		4.56		4.45	4.54	0.08
4	Oxygen + Nutrients				4.25		4.45		4.25	4.32	0.12
5	Sodium Sulfate				4.53		4.39		4.61	4.51	0.11
6	Sodium Sulfate + Ferrous Chloride				4.55		4.47		4.49	4.50	0.04
7	Sodium Sulfate + Ferrous Chloride + Lactate				4.52		4.51		4.41	4.48	0.06
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				4.43		4.24		4.75	4.47	0.26
9	Anaerobic + Nutrients				4.49		4.52		4.44	4.48	0.04
10	Sodium Sulfate + Nutrients				4.05		4.07		4.02	4.05	0.03
11	Sodium Sulfate + Ferrous Chloride + Nutrients				4.17		3.96		3.78	3.97	0.20
1	Killed Anaerobic Control	28	8/20/2014		5.14		5.00		5.09	5.08	0.07
2	Killed Aerobic Control		1 month		5.05		4.99		4.84	4.96	0.11
3	Unamended Anaerobic Live Control				4.79		4.88		5.04	4.90	0.13
4	Oxygen + Nutrients				2.05		2.09		3.65	2.60	0.91
5	Sodium Sulfate				4.87		4.87		5.13	4.96	0.15
6	Sodium Sulfate + Ferrous Chloride				4.89		5.03		4.93	4.95	0.07
7	Sodium Sulfate + Ferrous Chloride + Lactate				4.68		5.14		5.03	4.95	0.24
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.04	U	0.04	U	0.04	0.04	0.00
9	Anaerobic + Nutrients				4.76		4.72		4.79	4.76	0.04
10	Sodium Sulfate + Nutrients				4.87		4.92		4.84	4.88	0.04
11	Sodium Sulfate + Ferrous Chloride + Nutrients				4.82		4.50		4.56	4.63	0.17
1	Killed Anaerobic Control	62	10/21/2014		4.53		4.35		4.58	4.49	0.12
2	Killed Aerobic Control		3 months		4.31		4.24		4.59	4.38	0.19
3	Unamended Anaerobic Live Control				4.27		4.25		4.53	4.35	0.16
4	Oxygen + Nutrients				1.10		1.06		0.73	0.96	0.20
5	Sodium Sulfate				4.39		4.31		4.77	4.49	0.25
6	Sodium Sulfate + Ferrous Chloride				4.15		4.30		4.28	4.24	0.08
7	Sodium Sulfate + Ferrous Chloride + Lactate				4.15		4.47		4.01	4.21	0.24
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.19	U	0.19	U	0.19	0.19	0.00
9	Anaerobic + Nutrients				4.18		4.04		4.25	4.16	0.11
10	Sodium Sulfate + Nutrients				4.32		4.32		4.29	4.31	0.02
11	Sodium Sulfate + Ferrous Chloride + Nutrients				4.42		3.72		3.23	3.79	0.60
1	Killed Anaerobic Control	92	1/21/2015		4.34		3.84		NS	4.09	0.35
2	Killed Aerobic Control		6 months		3.57		3.42		3.62	3.54	0.10
3	Unamended Anaerobic Live Control				3.15		3.17		3.56	3.29	0.23
4	Oxygen + Nutrients			U	0.04	J	0.06	J	0.09	0.06	0.03
5	Sodium Sulfate				2.91		2.83		3.26	3.00	0.23
6	Sodium Sulfate + Ferrous Chloride				3.13		2.95		2.91	3.00	0.12
7	Sodium Sulfate + Ferrous Chloride + Lactate				2.82		3.19		3.09	3.03	0.19
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.04	U	0.04	U	0.04	0.04	0.00
9	Anaerobic + Nutrients				3.52		3.12		3.42	3.35	0.21
10	Sodium Sulfate + Nutrients				3.46		3.53		3.25	3.41	0.15
11	Sodium Sulfate + Ferrous Chloride + Nutrients				3.64		NS		NS	3.64	0.00

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL

U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

NS - No sample obtained.

When triplicates consisted of a combination of detected and non-detected values, the calculated MDL was used to represent the non-detected (U) values in calculations

Values shaded in gray represent initial EDB concentrations at the time of microcosm set up; these concentrations were insufficient, thus the microcosms were spiked with additional EDB on July 23, 2014 and sampled immediately after EDB addition. July 23 is considered time zero for EDB degradation in the microcosms.

Table A9. BTEX Concentrations in Kirtland Air Force Sidegradient Area Microcosms (10612R)

	Treatment	Time (days)	Date	Benzene (µg/L)								Toluene (µg/L)							
	10612R			Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD
1	Killed Anaerobic Control	0	6/25/2014		421		420		410	417	6		323		323		340	329	10
2	Killed Aerobic Control				335		367		311	338	28		270		285		237	264	25
3	Unamended Anaerobic Live Control				396		422		433	417	19		297		308		316	307	10
4	Oxygen + Nutrients				336		367		323	342	23		255		255		242	251	8
5	Sodium Sulfate				394		431		420	415	19		291		322		309	307	16
6	Sodium Sulfate + Ferrous Chloride				398		377		363	379	18		285		267		268	273	10
7	Sodium Sulfate + Ferrous Chloride + Lactate				394		426		387	402	21		296		325		293	305	18
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				389		395		406	397	9		285		301		301	296	9
9	Anaerobic + Nutrients				429		422		423	425	4		314		314		304	311	6
10	Sodium Sulfate + Nutrients				444		439		429	437	8		324		324		313	320	6
11	Sodium Sulfate + Ferrous Chloride + Nutrients				400		396		381	392	10		298		300		263	287	21
1	Killed Anaerobic Control	28	7/23/2014		435		443		446	441	6		369		348		341	353	15
2	Killed Aerobic Control		1 month		352		390		358	367	20		272		295		266	278	15
3	Unamended Anaerobic Live Control				381		377		431	396	30		197		205		140	181	35
4	Oxygen + Nutrients			U	3.9	U	3.9	U	3.9	3.9	0.0	U	7.0	U	7.0	U	7.0	7.0	0.0
5	Sodium Sulfate				387		443		381	404	34		204	J	14.0		201	140	109
6	Sodium Sulfate + Ferrous Chloride				390		367		398	385	16		287		266		308	287	21
7	Sodium Sulfate + Ferrous Chloride + Lactate				406		449		458	438	28		305		332		349	329	22
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				298		348		414	353	58		228		261		314	268	43
9	Anaerobic + Nutrients				327		320		424	357	58		83.3	J	56.4		141	93.6	43.2
10	Sodium Sulfate + Nutrients				343		331		333	336	6		90.7		78.7		112	93.8	16.9
11	Sodium Sulfate + Ferrous Chloride + Nutrients				397		404		398	400	4		260		253		232	248	15
1	Killed Anaerobic Control	56	8/20/2014		350		347		339	345	6		278		273		267	273	6
2	Killed Aerobic Control		2 months		257		272		248	259	12		201		211		204	205	5
3	Unamended Anaerobic Live Control				278		285		323	295	24		146		159		108	138	27
4	Oxygen + Nutrients			U	3.9	U	3.9	U	3.9	3.9	0.0	U	7.0	U	7.0	U	7.0	7.0	0.0
5	Sodium Sulfate				286		322		296	301	19		168	J	14.7		166	116	88
6	Sodium Sulfate + Ferrous Chloride				300		286		312	299	13		220		220		237	226	10
7	Sodium Sulfate + Ferrous Chloride + Lactate				327		365		346	346	19		242		285		268	265	22
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				233		265		318	272	43		174		209		248	210	37
9	Anaerobic + Nutrients				255		NS		318	287	45	J	68.0		NS		119	93.5	36.1
10	Sodium Sulfate + Nutrients				254		245		254	251	5		76.0		62.9		87.4	75.4	12.3
11	Sodium Sulfate + Ferrous Chloride + Nutrients				310		316		310	312	3		216		206		185	202	16
1	Killed Anaerobic Control	118	10/21/2014		376		360		390	375	15		285		263		294	281	16
2	Killed Aerobic Control		4 months		256		230		244	243	13		173		156		182	170	13
3	Unamended Anaerobic Live Control				308		295		354	319	31		153		157		115	142	23
4	Oxygen + Nutrients			U	3.9	U	3.9	U	3.9	3.9	0.0	U	7.0	U	7.0	U	7.0	7.0	0.0
5	Sodium Sulfate				298		341		312	317	22		160	J	20.6		164	115	82
6	Sodium Sulfate + Ferrous Chloride				330		297		296	308	19		232		212		217	220	10
7	Sodium Sulfate + Ferrous Chloride + Lactate				300		360		367	342	37		224		263		272	253	26
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				289		252		324	288	36		216		186		234	212	24
9	Anaerobic + Nutrients				269	U	3.9		357	210	184	J	69.9	J	7.4		128	68.4	60.3
10	Sodium Sulfate + Nutrients				263		255		285	268	16		77.4	J	68.0		97.2	80.9	14.9
11	Sodium Sulfate + Ferrous Chloride + Nutrients				NS		342		NS	342	0		NS		212		NS	212	0
1	Killed Anaerobic Control	210	1/21/2015		308		289		NS	299	13		213		193		NS	203	14
2	Killed Aerobic Control		7 months		153		165		163	160	6		101		106		113	107	6
3	Unamended Anaerobic Live Control				228		227		293	249	38		111		119		94	108	13
4	Oxygen + Nutrients			U	3.9	U	3.9	U	3.9	3.9	0.0	U	7.0	U	7.0	U	7.0	7.0	0.0
5	Sodium Sulfate				231		262		247	247	16		121	J	13.6		121	85	62
6	Sodium Sulfate + Ferrous Chloride				273		233		278	261	25		182		163		197	181	17
7	Sodium Sulfate + Ferrous Chloride + Lactate				275		308		302	295	18		184		208		214	202	16
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				209		222		236	222	14		145		156		158	153	7
9	Anaerobic + Nutrients				225	U	3.9		288	172	149	J	57.4	U	7.0		97.3	53.9	45.3
10	Sodium Sulfate + Nutrients				207		199		222	209	12	J	57.7	J	47.2		71.8	58.9	12.3
11	Sodium Sulfate + Ferrous Chloride + Nutrients				274		NS		NS	274	0		170		NS		NS	170	0

	Treatment	Ethylbenzene (µg/L)								Xylene (para and meta; µg/L)								Xylene (ortho; µg/L)							
	10612R	Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD
1	Killed Anaerobic Control		234		233		219	229	8		156		155		155	155	1	J	34.4	J	32.8	J	40.3	35.8	4.0
2	Killed Aerobic Control		186		202		163	184	20		127		134		117	126	9	J	31.1	J	31.1	J	25.6	29.3	3.2
3	Unamended Anaerobic Live Control		204		211		223	213	10		137		130		138	135	4	J	31.1	J	27.3	J	29.5	29.3	1.9
4	Oxygen + Nutrients		186		195		179	187	8		114		128		121	121	7	J	26.5	J	29.3	J	26.2	27.3	1.7
5	Sodium Sulfate		213		233		229	225	11		124		144		139	136	10	J	29.5	J	28.1	J	30.7	29.4	1.3
6	Sodium Sulfate + Ferrous Chloride		213		205		193	204	10		141		128		129	133	7	J	29.1	J	27.2	J	25.8	27.4	1.7
7	Sodium Sulfate + Ferrous Chloride + Lactate		212		233		204	216	15		134		145		132	137	7	J	27.6	J	28.0	J	28.6	28.1	0.5
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		210		220		218	216	5		133		139		135	136	3	J	28.7	J	28.3	J	26.0	27.7	1.5
9	Anaerobic + Nutrients		226		224		217	222	5		125		131		128	128	3	J	30.9	J	28.1	J	29.4	29.5	1.4
10	Sodium Sulfate + Nutrients		220		232		228	227	6		125		133		129	129	4	J	28.6	J	30.1	J	27.3	28.7	1.4
11	Sodium Sulfate + Ferrous Chloride + Nutrients		214		219		199	211	10		133		126		128	129	4	J	26.3	J	29.3	J	23.5	26.4	2.9
1	Killed Anaerobic Control		214		208		214	212	3		149		137		145	144	6	J	34.7	J	28.6	J	29.1	30.8	3.4
2	Killed Aerobic Control		166		184		156	169	14		117		123		102	114	11	J	26.0	J	24.9	J	20.4	23.8	3.0
3	Unamended Anaerobic Live Control		199		208		218	208	10	J	8.7	J	7.7	U	14.3	10.2	3.6	J	21.1	J	25.2	J	27.0	24.4	3.0
4	Oxygen + Nutrients	U	7.4	U	7.4	U	7.4	7.4	0.0	U	14.3	U	14.3	U	14.3	14.3	0.0	U	7.7	U	7.7	U	7.7	7.7	0.0
5	Sodium Sulfate		198		223		198	206	14	U	14.3	U	14.3	U	14.3	14.3	0.0	J	23.5	J	27.3	J	22.8	24.5	2.4
6	Sodium Sulfate + Ferrous Chloride		201		179		192	191	11	J	61.7	J	64.1		86.4	70.7	13.6	J	24.5	J	23.2	J	21.6	23.1	1.5
7	Sodium Sulfate + Ferrous Chloride + Lactate		186		217		219	207	19		122		128		146	132	12	J	24.4	J	24.5	J	32.1	27.0	4.4
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		145		161		194	167	25		95.3		105		122	107	14	J	20.0	J	17.6	J	24.1	20.6	3.3
9	Anaerobic + Nutrients		195		199		202	199	4	J	7.3	U	14.3	J	9.0	10.2	3.7	J	20.9	J	18.3	J	23.1	20.8	2.4
10	Sodium Sulfate + Nutrients		213		213		205	210	5	U	14.3	U	14.3	U	14.3	14.3	0.0	J	25.3	J	24.1	J	24.1	24.5	0.7
11	Sodium Sulfate + Ferrous Chloride + Nutrients		194		202		189	195	7	J	14.7	J	20.7	J	13.7	16.4	3.8	J	23.0	J	26.7	J	19.9	23.2	3.4
1	Killed Anaerobic Control		170		167		169	169	2		123		111		113	116	6	J	30.5	J	25.9	J	26.7	27.7	2.5
2	Killed Aerobic Control		120		130		119	123	6		82.0		95.1		78.7	85.3	8.7	J	19.9	J	20.9	J	19.7	20.2	0.6
3	Unamended Anaerobic Live Control		141		170		176	162	19	U	14.3	J	11.6	U	14.3	13.4	1.6	J	13.6	J	22.1	J	22.4	19.4	5.0
4	Oxygen + Nutrients	U	7.4	U	7.4	U	7.4	7.4	0.0	U	14.3	U	14.3	U	14.3	14.3	0.0	U	7.7	U	7.7	U	7.7	7.7	0.0
5	Sodium Sulfate		156		169		167	164	7	J	14.6	U	14.3	U	14.3	14.4	0.2	J	24.4	J	23.0	J	18.8	22.1	2.9
6	Sodium Sulfate + Ferrous Chloride		154		147		159	153	6	J	51.4	J	49.1	J	69.0	56.5	10.9	J	21.3	J	20.9	J	20.7	21.0	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate		159		172		166	166	7		102		100		103	102	2	J	20.4	J	22.8	J	21.1	21.4	1.2
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		115		130		151	132	18	J	66.9		84.8		91.0	80.9	12.5	J	14.8	J	16.5	J	18.1	16.5	1.7
9	Anaerobic + Nutrients		157		NS		154	156	2	U	14.3		NS	U	14.3	14.3	0.0	J	15.4		NS	J	17.9	16.7	1.8
10	Sodium Sulfate + Nutrients		159		158		163	160	3	J	13.2	U	14.3	U	14.3	13.9	0.6	J	25.9	J	19.9	J	19.3	21.7	3.6
11	Sodium Sulfate + Ferrous Chloride + Nutrients		148		160		148	152	7	J	16.1	U	14.3	J	17.8	16.1	1.8	J	16.0	J	17.1	J	17.8	17.0	0.9
1	Killed Anaerobic Control		165		153		174	164	11		96.7		90.0		98.7	95.1	4.6	J	25.8	J	22.3	J	24.5	24.2	1.8
2	Killed Aerobic Control		101		84.4		103	96.1	10.2	J	66.6	J	44.2	J	63.7	58.2	12.2	J	22.4	J	14.1	J	18.3	18.3	4.2
3	Unamended Anaerobic Live Control		147		148		165	153	10	U	14.3	U	14.3	U	14.3	14.3	0.0	J	19.3	J	21.0	J	21.4	20.6	1.1
4	Oxygen + Nutrients	U	7.4	U	7.4	U	7.4	7.4	0.0	U	14.3	U	14.3	U	14.3	14.3	0.0	U	7.7	U	7.7	U	7.7	7.7	0.0
5	Sodium Sulfate		145		139		155	146	8	U	14.3	U	14.3	U	14.3	14.3	0.0	J	21.0	J	22.4	J	20.0	21.1	1.2
6	Sodium Sulfate + Ferrous Chloride		146		141		140	142	3	J	44.8	J	45.9	J	58.7	49.8	7.7	J	20.6	J	19.7	J	18.6	19.6	1.0
7	Sodium Sulfate + Ferrous Chloride + Lactate		134		165		167	155	19		77.3		90.3		91.8	86.5	8.0	J	21.1	J	23.7	J	23.4	22.7	1.4
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		133		111		146	130	18		75.3		67.5		82.0	74.9	7.3	J	19.0	J	18.3	J	21.8	19.7	1.9
9	Anaerobic + Nutrients		152	J	8.0		154	105	84	U	14.3	U	14.3	U	14.3	14.3	0.0	J	21.4	U	7.7	J	20.0	16.4	7.5
10	Sodium Sulfate + Nutrients		151		147		162	153	8	U	14.3	U	14.3	U	14.3	14.3	0.0	J	20.3	J	19.5	J	21.8	20.5	1.2
11	Sodium Sulfate + Ferrous Chloride + Nutrients		NS		158		NS	158	0		NS	U	14.3		NS	14.3	0.0		NS	J	20.0		NS	20.0	0.0
1	Killed Anaerobic Control		128		112		NS	120	11	J	68.7	J	61.3		NS	65.0	5.2	J	18.1	J	13.7		NS	15.9	3.1
2	Killed Aerobic Control	J	52.5	J	58.0	J	62.2	57.6	4.9	J	30.7	J	47.9	J	41.6	40.1	8.7	J	8.0	J	16.5	J	12.6	12.4	4.3
3	Unamended Anaerobic Live Control		102		112		136	117	17	U	14.3	U	14.3	U	14.3	14.3	0.0	J	11.9	J	15.0	J	16.7	14.5	2.4
4	Oxygen + Nutrients	U	7.4	U	7.4	U	7.4	7.4	0.0	U	14.3	U	14.3	U	14.3	14.3	0.0	U	7.7	U	7.7	U	7.7	7.7	0.0
5	Sodium Sulfate		106		104		118	109	8	U	14.3	U	14.3	U	14.3	14.3	0.0	J	13.2	J	14.6	J	14.0	13.9	0.7
6	Sodium Sulfate + Ferrous Chloride		113		106		124	114	9	J	31.6	J	34.9	J	52.1	39.5	11.0	J	13.6	J	14.0	J	15.4	14.3	0.9
7	Sodium Sulfate + Ferrous Chloride + Lactate		115		126		128	123	7	J	68.5		74.5		71.3	71.4	3.0	J	16.0	J	18.6	J	18.3	17.6	1.4
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		82.9		92.5		96.0	90.5	6.8	J	46.1	J	53.2	J	52.2	50.5	3.8	J	11.1	J	13.0	J	13.3	12.5	1.2
9	Anaerobic + Nutrients		116	U	7.4		121	81.5	64.2	U	14.3	U	14.3	U	14.3	14.3	0.0	J	15.5	U	7.7	J	14.3	12.5	4.2
10	Sodium Sulfate + Nutrients		106		101		116	108	8	U	14.3	U	14.3	U	14.3	14.3	0.0	J	16.2	J	12.9	J	15.0	14.7	1.7
11	Sodium Sulfate + Ferrous Chloride + Nutrients		117		NS		NS	117	0	U	14.3		NS		NS	14.3	0.0	J	14.4		NS		NS	14.4	0.0

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL).

U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

NS - No sample obtained.

When triplicates consisted of a combination of detected and non-detected values, the calculated MDL was used to represent the non-detected (U) values in calculations

Table A10. Reduced Gas Concentrations in Kirtland Air Force Base Sidegradient Area Microcosms (10612R)

	Treatment	Time (days)	Date	Methane								Ethane								Ethene							
	10612R			Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD	Q	1	Q	2	Q	3	Average	SD
1	Killed Anaerobic Control	0	6/25/2014		19.2		25.4		24.1	22.9	3.3	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
2	Killed Aerobic Control		time zero		22.5		25.6		25.4	24.5	1.7	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
3	Unamended Anaerobic Live Control				27.3		29.9		21.0	26.1	4.6	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
4	Oxygen + Nutrients				26.9		29.4		27.3	27.9	1.3	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
5	Sodium Sulfate				27.8		28.3		21.4	25.8	3.8	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
6	Sodium Sulfate + Ferrous Chloride				27.6		23.8		28.3	26.6	2.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate				25.0		29.1		24.7	26.3	2.5	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				25.7		24.7		35.2	28.5	5.8	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
9	Anaerobic + Nutrients				26.8		27.2		26.9	27.0	0.2	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
10	Sodium Sulfate + Nutrients				23.6		18.7		23.8	22.0	2.9	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients				23.9		22.6		23.9	23.5	0.8	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
1	Killed Anaerobic Control	28	7/23/2014		21.3		24.3		24.2	23.3	1.7	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
2	Killed Aerobic Control		1 month		23.0		23.5		23.5	23.3	0.3	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
3	Unamended Anaerobic Live Control				24.3		22.9		22.6	23.3	0.9	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
4	Oxygen + Nutrients				23.9		24.5		23.7	24.0	0.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
5	Sodium Sulfate				23.9		24.1		25.9	24.6	1.1	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
6	Sodium Sulfate + Ferrous Chloride				24.1		24.8		24.1	24.3	0.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate				25.8		23.5		23.2	24.2	1.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				259		389		488	379	115	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
9	Anaerobic + Nutrients				24.3		22.1		22.6	23.0	1.2	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
10	Sodium Sulfate + Nutrients				24.2		21.9		24.7	23.6	1.5	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients				23.0		23.1		22.7	22.9	0.2	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
1	Killed Anaerobic Control	56	8/20/2014		18.9		18.8		18.1	18.6	0.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
2	Killed Aerobic Control		2 months		20.6		18.4		21.2	20.1	1.5	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
3	Unamended Anaerobic Live Control				17.4		19.9		20.5	19.3	1.6	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
4	Oxygen + Nutrients				19.6		17.9		11.4	16.3	4.3	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
5	Sodium Sulfate				18.9		19.3		19.2	19.1	0.2	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
6	Sodium Sulfate + Ferrous Chloride				18.4		19.0		19.0	18.8	0.3	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate				18.1		20.1		17.5	18.6	1.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				208		318		284	270	56	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
9	Anaerobic + Nutrients				19.6		19.8		22.2	20.5	1.4	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
10	Sodium Sulfate + Nutrients				18.5		16.9		18.2	17.9	0.9	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients				20.3		20.0		19.1	19.8	0.6	U	4.0	U	4.0	U	4.0	4.0	0.0	U	5.0	U	5.0	U	5.0	5.0	0.0
1	Killed Anaerobic Control	118	10/21/2014	U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
2	Killed Aerobic Control		4 months	U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
3	Unamended Anaerobic Live Control			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
4	Oxygen + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
5	Sodium Sulfate			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
6	Sodium Sulfate + Ferrous Chloride			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				225		95.4		149	156	65	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
9	Anaerobic + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
10	Sodium Sulfate + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
1	Killed Anaerobic Control	210	1/21/2015	U	2.2		16.8	U	2.2	7.0	8.5	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
2	Killed Aerobic Control		7 months	U	2.2		19.7	U	2.2	8.0	10.1	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
3	Unamended Anaerobic Live Control			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
4	Oxygen + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
5	Sodium Sulfate			U	2.2		18.3	U	2.2	7.5	9.3	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
6	Sodium Sulfate + Ferrous Chloride			U	2.2	U	2.2		17.3	7.2	8.7	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
7	Sodium Sulfate + Ferrous Chloride + Lactate				18.1		16.7	U	2.2	12.3	8.8	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				76.2		159		128	121	42	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
9	Anaerobic + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
10	Sodium Sulfate + Nutrients			U	2.2	U	2.2	U	2.2	2.2	0.0	U	4.1	U	4.1	U	4.1	4.1	0.0	U	3.9	U	3.9	U	3.9	3.9	0.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients			U	2.2		NS		NS	2.2	0.0	U	4.1		NS		NS	4.1	0.0	U	3.9		NS		NS	3.9	0.0

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL).
U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.
NS - No sample obtained.
When triplicates consisted of a combination of detected and non-detected values, the calculated MDL was used to represent the non-detected (U) values in calculations

Table A11. Anion Concentrations in Kirtland Air Force Base Sidegradient Area Microcosms (10612R)

	Treatment	Time (days)	Date	Chloride (mg/L)		Nitrite (mg/L)		Sulfate (mg/L)		Nitrate (mg/L)		Phosphate (mg/L)	
	10612R			Q		Q		Q		Q		Q	
1	Killed Anaerobic Control	0	6/25/2014		285	U	0.1		127		2.90	U	0.14
2	Killed Aerobic Control				346	U	0.1		124		2.80	U	0.14
3	Unamended Anaerobic Live Control				86.5	U	0.1		117		2.68	U	0.14
4	Oxygen + Nutrients				88.5	U	0.1		126		2.97		5.32
5	Sodium Sulfate				88.9	U	0.1		176		2.94	U	0.14
6	Sodium Sulfate + Ferrous Chloride				127	U	0.1		173		2.70	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				134	U	0.1		176		2.76	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				140	U	0.1		195		2.77	U	0.14
9	Anaerobic + Nutrients				95.5	U	0.1		128		2.79		4.55
10	Sodium Sulfate + Nutrients				87.6	U	0.1		183		2.87		5.49
11	Sodium Sulfate + Ferrous Chloride + Nutrients				130	U	0.1		178		2.78	U	0.14
1	Killed Anaerobic Control	13	7/8/2014		371	U	0.1		142		2.92	U	0.14
2	Killed Aerobic Control				397	U	0.1		34.8*	J	1.72	U	0.14
3	Unamended Anaerobic Live Control				101	U	0.1		142	J	1.18	U	0.14
4	Oxygen + Nutrients				103	U	0.1		146		2.98		3.85
5	Sodium Sulfate				98.3	U	0.1		207	J	1.85	U	0.14
6	Sodium Sulfate + Ferrous Chloride				151	U	0.1		209	J	1.20	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				149	U	0.1		207	J	1.19	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				172	U	0.1		170	J	1.19	U	0.14
9	Anaerobic + Nutrients				100	U	0.1		142	J	1.18	J	1.93
10	Sodium Sulfate + Nutrients				95.3	U	0.1		200	J	1.22		3.37
11	Sodium Sulfate + Ferrous Chloride + Nutrients				146	U	0.1		205	J	1.20	U	0.14
1	Killed Anaerobic Control	28	7/23/2014		284	U	0.1		117	J	1.71	U	0.14
2	Killed Aerobic Control		1 month		353	U	0.1		127	J	1.69	U	0.14
3	Unamended Anaerobic Live Control				94.5	U	0.1		119	U	0.18	U	0.14
4	Oxygen + Nutrients				81.2	U	0.1		133	J	1.88		4.00
5	Sodium Sulfate				87.3	U	0.1		172	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride				147	U	0.1		189	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				135	U	0.1		155	U	0.18	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				157	U	0.1		122	U	0.18	U	0.14
9	Anaerobic + Nutrients				87.1	U	0.1		115	U	0.18	J	0.44
10	Sodium Sulfate + Nutrients				95.5	U	0.1		187	U	0.18	J	1.07
11	Sodium Sulfate + Ferrous Chloride + Nutrients				154	U	0.1		199	U	0.18	U	0.14
1	Killed Anaerobic Control	41	8/5/2014	E	381	U	0.1		126	J	1.92	U	0.14
2	Killed Aerobic Control			E	462	U	0.1		140		2.49	U	0.14
3	Unamended Anaerobic Live Control				99.0	U	0.1		125	U	0.18	U	0.14
4	Oxygen + Nutrients				99.7	U	0.1		127	J	1.81	J	0.37
5	Sodium Sulfate				102	U	0.1		195	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride				145	U	0.1		182	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				140	U	0.1		142	U	0.18	J	1.57
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				168	U	0.1		129	U	0.18	J	1.86
9	Anaerobic + Nutrients				95.2	U	0.1		120	U	0.18	J	0.33
10	Sodium Sulfate + Nutrients				99.5	U	0.1		186	U	0.18	J	0.51
11	Sodium Sulfate + Ferrous Chloride + Nutrients				150	U	0.1		189	U	0.18	J	0.85
1	Killed Anaerobic Control	56	8/20/2014		385	U	0.1		132	J	1.95	U	0.14
2	Killed Aerobic Control		2 months		426	U	0.1		131	J	1.91	U	0.14
3	Unamended Anaerobic Live Control				102	U	0.1		133	U	0.18	U	0.14
4	Oxygen + Nutrients				99.6	U	0.1		132	J	1.89	J	1.07
5	Sodium Sulfate				100	U	0.1		198	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride				149	U	0.1		192	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				153	U	0.1		157	U	0.18	J	1.33
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				177	U	0.1		140	U	0.18	J	1.52
9	Anaerobic + Nutrients				102	U	0.1		135	U	0.18		2.52
10	Sodium Sulfate + Nutrients				103	U	0.1		203	U	0.18		2.65
11	Sodium Sulfate + Ferrous Chloride + Nutrients				156	U	0.1		205	U	0.18		2.89
1	Killed Anaerobic Control	70	9/3/2014	E	440	U	0.1		131	J	1.86	U	0.14
2	Killed Aerobic Control			E	492	U	0.1		130	J	1.85	U	0.14
3	Unamended Anaerobic Live Control				150	U	0.1		134	U	0.18	U	0.14
4	Oxygen + Nutrients				172	U	0.1		136	J	1.85	U	0.14
5	Sodium Sulfate				157	U	0.1		196	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride				204	U	0.1		195	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				204	U	0.1		157	U	0.18	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				227	U	0.1		139	J	0.29	U	0.14
9	Anaerobic + Nutrients				164	U	0.1		134	U	0.18	U	0.14
10	Sodium Sulfate + Nutrients				151	U	0.1		193	U	0.18	U	0.14
11	Sodium Sulfate + Ferrous Chloride + Nutrients				204	U	0.1		195	U	0.18	U	0.14
1	Killed Anaerobic Control	99	10/2/2014	E	410	U	0.1		118	J	1.67	U	0.14
2	Killed Aerobic Control			E	469	U	0.1		120	J	1.69	U	0.14
3	Unamended Anaerobic Live Control				142	U	0.1		123	U	0.18	U	0.14
4	Oxygen + Nutrients				155	U	0.1		120	J	1.61	U	0.14
5	Sodium Sulfate				143	U	0.1		172	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride				193	U	0.1		178	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				190	U	0.1		140	U	0.18	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				214	U	0.1		125	U	0.18	U	0.14
9	Anaerobic + Nutrients				149	U	0.1		117	U	0.18	U	0.14
10	Sodium Sulfate + Nutrients				133	U	0.1		167	U	0.18	U	0.14
11	Sodium Sulfate + Ferrous Chloride + Nutrients				185	U	0.1		172	U	0.18	U	0.14
1	Killed Anaerobic Control	118	10/21/2014		340	U	0.1		105	J	1.46	U	0.14
2	Killed Aerobic Control		4 months		427	U	0.1		115	J	1.63	U	0.14
3	Unamended Anaerobic Live Control				122	U	0.1		133	U	0.18	U	0.14
4	Oxygen + Nutrients				153	U	0.1		125	J	1.67	U	0.14
5	Sodium Sulfate				130	U	0.1		166	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride				189	U	0.1		185	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				180	U	0.1		139	U	0.18	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				126	U	0.1		140	U	0.18	U	0.14
9	Anaerobic + Nutrients				143	U	0.1		119	U	0.18	U	0.14
10	Sodium Sulfate + Nutrients				134	U	0.1		177	U	0.18	U	0.14
11	Sodium Sulfate + Ferrous Chloride + Nutrients				185	U	0.1		183	U	0.18	U	0.14
1	Killed Anaerobic Control	167	12/9/2014	E	473	U	0.1		134		2.70	U	0.14
2	Killed Aerobic Control			E	507	U	0.1		132		1.99	U	0.14
3	Unamended Anaerobic Live Control				217	U	0.1		135	U	0.18	U	0.14
4	Oxygen + Nutrients				248	U	0.1		128	J	1.89	U	0.14
5	Sodium Sulfate				233	U	0.1		204	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride			E	271	U	0.1		198	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate			E	279	U	0.1		164	U	0.18	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			E	285	U	0.1		138	U	0.18	U	0.14
9	Anaerobic + Nutrients				240	U	0.1		128	U	0.18	U	0.14
10	Sodium Sulfate + Nutrients				230	U	0.1		203	U	0.18	U	0.14
11	Sodium Sulfate + Ferrous Chloride + Nutrients			E	259	U	0.1		194	U	0.18	U	0.14
1	Killed Anaerobic Control	210	1/21/2015		467	U	0.1		133	J	1.89	U	0.14
2	Killed Aerobic Control		7 months		518	U	0.1		136	J	1.88	U	0.14
3	Unamended Anaerobic Live Control				205	U	0.1		131	U	0.18	U	0.14
4	Oxygen + Nutrients				259	U	0.1		139	J	1.95	U	0.14
5	Sodium Sulfate				241	U	0.1		215	U	0.18	U	0.14
6	Sodium Sulfate + Ferrous Chloride				281	U	0.1		210	U	0.18	U	0.14
7	Sodium Sulfate + Ferrous Chloride + Lactate				287	U	0.1		170	U	0.18	U	0.14
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				315	U	0.1		154	U	0.18	U	0.14
9	Anaerobic + Nutrients				261	U	0.1		141	U	0.18	U	0.14
10	Sodium Sulfate + Nutrients				230	U	0.1		208	U	0.18	U	0.14
11	Sodium Sulfate + Ferrous Chloride + Nutrients				278	U	0.1		215	U	0.18	U	0.14

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL).

U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

E - Estimated value beyond linear range

*Outlier; removed from data analysis and graphs

Table A12. Volatile Fatty Acid Concentrations in Kirtland Air Force Base Sidegradient Area Microcosms (10612R)

	Treatment	Time (days)	Date	**Lactate (mg/L)**		**Acetate (mg/L)**		**Propionate (mg/L)**		**Formate (mg/L)**		**Butyrate (mg/L)**		**Pyruvate (mg/L)**		**Valeric Acid (mg/L)**	
	10612R			Q		Q		Q		Q		Q		Q		Q	
7	Sodium Sulfate + Ferrous Chloride + Lactate	0	6/25/2014		89.1	U	0.2	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				94.5	U	0.2	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	28	7/23/2014		38.9		29.4	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		1 month	U	1.0		82.0	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	41	8/5/2014	U	1.0		48.1	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	1.0		88.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	56	8/20/2014	U	0.1		47.2	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		2 months	U	0.1		86.2	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	118	10/21/2014	U	0.1		47.2	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		4 months	U	0.1		77.5	U	0.3	U	0.3	J	0.78	U	0.3	U	0.3
7	Sodium Sulfate + Ferrous Chloride + Lactate	210	1/21/2015	U	0.1		47.8	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9		7 months	U	0.1		72.5	U	0.3	U	0.3	J	0.78	U	0.3	U	0.3

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL).

U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

Table A13. pH and Dissolved Iron Concentration in Kirtland Air Force Base Sidegradient Area Microcosms (10612R)

	Treatment	Time (days)	Date	Dissolved Iron (mg/L)		pH
	10612R			Q	1	
1	Killed Anaerobic Control	0	6/25/2014		31.0	7.4
2	Killed Aerobic Control				30.6	7.2
3	Unamended Anaerobic Live Control			J	0.2	7.8
4	Oxygen + Nutrients				0.6	8.1
5	Sodium Sulfate			U	0.1	8.1
6	Sodium Sulfate + Ferrous Chloride				1.2	7.2
7	Sodium Sulfate + Ferrous Chloride + Lactate			U	0.1	7.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				1.0	7.2
9	Anaerobic + Nutrients			J	0.4	8.0
10	Sodium Sulfate + Nutrients			U	0.1	8.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients			J	0.2	7.3
1	Killed Anaerobic Control	28	7/23/2014		30.0	8.1
2	Killed Aerobic Control		1 month		30.1	7.8
3	Unamended Anaerobic Live Control				3.4	8.3
4	Oxygen + Nutrients				4.0	9.0
5	Sodium Sulfate				7.2	8.8
6	Sodium Sulfate + Ferrous Chloride				3.1	8.6
7	Sodium Sulfate + Ferrous Chloride + Lactate				6.1	8.2
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9				6.1	8.4
9	Anaerobic + Nutrients				4.7	9.6
10	Sodium Sulfate + Nutrients				3.1	9.2
11	Sodium Sulfate + Ferrous Chloride + Nutrients				2.8	8.6
1	Killed Anaerobic Control	56	8/20/2014		23.4	8.2
2	Killed Aerobic Control		2 months		30.9	8.2
3	Unamended Anaerobic Live Control			J	0.4	8.3
4	Oxygen + Nutrients			J	0.4	9.3
5	Sodium Sulfate			J	0.3	9.2
6	Sodium Sulfate + Ferrous Chloride			J	0.3	9.0
7	Sodium Sulfate + Ferrous Chloride + Lactate			J	0.4	9.4
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			J	0.3	9.3
9	Anaerobic + Nutrients			J	0.2	9.4
10	Sodium Sulfate + Nutrients			U	0.1	9.3
11	Sodium Sulfate + Ferrous Chloride + Nutrients			U	0.1	9.1
1	Killed Anaerobic Control	118	10/21/2014		19.6	8.1
2	Killed Aerobic Control		3 months		29.9	8.0
3	Unamended Anaerobic Live Control				0.8	9.0
4	Oxygen + Nutrients				0.6	8.9
5	Sodium Sulfate			J	0.5	9.3
6	Sodium Sulfate + Ferrous Chloride			J	0.4	9.0
7	Sodium Sulfate + Ferrous Chloride + Lactate			U	0.1	9.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.1	9.2
9	Anaerobic + Nutrients			U	0.1	9.3
10	Sodium Sulfate + Nutrients			U	0.1	9.2
11	Sodium Sulfate + Ferrous Chloride + Nutrients			U	0.1	9.2
1	Killed Anaerobic Control	210	1/21/2015		15.7	8.0
2	Killed Aerobic Control		7 months		18.2	8.1
3	Unamended Anaerobic Live Control			J	0.4	8.6
4	Oxygen + Nutrients				2.7	8.8
5	Sodium Sulfate			J	0.4	9.2
6	Sodium Sulfate + Ferrous Chloride			J	0.2	9.0
7	Sodium Sulfate + Ferrous Chloride + Lactate			J	0.3	9.3
8	Sodium Sulfate + Ferrous Chloride + Lactate + SDC-9			U	0.1	9.2
9	Anaerobic + Nutrients				1.0	9.2
10	Sodium Sulfate + Nutrients			U	0.1	9.0
11	Sodium Sulfate + Ferrous Chloride + Nutrients			J	0.7	9.0

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantita
U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

Table A14. Oxygen Concentrations in Kirtland Air Force Base Sidegradient Area Microcosms (10612R)

	Treatment	Time (days)	Date	**% O2**
	10612R			
2	Killed Aerobic Control	0	6/25/2014	25.7
4	Oxygen + Nutrients			32.2
2	Killed Aerobic Control	6	7/1/2014	42.3
4	Oxygen + Nutrients			51.8
2	Killed Aerobic Control	13	7/8/2014	49.9
4	Oxygen + Nutrients			51.0
2	Killed Aerobic Control	20	7/15/2014	49.9
4	Oxygen + Nutrients			45.9
2	Killed Aerobic Control	28	7/23/2014	48.2
4	Oxygen + Nutrients		1 month	49.9
2	Killed Aerobic Control	34	7/29/2014	59.8
4	Oxygen + Nutrients			58.9
2	Killed Aerobic Control	41	8/5/2014	54.2
4	Oxygen + Nutrients			48.7
2	Killed Aerobic Control	49	8/13/2014	64.3
4	Oxygen + Nutrients			61.1
2	Killed Aerobic Control	56	8/20/2014	55.1
4	Oxygen + Nutrients		2 months	56.2
2	Killed Aerobic Control	64	8/28/2014	77.4
4	Oxygen + Nutrients			68.0
2	Killed Aerobic Control	70	9/3/2014	82.5
4	Oxygen + Nutrients			75.3
2	Killed Aerobic Control	85	9/18/2014	72.4
4	Oxygen + Nutrients			66.4
2	Killed Aerobic Control	99	10/2/2014	75.0
4	Oxygen + Nutrients			68.8
2	Killed Aerobic Control	118	10/21/2014	83.0
4	Oxygen + Nutrients		4 months	80.0
2	Killed Aerobic Control	162	12/4/2014	58.9
4	Oxygen + Nutrients			68.0
2	Killed Aerobic Control	210	1/21/2015	48.0
4	Oxygen + Nutrients		7 months	50.9

Values are reported as percent oxygen gas detected in the microcosm headspace.

Table A15. EDB Concentrations in Kirtland Air Force Base Aerobic Sidegradient Area Biostimulation Microcosms (10612R)

Treatment	Time (weeks)	Date	EDB (μg/L)							
10612R			Q	1	Q	2	Q	3	Average	SD
Killed control	0	6/4/2014		3980		3960		4010	3983	25
Live control				4060		4040		4190	4097	81
Ethane				3740		4260		4000	4000	260
Methane				3980		4010		3960	3983	25
Propane				3850		3690		4060	3867	186
Killed control	4	7/3/2014		3470		3980		3840	3763	264
Live control				3980		3490		4120	3863	331
Ethane				3720		3950		3950	3873	133
Methane				3710		3670		3690	3690	20
Propane				3620		3520		3870	3670	180
Killed control	9	8/4/2014		3620		3790		3740	3717	87
Live control				3800		3350		3910	3687	297
Ethane				3330		3550		3700	3527	186
Methane				3860		3720		3610	3730	125
Propane				3730		3560		3740	3677	101
Killed control	13	9/4/2014		3790		4110		4210	4037	219
Live control				4160		3660		4040	3953	261
Ethane				3850		4140		4160	4050	173
Methane				3980		4020		4170	4057	100
Propane				4050		3940		4010	4000	56
Killed control	20	10/22/2014		3850		4570		4020	4147	376
Live control				3940		3430		4060	3810	335
Ethane				3560		3570		3800	3643	136
Methane				3800		3840		3720	3787	61
Propane				3760		3560		3760	3693	115
Killed control	27	12/8/2014		3130		3190		3250	3190	60
Live control				3380		2670		3260	3103	380
Ethane				3000		2780		2870	2883	111
Methane				2900		2950		2970	2940	36
Propane				3000		3020		2940	2987	42

Table A16. EDB Concentrations in Kirtland Air Force Base Aerobic Sidegradient Area Bioaugmentation Microcosms (10612R)

Treatment	Time (days)	Date	EDB (µg/L)							
			Q	1	Q	2	Q	3	Average	SD
Bioaug-ENV425	0	7/24/2014		4130		4670		4350	4383	272
Bioaug-ENV482				4590		4530		4350	4490	125
O2 only				4520		4750		4540	4603	127
Killed				4470		4570		4710	4583	121
Bioaug-ENV425	4	7/28/2014		4070		4060		4180	4103	67
Bioaug-ENV482				3180		2870		2990	3013	156
O2 only				4450		4550		4600	4533	76
Killed				4540		4380		4590	4503	110
Bioaug-ENV425	7	7/31/2014		2780		2810		3210	2933	240
Bioaug-ENV482				1420		1490		1530	1480	56
O2 only				4530		4730		4540	4600	113
Killed				4420		4570		4620	4537	104
Bioaug-ENV425	11	8/4/2014		916		966		1038	973	61
Bioaug-ENV482			U	21.0	J	37.4	U	21.0	26.5	9.5
O2 only				3830		3910		4080	3940	128
Killed				3750		3850		3870	3823	64
Bioaug-ENV425	18	8/11/2014		822		747		790	786	38
Bioaug-ENV482			J	9.90	U	8.5	U	8.5	9.0	0.8
O2 only				3880		3830		3660	3790	115
Killed				3750		3720		3830	3767	57
Bioaug-ENV425	25	8/18/2014		802		801		819	807	10
Bioaug-ENV482			U	8.5	U	8.5	U	8.5	8.5	0.0
O2 only				3980		3750		3890	3873	116
Killed				4030		3970		4130	4043	81

J - Approximate concentration of the compound. Detection of compound above calculated Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL).
U - The compound was not detected at the indicated MDL concentration. U values are reported and graphed as the MDL.

APPENDIX D GROUNDWATER ANALYTICAL RESULTS – EDB ATTENUATION EVALUATION

APPENDIX D

GROUNDWATER ANALYTICAL RESULTS – EDB ATTENUATION EVALUATION

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-10610			KAFB-10610			KAFB-10627			KAFB-10627			KAFB-10628-510			KAFB-10628-510			KAFB-106059			KAFB-106064		
					SAMPLE NO	GW1860[e]			QUANT ARRAY CHLOR-06			GW1893			KAFB-106027			GW1916[e]			QUANT ARRAY CHLOR-01			GW1910			GW1915[e]		
					SAMPLE DATE	24-Nov-14			24-Nov-14			7-Oct-14			7-Oct-14			5-Nov-14			5-Nov-14			17-Nov-14			5-Nov-14		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	483-508 FT			-			481-501 FT			-			486-511 FT			-			483-503 FT			485-505 FT		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L) Method 8015C	DIESEL RANGE ORGANICS	N/A	N/A	N/A	N/A	13400		4000				ND	U	385				9050		4000				25400		8000	37400		7840
	GASOLINE RANGE ORGANICS	N/A	N/A	N/A	N/A	6070		1500				ND	U	150				3320		300				61800		7500	25500		3750
VOCs (µg/L) Method 8260B	1,2-DIBROMOETHANE (Method 8011)	0.1	N/A	0.05	0.0075	**6.88**		0.282				ND	U	0.0281				**14.3**		0.709				**8.46**		0.286	**19.7**		0.718
	1,1,1,2-TETRACHLOROETHANE	N/A	N/A	N/A	0.57	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,1,1-TRICHLOROETHANE	60	N/A	200	8000	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,1,2,2-TETRACHLOROETHANE	10	N/A	N/A	0.076	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,1,2-TRICHLOROETHANE	10	N/A	5	0.28	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,1-DICHLOROETHANE	25	N/A	N/A	2.7	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,1-DICHLOROETHENE	5	N/A	7	280	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,1-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,2,3-TRICHLOROBENZENE	N/A	N/A	N/A	7	ND	U	10				ND	U	2				ND	U	10				ND	U	200	ND	U	200
	1,2,3-TRICHLOROPROPANE	N/A	N/A	N/A	0.00075	ND	U	10				ND	U	2				ND	U	10				ND	U	200	ND	U	200
	1,2,4-TRICHLOROBENZENE	N/A	N/A	70	1.1	ND	U	10				ND	U	2				ND	U	10				ND	U	200	ND	U	200
	1,2,4-TRIMETHYLBENZENE	N/A	N/A	N/A	15	52.7		5				ND	U	1				18.8		5				530		100	158		100
	1,2-DIBROMO-3-CHLOROPROPANE	N/A	N/A	0.2	0.00033	ND	U	10				ND	U	2				ND	U	10				ND	U	200	ND	U	200
	1,2-DIBROMOETHANE	0.1	N/A	0.05	0.0075	**9.42**		5				ND	U	1				**10.5**		5				ND	U	100	ND	U	100
	1,2-DICHLOROBENZENE	N/A	N/A	600	300	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,2-DICHLOROETHANE	10	N/A	5	0.17	3.13	J	5				ND	U	1				2.39	J	5				ND	U	100	ND	U	100
	1,2-DICHLOROPROPANE	N/A	N/A	5	0.44	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,3,5-TRIMETHYLBENZENE	N/A	N/A	N/A	120	17.6		5				ND	U	1				6.5		5				155		100	60.9	J	100
	1,3-DICHLOROBENZENE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,3-DICHLOROPROPANE	N/A	N/A	N/A	370	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	1,4-DICHLOROBENZENE	N/A	N/A	75	0.48	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	2,2-DICHLOROPROPANE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	2-BUTANONE	N/A	N/A	N/A	5600	25	J	50				ND	U	10				ND	U	50				ND	U	1000	ND	U	1000
	2-CHLOROTOLUENE	N/A	N/A	N/A	240	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	2-HEXANONE	N/A	N/A	N/A	38	ND	U	25				ND	U	5				11.6	J	25				ND	U	500	ND	U	500
	4-CHLOROTOLUENE	N/A	N/A	N/A	250	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	4-METHYL-2-PENTANONE	N/A	N/A	N/A	1200	ND	U	25				ND	U	5				14.4	J	25				ND	U	500	133	J	500
	ACETONE	N/A	N/A	N/A	14000	138	J+	50				ND	U	10				44.7	J+	50				ND	U	1000	ND	U	1000
	BENZENE	10	N/A	5	0.45	**642**		5				ND	U	1				**435**		5				**11800**		100	**8220**		100
	BROMOBENZENE	N/A	N/A	N/A	62	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	BROMOCHLOROMETHANE	N/A	N/A	N/A	83	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	BROMODICHLOROMETHANE	N/A	N/A	80	0.13	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	BROMOFORM	N/A	N/A	80	9.2	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	BROMOMETHANE	N/A	N/A	N/A	7.5	ND	U	10				ND	U	2				ND	U	10				ND	U	200	ND	U	200
	CARBON DISULFIDE	N/A	N/A	N/A	810	9.27		5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	CARBON TETRACHLORIDE	10	N/A	5	0.45	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	CHLOROBENZENE	N/A	N/A	100	78	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	CHLOROETHANE	N/A	N/A	N/A	21000	ND	U	10				ND	U	2				ND	U	10				ND	U	200	ND	U	200
	CHLOROFORM	100	N/A	80	0.22	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	CHLOROMETHANE	N/A	N/A	N/A	190	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	CIS-1,2-DICHLOROETHENE	N/A	N/A	70	36	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	CIS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	DIBROMOCHLOROMETHANE	N/A	N/A	80	0.17	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	DIBROMOMETHANE	N/A	N/A	N/A	8	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	DICHLORODIFLUOROMETHANE	N/A	N/A	N/A	200	ND	U	10				ND	U	2				ND	U	10				ND	U	200	ND	U	200
	ETHYLBENZENE	750	N/A	700	1.5	393		5				ND	U	1				79.1		5				**1530**		100	**1050**		100
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	ND	U	10				ND	U	2				ND	UJ	10				ND	U	200	ND	UJ	200
	ISOPROPYLBENZENE	N/A	N/A	N/A	450	87.5		5				ND	U	1				12.4		5				107		100	67.4	J	100
	METHYL TERT-BUTYL ETHER	N/A	N/A	N/A	14	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	METHYLENE CHLORIDE	100	N/A	5	11	ND	U	10				ND	U	2				ND	U	10				ND	U	200	ND	U	200
	NAPHTHALENE	30	N/A	N/A	0.17	12.6	J-	10				ND	U	2				6.2	J	10				**159**	J	200	**82**	J	200
	N-BUTYLBENZENE	N/A	N/A	N/A	1000	3.44	J	5				ND	U	1				1.63	J	5				ND	U	100	ND	U	100
	N-PROPYLBENZENE	N/A	N/A	N/A	660	44.5		5				ND	U	1				9.16		5				119		100	59.5	J	100
	P-ISOPROPYLTOLUENE	N/A	N/A	N/A	N/A	38.9		5				ND	U	1				2.15	J	5				ND	U	100	50	J	100
	SEC-BUTYLBENZENE	N/A	N/A	N/A	2000	6.41		5				ND	U	1				2.91	J	5				ND	U	100	ND	U	100
	STYRENE	N/A	N/A	100	1200	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	TERT-BUTYLBENZENE	N/A	N/A	N/A	690	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	TETRACHLOROETHENE	20	N/A	5	11	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	TOLUENE	750	N/A	1000	1100	594		5				ND	U	1				477		5				**16200**		100	**3780**		100
	TRANS-1,2-DICHLOROETHENE	N/A	N/A	100	360	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	TRANS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	TRICHLOROETHENE	100	N/A	5	0.49	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	TRICHLOROFLUOROMETHANE	N/A	N/A	N/A	1100	ND	U	10				ND	U	2				ND	U	10				ND	U	200	ND	U	200
	VINYL CHLORIDE	1	N/A	2	0.019	ND	U	5				ND	U	1				ND	U	5				ND	U	100	ND	U	100
	XYLENES	620	N/A	10000	190	328		15				ND	U	3				119		15				**5290**		300	**1460**		300

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-10610			KAFB-10610			KAFB-10627			KAFB-10627			KAFB-10628-510			KAFB-10628-510			KAFB-106059			KAFB-106064		
					SAMPLE NO	GW1860[e]			QUANT ARRAY CHLOR-06			GW1893			KAFB-106027			GW1916[e]			QUANT ARRAY CHLOR-01			GW1910			GW1915[e]		
					SAMPLE DATE	24-Nov-14			24-Nov-14			7-Oct-14			7-Oct-14			5-Nov-14			5-Nov-14			17-Nov-14			5-Nov-14		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	483-508 FT			-			481-501 FT			-			486-511 FT			-			483-503 FT			485-505 FT		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
SVOCs (μg/L) Method 8270D	1,1-BIPHENYL	N/A	N/A	N/A	0.83	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	1,2-DIPHENYLHYDRAZINE	N/A	N/A	N/A	0.077	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	ND	U	50				ND	U	4.85				6.82	J	24.5				**60.2**		25	ND	U	100
	2,4,5-TRICHLOROPHENOL	5	N/A	N/A	1200	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	2,4,6-TRICHLOROPHENOL	5	N/A	N/A	4	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	2,4-DICHLOROPHENOL	5	N/A	N/A	46	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	2,4-DIMETHYLPHENOL	5	N/A	N/A	360	ND	U	200				ND	U	19.4				ND	U	98				**28.4**	J	100	ND	U	400
	2,4-DINITROPHENOL	5	N/A	N/A	39	ND	U	500				ND	U	48.5				ND	U	245				ND	U	250	ND	U	1000
	2,4-DINITROTOLUENE	N/A	N/A	N/A	0.24	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	2,6-DINITROTOLUENE	N/A	N/A	N/A	0.048	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	2-CHLORONAPHTHALENE	N/A	N/A	N/A	750	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	2-CHLOROPHENOL	5	N/A	N/A	91	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	ND	U	50				ND	U	4.85				ND	U	24.5				**68.1**		25	ND	U	100
	2-METHYLPHENOL	5	N/A	N/A	930	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	2-NITROANILINE	N/A	N/A	N/A	190	ND	U	200				ND	U	19.4				ND	U	98				ND	U	100	ND	U	400
	2-NITROPHENOL	5	N/A	N/A	N/A	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	3,3'-DICHLOROBENZIDINE	N/A	N/A	N/A	0.12	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	N/A	N/A	930	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	3-NITROANILINE	N/A	N/A	N/A	N/A	ND	U	200				ND	U	19.4				ND	U	98				ND	U	100	ND	U	400
	4,6-DINITRO-2-METHYLPHENOL	5	N/A	N/A	1.5	ND	U	200				ND	U	19.4				ND	U	98				ND	U	100	ND	U	400
	4-BROMOPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	4-CHLORO-3-METHYLPHENOL	5	N/A	N/A	1400	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	4-CHLOROANILINE	N/A	N/A	N/A	0.36	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	4-CHLOROPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	4-NITROANILINE	N/A	N/A	N/A	3.8	ND	U	200				ND	U	19.4				ND	U	98				ND	U	100	ND	U	400
	4-NITROPHENOL	5	N/A	N/A	N/A	ND	U	200				ND	U	19.4				ND	U	98				ND	U	100	ND	U	400
	ACENAPHTHENE	N/A	N/A	N/A	530	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	ACETOPHENONE	N/A	N/A	N/A	1900	357		50				ND	U	4.85				306		24.5				1240		250	890		100
	ANTHRACENE	N/A	N/A	N/A	1800	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	ATRAZINE	N/A	N/A	3	0.3	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BENZALDEHYDE	N/A	N/A	N/A	1900	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BENZIDINE	N/A	N/A	N/A	0.00011	ND	U	1000				ND	U	97.1				ND	U	490				ND	U	500	ND	U	2000
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BENZOIC ACID	N/A	N/A	N/A	75000	ND	U	1000				ND	U	97.1				ND	U	490				ND	U	500	ND	U	2000
	BIS(2-CHLOROETHOXY)METHANE	N/A	N/A	N/A	59	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BIS(2-CHLOROETHYL)ETHER	N/A	N/A	N/A	0.014	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BIS(2-CHLOROISOPROPYL)ETHER	N/A	N/A	N/A	0.36	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BIS(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	6	5.6	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	BUTYL BENZYL PHTHALATE	N/A	N/A	N/A	16	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	CAPROLACTAM	N/A	N/A	N/A	9900	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	CARBAZOLE	N/A	N/A	N/A	N/A	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	CHRYSENE	N/A	N/A	N/A	3.4	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	DIBENZOFURAN	N/A	N/A	N/A	7.9	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	DIETHYL PHTHALATE	N/A	N/A	N/A	15000	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	DIMETHYL PHTHALATE	N/A	N/A	N/A	N/A	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	DI-N-BUTYL PHTHALATE	N/A	N/A	N/A	900	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	DI-N-OCTYL PHTHALATE	N/A	N/A	N/A	200	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	FLUORANTHENE	N/A	N/A	N/A	800	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	FLUORENE	N/A	N/A	N/A	290	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	HEXACHLOROBENZENE	N/A	N/A	1	0.049	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	HEXACHLOROCYCLOPENTADIENE	N/A	N/A	50	31	ND	U	100				ND	U	9.71				ND	U	49				ND	U	50	ND	U	200
	HEXACHLOROETHANE	N/A	N/A	N/A	0.9	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	ISOPHORONE	N/A	N/A	N/A	78	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	NAPHTHALENE	30	N/A	N/A	0.17	16.2	J	50				ND	U	4.85				ND	U	24.5				**160**		25	**73.7**	J	100
	NITROBENZENE	N/A	N/A	N/A	0.14	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	N-NITROSO-DI-N-PROPYLAMINE	N/A	N/A	N/A	0.011	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	N-NITROSODIPHENYLAMINE	N/A	N/A	N/A	12	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	PENTACHLOROPHENOL	5	N/A	1	0.04	ND	U	200				ND	U	19.4				ND	U	98				ND	U	100	ND	U	400
	PHENANTHRENE	N/A	N/A	N/A	N/A	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	PHENOL	5	N/A	N/A	5800	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100
	PYRENE	N/A	N/A	N/A	120	ND	U	50				ND	U	4.85				ND	U	24.5				ND	U	25	ND	U	100

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-10610			KAFB-10610			KAFB-10627			KAFB-10627			KAFB-10628-510			KAFB-10628-510			KAFB-106059			KAFB-106064		
					SAMPLE NO	GW1860[e]			QUANT ARRAY CHLOR-06			GW1893			KAFB-106027			GW1916[e]			QUANT ARRAY CHLOR-01			GW1910			GW1915[e]		
					SAMPLE DATE	24-Nov-14			24-Nov-14			7-Oct-14			7-Oct-14			5-Nov-14			5-Nov-14			17-Nov-14			5-Nov-14		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	483-508 FT			-			481-501 FT			-			486-511 FT			-			483-503 FT			485-505 FT		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
PAHs (µg/L)	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Method 8270D	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Low Detection Limit	ACENAPHTHENE	N/A	N/A	N/A	530	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ANTHRACENE	N/A	N/A	N/A	1800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CHRYSENE	N/A	N/A	N/A	3.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L)	CALCIUM	N/A	N/A	N/A	N/A	71.1		5				37.3		5				85.1		5				81.9		5	87.2		5
Method 6010C	LEAD	0.05	0.01	0.015	0.015	ND	U	0.005				ND	U	0.005				0.00533		0.005				ND	U	0.005	0.00569		0.005
	MAGNESIUM	N/A	N/A	N/A	N/A	10.9		5				5.41		5				12.7		5				14.1		5	14.1		5
	POTASSIUM	N/A	N/A	N/A	N/A	2.88	J	5				2.1	J	5				3.03	J	5				2.96	J	5	2.86	J	5
	SODIUM	N/A	N/A	N/A	N/A	30.1		5				21.4		5				34.5		5				31.1		5	31.8		5
	IRON, DISSOLVED	1	N/A	N/A	14	0.24		0.1				ND	U	0.1				0.63		0.1				**2.11**		0.1	**6.72**		0.1
	MANGANESE, DISSOLVED	0.2	N/A	N/A	0.43	**1.83**		0.015				ND	U	0.015				**2.13**		0.015				**2.56**		0.015	**3.72**		0.015
Biological	APS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	338000		5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	302000		5	N/A	N/A	N/A	N/A	N/A	N/A
Parameters	BVC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	UJ	0.2	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	N/A	N/A	N/A
(cells/mL)	CFR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A
Method	DCM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	74.6		5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	25.8		5	N/A	N/A	N/A	N/A	N/A	N/A
QUANT ARRAY	DECO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A
	DHBT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	45400		5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	20900		5	N/A	N/A	N/A	N/A	N/A	N/A
	DHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.2		0.5	N/A	N/A	N/A	17	J	0.2	N/A	N/A	N/A	1.8		0.5	N/A	N/A	N/A	N/A	N/A	N/A
	DHG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	92500		5.1	N/A	N/A	N/A	57.3	J	2.5	N/A	N/A	N/A	6690		5	N/A	N/A	N/A	N/A	N/A	N/A
	DSB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	14700		5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	1490		5	N/A	N/A	N/A	N/A	N/A	N/A
	DSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1420		5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	135		5	N/A	N/A	N/A	N/A	N/A	N/A
	EBAC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2350000		5.1	N/A	N/A	N/A	117000	J	2.5	N/A	N/A	N/A	3560000		5	N/A	N/A	N/A	N/A	N/A	N/A
	ETNC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A
	ETNE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	6.7		5	N/A	N/A	N/A	N/A	N/A	N/A
	MGN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	22200		5.1	N/A	N/A	N/A	13.8	J	2.5	N/A	N/A	N/A	468		5	N/A	N/A	N/A	N/A	N/A	N/A
	PHE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	335		5.1	N/A	N/A	N/A	9.7	J	2.5	N/A	N/A	N/A	1310		5	N/A	N/A	N/A	N/A	N/A	N/A
	PMMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	84.9		5.1	N/A	N/A	N/A	0.1	J	2.5	N/A	N/A	N/A	23		5	N/A	N/A	N/A	N/A	N/A	N/A
	RDEG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2380		5.1	N/A	N/A	N/A	104	J	2.5	N/A	N/A	N/A	1880		5	N/A	N/A	N/A	N/A	N/A	N/A
	RMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	48.2		5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	3000		5	N/A	N/A	N/A	N/A	N/A	N/A
	SMMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9400		5.1	N/A	N/A	N/A	91.6	J	2.5	N/A	N/A	N/A	1910		5	N/A	N/A	N/A	N/A	N/A	N/A
	TCBO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A
	TCE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	0.9	J	0.2	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	N/A	N/A	N/A
	TOD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2260		5.1	N/A	N/A	N/A	4.05	J	2.5	N/A	N/A	N/A	2530		5	N/A	N/A	N/A	N/A	N/A	N/A
	VCR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	UJ	0.2	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	N/A	N/A	N/A

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-10610			KAFB-10610			KAFB-10627			KAFB-10627			KAFB-10628-510			KAFB-10628-510			KAFB-106059			KAFB-106064		
					SAMPLE NO	GW1860[e]			QUANT ARRAY CHLOR-06			GW1893			KAFB-106027			GW1916[e]			QUANT ARRAY CHLOR-01			GW1910			GW1915[e]		
					SAMPLE DATE	24-Nov-14			24-Nov-14			7-Oct-14			7-Oct-14			5-Nov-14			5-Nov-14			17-Nov-14			5-Nov-14		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	483-508 FT			-			481-501 FT			-			486-511 FT			-			483-503 FT			485-505 FT		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
Anions (mg/L) Method E300.0	BROMIDE	N/A	N/A	N/A	N/A	0.793		0.25				3.16		0.25				0.256		0.25				0.51		0.25	0.349		0.25
	CHLORIDE	250	N/A	N/A	N/A	57.8	J+	0.5				7.15		0.5				27.2		2.5				27.1	J+	0.5	13.8		2.5
	SULFATE	600	N/A	N/A	N/A	45.5		2.5				27.5		2.5				41.5		2.5				8.9		2.5	ND	U	2.5
	NITROGEN, NITRATE-NITRITE (Method E353.2)	10	4	10	N/A	ND	U	0.2				ND	U	0.2				ND	U	0.2				ND	U	0.2	ND	U	0.2
	AMMONIA (AS N) (Method 4500NH3BG)	N/A	N/A	N/A	N/A	ND	U	0.3				ND	U	0.3				ND	U	0.3				ND	U	0.3	ND	U	0.3
	SULFIDE, TOTAL (Method 4500S2CF)	N/A	N/A	N/A	N/A	0.906	J	3.77				ND	U	3.92				ND	U	3.7				ND	U	3.85	ND	U	3.7
Alkalinity (mg/L) Method SM2320B	ALKALINITY, BICARBONATE (AS CACO3)	N/A	N/A	N/A	N/A	160		1				126		1				258		1				310		1	287		1
	ALKALINITY, CARBONATE (AS CACO3)	N/A	N/A	N/A	N/A	ND	U	1				ND	U	1				ND	U	1				ND	U	1	ND	U	1
Field Parameters	Temperature (°C)	N/A	N/A	N/A	N/A	18.42			N/A			18.85			N/A			18.45			N/A			17.53			17.56		
	pH (S.U.)	N/A	N/A	N/A	N/A	7.43			N/A			7.78			N/A			7.28			N/A			7.07			6.91		
	Spec Cond (µS/cm)	N/A	N/A	N/A	N/A	596.5			N/A			310.9			N/A			646.6			N/A			537.5			550.1		
	DO (mg/L)	N/A	N/A	N/A	N/A	0			N/A			4.37			N/A			0			N/A			0.03			0		
	ORP (mV)	N/A	N/A	N/A	N/A	-320			N/A			131			N/A			-256			N/A			-227			-123		
	Turbidity (NTU)	N/A	N/A	N/A	N/A	0.83			N/A			0.29			N/A			2.19			N/A			1.63			0.78		
	Alkalinity (mg/L as CaCO3)	N/A	N/A	N/A	N/A	160			N/A			120			N/A			260			N/A			278			324		

EPA MCL and tap water RSLs are from the EPA RSL Table, dated November 2014.
The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-
The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 2-methylphenol, 2-nitrophenol, 3 and 4-methylphenol, 2,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-nitrophenol, and pentachlorophenol.
Sample GW0998 for SVOC analysis was not performed due to laboratory errors
Sample GW0886 for PAH analysis was not colllected due to an oversight.
KAFB-10612 not measured due to a non-operational corroded pump
The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.
The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene
a. EPA analytical methods listed are for the most recent sampling event.
b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and 2-methylnapthalene.
c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water.
d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs), or if more stringent, New Mexico Water Quality Control Commission (WQCC) Regulations as denoted by "*". Concentration exceeding standards are **BOLD.**
e. Sample contained bubbles.
f. ORP reading is faulty due to a malfunctioning sensor. Faulty readings are not reported on Figures 5-40, 5-41, and 5-42
Shading indicates the analyte was detected.
Bold indicated analyte detected greater than regulatory standard.
J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).
J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.
J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.
N/A = Not analyzed.
ND = Not detected.
NM = Not measured due to equipment malfunction.
NR = Not recorded or reported due to operational error.
R = Sample data rejected due to site contamination.
RSL = Regional Screening Level.
U = Analyte was not detected. The reported numerical value is at or below the LOQ.
UJ = Analyte was tentatively not detected. The reported numerical value is at or below the LOQ.

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-106067			KAFB-106075			KAFB-106075			KAFB-106075			KAFB-106076			KAFB-106076			KAFB-106079			KAFB-106079		
					SAMPLE NO	GW1920			GW1928[e]			GW1929[e]			KAFB-106075			GW1930			QUANT ARRAY CHLOR-05			GW1933[e]			QUANT ARRAY CHLOR-03		
					SAMPLE DATE	28-Oct-14			8-Oct-14			8-Oct-14			8-Oct-14			19-Nov-14			19-Nov-14			10-Nov-14			10-Nov-14		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	485-505 FT			480-500 FT			480-500 FT			-			480-500 FT			-			484-504 FT			-		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L)	DIESEL RANGE ORGANICS	N/A	N/A	N/A	N/A	8160		3850	1190		377	1420		400				93700		16000				28200		7690			
Method 8015C	GASOLINE RANGE ORGANICS	N/A	N/A	N/A	N/A	2870		150	316		150	316		150				29300		7500				12900		3750			
VOCs (µg/L)	1,2-DIBROMOETHANE (Method 8011)	0.1	N/A	0.05	0.0075	**0.26**	J	0.0283	**0.195**	J	0.0277	**0.182**		0.0279				**142**		5.63				**0.98**		0.0282			
Method 8260B	1,1,1,2-TETRACHLOROETHANE	N/A	N/A	N/A	0.57	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,1,1-TRICHLOROETHANE	60	N/A	200	8000	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,1,2,2-TETRACHLOROETHANE	10	N/A	N/A	0.076	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,1,2-TRICHLOROETHANE	10	N/A	5	0.28	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,1-DICHLOROETHANE	25	N/A	N/A	2.7	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,1-DICHLOROETHENE	5	N/A	7	280	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,1-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,2,3-TRICHLOROBENZENE	N/A	N/A	N/A	7	ND	U	10	ND	UJ	4	ND	UJ	4				ND	U	40				ND	U	100			
	1,2,3-TRICHLOROPROPANE	N/A	N/A	N/A	0.00075	ND	U	10	ND	U	4	ND	U	4				ND	U	40				ND	U	100			
	1,2,4-TRICHLOROBENZENE	N/A	N/A	70	1.1	ND	U	10	ND	U	4	ND	U	4				ND	U	40				ND	U	100			
	1,2,4-TRIMETHYLBENZENE	N/A	N/A	N/A	15	ND	U	5	ND	UJ	2	ND	UJ	2				264		20				37.8	J	50			
	1,2-DIBROMO-3-CHLOROPROPANE	N/A	N/A	0.2	0.00033	ND	U	10	ND	UJ	4	ND	UJ	4				ND	U	40				ND	U	100			
	1,2-DIBROMOETHANE	0.1	N/A	0.05	0.0075	ND	U	5	ND	U	2	ND	U	2				**117**		20				ND	U	50			
	1,2-DICHLOROBENZENE	N/A	N/A	600	300	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,2-DICHLOROETHANE	10	N/A	5	0.17	ND	U	5	1.05	J	2	1.19	J	2				ND	U	20				ND	U	50			
	1,2-DICHLOROPROPANE	N/A	N/A	5	0.44	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,3,5-TRIMETHYLBENZENE	N/A	N/A	N/A	120	10.5		5	ND	U	2	ND	U	2				71.7		20				41.6	J	50			
	1,3-DICHLOROBENZENE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,3-DICHLOROPROPANE	N/A	N/A	N/A	370	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	1,4-DICHLOROBENZENE	N/A	N/A	75	0.48	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	2,2-DICHLOROPROPANE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	2-BUTANONE	N/A	N/A	N/A	5600	ND	U	50	ND	U	20	ND	U	20				508		200				ND	U	500			
	2-CHLOROTOLUENE	N/A	N/A	N/A	240	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	2-HEXANONE	N/A	N/A	N/A	38	ND	U	25	ND	U	10	ND	U	10				1820		100				ND	U	250			
	4-CHLOROTOLUENE	N/A	N/A	N/A	250	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	4-METHYL-2-PENTANONE	N/A	N/A	N/A	1200	ND	U	25	ND	U	10	ND	U	10				1450		100				ND	U	250			
	ACETONE	N/A	N/A	N/A	14000	43.4	J+	50	63.4		20	86.2		20				1790	J+	200				ND	U	500			
	BENZENE	10	N/A	5	0.45	**356**		5	ND	U	2	ND	U	2				**516**		20				**5310**		50			
	BROMOBENZENE	N/A	N/A	N/A	62	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	BROMOCHLOROMETHANE	N/A	N/A	N/A	83	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	BROMODICHLOROMETHANE	N/A	N/A	80	0.13	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	BROMOFORM	N/A	N/A	80	9.2	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	UJ	50			
	BROMOMETHANE	N/A	N/A	N/A	7.5	ND	U	10	ND	U	4	ND	U	4				ND	U	40				ND	U	100			
	CARBON DISULFIDE	N/A	N/A	N/A	810	ND	U	5	ND	U	2	ND	U	2				6.64	J	20				ND	U	50			
	CARBON TETRACHLORIDE	10	N/A	5	0.45	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	CHLOROBENZENE	N/A	N/A	100	78	ND	U	5	ND	U	2	1.1	J	2				ND	U	20				ND	U	50			
	CHLOROETHANE	N/A	N/A	N/A	21000	ND	U	10	ND	U	4	ND	U	4				ND	U	40				ND	U	100			
	CHLOROFORM	100	N/A	80	0.22	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	CHLOROMETHANE	N/A	N/A	N/A	190	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	CIS-1,2-DICHLOROETHENE	N/A	N/A	70	36	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	CIS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	DIBROMOCHLOROMETHANE	N/A	N/A	80	0.17	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	DIBROMOMETHANE	N/A	N/A	N/A	8	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	DICHLORODIFLUOROMETHANE	N/A	N/A	N/A	200	ND	U	10	ND	U	4	ND	U	4				ND	U	40				ND	U	100			
	ETHYLBENZENE	750	N/A	700	1.5	215		5	ND	U	2	ND	U	2				371		20				398		50			
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	ND	U	10	ND	U	4	ND	U	4				ND	U	40				ND	UJ	100			
	ISOPROPYLBENZENE	N/A	N/A	N/A	450	37.8		5	9.29		2	10.1		2				37.7		20				36.5	J	50			
	METHYL TERT-BUTYL ETHER	N/A	N/A	N/A	14	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	METHYLENE CHLORIDE	100	N/A	5	11	ND	U	10	ND	U	4	ND	U	4				ND	U	40				ND	U	100			
	NAPHTHALENE	30	N/A	N/A	0.17	12.8		10	ND	UJ	4	ND	UJ	4				**237**		40				**39.2**	J	100			
	N-BUTYLBENZENE	N/A	N/A	N/A	1000	2.63	J	5	ND	U	2	ND	U	2				14.8	J	20				ND	U	50			
	N-PROPYLBENZENE	N/A	N/A	N/A	660	16.6		5	1.64	J	2	1.87	J	2				41.2		20				26.4	J	50			
	P-ISOPROPYLTOLUENE	N/A	N/A	N/A	N/A	2.97	J	5	ND	U	2	ND	U	2				9.05	J	20				ND	U	50			
	SEC-BUTYLBENZENE	N/A	N/A	N/A	2000	3.89	J	5	0.985	J	2	1.04	J	2				11.4	J	20				ND	U	50			
	STYRENE	N/A	N/A	100	1200	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	TERT-BUTYLBENZENE	N/A	N/A	N/A	690	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	TETRACHLOROETHENE	20	N/A	5	11	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	TOLUENE	750	N/A	1000	1100	20.4		5	ND	U	2	ND	U	2				504		20				156		50			
	TRANS-1,2-DICHLOROETHENE	N/A	N/A	100	360	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	TRANS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	TRICHLOROETHENE	100	N/A	5	0.49	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	TRICHLOROFLUOROMETHANE	N/A	N/A	N/A	1100	ND	U	10	ND	U	4	ND	U	4				ND	U	40				ND	U	100			
	VINYL CHLORIDE	1	N/A	2	0.019	ND	U	5	ND	U	2	ND	U	2				ND	U	20				ND	U	50			
	XYLENES	620	N/A	10000	190	44.2		15	ND	U	6	ND	U	6				**1520**		60				76.3	J	150			

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-106067			KAFB-106075			KAFB-106075			KAFB-106075			KAFB-106076			KAFB-106076			KAFB-106079			KAFB-106079		
					SAMPLE NO	GW1920			GW1928[e]			GW1929[e]			KAFB-106075			GW1930			QUANT ARRAY CHLOR-05			GW1933[e]			QUANT ARRAY CHLOR-03		
					SAMPLE DATE	28-Oct-14			8-Oct-14			8-Oct-14			8-Oct-14			19-Nov-14			19-Nov-14			10-Nov-14			10-Nov-14		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	485-505 FT			480-500 FT			480-500 FT			-			480-500 FT			-			484-504 FT			-		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
SVOCs (µg/L) Method 8270D	1,1-BIPHENYL	N/A	N/A	N/A	0.83	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	1,2-DIPHENYLHYDRAZINE	N/A	N/A	N/A	0.077	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				25.1	J	47.6			
	2,4,5-TRICHLOROPHENOL	5	N/A	N/A	1200	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	2,4,6-TRICHLOROPHENOL	5	N/A	N/A	4	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	2,4-DICHLOROPHENOL	5	N/A	N/A	46	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	2,4-DIMETHYLPHENOL	5	N/A	N/A	360	ND	U	20	ND	U	20	ND	U	19.2				ND	U	4000				ND	U	190			
	2,4-DINITROPHENOL	5	N/A	N/A	39	ND	U	50	ND	U	50	ND	U	48.1				ND	U	10000				ND	U	476			
	2,4-DINITROTOLUENE	N/A	N/A	N/A	0.24	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	2,6-DINITROTOLUENE	N/A	N/A	N/A	0.048	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	2-CHLORONAPHTHALENE	N/A	N/A	N/A	750	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	2-CHLOROPHENOL	5	N/A	N/A	91	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				24.8	J	47.6			
	2-METHYLPHENOL	5	N/A	N/A	930	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	2-NITROANILINE	N/A	N/A	N/A	190	ND	U	20	ND	U	20	ND	U	19.2				ND	U	4000				ND	U	190			
	2-NITROPHENOL	5	N/A	N/A	N/A	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	3,3'-DICHLOROBENZIDINE	N/A	N/A	N/A	0.12	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	N/A	N/A	930	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	3-NITROANILINE	N/A	N/A	N/A	N/A	ND	U	20	ND	U	20	ND	U	19.2				ND	U	4000				ND	UJ	190			
	4,6-DINITRO-2-METHYLPHENOL	5	N/A	N/A	1.5	ND	U	20	ND	U	20	ND	U	19.2				ND	U	4000				ND	U	190			
	4-BROMOPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	4-CHLORO-3-METHYLPHENOL	5	N/A	N/A	1400	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	4-CHLOROANILINE	N/A	N/A	N/A	0.36	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	4-CHLOROPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	4-NITROANILINE	N/A	N/A	N/A	3.8	ND	U	20	ND	U	20	ND	U	19.2				ND	U	4000				ND	UJ	190			
	4-NITROPHENOL	5	N/A	N/A	N/A	ND	U	20	ND	U	20	ND	U	19.2				ND	U	4000				ND	UJ	190			
	ACENAPHTHENE	N/A	N/A	N/A	530	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	ACETOPHENONE	N/A	N/A	N/A	1900	ND	U	5	ND	U	5	ND	U	4.81				14600		1000				392		47.6			
	ANTHRACENE	N/A	N/A	N/A	1800	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	ATRAZINE	N/A	N/A	3	0.3	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BENZALDEHYDE	N/A	N/A	N/A	1900	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BENZIDINE	N/A	N/A	N/A	0.00011	ND	U	100	ND	U	100	ND	U	96.2				ND	U	20000				ND	U	952			
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BENZOIC ACID	N/A	N/A	N/A	75000	ND	U	100	ND	U	100	ND	U	96.2				ND	U	20000				ND	U	952			
	BIS(2-CHLOROETHOXY)METHANE	N/A	N/A	N/A	59	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BIS(2-CHLOROETHYL)ETHER	N/A	N/A	N/A	0.014	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BIS(2-CHLOROISOPROPYL)ETHER	N/A	N/A	N/A	0.36	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BIS(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	6	5.6	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	BUTYL BENZYL PHTHALATE	N/A	N/A	N/A	16	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	CAPROLACTAM	N/A	N/A	N/A	9900	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	UJ	47.6			
	CARBAZOLE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	CHRYSENE	N/A	N/A	N/A	3.4	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	DIBENZOFURAN	N/A	N/A	N/A	7.9	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	DIETHYL PHTHALATE	N/A	N/A	N/A	15000	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	DIMETHYL PHTHALATE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	DI-N-BUTYL PHTHALATE	N/A	N/A	N/A	900	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	DI-N-OCTYL PHTHALATE	N/A	N/A	N/A	200	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	FLUORANTHENE	N/A	N/A	N/A	800	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	FLUORENE	N/A	N/A	N/A	290	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	HEXACHLOROBENZENE	N/A	N/A	1	0.049	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	HEXACHLOROCYCLOPENTADIENE	N/A	N/A	50	31	ND	U	10	ND	U	10	ND	U	9.62				ND	U	2000				ND	U	95.2			
	HEXACHLOROETHANE	N/A	N/A	N/A	0.9	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	ISOPHORONE	N/A	N/A	N/A	78	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	NAPHTHALENE	30	N/A	N/A	0.17	6.47		5	ND	U	5	ND	U	4.81				ND	U	1000				**42.3**	J	47.6			
	NITROBENZENE	N/A	N/A	N/A	0.14	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	N-NITROSO-DI-N-PROPYLAMINE	N/A	N/A	N/A	0.011	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	N-NITROSODIPHENYLAMINE	N/A	N/A	N/A	12	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	PENTACHLOROPHENOL	5	N/A	1	0.04	ND	U	20	ND	U	20	ND	U	19.2				ND	U	4000				ND	U	190			
	PHENANTHRENE	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	PHENOL	5	N/A	N/A	5800	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			
	PYRENE	N/A	N/A	N/A	120	ND	U	5	ND	U	5	ND	U	4.81				ND	U	1000				ND	U	47.6			

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-106067			KAFB-106075			KAFB-106075			KAFB-106075			KAFB-106076			KAFB-106076			KAFB-106079			KAFB-106079		
					SAMPLE NO	GW1920			GW1928[e]			GW1929[e]			KAFB-106075			GW1930			QUANT ARRAY CHLOR-05			GW1933[e]			QUANT ARRAY CHLOR-03		
					SAMPLE DATE	28-Oct-14			8-Oct-14			8-Oct-14			8-Oct-14			19-Nov-14			19-Nov-14			10-Nov-14			10-Nov-14		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	485-505 FT			480-500 FT			480-500 FT			-			480-500 FT			-			484-504 FT			-		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
PAHs (µg/L) Method 8270D Low Detection Limit	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ACENAPHTHENE	N/A	N/A	N/A	530	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ANTHRACENE	N/A	N/A	N/A	1800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CHRYSENE	N/A	N/A	N/A	3.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L) Method 6010C	CALCIUM	N/A	N/A	N/A	N/A	81.4		5	79.8		5	77.4		5				145		5				123		5			
	LEAD	0.05	0.01	0.015	0.015	ND	U	0.005	ND	U	0.005	ND	U	0.005				ND	U	0.005				ND	U	0.005			
	MAGNESIUM	N/A	N/A	N/A	N/A	12.1		5	10.7		5	10.4		5				32.8		5				20.5		5			
	POTASSIUM	N/A	N/A	N/A	N/A	2.93	J	5	3.29	J	5	3.37	J	5				4.5	J	5				3.59	J	5			
	SODIUM	N/A	N/A	N/A	N/A	34		5	32		5	32.8		5				60.6		5				51.7		5			
	IRON, DISSOLVED	1	N/A	N/A	14	**1.63**		0.1	0.0449	J	0.1	0.0461	J	0.1				**1.35**		0.1				**6.17**		0.1			
	MANGANESE, DISSOLVED	0.2	N/A	N/A	0.43	**1.85**		0.015	**0.803**		0.015	**0.756**		0.015				**1.76**		0.015				**5.86**		0.015			
Biological Parameters (cells/mL) Method QUANT ARRAY	APS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4370		2.5	N/A	N/A	N/A	202000		12.5	N/A	N/A	N/A	180000		5
	BVC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	ND	U	1.3	N/A	N/A	N/A	ND	U	0.5
	CFR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2.5	N/A	N/A	N/A	ND	U	12.5	N/A	N/A	N/A	ND	U	5
	DCM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2.5	N/A	N/A	N/A	ND	U	12.5	N/A	N/A	N/A	577		5
	DECO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2.5	N/A	N/A	N/A	ND	U	12.5	N/A	N/A	N/A	ND	U	5
	DHBT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	72.3		2.5	N/A	N/A	N/A	1420		12.5	N/A	N/A	N/A	3990		5
	DHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	2.55		1.3	N/A	N/A	N/A	9.5		0.5
	DHG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6370		2.5	N/A	N/A	N/A	40600		12.5	N/A	N/A	N/A	179000		5
	DSB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2.5	N/A	N/A	N/A	2260		12.5	N/A	N/A	N/A	14400		5
	DSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	33.6		2.5	N/A	N/A	N/A	45.3		12.5	N/A	N/A	N/A	ND	U	5
	EBAC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2120000		2.5	N/A	N/A	N/A	3260000		12.5	N/A	N/A	N/A	7070000		5
	ETNC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.9		2.5	N/A	N/A	N/A	ND	U	12.5	N/A	N/A	N/A	ND	U	5
	ETNE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2.5	N/A	N/A	N/A	ND	U	12.5	N/A	N/A	N/A	ND	U	5
	MGN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	671		2.5	N/A	N/A	N/A	1630		12.5	N/A	N/A	N/A	45.4		5
	PHE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	124		2.5	N/A	N/A	N/A	23000		12.5	N/A	N/A	N/A	1700		5
	PMMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10.6		2.5	N/A	N/A	N/A	745		12.5	N/A	N/A	N/A	798		5
	RDEG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	197		2.5	N/A	N/A	N/A	487000		12.5	N/A	N/A	N/A	348		5
	RMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	185		2.5	N/A	N/A	N/A	106000		12.5	N/A	N/A	N/A	377		5
	SMMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	453		2.5	N/A	N/A	N/A	11500		12.5	N/A	N/A	N/A	7650		5
	TCBO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2.5	N/A	N/A	N/A	87.3		12.5	N/A	N/A	N/A	ND	U	5
	TCE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	ND	U	1.3	N/A	N/A	N/A	ND	U	0.5
	TOD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	106		2.5	N/A	N/A	N/A	638		12.5	N/A	N/A	N/A	319		5
	VCR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	ND	U	1.3	N/A	N/A	N/A	ND	U	0.5

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-106067			KAFB-106075			KAFB-106075			KAFB-106075		
					SAMPLE NO	GW1920			GW1928[e]			GW1929[e]			KAFB-106075		
					SAMPLE DATE	28-Oct-14			8-Oct-14			8-Oct-14			8-Oct-14		
					SAMPLE PURPOSE	REG			REG			FD			REG		
					SAMPLE DEPTH	485-505 FT			480-500 FT			480-500 FT			-		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
Anions (mg/L) Method E300.0	BROMIDE	N/A	N/A	N/A	N/A	0.286		0.25	0.886		0.25	0.89		0.25			
	CHLORIDE	250	N/A	N/A	N/A	14.1		0.5	71.6		0.5	72.3		0.5			
	SULFATE	600	N/A	N/A	N/A	8.7		2.5	54.1		2.5	54.6		2.5			
	NITROGEN, NITRATE-NITRITE (Method E353.2)	10	4	10	N/A	ND	U	0.2	0.25		0.2	0.105	J	0.2			
	AMMONIA (AS N) (Method 4500NH3BG)	N/A	N/A	N/A	N/A	ND	U	0.3	ND	U	0.3	0.395		0.3			
	SULFIDE, TOTAL (Method 4500S2CF)	N/A	N/A	N/A	N/A	ND	U	3.85	ND	U	3.51	ND	U	3.92			
Alkalinity (mg/L) Method SM2320B	ALKALINITY, BICARBONATE (AS CACO3)	N/A	N/A	N/A	N/A	303		1	155		1	158		1			
	ALKALINITY, CARBONATE (AS CACO3)	N/A	N/A	N/A	N/A	ND	U	1	ND	U	1	ND	U	1			
Field Parameters	Temperature (°C)	N/A	N/A	N/A	N/A	18.71			18.31			18.31			N/A		
	pH (S.U.)	N/A	N/A	N/A	N/A	7.14			7.42			7.42			N/A		
	Spec Cond (µS/cm)	N/A	N/A	N/A	N/A	530.9			608.4			608.4			N/A		
	DO (mg/L)	N/A	N/A	N/A	N/A	0.05			0.04			0.04			N/A		
	ORP (mV)	N/A	N/A	N/A	N/A	-114			-32			-32			N/A		
	Turbidity (NTU)	N/A	N/A	N/A	N/A	2.17			0.89			0.89			N/A		
	Alkalinity (mg/L as CaCO3)	N/A	N/A	N/A	N/A	288			162			162			N/A		

	LOCATION CODE	KAFB-106076			KAFB-106076			KAFB-106079			KAFB-106079		
	SAMPLE NO	GW1930			QUANT ARRAY CHLOR-05			GW1933[e]			QUANT ARRAY CHLOR-03		
	SAMPLE DATE	19-Nov-14			19-Nov-14			10-Nov-14			10-Nov-14		
	SAMPLE PURPOSE	REG			REG			REG			REG		
	SAMPLE DEPTH	480-500 FT			-			484-504 FT			-		
Chemical Class & Analytical Method[a]	Parameter	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
Anions (mg/L) Method E300.0	BROMIDE	2.02		0.25				0.862		0.25			
	CHLORIDE	67.8		0.5				74.9	J+	0.5			
	SULFATE	142		2.5				2.25	J	2.5			
	NITROGEN, NITRATE-NITRITE (Method E353.2)	ND	U	0.2				0.147	J	0.2			
	AMMONIA (AS N) (Method 4500NH3BG)	ND	U	0.3				ND	U	0.3			
	SULFIDE, TOTAL (Method 4500S2CF)	2.02	J	3.88				ND	U	3.51			
Alkalinity (mg/L) Method SM2320B	ALKALINITY, BICARBONATE (AS CACO3)	284		1				404		1			
	ALKALINITY, CARBONATE (AS CACO3)	ND	U	1				ND	U	1			
Field Parameters	Temperature (°C)	18.88			N/A			18.16			N/A		
	pH (S.U.)	7.13			N/A			6.85			N/A		
	Spec Cond (µS/cm)	968.3			N/A			1008			N/A		
	DO (mg/L)	0			N/A			0			N/A		
	ORP (mV)	-242			N/A			-193			N/A		
	Turbidity (NTU)	3.07			N/A			2.27			N/A		
	Alkalinity (mg/L as CaCO3)	352			N/A			214			N/A		

EPA MCL and tap water RSLs are from the EPA RSL Table, dated November 2014.
The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-
The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 2-methylphenol, 2-nitrophenol, 3 and 4-methylphenol, 2,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-nitrophenol, and pentachlorophenol.
Sample GW0998 for SVOC analysis was not performed due to laboratory errors
Sample GW0886 for PAH analysis was not colllected due to an oversight.
KAFB-10612 not measured due to a non-operational corroded pump
The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.
The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene
a. EPA analytical methods listed are for the most recent sampling event.
b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and 2-methylnapthalene.
c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water.
d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs), or if more stringent, New Mexico Water Quality Control Commission (WQCC) Regulations as denoted by "*". Concentration exceeding standards are **BOLD.**
e. Sample contained bubbles.
f. ORP reading is faulty due to a malfunctioning sensor. Faulty readings are not reported on Figures 5-40, 5-41, and 5-42
Shading indicates the analyte was detected.
Bold indicated analyte detected greater than regulatory standard.
J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).
J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.
J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.
N/A = Not analyzed.
ND = Not detected.
NM = Not measured due to equipment malfunction.
NR = Not recorded or reported due to operational error.
R = Sample data rejected due to site contamination.
RSL = Regional Screening Level.
U = Analyte was not detected. The reported numerical value is at or below the LOQ.
UJ = Analyte was tentatively not detected. The reported numerical value is at or below the LOQ.

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-106082			KAFB-106082			KAFB-106088			KAFB-106088			KAFB-106091			KAFB-106091			KAFB-106094			KAFB-106094		
					SAMPLE NO	GW1936			QUANT ARRAY CHLOR-04			GW1943			KAFB-106088			GW1946[e]			QUANT ARRAY CHLOR-07			GW1949[e]			QUANT ARRAY CHLOR-02		
					SAMPLE DATE	13-Nov-14			13-Nov-14			6-Oct-14			6-Oct-14			24-Nov-14			24-Nov-14			5-Nov-14			5-Nov-14		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	472-492 FT			-			460-480 FT			-			454-474 FT			-			484-504 FT			-		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L) Method 8015C	DIESEL RANGE ORGANICS	N/A	N/A	N/A	N/A	215	J	400				ND	U	385				953		385				5870		1960			
	GASOLINE RANGE ORGANICS	N/A	N/A	N/A	N/A	1060		150				ND	U	150				427		150				1480		150			
VOCs (µg/L) Method 8260B	1,2-DIBROMOETHANE (Method 8011)	0.1	N/A	0.05	0.0075	**0.162**		0.028				**0.0745**		0.028				0.0357	J	0.0282				**0.297**	J	0.0284			
	1,1,1,2-TETRACHLOROETHANE	N/A	N/A	N/A	0.57	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,1,1-TRICHLOROETHANE	60	N/A	200	8000	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,1,2,2-TETRACHLOROETHANE	10	N/A	N/A	0.076	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,1,2-TRICHLOROETHANE	10	N/A	5	0.28	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,1-DICHLOROETHANE	25	N/A	N/A	2.7	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,1-DICHLOROETHENE	5	N/A	7	280	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,1-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,2,3-TRICHLOROBENZENE	N/A	N/A	N/A	7	ND	U	4				ND	U	2				ND	U	4				ND	U	4			
	1,2,3-TRICHLOROPROPANE	N/A	N/A	N/A	0.00075	ND	U	4				ND	U	2				ND	U	4				ND	U	4			
	1,2,4-TRICHLOROBENZENE	N/A	N/A	70	1.1	ND	U	4				ND	U	2				ND	U	4				ND	U	4			
	1,2,4-TRIMETHYLBENZENE	N/A	N/A	N/A	15	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,2-DIBROMO-3-CHLOROPROPANE	N/A	N/A	0.2	0.00033	ND	U	4				ND	U	2				ND	U	4				ND	U	4			
	1,2-DIBROMOETHANE	0.1	N/A	0.05	0.0075	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,2-DICHLOROBENZENE	N/A	N/A	600	300	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,2-DICHLOROETHANE	10	N/A	5	0.17	2.02		2				ND	U	1				1.29	J	2				4.31		2			
	1,2-DICHLOROPROPANE	N/A	N/A	5	0.44	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,3,5-TRIMETHYLBENZENE	N/A	N/A	N/A	120	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,3-DICHLOROBENZENE	N/A	N/A	N/A	N/A	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,3-DICHLOROPROPANE	N/A	N/A	N/A	370	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	1,4-DICHLOROBENZENE	N/A	N/A	75	0.48	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	2,2-DICHLOROPROPANE	N/A	N/A	N/A	N/A	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	2-BUTANONE	N/A	N/A	N/A	5600	ND	U	20				ND	U	10				ND	U	20				ND	U	20			
	2-CHLOROTOLUENE	N/A	N/A	N/A	240	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	2-HEXANONE	N/A	N/A	N/A	38	ND	U	10				ND	U	5				ND	U	10				ND	U	10			
	4-CHLOROTOLUENE	N/A	N/A	N/A	250	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	4-METHYL-2-PENTANONE	N/A	N/A	N/A	1200	ND	U	10				ND	U	5				ND	U	10				ND	U	10			
	ACETONE	N/A	N/A	N/A	14000	20.4		20				ND	U	10				92.5	J+	20				50.4	J+	20			
	BENZENE	10	N/A	5	0.45	ND	U	2				ND	U	1				ND	U	2				1.4	J	2			
	BROMOBENZENE	N/A	N/A	N/A	62	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	BROMOCHLOROMETHANE	N/A	N/A	N/A	83	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	BROMODICHLOROMETHANE	N/A	N/A	80	0.13	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	BROMOFORM	N/A	N/A	80	9.2	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	BROMOMETHANE	N/A	N/A	N/A	7.5	ND	U	4				ND	U	2				ND	U	4				ND	U	4			
	CARBON DISULFIDE	N/A	N/A	N/A	810	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	CARBON TETRACHLORIDE	10	N/A	5	0.45	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	CHLOROBENZENE	N/A	N/A	100	78	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	CHLOROETHANE	N/A	N/A	N/A	21000	ND	U	4				ND	U	2				ND	U	4				ND	U	4			
	CHLOROFORM	100	N/A	80	0.22	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	CHLOROMETHANE	N/A	N/A	N/A	190	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	CIS-1,2-DICHLOROETHENE	N/A	N/A	70	36	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	CIS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	DIBROMOCHLOROMETHANE	N/A	N/A	80	0.17	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	DIBROMOMETHANE	N/A	N/A	N/A	8	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	DICHLORODIFLUOROMETHANE	N/A	N/A	N/A	200	ND	U	4				ND	U	2				ND	U	4				ND	U	4			
	ETHYLBENZENE	750	N/A	700	1.5	13.5		2				ND	U	1				ND	U	2				64.1		2			
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	ND	U	4				ND	U	2				ND	U	4				ND	UJ	4			
	ISOPROPYLBENZENE	N/A	N/A	N/A	450	21.4		2				ND	U	1				3.47		2				33.9		2			
	METHYL TERT-BUTYL ETHER	N/A	N/A	N/A	14	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	METHYLENE CHLORIDE	100	N/A	5	11	ND	U	4				ND	U	2				ND	U	4				ND	U	4			
	NAPHTHALENE	30	N/A	N/A	0.17	ND	U	4				ND	U	2				ND	UJ	4				ND	U	4			
	N-BUTYLBENZENE	N/A	N/A	N/A	1000	0.862	J	2				ND	U	1				ND	U	2				1.91	J	2			
	N-PROPYLBENZENE	N/A	N/A	N/A	660	8.91		2				ND	U	1				ND	U	2				13.4		2			
	P-ISOPROPYLTOLUENE	N/A	N/A	N/A	N/A	ND	U	2				ND	U	1				ND	U	2				0.841	J	2			
	SEC-BUTYLBENZENE	N/A	N/A	N/A	2000	1.99	J	2				ND	U	1				ND	U	2				3.35		2			
	STYRENE	N/A	N/A	100	1200	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	TERT-BUTYLBENZENE	N/A	N/A	N/A	690	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	TETRACHLOROETHENE	20	N/A	5	11	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	TOLUENE	750	N/A	1000	1100	ND	U	2				ND	U	1				ND	U	2				5.51		2			
	TRANS-1,2-DICHLOROETHENE	N/A	N/A	100	360	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	TRANS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	TRICHLOROETHENE	100	N/A	5	0.49	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	TRICHLOROFLUOROMETHANE	N/A	N/A	N/A	1100	ND	U	4				ND	U	2				ND	U	4				ND	U	4			
	VINYL CHLORIDE	1	N/A	2	0.019	ND	U	2				ND	U	1				ND	U	2				ND	U	2			
	XYLENES	620	N/A	10000	190	ND	U	6				ND	U	3				ND	U	6				2.51	J	6			

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-106082			KAFB-106082			KAFB-106088			KAFB-106088			KAFB-106091			KAFB-106091			KAFB-106094			KAFB-106094		
					SAMPLE NO	GW1936			QUANT ARRAY CHLOR-04			GW1943			KAFB-106088			GW1946[e]			QUANT ARRAY CHLOR-07			GW1949[e]			QUANT ARRAY CHLOR-02		
					SAMPLE DATE	13-Nov-14			13-Nov-14			6-Oct-14			6-Oct-14			24-Nov-14			24-Nov-14			5-Nov-14			5-Nov-14		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	472-492 FT			-			460-480 FT			-			454-474 FT			-			484-504 FT			-		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
SVOCs (µg/L) Method 8270D	1,1-BIPHENYL	N/A	N/A	N/A	0.83	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	1,2-DIPHENYLHYDRAZINE	N/A	N/A	N/A	0.077	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	2.98	J	5				ND	U	5				ND	U	5.1				5.95	J	9.71			
	2,4,5-TRICHLOROPHENOL	5	N/A	N/A	1200	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	2,4,6-TRICHLOROPHENOL	5	N/A	N/A	4	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	2,4-DICHLOROPHENOL	5	N/A	N/A	46	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	2,4-DIMETHYLPHENOL	5	N/A	N/A	360	ND	U	20				ND	U	20				ND	U	20.4				ND	U	38.8			
	2,4-DINITROPHENOL	5	N/A	N/A	39	ND	U	50				ND	U	50				ND	U	51				ND	U	97.1			
	2,4-DINITROTOLUENE	N/A	N/A	N/A	0.24	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	2,6-DINITROTOLUENE	N/A	N/A	N/A	0.048	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	2-CHLORONAPHTHALENE	N/A	N/A	N/A	750	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	2-CHLOROPHENOL	5	N/A	N/A	91	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	2-METHYLPHENOL	5	N/A	N/A	930	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	2-NITROANILINE	N/A	N/A	N/A	190	ND	U	20				ND	U	20				ND	U	20.4				ND	U	38.8			
	2-NITROPHENOL	5	N/A	N/A	N/A	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	3,3'-DICHLOROBENZIDINE	N/A	N/A	N/A	0.12	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	N/A	N/A	930	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	3-NITROANILINE	N/A	N/A	N/A	N/A	ND	U	20				ND	U	20				ND	U	20.4				ND	U	38.8			
	4,6-DINITRO-2-METHYLPHENOL	5	N/A	N/A	1.5	ND	U	20				ND	U	20				ND	U	20.4				ND	U	38.8			
	4-BROMOPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	4-CHLORO-3-METHYLPHENOL	5	N/A	N/A	1400	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	4-CHLOROANILINE	N/A	N/A	N/A	0.36	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	4-CHLOROPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	4-NITROANILINE	N/A	N/A	N/A	3.8	ND	U	20				ND	U	20				ND	U	20.4				ND	U	38.8			
	4-NITROPHENOL	5	N/A	N/A	N/A	ND	U	20				ND	U	20				ND	U	20.4				ND	U	38.8			
	ACENAPHTHENE	N/A	N/A	N/A	530	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	ACETOPHENONE	N/A	N/A	N/A	1900	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	ANTHRACENE	N/A	N/A	N/A	1800	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	ATRAZINE	N/A	N/A	3	0.3	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BENZALDEHYDE	N/A	N/A	N/A	1900	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BENZIDINE	N/A	N/A	N/A	0.00011	ND	U	100				ND	U	100				ND	U	102				ND	U	194			
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BENZOIC ACID	N/A	N/A	N/A	75000	ND	U	100				ND	U	100				ND	U	102				ND	U	194			
	BIS(2-CHLOROETHOXY)METHANE	N/A	N/A	N/A	59	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BIS(2-CHLOROETHYL)ETHER	N/A	N/A	N/A	0.014	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BIS(2-CHLOROISOPROPYL)ETHER	N/A	N/A	N/A	0.36	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BIS(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	6	5.6	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	BUTYL BENZYL PHTHALATE	N/A	N/A	N/A	16	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	CAPROLACTAM	N/A	N/A	N/A	9900	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	CARBAZOLE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	CHRYSENE	N/A	N/A	N/A	3.4	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	DIBENZOFURAN	N/A	N/A	N/A	7.9	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	DIETHYL PHTHALATE	N/A	N/A	N/A	15000	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	DIMETHYL PHTHALATE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	DI-N-BUTYL PHTHALATE	N/A	N/A	N/A	900	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	DI-N-OCTYL PHTHALATE	N/A	N/A	N/A	200	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	FLUORANTHENE	N/A	N/A	N/A	800	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	FLUORENE	N/A	N/A	N/A	290	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	HEXACHLOROBENZENE	N/A	N/A	1	0.049	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	HEXACHLOROCYCLOPENTADIENE	N/A	N/A	50	31	ND	U	10				ND	U	10				ND	U	10.2				ND	U	19.4			
	HEXACHLOROETHANE	N/A	N/A	N/A	0.9	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	ISOPHORONE	N/A	N/A	N/A	78	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	NAPHTHALENE	30	N/A	N/A	0.17	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	NITROBENZENE	N/A	N/A	N/A	0.14	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	N-NITROSO-DI-N-PROPYLAMINE	N/A	N/A	N/A	0.011	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	N-NITROSODIPHENYLAMINE	N/A	N/A	N/A	12	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	PENTACHLOROPHENOL	5	N/A	1	0.04	ND	U	20				ND	U	20				ND	U	20.4				ND	U	38.8			
	PHENANTHRENE	N/A	N/A	N/A	N/A	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	PHENOL	5	N/A	N/A	5800	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			
	PYRENE	N/A	N/A	N/A	120	ND	U	5				ND	U	5				ND	U	5.1				ND	U	9.71			

Appendix D
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October - December 2014

					LOCATION CODE	KAFB-106082			KAFB-106082			KAFB-106088			KAFB-106088			KAFB-106091			KAFB-106091			KAFB-106094			KAFB-106094		
					SAMPLE NO	GW1936			QUANT ARRAY CHLOR-04			GW1943			KAFB-106088			GW1946[e]			QUANT ARRAY CHLOR-07			GW1949[e]			QUANT ARRAY CHLOR-02		
					SAMPLE DATE	13-Nov-14			13-Nov-14			6-Oct-14			6-Oct-14			24-Nov-14			24-Nov-14			5-Nov-14			5-Nov-14		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	472-492 FT			-			460-480 FT			-			454-474 FT			-			484-504 FT			-		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
PAHs (µg/L) Method 8270D Low Detection Limit	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ACENAPHTHENE	N/A	N/A	N/A	530	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ANTHRACENE	N/A	N/A	N/A	1800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CHRYSENE	N/A	N/A	N/A	3.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L) Method 6010C	CALCIUM	N/A	N/A	N/A	N/A	76.4		5				45.2		5				49.3		5				74		5			
	LEAD	0.05	0.01	0.015	0.015	ND	U	0.005				ND	U	0.005				ND	U	0.005				0.00549		0.005			
	MAGNESIUM	N/A	N/A	N/A	N/A	10.9		5				6.02		5				6.87		5				11.3		5			
	POTASSIUM	N/A	N/A	N/A	N/A	3.01	J	5				2.22	J	5				2.77	J	5				2.97	J	5			
	SODIUM	N/A	N/A	N/A	N/A	31.6		5				23.8		5				26		5				31.3		5			
	IRON, DISSOLVED	1	N/A	N/A	14	0.247		0.1				ND	U	0.1				ND	U	0.1				**1.02**		0.1			
	MANGANESE, DISSOLVED	0.2	N/A	N/A	0.43	**0.617**		0.015				ND	U	0.015				0.129		0.015				**1.31**		0.015			
Biological Parameters (cells/mL) Method QUANT ARRAY	APS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	99200		5.1	N/A	N/A	N/A	55	J	2.5	N/A	N/A	N/A	46800		5	N/A	N/A	N/A	227000		5.1
	BVC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	UJ	0.2	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5
	CFR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	5.1
	DCM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	1.2	J	5	N/A	N/A	N/A	24.1		5.1
	DECO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	5.1
	DHBT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	384		5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	63.1		5	N/A	N/A	N/A	127		5.1
	DHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.6		0.5	N/A	N/A	N/A	ND	UJ	0.2	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	1		0.5
	DHG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5340		5.1	N/A	N/A	N/A	110	J	2.5	N/A	N/A	N/A	957		5	N/A	N/A	N/A	7610		5.1
	DSB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	67.1		5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	41.8		5	N/A	N/A	N/A	1120		5.1
	DSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	32200		5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	52.2		5	N/A	N/A	N/A	231		5.1
	EBAC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3010000		5.1	N/A	N/A	N/A	615000	J	2.5	N/A	N/A	N/A	377000		5	N/A	N/A	N/A	3940000		5.1
	ETNC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	3.5	J	5	N/A	N/A	N/A	7.3		5.1
	ETNE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	5.8		5	N/A	N/A	N/A	4.9	J	5.1
	MGN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	70.1		5.1	N/A	N/A	N/A	17	J	2.5	N/A	N/A	N/A	414		5	N/A	N/A	N/A	1270		5.1
	PHE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	61.5		5.1	N/A	N/A	N/A	40.4	J	2.5	N/A	N/A	N/A	477		5	N/A	N/A	N/A	723		5.1
	PMMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.8	J	5.1	N/A	N/A	N/A	16.4	J	2.5	N/A	N/A	N/A	45.7		5	N/A	N/A	N/A	32.8		5.1
	RDEG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	670		5.1	N/A	N/A	N/A	11.5	J	2.5	N/A	N/A	N/A	7050		5	N/A	N/A	N/A	216		5.1
	RMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	41.5		5.1	N/A	N/A	N/A	204	J	2.5	N/A	N/A	N/A	70.2		5	N/A	N/A	N/A	25.2		5.1
	SMMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1260		5.1	N/A	N/A	N/A	537	J	2.5	N/A	N/A	N/A	7850		5	N/A	N/A	N/A	6590		5.1
	TCBO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	N/A	N/A	N/A	ND	UJ	2.5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	5.1
	TCE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	UJ	0.2	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5
	TOD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	49.8		5.1	N/A	N/A	N/A	38	J	2.5	N/A	N/A	N/A	201		5	N/A	N/A	N/A	653		5.1
	VCR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	UJ	0.2	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
October - December 2014

					LOCATION CODE	KAFB-106082			KAFB-106082			KAFB-106088			KAFB-106088			KAFB-106091			KAFB-106091			KAFB-106094			KAFB-106094		
					SAMPLE NO	GW1936			QUANT ARRAY CHLOR-04			GW1943			KAFB-106088			GW1946[e]			QUANT ARRAY CHLOR-07			GW1949[e]			QUANT ARRAY CHLOR-02		
					SAMPLE DATE	13-Nov-14			13-Nov-14			6-Oct-14			6-Oct-14			24-Nov-14			24-Nov-14			5-Nov-14			5-Nov-14		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	472-492 FT			-			460-480 FT			-			454-474 FT			-			484-504 FT			-		
Chemical Class & Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
Anions (mg/L) Method E300.0	BROMIDE	N/A	N/A	N/A	N/A	0.697		0.25				ND	U	0.25				0.219	J	0.25				0.493		0.25			
	CHLORIDE	250	N/A	N/A	N/A	56.1	J+	0.5				13		0.5				20.5	J+	0.5				37.9		2.5			
	SULFATE	600	N/A	N/A	N/A	64.1		2.5				34.6		2.5				42.5		2.5				56.6		2.5			
	NITROGEN, NITRATE-NITRITE (Method E353.2)	10	4	10	N/A	ND	U	0.2				0.125	J	0.2				ND	U	0.2				ND	U	0.2			
	AMMONIA (AS N) (Method 4500NH3BG)	N/A	N/A	N/A	N/A	ND	U	0.3				ND	U	0.3				ND	U	0.3				ND	U	0.3			
	SULFIDE, TOTAL (Method 4500S2CF)	N/A	N/A	N/A	N/A	ND	U	3.85				ND	U	4				ND	U	3.77				ND	U	3.77			
Alkalinity (mg/L) Method SM2320B	ALKALINITY, BICARBONATE (AS CACO3)	N/A	N/A	N/A	N/A	165		1				140		1				138		1				170		1			
	ALKALINITY, CARBONATE (AS CACO3)	N/A	N/A	N/A	N/A	ND	U	1				ND	U	1				ND	U	1				ND	U	1			
Field Parameters	Temperature (°C)	N/A	N/A	N/A	N/A	17.77			N/A			18.69			N/A			18.41			N/A			18.67			N/A		
	pH (S.U.)	N/A	N/A	N/A	N/A	7.5			N/A			7.71			N/A			7.6			N/A			7.51			N/A		
	Spec Cond (µS/cm)	N/A	N/A	N/A	N/A	515.5			N/A			372			N/A			430			N/A			512.1			N/A		
	DO (mg/L)	N/A	N/A	N/A	N/A	2.31			N/A			1.25			N/A			2.74			N/A			0.04			N/A		
	ORP (mV)	N/A	N/A	N/A	N/A	-103			N/A			0			N/A			130			N/A			-174			N/A		
	Turbidity (NTU)	N/A	N/A	N/A	N/A	0.67			N/A			0.95			N/A			0.64			N/A			1.42			N/A		
	Alkalinity (mg/L as CaCO3)	N/A	N/A	N/A	N/A	168			N/A			136			N/A			148			N/A			232			N/A		

EPA MCL and tap water RSLs are from the EPA RSL Table, dated November 2014.
The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-
The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 2-methylphenol, 2-nitrophenol, 3 and 4-methylphenol, 2,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-nitrophenol, and pentachlorophenol.
Sample GW0998 for SVOC analysis was not performed due to laboratory errors
Sample GW0886 for PAH analysis was not colllected due to an oversight.
KAFB-10612 not measured due to a non-operational corroded pump
The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.
The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene
a. EPA analytical methods listed are for the most recent sampling event.
b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and 2-methylnapthalene.
c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water.
d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs), or if more stringent, New Mexico Water Quality Control Commission (WQCC) Regulations as denoted by "*". Concentration exceeding standards are **BOLD.**
e. Sample contained bubbles.
f. ORP reading is faulty due to a malfunctioning sensor. Faulty readings are not reported on Figures 5-40, 5-41, and 5-42
Shading indicates the analyte was detected.
Bold indicated analyte detected greater than regulatory standard.
J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).
J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.
J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.
N/A = Not analyzed.
ND = Not detected.
NM = Not measured due to equipment malfunction.
NR = Not recorded or reported due to operational error.
R = Sample data rejected due to site contamination.
RSL = Regional Screening Level.
U = Analyte was not detected. The reported numerical value is at or below the LOQ.
UJ = Analyte was tentatively not detected. The reported numerical value is at or below the LOQ.

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-10610[f]			KAFB-10610			KAFB-10610			KAFB-10627[f]			KAFB-10627			KAFB-10628-510[f]			KAFB-10628-510			KAFB-106059[f]			KAFB-106059			KAFB-106059			KAFB-106064[f]		
					SAMPLE NO	GW1993			GW2123			GW2124			GW2026			GW2126			GW2049			GW2118			GW2043			GW2129			GW2130			GW2048		
					SAMPLE DATE	10-Mar-15			10-Mar-15			10-Mar-15			17-Feb-15			17-Feb-15			24-Feb-15			24-Feb-15			3-Mar-15			3-Mar-15			3-Mar-15			25-Feb-15		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			REG			REG			REG			REG			FD			REG		
					SAMPLE DEPTH	483-509 FT			483-508 FT			483-508 FT			481-501 FT			481-501 FT			486-511 FT			486-511 FT			483-503 FT			483-503 FT			483-503 FT			485-505 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L) Method 8015C/8015D	DIESEL RANGE ORGANICS	N/A	N/A	N/A	N/A	10300		3920	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	377	N/A	N/A	N/A	6690		1850	N/A	N/A	N/A	26700		7550	N/A	N/A	N/A	N/A	N/A	N/A	28800		7410
	GASOLINE RANGE ORGANICS	N/A	N/A	N/A	N/A	4860		1500	N/A	N/A	N/A	N/A	N/A	N/A	70.9	J	150	N/A	N/A	N/A	1310		150	N/A	N/A	N/A	17300		15000	N/A	N/A	N/A	N/A	N/A	N/A	17000		1500
VOCs (µg/L) Method 8260B	1,2-DIBROMOETHANE (Method 8011)	0.1	N/A	0.05	0.0075	**0.648**		0.0282	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.0282	N/A	N/A	N/A	**0.801**	J	0.0278	N/A	N/A	N/A	**6.56**		0.28	N/A	N/A	N/A	N/A	N/A	N/A	**7.45**	J	0.557
	1,1,1,2-TETRACHLOROETHANE	N/A	N/A	N/A	0.57	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,1,1-TRICHLOROETHANE	60	N/A	200	8000	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,1,2,2-TETRACHLOROETHANE	10	N/A	N/A	0.076	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,1,2-TRICHLOROETHANE	10	N/A	5	0.28	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,1-DICHLOROETHANE	25	N/A	N/A	2.7	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,1-DICHLOROETHENE	5	N/A	7	280	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,1-DICHLOROPROPENE	N/A	N/A	N/A	83000	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,2,3-TRICHLOROBENZENE	N/A	N/A	N/A	7	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	UJ	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	1,2,3-TRICHLOROPROPANE	N/A	N/A	N/A	0.00075	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	1,2,4-TRICHLOROBENZENE	N/A	N/A	70	1.1	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	1,2,4-TRIMETHYLBENZENE	N/A	N/A	N/A	15	15.6		5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	5.67		2	N/A	N/A	N/A	622		200	N/A	N/A	N/A	N/A	N/A	N/A	175		25
	1,2-DIBROMO-3-CHLOROPROPANE	N/A	N/A	0.2	0.00033	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	1,2-DIBROMOETHANE	0.1	N/A	0.05	0.0075	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,2-DICHLOROBENZENE	N/A	N/A	600	300	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,2-DICHLOROETHANE	10	N/A	5	0.17	2.52	J	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	1.87	J	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,2-DICHLOROPROPANE	N/A	N/A	5	0.44	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,3,5-TRIMETHYLBENZENE	N/A	N/A	N/A	120	5.57		5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	2.35		2	N/A	N/A	N/A	184	J	200	N/A	N/A	N/A	N/A	N/A	N/A	75.2		25
	1,3-DICHLOROBENZENE	N/A	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,3-DICHLOROPROPANE	N/A	N/A	N/A	370	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	1,4-DICHLOROBENZENE	N/A	N/A	75	0.48	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	2,2-DICHLOROPROPANE	N/A	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	2-BUTANONE	N/A	N/A	N/A	5600	ND	U	50	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	2000	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	250
	2-CHLOROTOLUENE	N/A	N/A	N/A	240	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	2-HEXANONE	N/A	N/A	N/A	38	ND	U	25	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	1000	N/A	N/A	N/A	N/A	N/A	N/A	40.5	J	125
	4-CHLOROTOLUENE	N/A	N/A	N/A	250	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	4-METHYL-2-PENTANONE	N/A	N/A	N/A	1200	11.1	J	25	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	1000	N/A	N/A	N/A	N/A	N/A	N/A	159		125
	ACETONE	N/A	N/A	N/A	14000	199		50	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	48.2		20	N/A	N/A	N/A	ND	U	2000	N/A	N/A	N/A	N/A	N/A	N/A	122	J	250
	BENZENE	10	N/A	5	0.45	**177**		5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	**23.6**		2	N/A	N/A	N/A	**15200**		200	N/A	N/A	N/A	N/A	N/A	N/A	**7820**		50
	BROMOBENZENE	N/A	N/A	N/A	62	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	BROMOCHLOROMETHANE	N/A	N/A	N/A	83	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	BROMODICHLOROMETHANE	N/A	N/A	80	0.13	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	BROMOFORM	N/A	N/A	80	9.2	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	BROMOMETHANE	N/A	N/A	N/A	7.5	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	CARBON DISULFIDE	N/A	N/A	N/A	810	21.4		5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	0.516	J	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	CARBON TETRACHLORIDE	10	N/A	5	0.45	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	CHLOROBENZENE	N/A	N/A	100	78	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	CHLOROETHANE	N/A	N/A	N/A	21000	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	CHLOROFORM	100	N/A	80	0.22	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	CHLOROMETHANE	N/A	N/A	N/A	190	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	CIS-1,2-DICHLOROETHENE	N/A	N/A	70	36	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	CIS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	CYCLOTETRASILOXANE, OCTAMETHYL-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBROMOCHLOROMETHANE	N/A	N/A	80	0.17	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	DIBROMOMETHANE	N/A	N/A	N/A	8	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	DICHLORODIFLUOROMETHANE	N/A	N/A	N/A	200	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	ETHANE, 1,1-DIFLUORO-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ETHYLBENZENE	750	N/A	700	1.5	282		5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	16.2		2	N/A	N/A	N/A	**1540**		200	N/A	N/A	N/A	N/A	N/A	N/A	**1030**		25
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	ISOPROPYLBENZENE	N/A	N/A	N/A	450	65.3		5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	4.86		2	N/A	N/A	N/A	90.5	J	200	N/A	N/A	N/A	N/A	N/A	N/A	90.2		25
	M,P-XYLENES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	METHYL TERT-BUTYL ETHER	N/A	N/A	N/A	14	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	0.712	J	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	METHYLENE CHLORIDE	100	N/A	5	11	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	NAPHTHALENE	30	N/A	N/A	0.17	7.6	J	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	UJ	2	N/A	N/A	N/A	1.88	J	4	N/A	N/A	N/A	**204**	J	400	N/A	N/A	N/A	N/A	N/A	N/A	**94**		50
	N-BUTYLBENZENE	N/A	N/A	N/A	1000	2.3	J	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	0.888	J	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	8.33	J	25
	N-PROPYLBENZENE	N/A	N/A	N/A	660	30.4		5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	3.57		2	N/A	N/A	N/A	146	J	200	N/A	N/A	N/A	N/A	N/A	N/A	75.4		25
	O-XYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	P-ISOPROPYLTOLUENE	N/A	N/A	N/A	N/A	8.67		5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	1.21	J	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	75.3		25
	SEC-BUTYLBENZENE	N/A	N/A	N/A	2000	4.3	J	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	1.96	J	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	STYRENE	N/A	N/A	100	1200	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	TERT-BUTYLBENZENE	N/A	N/A	N/A	690	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	TETRACHLOROETHENE	20	N/A	5	11	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	TOLUENE	750	N/A	1000	1100	176		5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	43.4		2	N/A	N/A	N/A	**16100**		200	N/A	N/A	N/A	N/A	N/A	N/A	**1680**		25
	TRANS-1,2-DICHLOROETHENE	N/A	N/A	100	360	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	TRANS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	TRICHLOROETHENE	100	N/A	5	0.49	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	0.288	J	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	TRICHLOROFLUOROMETHANE	N/A	N/A	N/A	1100	ND	U	10	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	50
	VINYL CHLORIDE	1	N/A	2	0.019	ND	U	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	200	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	25
	XYLENES	620	N/A	10000	190	80.6		15	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	3	N/A	N/A	N/A	24.3		6	N/A	N/A	N/A	**5170**		600	N/A	N/A	N/A	N/A	N/A	N/A	**960**		75
Gases (µg/L) Method EPA RSK175	HYDROGEN (AM20GAX) (nM)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.2		0.6	1.1		0.6	N/A	N/A	N/A	1.6		0.6	N/A	N/A	N/A	1.8	N/A	0.6	N/A	N/A	N/A	4.9		0.6	5.2		0.6	N/A	N/A	N/A
	ETHANE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.3	J	0.2	3.2	J	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	5	N/A	0.2	N/A	N/A	N/A	5.4	J	0.2	5.6	J	0.2	N/A	N/A	N/A
	ETHYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.1	J	0.2	1.7	J	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	0.31	N/A	0.2	N/A	N/A	N/A	37	J	0.2	40	J	0.2	N/A	N/A	N/A
	METHANE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	34	J	0.2	35	J	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	4.6	N/A	0.2	N/A	N/A	N/A	56	J	0.2	61	J	0.2	N/A	N/A	N/A

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	KAFB-10610[f] Result	VAL QUAL	LOQ	KAFB-10610 Result	VAL QUAL	LOQ	KAFB-10610 Result	VAL QUAL	LOQ	KAFB-10627[f] Result	VAL QUAL	LOQ	KAFB-10627 Result	VAL QUAL	LOQ	KAFB-10628-510[f] Result	VAL QUAL	LOQ	KAFB-10628-510 Result	VAL QUAL	LOQ	KAFB-106059[f] Result	VAL QUAL	LOQ	KAFB-106059 Result	VAL QUAL	LOQ	KAFB-106059 Result	VAL QUAL	LOQ	KAFB-106064[f] Result	VAL QUAL	LOQ
					SAMPLE NO	GW1993			GW2123			GW2124			GW2026			GW2126			GW2049			GW2118			GW2043			GW2129			GW2130			GW2048		
					SAMPLE DATE	10-Mar-15			10-Mar-15			10-Mar-15			17-Feb-15			17-Feb-15			24-Feb-15			24-Feb-15			3-Mar-15			3-Mar-15			3-Mar-15			25-Feb-15		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			REG			REG			REG			REG			FD			REG		
					SAMPLE DEPTH	483-509 FT			483-508 FT			483-508 FT			481-501 FT			481-501 FT			486-511 FT			486-511 FT			483-503 FT			483-503 FT			483-503 FT			485-505 FT		
SVOCs (µg/L) Method 8270D/8270C	1,1-BIPHENYL	N/A	N/A	N/A	0.83	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	1,2-DIPHENYLHYDRAZINE	N/A	N/A	N/A	0.077	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	3.13	J	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	8.42		4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	3.63	J	9.26	N/A	N/A	N/A	70.3		48.1	N/A	N/A	N/A	N/A	N/A	N/A	20.7	J	46.3
	1-PROPENE, 1,2,3-TRICHLORO-, (Z)-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2,4,5-TRICHLOROPHENOL	5	N/A	N/A	1200	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	2,4,6-TRICHLOROPHENOL	5	N/A	N/A	4	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	2,4-DICHLOROPHENOL	5	N/A	N/A	46	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	2,4-DIMETHYLPHENOL	5	N/A	N/A	360	ND	U	19.6	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	37	N/A	N/A	N/A	ND	U	192	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	185
	2,4-DINITROPHENOL	5	N/A	N/A	39	ND	U	49	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	ND	U	92.6	N/A	N/A	N/A	ND	U	481	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	463
	2,4-DINITROTOLUENE	N/A	N/A	N/A	0.24	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	2,6-DINITROTOLUENE	N/A	N/A	N/A	0.048	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	2-CHLORONAPHTHALENE	N/A	N/A	N/A	750	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	2-CHLOROPHENOL	5	N/A	N/A	91	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	1.71	J	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	**82.2**		48.1	N/A	N/A	N/A	N/A	N/A	N/A	19.2	J	46.3
	2-METHYLPHENOL	5	N/A	N/A	930	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	2-NITROANILINE	N/A	N/A	N/A	190	ND	U	19.6	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	37	N/A	N/A	N/A	ND	U	192	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	185
	2-NITROPHENOL	5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	3,3'-DICHLOROBENZIDINE	N/A	N/A	N/A	0.12	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	N/A	N/A	930	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	3-NITROANILINE	N/A	N/A	N/A	N/A	ND	U	19.6	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	37	N/A	N/A	N/A	ND	U	192	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	185
	4,6-DINITRO-2-METHYLPHENOL	5	N/A	N/A	1.5	ND	U	19.6	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	37	N/A	N/A	N/A	ND	U	192	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	185
	4-BROMOPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	4-CHLORO-3-METHYLPHENOL	5	N/A	N/A	1400	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	4-CHLOROANILINE	N/A	N/A	N/A	0.36	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	4-CHLOROPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	4-NITROANILINE	N/A	N/A	N/A	3.8	ND	U	19.6	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	37	N/A	N/A	N/A	ND	U	192	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	185
	4-NITROPHENOL	5	N/A	N/A	N/A	ND	U	19.6	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	37	N/A	N/A	N/A	ND	U	192	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	185
	ACENAPHTHENE	N/A	N/A	N/A	530	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	ACETOPHENONE	N/A	N/A	N/A	1900	234		24.5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	60.2		9.26	N/A	N/A	N/A	1660		240	N/A	N/A	N/A	N/A	N/A	N/A	445		46.3
	ANTHRACENE	N/A	N/A	N/A	1800	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	ATRAZINE	N/A	N/A	3	0.3	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BENZALDEHYDE	N/A	N/A	N/A	1900	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BENZIDINE	N/A	N/A	N/A	0.00011	ND	U	98	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	96.2	N/A	N/A	N/A	ND	U	185	N/A	N/A	N/A	ND	U	962	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	926
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BENZOIC ACID	N/A	N/A	N/A	75000	ND	U	98	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	96.2	N/A	N/A	N/A	ND	U	185	N/A	N/A	N/A	ND	U	962	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	926
	BIS(2-CHLOROETHOXY)METHANE	N/A	N/A	N/A	59	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BIS(2-CHLOROETHYL)ETHER	N/A	N/A	N/A	0.014	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BIS(2-CHLOROISOPROPYL)ETHER	N/A	N/A	N/A	0.36	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BIS(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	6	5.6	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	BUTANE, 2-METHOXY-2-METHYL-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BUTYL BENZYL PHTHALATE	N/A	N/A	N/A	16	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	CAPROLACTAM	N/A	N/A	N/A	9900	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	CARBAZOLE	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	CHRYSENE	N/A	N/A	N/A	3.4	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	CYCLOHEXANE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	DIBENZOFURAN	N/A	N/A	N/A	7.9	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	DIETHYL PHTHALATE	N/A	N/A	N/A	15000	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	DIMETHYL PHTHALATE	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	DI-N-BUTYL PHTHALATE	N/A	N/A	N/A	900	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	DI-N-OCTYL PHTHALATE	N/A	N/A	N/A	200	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	ETHANOL, 2-(2-ETHOXYETHOXY)-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	FLUORENE	N/A	N/A	N/A	290	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	HEXACHLOROBENZENE	N/A	N/A	1	0.049	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	HEXACHLOROCYCLOPENTADIENE	N/A	N/A	50	31	ND	U	9.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	9.62	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A	ND	U	96.2	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	92.6
	HEXACHLOROETHANE	N/A	N/A	N/A	0.9	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	ISOPHORONE	N/A	N/A	N/A	78	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	NAPHTHALENE	30	N/A	N/A	0.17	6.66		4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	**175**		48.1	N/A	N/A	N/A	N/A	N/A	N/A	**71.6**		46.3
	NITROBENZENE	N/A	N/A	N/A	0.14	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	N-NITROSO-DI-N-PROPYLAMINE	N/A	N/A	N/A	0.011	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	N-NITROSODIPHENYLAMINE	N/A	N/A	N/A	12	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	PENTACHLOROPHENOL	5	N/A	1	0.04	ND	U	19.6	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	37	N/A	N/A	N/A	ND	U	192	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	185
	PHENANTHRENE	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	PHENOL	5	N/A	N/A	5800	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	PYRENE	N/A	N/A	N/A	120	ND	U	4.9	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	46.3
	UNKNOWN[i]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PAHs (µg/L) Method 8270D Low Detection Limit	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ACENAPHTHENE	N/A	N/A	N/A	530	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-10610[f]			KAFB-10610			KAFB-10610			KAFB-10627[f]			KAFB-10627			KAFB-10628-510[f]			KAFB-10628-510			KAFB-106059[f]			KAFB-106059			KAFB-106059			KAFB-106064[f]		
					SAMPLE NO	GW1993			GW2123			GW2124			GW2026			GW2126			GW2049			GW2118			GW2043			GW2129			GW2130			GW2048		
					SAMPLE DATE	10-Mar-15			10-Mar-15			10-Mar-15			17-Feb-15			17-Feb-15			24-Feb-15			24-Feb-15			3-Mar-15			3-Mar-15			3-Mar-15			25-Feb-15		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			REG			REG			REG			REG			FD			REG		
					SAMPLE DEPTH	483-509 FT			483-508 FT			483-508 FT			481-501 FT			481-501 FT			486-511 FT			486-511 FT			483-503 FT			483-503 FT			483-503 FT			485-505 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ANTHRACENE	N/A	N/A	N/A	1800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CHRYSENE	N/A	N/A	N/A	3.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Solvents (µg/L) Method 8321	2,2'-OXYBISETHANOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ETHYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PROPYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TETRAETHYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TRIETHYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oil/Grease (mg/L) Method E1664	HEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SGT-HEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L) Method 6010C	ALUMINUM	5	N/A	N/A	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ANTIMONY	N/A	N/A	0.006	0.0078	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ARSENIC	0.1	N/A	0.01	0.000052	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BARIUM	1	N/A	2	3.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BERYLLIUM	N/A	N/A	0.004	0.025	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CADMIUM	0.01	N/A	0.005	0.0092	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CALCIUM	N/A	N/A	N/A	N/A	67.1		5	N/A	N/A	N/A	N/A	N/A	N/A	35		5				82.8		5				94.6		5	N/A	N/A	N/A	N/A	N/A	N/A	86.6		5
	CHROMIUM	0.05	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	COBALT	0.05	N/A	N/A	0.006	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	COPPER	1	N/A	1.3	0.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	IRON	1	N/A	N/A	14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	LEAD	0.05	0.01	0.015	0.015	ND	U	0.005	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.005				ND	U	0.005				ND	U	0.005	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.005
	MAGNESIUM	N/A	N/A	N/A	N/A	8.43		5	N/A	N/A	N/A	N/A	N/A	N/A	4.86	J	5				11.7		5				15.4		5	N/A	N/A	N/A	N/A	N/A	N/A	13.5		5
	MANGANESE	0.2	N/A	N/A	0.43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	MOLYBDENUM	1	N/A	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NICKEL	0.2	N/A	N/A	0.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	POTASSIUM	N/A	N/A	N/A	N/A	2.35	J	5	N/A	N/A	N/A	N/A	N/A	N/A	2.08	J	5				3.23	J	5				3.09	J	5	N/A	N/A	N/A	N/A	N/A	N/A	2.68	J	5
	SELENIUM	0.05	N/A	0.05	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SILVER	0.05	N/A	N/A	0.094	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SODIUM	N/A	N/A	N/A	N/A	24		5	N/A	N/A	N/A	N/A	N/A	N/A	22		5				37.1		5				33.2		5	N/A	N/A	N/A	N/A	N/A	N/A	30.4		5
	THALLIUM	N/A	N/A	0.002	0.0002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	VANADIUM	N/A	N/A	N/A	0.086	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ZINC	10	N/A	N/A	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	MERCURY (Method 7470A)	0.002	N/A	0.002	0.0057	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	IRON, DISSOLVED	1	N/A	N/A	14	0.861		0.1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.1	N/A	N/A	N/A	0.709		0.1	N/A	N/A	N/A	**2.65**		0.1	N/A	N/A	N/A	N/A	N/A	N/A	**4.98**		0.1
	MANGANESE, DISSOLVED	0.2	N/A	N/A	0.43	**1.78**		0.015	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.015	N/A	N/A	N/A	**1.97**		0.015	N/A	N/A	N/A	**2.9**		0.015	N/A	N/A	N/A	N/A	N/A	N/A	**3.49**		0.015
Anions (mg/L) Method E300.0	BROMIDE	N/A	N/A	N/A	N/A	0.636		0.25	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.25	N/A	N/A	N/A	0.482	J	2.5	N/A	N/A	N/A	ND	U	0.25	N/A	N/A	N/A	N/A	N/A	N/A	0.251		0.25
	CHLORIDE	250	N/A	N/A	N/A	57.7		0.5	N/A	N/A	N/A	N/A	N/A	N/A	6.86		0.5	N/A	N/A	N/A	26.8		5	N/A	N/A	N/A	32.2		0.5	N/A	N/A	N/A	N/A	N/A	N/A	13.1		0.5
	SULFATE	600	N/A	N/A	N/A	44.9		2.5	N/A	N/A	N/A	N/A	N/A	N/A	29.9		2.5	N/A	N/A	N/A	42.5		25	N/A	N/A	N/A	6.23	J-	2.5	N/A	N/A	N/A	N/A	N/A	N/A	0.532	J	2.5
	NITROGEN, NITRATE-NITRITE	10	4	10	N/A	ND	U	0.2	N/A	N/A	N/A	N/A	N/A	N/A	0.119	J	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.2
	AMMONIA (AS N)	N/A	N/A	N/A	N/A	0.205	J	0.3	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.3	N/A	N/A	N/A	ND	U	0.3	N/A	N/A	N/A	ND	U	0.3	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.3
	SULFIDE, TOTAL	N/A	N/A	N/A	N/A	0.383	J	0.957	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.98	N/A	N/A	N/A	0.453	J	0.943	N/A	N/A	N/A	ND	U	0.98	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.957
Alkalinity (mg/L) Method SM2320B/A2320B	ALKALINITY, TOTAL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ALKALINITY, BICARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	140		1	N/A	N/A	N/A	N/A	N/A	N/A	117		1	N/A	N/A	N/A	234		1	N/A	N/A	N/A	331	J-	1	N/A	N/A	N/A	N/A	N/A	N/A	314		1
	ALKALINITY, CARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	UJ	1	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1
Biological Parameters (cells/mL) Method QUANT ARRAY	APS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	707000		5.1	734000		5	N/A	N/A	N/A	5		4.9	N/A	N/A	N/A	698000		4.9	N/A	N/A	N/A	607000		0	404000		0	N/A	N/A	N/A
	BVC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	ND	U	0.5	N/A	N/A	N/A
	CFR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	ND	U	5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	0	ND	U	0	N/A	N/A	N/A
	DCA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	ND	U	5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.8	ND	U	4.8	N/A	N/A	N/A
	DCAR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	627		5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	0	ND	U	0	N/A	N/A	N/A
	DCM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	384		5.1	376		5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	361		4.8	358		4.8	N/A	N/A	N/A
	DCMA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	ND	U	5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	0	ND	U	0	N/A	N/A	N/A
	DECO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	ND	U	5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.8	ND	U	4.8	N/A	N/A	N/A
	DHBt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	104000		5.1	4170		5	N/A	N/A	N/A	33.9		4.9	N/A	N/A	N/A	6470		4.9	N/A	N/A	N/A	8360		4.8	5470		4.8	N/A	N/A	N/A
	DHC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8		0.5	4.8		0.5	N/A	N/A	N/A	0.2	J	0.5	N/A	N/A	N/A	3.5		0.5	N/A	N/A	N/A	1.7		0.5	1.3		0.5	N/A	N/A	N/A
	DHG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	74100		5.1	28900		5	N/A	N/A	N/A	98.2		4.9	N/A	N/A	N/A	956		4.9	N/A	N/A	N/A	560000		4.8	306000		4.8	N/A	N/A	N/A
	DSB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3820		5.1	1890		5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	502		4.9	N/A	N/A	N/A	6600		4.8	4820		4.8	N/A	N/A	N/A
Biological Parameters (cells/mL) Method QUANT ARRAY	DSM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	20900		5.1	13700		5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	56.3		4.9	N/A	N/A	N/A	ND	U	0	ND	U	0	N/A	N/A	N/A
	EBAC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1610000		5.1	1350000		5	N/A	N/A	N/A	312000		4.9	N/A	N/A	N/A	2980000		4.9	N/A	N/A	N/A	4610000		4.8	4010000		4.8	N/A	N/A	N/A
	EtnC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	ND	U	5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.8	ND	U	4.8	N/A	N/A	N/A
	EtnE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	ND	U	5	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	0	ND	U	0	N/A	N/A	N/A
	MGN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	11000		5.1	6380		5	N/A	N/A	N/A	6.1		4.9	N/A	N/A	N/A	97		4.9	N/A	N/A	N/A	8640		4.8	7180		4.8	N/A	N/A	N/A
	PHE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3160		5.1	3440		5	N/A	N/A	N/A	160		4.9	N/A	N/A	N/A	605		4.9	N/A	N/A	N/A	44300		0	22700		0	N/A	N/A	N/A
	PMMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	31.2		5.1	32.1		5	N/A	N/A	N/A	2.2	J	4.9	N/A	N/A	N/A	143		4.9	N/A	N/A	N/A	231		0	435		0	N/A	N/A	N/A
	RDEG	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2820		5.1	1210		5	N/A	N/A	N/A	1330		4.9	N/A	N/A	N/A	855		4.9	N/A	N/A	N/A	111000		0	76400		0	N/A	N/A	N/A

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-10610[f]			KAFB-10610			KAFB-10610			KAFB-10627[f]			KAFB-10627		
					SAMPLE NO	GW1993			GW2123			GW2124			GW2026			GW2126		
					SAMPLE DATE	10-Mar-15			10-Mar-15			10-Mar-15			17-Feb-15			17-Feb-15		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG		
					SAMPLE DEPTH	483-509 FT			483-508 FT			483-508 FT			481-501 FT			481-501 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
	RMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2310		5.1	1430		5	N/A	N/A	N/A	14.2		4.9
	SMMO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4170		5.1	4190		5	N/A	N/A	N/A	406		4.9
	TCBO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5.1	ND	U	5	N/A	N/A	N/A	ND	U	4.9
	TCE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5
	TOD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	979		5.1	880		5	N/A	N/A	N/A	138		4.9
	VCR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5
Field Parameters	Temperature (°C)	N/A	N/A	N/A	N/A	18.96			18.96			18.96			17.57			17.57		
	pH (S.U.)	N/A	N/A	N/A	N/A	8.76			8.76			8.76			7.87			7.87		
	Spec Cond (µS/cm2)	N/A	N/A	N/A	N/A	553.3			553.3			553.3			294.1			294.1		
	DO (mg/L)	N/A	N/A	N/A	N/A	0.03			0.03			0.03			4.26			4.26		
	ORP (mV)	N/A	N/A	N/A	N/A	-270			-270			-270			143			143		
	Turbidity (NTU)	N/A	N/A	N/A	N/A	0.91			0.91			0.91			0.49			0.49		
	Alkalinity (mg/L as CaCO3)	N/A	N/A	N/A	N/A	170			170			170			112			112		

	LOCATION CODE	KAFB-10628-510[f]			KAFB-10628-510			KAFB-106059[f]			KAFB-106059			KAFB-106059			KAFB-106064[f]		
	SAMPLE NO	GW2049			GW2118			GW2043			GW2129			GW2130			GW2048		
	SAMPLE DATE	24-Feb-15			24-Feb-15			3-Mar-15			3-Mar-15			3-Mar-15			25-Feb-15		
	SAMPLE PURPOSE	REG			REG			REG			REG			FD			REG		
	SAMPLE DEPTH	486-511 FT			486-511 FT			483-503 FT			483-503 FT			483-503 FT			485-505 FT		
Chemical Class and Analytical Method[a]	Parameter	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
	RMO	N/A	N/A	N/A	1120		4.9	N/A	N/A	N/A	165000		0	157000		0	N/A	N/A	N/A
	SMMO	N/A	N/A	N/A	635		4.9	N/A	N/A	N/A	9360		4.8	7310		4.8	N/A	N/A	N/A
	TCBO	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.8	ND	U	4.8	N/A	N/A	N/A
	TCE	N/A	N/A	N/A	1.2		0.5	N/A	N/A	N/A	ND	U	0.5	ND	U	0.5	N/A	N/A	N/A
	TOD	N/A	N/A	N/A	377		4.9	N/A	N/A	N/A	7440		4.8	5940		4.8	N/A	N/A	N/A
	VCR	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	ND	U	0.5	N/A	N/A	N/A
Field Parameters	Temperature (°C)	17.94			17.94			18.89			18.89			18.89			18.12		
	pH (S.U.)	7.37			7.37			7.1			7.1			7.1			7		
	Spec Cond (µS/cm2)	593.9			593.9			700.9			700.9			700.9			633.2		
	DO (mg/L)	0			0			0.04			0.04			0.04			-0.04		
	ORP (mV)	-319			-319			-245			-245			-245			-138		
	Turbidity (NTU)	3.52			3.52			0.83			0.83			0.83			1.97		
	Alkalinity (mg/L as CaCO3)	240			240			312			312			312			280		

EPA MCL and tap water RSLs are from the EPA RSL Table, dated November 2014.
The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and
The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol,
Sample GW0998 for SVOC analysis was not performed due to laboratory errors.
Sample GW0886 for PAH analysis was not colllected due to an oversight.
KAFB-10612 not measured due to a non-operational corroded pump.
The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.
The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and
a. EPA analytical methods listed are for the most recent sampling event.
b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and
c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water. Concentrations
d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs), or if more stringent, New Mexico Water
e. Sample contained bubbles.
f. Sample was also collected for Quant Array, dissolved gases, and hydrogen. Hydrogen samples were collected using a
g. Used YSI instead of In-Situ to collect water parameter readings.
h. Well was damaged. Used YSI instead of In-Situ to collect water parameter readings. The following analytical methods were used to
i. Faulty water level meter.
j. "Unknown" compound is based on the SVOC tentatively identified compound search. The compound is tentatively present in the
k. Well was sampled for EDB only during the time-critical sampling event.
Shading indicates the analyte was detected.
Bold indicated analyte detected greater than regulatory standard.
°C = degrees Celcius
J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).
J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.
J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.
KAFB = Kirtland Air Force Base
µS/cm^2 = microsiemens per square centimeter
mg/L = milligram per liter
mV = millivolts
N/A = Not analyzed.
ND = Not detected.
NM = Not measured due to equipment malfunction.
No. = number
NR = Not recorded or reported due to operational error.
NR = not recorded
NTU = Nephelometric Turbidity Unit
R = Sample data rejected due to site contamination.
RSL = Regional Screening Level.
S.U. = Standard Unit
U = Analyte was not detected. The reported numerical value is at or below the LOQ.

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-106064			KAFB-106067[f]			KAFB-106067[f]			KAFB-106067			KAFB-106075[f]			KAFB-106075			KAFB-106076[f]			KAFB-106076			KAFB-106079[f]			KAFB-106079			KAFB-106082[f]		
					SAMPLE NO	GW2131			GW2052			GW2053			GW2132			GW2061			GW2127			GW2062[e]			GW2122			GW2066			GW2120			GW2069		
					SAMPLE DATE	25-Feb-15			23-Feb-15			23-Feb-15			23-Feb-15			18-Feb-15			18-Feb-15			5-Mar-15			5-Mar-15			19-Feb-15			19-Feb-15			26-Feb-15		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	485-505 FT			485-505 FT			485-505 FT			485-505 FT			480-500 FT			480-500 FT			480-500 FT			480-500 FT			484-504 FT			484-5042 FT			472-492 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L) Method 8015C/8015D	DIESEL RANGE ORGANICS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4990		400	4770		2000	N/A	N/A	N/A	1280		370	N/A	N/A	N/A	94000		7690	N/A	N/A	N/A	14000		1850	N/A	N/A	N/A	3620		1850
	GASOLINE RANGE ORGANICS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1750		150	1790		150	N/A	N/A	N/A	407		150	N/A	N/A	N/A	29800		1500	N/A	N/A	N/A	3630		150	N/A	N/A	N/A	1250		150
VOCs (µg/L) Method 8260B	1,2-DIBROMOETHANE (Method 8011)	0.1	N/A	0.05	0.0075	N/A	N/A	N/A	**0.134**	J	0.0278	**0.144**	J	0.0282	N/A	N/A	N/A	**0.317**	J	0.0282	N/A	N/A	N/A	**205**		14.1	N/A	N/A	N/A	**0.613**		0.0283	N/A	N/A	N/A	**0.0801**	J	0.028
	1,1,1,2-TETRACHLOROETHANE	N/A	N/A	N/A	0.57	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,1,1-TRICHLOROETHANE	60	N/A	200	8000	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,1,2,2-TETRACHLOROETHANE	10	N/A	N/A	0.076	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,1,2-TRICHLOROETHANE	10	N/A	5	0.28	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,1-DICHLOROETHANE	25	N/A	N/A	2.7	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,1-DICHLOROETHENE	5	N/A	7	280	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,1-DICHLOROPROPENE	N/A	N/A	N/A	83000	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,2,3-TRICHLOROBENZENE	N/A	N/A	N/A	7	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	UJ	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	UJ	10	N/A	N/A	N/A	ND	U	4
	1,2,3-TRICHLOROPROPANE	N/A	N/A	N/A	0.00075	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	4
	1,2,4-TRICHLOROBENZENE	N/A	N/A	70	1.1	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	4
	1,2,4-TRIMETHYLBENZENE	N/A	N/A	N/A	15	N/A	N/A	N/A	36.9		2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	278		20	N/A	N/A	N/A	13.7		5	N/A	N/A	N/A	ND	U	2
	1,2-DIBROMO-3-CHLOROPROPANE	N/A	N/A	0.2	0.00033	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	4
	1,2-DIBROMOETHANE	0.1	N/A	0.05	0.0075	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	**166**		20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,2-DICHLOROBENZENE	N/A	N/A	600	300	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,2-DICHLOROETHANE	10	N/A	5	0.17	N/A	N/A	N/A	1.53	J	2	1.49	J	2	N/A	N/A	N/A	1.29	J	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	**5.3**		5	N/A	N/A	N/A	2.75		2
	1,2-DICHLOROPROPANE	N/A	N/A	5	0.44	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,3,5-TRIMETHYLBENZENE	N/A	N/A	N/A	120	N/A	N/A	N/A	8.38		2	8.22		2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	82.7		20	N/A	N/A	N/A	16.3		5	N/A	N/A	N/A	ND	U	2
	1,3-DICHLOROBENZENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,3-DICHLOROPROPANE	N/A	N/A	N/A	370	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	1,4-DICHLOROBENZENE	N/A	N/A	75	0.48	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	2,2-DICHLOROPROPANE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	2-BUTANONE	N/A	N/A	N/A	5600	N/A	N/A	N/A	ND	U	20	ND	U	20	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	327		200	N/A	N/A	N/A	ND	U	50	N/A	N/A	N/A	ND	U	20
	2-CHLOROTOLUENE	N/A	N/A	N/A	240	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	2-HEXANONE	N/A	N/A	N/A	38	N/A	N/A	N/A	ND	U	10	ND	U	10	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	808		100	N/A	N/A	N/A	ND	U	25	N/A	N/A	N/A	ND	U	10
	4-CHLOROTOLUENE	N/A	N/A	N/A	250	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	4-METHYL-2-PENTANONE	N/A	N/A	N/A	1200	N/A	N/A	N/A	6.43	J	10	5.83	J	10	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	663		100	N/A	N/A	N/A	19.3	J	25	N/A	N/A	N/A	ND	U	10
	ACETONE	N/A	N/A	N/A	14000	N/A	N/A	N/A	87.8	J+	20	110	J+	20	N/A	N/A	N/A	43.2		20	N/A	N/A	N/A	1270		200	N/A	N/A	N/A	166		50	N/A	N/A	N/A	68.6		20
	BENZENE	10	N/A	5	0.45	N/A	N/A	N/A	**127**		2	**134**		2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	**2840**		20	N/A	N/A	N/A	**739**		5	N/A	N/A	N/A	ND	U	2
	BROMOBENZENE	N/A	N/A	N/A	62	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	BROMOCHLOROMETHANE	N/A	N/A	N/A	83	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	BROMODICHLOROMETHANE	N/A	N/A	80	0.13	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	BROMOFORM	N/A	N/A	80	9.2	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	BROMOMETHANE	N/A	N/A	N/A	7.5	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	4
	CARBON DISULFIDE	N/A	N/A	N/A	810	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	23.2		20	N/A	N/A	N/A	1.58	J	5	N/A	N/A	N/A	0.555	J	2
	CARBON TETRACHLORIDE	10	N/A	5	0.45	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	CHLOROBENZENE	N/A	N/A	100	78	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	CHLOROETHANE	N/A	N/A	N/A	21000	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	4
	CHLOROFORM	100	N/A	80	0.22	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	CHLOROMETHANE	N/A	N/A	N/A	190	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	CIS-1,2-DICHLOROETHENE	N/A	N/A	70	36	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	CIS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	CYCLOTETRASILOXANE, OCTAMETHYL-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBROMOCHLOROMETHANE	N/A	N/A	80	0.17	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	DIBROMOMETHANE	N/A	N/A	N/A	8	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	DICHLORODIFLUOROMETHANE	N/A	N/A	N/A	200	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	4
	ETHANE, 1,1-DIFLUORO-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ETHYLBENZENE	750	N/A	700	1.5	N/A	N/A	N/A	128		2	131		2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	350		20	N/A	N/A	N/A	55		5	N/A	N/A	N/A	8.29		2
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	4
	ISOPROPYLBENZENE	N/A	N/A	N/A	450	N/A	N/A	N/A	24.8		2	25.4		2	N/A	N/A	N/A	9.42		2	N/A	N/A	N/A	38.9		20	N/A	N/A	N/A	7.44		5	N/A	N/A	N/A	9.47		2
	M,P-XYLENES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	METHYL TERT-BUTYL ETHER	N/A	N/A	N/A	14	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	2.5	J	5	N/A	N/A	N/A	0.543	J	2
	METHYLENE CHLORIDE	100	N/A	5	11	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	4
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	8.4		4	8.49		4	N/A	N/A	N/A	ND	UJ	4	N/A	N/A	N/A	**179**		40	N/A	N/A	N/A	7.55	J-	10	N/A	N/A	N/A	ND	U	4
	N-BUTYLBENZENE	N/A	N/A	N/A	1000	N/A	N/A	N/A	2.01		2	1.9	J	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	11.8	J	20	N/A	N/A	N/A	1.39	J	5	N/A	N/A	N/A	ND	U	2
	N-PROPYLBENZENE	N/A	N/A	N/A	660	N/A	N/A	N/A	11.8		2	12		2	N/A	N/A	N/A	1.38	J	2	N/A	N/A	N/A	46.6		20	N/A	N/A	N/A	4.72	J	5	N/A	N/A	N/A	4.11		2
	O-XYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	P-ISOPROPYLTOLUENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.26		2	2.57		2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	8.97	J	20	N/A	N/A	N/A	3.15	J	5	N/A	N/A	N/A	ND	U	2
	SEC-BUTYLBENZENE	N/A	N/A	N/A	2000	N/A	N/A	N/A	3.02		2	3.01		2	N/A	N/A	N/A	1.01	J	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	3.39	J	5	N/A	N/A	N/A	0.946	J	2
	STYRENE	N/A	N/A	100	1200	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	TERT-BUTYLBENZENE	N/A	N/A	N/A	690	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	TETRACHLOROETHENE	20	N/A	5	11	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	TOLUENE	750	N/A	1000	1100	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	**842**		20	N/A	N/A	N/A	133		5	N/A	N/A	N/A	ND	U	2
	TRANS-1,2-DICHLOROETHENE	N/A	N/A	100	360	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	TRANS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	TRICHLOROETHENE	100	N/A	5	0.49	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	TRICHLOROFLUOROMETHANE	N/A	N/A	N/A	1100	N/A	N/A	N/A	ND	U	4	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	40	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	4
	VINYL CHLORIDE	1	N/A	2	0.019	N/A	N/A	N/A	ND	U	2	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	2
	XYLENES	620	N/A	10000	190	N/A	N/A	N/A	1.92	J	6	7.43		6	N/A	N/A	N/A	ND	U	6	N/A	N/A	N/A	**1610**		60	N/A	N/A	N/A	52.6		15	N/A	N/A	N/A	ND	U	6
Gases (µg/L) Method EPA RSK175	HYDROGEN (AM20GAX) (nM)	N/A	N/A	N/A	N/A	1.4	N/A	0.6	N/A	N/A	N/A	N/A	N/A	N/A	1.6	N/A	0.6	N/A	N/A	N/A	1.4	N/A	1.2	N/A	N/A	N/A	1.4		0.6	N/A	N/A	N/A	1.2	N/A	0.6	N/A	N/A	N/A
	ETHANE	N/A	N/A	N/A	N/A	16	N/A	0.2	N/A	N/A	N/A	N/A	N/A	N/A	0.86	N/A	0.2	N/A	N/A	N/A	0.27	N/A	0.2	N/A	N/A	N/A	19	J	0.2	N/A	N/A	N/A	13	N/A	0.2	N/A	N/A	N/A
	ETHYLENE	N/A	N/A	N/A	N/A	25	N/A	0.2	N/A	N/A	N/A	N/A	N/A	N/A	0.77	N/A	0.2	N/A	N/A	N/A	0.36	N/A	0.2	N/A	N/A	N/A	11	J	0.2	N/A	N/A	N/A	1.9	N/A	0.2	N/A	N/A	N/A
	METHANE	N/A	N/A	N/A	N/A	47	N/A	0.2	N/A	N/A	N/A	N/A	N/A	N/A	1.5	N/A	0.2	N/A	N/A	N/A	0.37	N/A	0.2	N/A	N/A	N/A	16	J	0.2	N/A	N/A	N/A	14	N/A	0.2	N/A	N/A	N/A

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-106064			KAFB-106067[f]			KAFB-106067[f]			KAFB-106067			KAFB-106075[f]			KAFB-106075			KAFB-106076[f]			KAFB-106076			KAFB-106079[f]			KAFB-106079			KAFB-106082[f]		
					SAMPLE NO	GW2131			GW2052			GW2053			GW2132			GW2061			GW2127			GW2062[e]			GW2122			GW2066			GW2120			GW2069		
					SAMPLE DATE	25-Feb-15			23-Feb-15			23-Feb-15			23-Feb-15			18-Feb-15			18-Feb-15			5-Mar-15			5-Mar-15			19-Feb-15			19-Feb-15			26-Feb-15		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	485-505 FT			485-505 FT			485-505 FT			485-505 FT			480-500 FT			480-500 FT			480-500 FT			480-500 FT			484-504 FT			484-5042 FT			472-492 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
SVOCs (µg/L) Method 8270D/8270C	1,1-BIPHENYL	N/A	N/A	N/A	0.83	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	1.64	J	4.81	N/A	N/A	N/A	ND	U	4.63
	1,2-DIPHENYLHYDRAZINE	N/A	N/A	N/A	0.077	N/A	N/A	N/A	3.74	J	5	3.76	J	5	N/A	N/A	N/A	1.97	J	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	6.65		4.81	N/A	N/A	N/A	ND	U	4.63
	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	1.92	J	5	1.87	J	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	10.5		4.81	N/A	N/A	N/A	ND	U	4.63
	1-PROPENE, 1,2,3-TRICHLORO-, (Z)-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2,4,5-TRICHLOROPHENOL	5	N/A	N/A	1200	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	2,4,6-TRICHLOROPHENOL	5	N/A	N/A	4	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	2,4-DICHLOROPHENOL	5	N/A	N/A	46	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	2,4-DIMETHYLPHENOL	5	N/A	N/A	360	N/A	N/A	N/A	ND	U	20	ND	U	20	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	1890	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	18.5
	2,4-DINITROPHENOL	5	N/A	N/A	39	N/A	N/A	N/A	ND	U	50	ND	U	50	N/A	N/A	N/A	ND	U	50	N/A	N/A	N/A	ND	U	4720	N/A	N/A	N/A	ND	U	48.1	N/A	N/A	N/A	ND	U	46.3
	2,4-DINITROTOLUENE	N/A	N/A	N/A	0.24	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	2,6-DINITROTOLUENE	N/A	N/A	N/A	0.048	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	2-CHLORONAPHTHALENE	N/A	N/A	N/A	750	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	2-CHLOROPHENOL	5	N/A	N/A	91	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	**121**	J	472	N/A	N/A	N/A	6.21		4.81	N/A	N/A	N/A	ND	U	4.63
	2-METHYLPHENOL	5	N/A	N/A	930	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	2-NITROANILINE	N/A	N/A	N/A	190	N/A	N/A	N/A	ND	U	20	ND	U	20	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	1890	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	18.5
	2-NITROPHENOL	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	3,3'-DICHLOROBENZIDINE	N/A	N/A	N/A	0.12	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	N/A	N/A	930	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	3-NITROANILINE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	20	ND	U	20	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	1890	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	18.5
	4,6-DINITRO-2-METHYLPHENOL	5	N/A	N/A	1.5	N/A	N/A	N/A	ND	U	20	ND	U	20	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	1890	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	18.5
	4-BROMOPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	4-CHLORO-3-METHYLPHENOL	5	N/A	N/A	1400	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	4-CHLOROANILINE	N/A	N/A	N/A	0.36	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	4-CHLOROPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	4-NITROANILINE	N/A	N/A	N/A	3.8	N/A	N/A	N/A	ND	U	20	ND	U	20	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	1890	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	18.5
	4-NITROPHENOL	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	20	ND	U	20	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	1890	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	18.5
	ACENAPHTHENE	N/A	N/A	N/A	530	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	ACETOPHENONE	N/A	N/A	N/A	1900	N/A	N/A	N/A	3.82	J	5	3.7	J	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	10300		943	N/A	N/A	N/A	391		48.1	N/A	N/A	N/A	ND	U	4.63
	ANTHRACENE	N/A	N/A	N/A	1800	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	ATRAZINE	N/A	N/A	3	0.3	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BENZALDEHYDE	N/A	N/A	N/A	1900	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BENZIDINE	N/A	N/A	N/A	0.00011	N/A	N/A	N/A	ND	U	100	ND	U	100	N/A	N/A	N/A	ND	U	100	N/A	N/A	N/A	ND	U	9430	N/A	N/A	N/A	ND	U	96.2	N/A	N/A	N/A	ND	UJ	92.6
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BENZOIC ACID	N/A	N/A	N/A	75000	N/A	N/A	N/A	24.3	J	100	23.2	J	100	N/A	N/A	N/A	ND	U	100	N/A	N/A	N/A	ND	U	9430	N/A	N/A	N/A	ND	U	96.2	N/A	N/A	N/A	ND	U	92.6
	BIS(2-CHLOROETHOXY)METHANE	N/A	N/A	N/A	59	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BIS(2-CHLOROETHYL)ETHER	N/A	N/A	N/A	0.014	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BIS(2-CHLOROISOPROPYL)ETHER	N/A	N/A	N/A	0.36	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BIS(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	6	5.6	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	BUTANE, 2-METHOXY-2-METHYL-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BUTYL BENZYL PHTHALATE	N/A	N/A	N/A	16	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	CAPROLACTAM	N/A	N/A	N/A	9900	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	CARBAZOLE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	CHRYSENE	N/A	N/A	N/A	3.4	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	CYCLOHEXANE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	DIBENZOFURAN	N/A	N/A	N/A	7.9	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	DIETHYL PHTHALATE	N/A	N/A	N/A	15000	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	DIMETHYL PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	DI-N-BUTYL PHTHALATE	N/A	N/A	N/A	900	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	DI-N-OCTYL PHTHALATE	N/A	N/A	N/A	200	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	ETHANOL, 2-(2-ETHOXYETHOXY)-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	HEXACHLOROBENZENE	N/A	N/A	1	0.049	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	HEXACHLOROCYCLOPENTADIENE	N/A	N/A	50	31	N/A	N/A	N/A	ND	U	10	ND	U	10	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	943	N/A	N/A	N/A	ND	U	9.62	N/A	N/A	N/A	ND	U	9.26
	HEXACHLOROETHANE	N/A	N/A	N/A	0.9	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	ISOPHORONE	N/A	N/A	N/A	78	N/A	N/A	N/A	1.27	J	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	2.61	J	5	2.43	J	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	**196**	J	472	N/A	N/A	N/A	8.78		4.81	N/A	N/A	N/A	ND	U	4.63
	NITROBENZENE	N/A	N/A	N/A	0.14	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	N-NITROSO-DI-N-PROPYLAMINE	N/A	N/A	N/A	0.011	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	N-NITROSODIPHENYLAMINE	N/A	N/A	N/A	12	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	PENTACHLOROPHENOL	5	N/A	1	0.04	N/A	N/A	N/A	ND	U	20	ND	U	20	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	1890	N/A	N/A	N/A	ND	U	19.2	N/A	N/A	N/A	ND	U	18.5
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	PHENOL	5	N/A	N/A	5800	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	ND	U	5	ND	U	5	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	472	N/A	N/A	N/A	ND	U	4.81	N/A	N/A	N/A	ND	U	4.63
	UNKNOWN[j]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PAHs (µg/L) Method 8270D Low Detection Limit	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ACENAPHTHENE	N/A	N/A	N/A	530	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-106064			KAFB-106067[f]			KAFB-106067[f]			KAFB-106067			KAFB-106075[f]			KAFB-106075			KAFB-106076[f]			KAFB-106076			KAFB-106079[f]			KAFB-106079			KAFB-106082[f]		
					SAMPLE NO	GW2131			GW2052			GW2053			GW2132			GW2061			GW2127			GW2062[e]			GW2122			GW2066			GW2120			GW2069		
					SAMPLE DATE	25-Feb-15			23-Feb-15			23-Feb-15			23-Feb-15			18-Feb-15			18-Feb-15			5-Mar-15			5-Mar-15			19-Feb-15			19-Feb-15			26-Feb-15		
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	485-505 FT			485-505 FT			485-505 FT			485-505 FT			480-500 FT			480-500 FT			480-500 FT			480-500 FT			484-504 FT			484-5042 FT			472-492 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ANTHRACENE	N/A	N/A	N/A	1800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CHRYSENE	N/A	N/A	N/A	3.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Solvents (µg/L) Method 8321	2,2'-OXYBISETHANOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ETHYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PROPYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TETRAETHYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TRIETHYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oil/Grease (mg/L) Method E1664	HEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SGT-HEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L) Method 6010C	ALUMINUM	5	N/A	N/A	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ANTIMONY	N/A	N/A	0.006	0.0078	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ARSENIC	0.1	N/A	0.01	0.000052	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BARIUM	1	N/A	2	3.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BERYLLIUM	N/A	N/A	0.004	0.025	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CADMIUM	0.01	N/A	0.005	0.0092	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CALCIUM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	74.6		5	71.9		5	N/A	N/A	N/A	74.1		5	N/A	N/A	N/A	94.2		5	N/A	N/A	N/A	99.3		5	N/A	N/A	N/A	86.5		5
	CHROMIUM	0.05	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	COBALT	0.05	N/A	N/A	0.006	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	COPPER	1	N/A	1.3	0.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	IRON	1	N/A	N/A	14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	LEAD	0.05	0.01	0.015	0.015	N/A	N/A	N/A	ND	U	0.005	ND	U	0.005	N/A	N/A	N/A	ND	U	0.005	N/A	N/A	N/A	ND	U	0.005	N/A	N/A	N/A	0.00178	J	0.005	N/A	N/A	N/A	ND	U	0.005
	MAGNESIUM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.69		5	9.48		5	N/A	N/A	N/A	10.3		5	N/A	N/A	N/A	20		5	N/A	N/A	N/A	15.9		5	N/A	N/A	N/A	12.6		5
	MANGANESE	0.2	N/A	N/A	0.43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	MOLYBDENUM	1	N/A	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NICKEL	0.2	N/A	N/A	0.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	POTASSIUM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.9	J	5	2.82	J	5	N/A	N/A	N/A	3.08	J	5	N/A	N/A	N/A	3.23	J	5	N/A	N/A	N/A	3.5	J	5	N/A	N/A	N/A	3.04	J	5
	SELENIUM	0.05	N/A	0.05	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SILVER	0.05	N/A	N/A	0.094	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SODIUM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	32.7		5	31.5		5	N/A	N/A	N/A	30.4		5	N/A	N/A	N/A	41.4		5	N/A	N/A	N/A	51.2		5	N/A	N/A	N/A	32.5		5
	THALLIUM	N/A	N/A	0.002	0.0002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	VANADIUM	N/A	N/A	N/A	0.086	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ZINC	10	N/A	N/A	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	MERCURY (Method 7470A)	0.002	N/A	0.002	0.0057	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	IRON, DISSOLVED	1	N/A	N/A	14	N/A	N/A	N/A	0.649		0.1	0.654		0.1	N/A	N/A	N/A	0.0507	J	0.1	N/A	N/A	N/A	0.347		0.1	N/A	N/A	N/A	**3.8**		0.1	N/A	N/A	N/A	0.411		0.1
	MANGANESE, DISSOLVED	0.2	N/A	N/A	0.43	N/A	N/A	N/A	**1.04**		0.015	**1.03**		0.015	N/A	N/A	N/A	**0.947**		0.015	N/A	N/A	N/A	**1.81**		0.015	N/A	N/A	N/A	**4.51**		0.015	N/A	N/A	N/A	**0.805**		0.015
Anions (mg/L) Method E300.0	BROMIDE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.422	J	2.5	0.434	J	2.5	N/A	N/A	N/A	0.73		0.25	N/A	N/A	N/A	0.779		0.25	N/A	N/A	N/A	0.645	J	2.5	N/A	N/A	N/A	0.717		0.25
	CHLORIDE	250	N/A	N/A	N/A	N/A	N/A	N/A	13.6		5	13.6		5	N/A	N/A	N/A	66.6		0.5	N/A	N/A	N/A	31.5		0.5	N/A	N/A	N/A	46.8		5	N/A	N/A	N/A	63.4		0.5
	SULFATE	600	N/A	N/A	N/A	N/A	N/A	N/A	19.7	J	25	20.2	J	25	N/A	N/A	N/A	54.1		2.5	N/A	N/A	N/A	35.9		2.5	N/A	N/A	N/A	25.9		25	N/A	N/A	N/A	70.3		2.5
	NITROGEN, NITRATE-NITRITE	10	4	10	N/A	N/A	N/A	N/A	ND	U	0.2	ND	U	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	ND	U	0.2
	AMMONIA (AS N)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.3	ND	U	0.3	N/A	N/A	N/A	ND	U	0.3	N/A	N/A	N/A	ND	U	0.3	N/A	N/A	N/A	ND	U	0.3	N/A	N/A	N/A	ND	U	0.3
	SULFIDE, TOTAL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1.01	ND	U	0.943	N/A	N/A	N/A	ND	U	0.948	N/A	N/A	N/A	0.526	J	0.939	N/A	N/A	N/A	ND	U	0.948	N/A	N/A	N/A	ND	U	0.971
Alkalinity (mg/L) Method SM2320B/A2320B	ALKALINITY, TOTAL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ALKALINITY, BICARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	250		1	242		1	N/A	N/A	N/A	152		1	N/A	N/A	N/A	549		1	N/A	N/A	N/A	324		1	N/A	N/A	N/A	173		1
	ALKALINITY, CARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	ND	U	1	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	1
Biological Parameters (cells/mL) Method QUANT ARRAY	APS	N/A	N/A	N/A	N/A	226000		4.8	N/A	N/A	N/A	N/A	N/A	N/A	708000		4.8	N/A	N/A	N/A	145000		4.7	N/A	N/A	N/A	1340000		15.9	N/A	N/A	N/A	357000		4.8	N/A	N/A	N/A
	BVC	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	1.6	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A
	CFR	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	ND	U	4.7	N/A	N/A	N/A	53.8		15.9	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A
	DCA	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	ND	U	4.7	N/A	N/A	N/A	ND	U	15.9	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A
	DCAR	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	ND	U	4.7	N/A	N/A	N/A	ND	U	15.9	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A
	DCM	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	12.8		4.8	N/A	N/A	N/A	ND	U	4.7	N/A	N/A	N/A	1580		15.9	N/A	N/A	N/A	367		4.8	N/A	N/A	N/A
	DCMA	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	ND	U	4.7	N/A	N/A	N/A	ND	U	15.9	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A
	DECO	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	ND	U	4.7	N/A	N/A	N/A	ND	U	15.9	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A
	DHBt	N/A	N/A	N/A	N/A	1940		4.8	N/A	N/A	N/A	N/A	N/A	N/A	2170		4.8	N/A	N/A	N/A	ND	U	4.7	N/A	N/A	N/A	1420		15.9	N/A	N/A	N/A	9920		4.8	N/A	N/A	N/A
	DHC	N/A	N/A	N/A	N/A	2.9		0.5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	15		1.6	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A
	DHG	N/A	N/A	N/A	N/A	112000		4.8	N/A	N/A	N/A	N/A	N/A	N/A	7130		4.8	N/A	N/A	N/A	19200		4.7	N/A	N/A	N/A	43800		15.9	N/A	N/A	N/A	42200		4.8	N/A	N/A	N/A
	DSB	N/A	N/A	N/A	N/A	7520		4.8	N/A	N/A	N/A	N/A	N/A	N/A	1550		4.8	N/A	N/A	N/A	316		4.7	N/A	N/A	N/A	5550		15.9	N/A	N/A	N/A	4870		4.8	N/A	N/A	N/A
Biological Parameters (cells/mL) Method QUANT ARRAY	DSM	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	858		4.7	N/A	N/A	N/A	ND	U	15.9	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A
	EBAC	N/A	N/A	N/A	N/A	2240000		4.8	N/A	N/A	N/A	N/A	N/A	N/A	2190000		4.8	N/A	N/A	N/A	3540000		4.7	N/A	N/A	N/A	1E+07		15.9	N/A	N/A	N/A	2480000		4.8	N/A	N/A	N/A
	EtnC	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	7.4		4.7	N/A	N/A	N/A	ND	U	15.9	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A
	EtnE	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	18.1		4.7	N/A	N/A	N/A	ND	U	15.9	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A
	MGN	N/A	N/A	N/A	N/A	3200		4.8	N/A	N/A	N/A	N/A	N/A	N/A	153		4.8	N/A	N/A	N/A	244		4.7	N/A	N/A	N/A	805		15.9	N/A	N/A	N/A	47.9		4.8	N/A	N/A	N/A
	PHE	N/A	N/A	N/A	N/A	3160		4.8	N/A	N/A	N/A	N/A	N/A	N/A	4560		4.8	N/A	N/A	N/A	4480		4.7	N/A	N/A	N/A	94900		15.9	N/A	N/A	N/A	3660		4.8	N/A	N/A	N/A
	PMMO	N/A	N/A	N/A	N/A	98.3		4.8	N/A	N/A	N/A	N/A	N/A	N/A	19.4		4.8	N/A	N/A	N/A	77.7		4.7	N/A	N/A	N/A	242		15.9	N/A	N/A	N/A	55.6		4.8	N/A	N/A	N/A
	RDEG	N/A	N/A	N/A	N/A	1710		4.8	N/A	N/A	N/A	N/A	N/A	N/A	1560		4.8	N/A	N/A	N/A	1090		4.7	N/A	N/A	N/A	92800		15.9	N/A	N/A	N/A	583		4.8	N/A	N/A	N/A

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-106064			KAFB-106067[f]			KAFB-106067[f]			KAFB-106067			KAFB-106075[f]			
					SAMPLE NO	GW2131			GW2052			GW2053			GW2132			GW2061			
					SAMPLE DATE	25-Feb-15			23-Feb-15			23-Feb-15			23-Feb-15			18-Feb-15			
					SAMPLE PURPOSE	REG			REG			FD			REG			REG			
					SAMPLE DEPTH	485-505 FT			485-505 FT			485-505 FT			485-505 FT			480-500 FT			
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	
	RMO	N/A	N/A	N/A	N/A	3500		4.8	N/A	N/A	N/A	N/A	N/A	N/A	3400		4.8	N/A	N/A	N/A	
	SMMO	N/A	N/A	N/A	N/A	2370		4.8	N/A	N/A	N/A	N/A	N/A	N/A	1660		4.8	N/A	N/A	N/A	
	TCBO	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.8	N/A	N/A	N/A	
	TCE	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	
	TOD	N/A	N/A	N/A	N/A	115		4.8	N/A	N/A	N/A	N/A	N/A	N/A	286		4.8	N/A	N/A	N/A	
	VCR	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	
Field Parameters	Temperature (°C)	N/A	N/A	N/A	N/A	18.12			17.42			17.42			17.42			18.87			
	pH (S.U.)	N/A	N/A	N/A	N/A	7			6.16			6.16			6.16			7.57			
	Spec Cond (µS/cm2)	N/A	N/A	N/A	N/A	633.2			527.1			527.1			527.1			592			
	DO (mg/L)	N/A	N/A	N/A	N/A	-0.04			0.05			0.05			0.05			0.06			
	ORP (mV)	N/A	N/A	N/A	N/A	-138			286			286			286			-24			
	Turbidity (NTU)	N/A	N/A	N/A	N/A	1.97			0.84			0.84			0.84			1.51			
	Alkalinity (mg/L as CaCO3)	N/A	N/A	N/A	N/A	280			244			244			244			180			

LOCATION CODE	KAFB-106075			KAFB-106076[f]			KAFB-106076			KAFB-106079[f]			KAFB-106079			KAFB-106082[f]		
SAMPLE NO	GW2127			GW2062[e]			GW2122			GW2066			GW2120			GW2069		
SAMPLE DATE	18-Feb-15			5-Mar-15			5-Mar-15			19-Feb-15			19-Feb-15			26-Feb-15		
SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG		
SAMPLE DEPTH	480-500 FT			480-500 FT			480-500 FT			484-504 FT			484-5042 FT			472-492 FT		
Parameter	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
RMO	14500		4.7	N/A	N/A	N/A	146000		15.9	N/A	N/A	N/A	3930		4.8	N/A	N/A	N/A
SMMO	2550		4.7	N/A	N/A	N/A	8520		15.9	N/A	N/A	N/A	6900		4.8	N/A	N/A	N/A
TCBO	ND	U	4.7	N/A	N/A	N/A	111		15.9	N/A	N/A	N/A	22.5		4.8	N/A	N/A	N/A
TCE	ND	U	0.5	N/A	N/A	N/A	ND	U	1.6	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A
TOD	207		4.7	N/A	N/A	N/A	609		15.9	N/A	N/A	N/A	3420		4.8	N/A	N/A	N/A
VCR	ND	U	0.5	N/A	N/A	N/A	ND	U	1.6	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A
Temperature (°C)	18.87			17.26			17.26			18.76			18.76			14.96		
pH (S.U.)	7.57			7.11			7.11			7.05			7.05			7.47		
Spec Cond (µS/cm2)	592			736.5			736.5			768.8			768.8			651.5		
DO (mg/L)	0.06			0			0			0			0			1.19		
ORP (mV)	-24			-302			-302			-135			-135			-187		
Turbidity (NTU)	1.51			8.56			8.56			1.53			1.53			2.46		
Alkalinity (mg/L as CaCO3)	180			304			304			380			380			180		

EPA MCL and tap water RSLs are from the EPA RSL Table, dated November 2014.
The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and
The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol,
Sample GW0998 for SVOC analysis was not performed due to laboratory errors.
Sample GW0886 for PAH analysis was not colllected due to an oversight.
KAFB-10612 not measured due to a non-operational corroded pump.
The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.
The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and
a. EPA analytical methods listed are for the most recent sampling event.
b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and
c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water. Concentrations
d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs), or if more stringent, New Mexico Water
e. Sample contained bubbles.
f. Sample was also collected for Quant Array, dissolved gases, and hydrogen. Hydrogen samples were collected using a
g. Used YSI instead of In-Situ to collect water parameter readings.
h. Well was damaged. Used YSI instead of In-Situ to collect water parameter readings. The following analytical methods were used to
i. Faulty water level meter.
j. "Unknown" compound is based on the SVOC tentatively identified compound search. The compound is tentatively present in the
k. Well was sampled for EDB only during the time-critical sampling event.
Shading indicates the analyte was detected.
Bold indicated analyte detected greater than regulatory standard.
°C = degrees Celcius
J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).
J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.
J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.
KAFB = Kirtland Air Force Base
µS/cm^2 = microsiemens per square centimeter
mg/L = milligram per liter
mV = millivolts
N/A = Not analyzed.
ND = Not detected.
NM = Not measured due to equipment malfunction.
No. = number
NR = Not recorded or reported due to operational error.
NR = not recorded
NTU = Nephelometric Turbidity Unit
R = Sample data rejected due to site contamination.
RSL = Regional Screening Level.
S.U. = Standard Unit
U = Analyte was not detected. The reported numerical value is at or below the LOQ.

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-106082			KAFB-106088[f]			KAFB-106088			KAFB-106091[f]			KAFB-106091			KAFB-106094[f]			KAFB-106094		
					SAMPLE NO	GW2121			GW2076			GW2128			GW2079			GW2125			GW2082			GW2119		
					SAMPLE DATE	26-Feb-15			19-Feb-15			19-Feb-15			17-Feb-15			17-Feb-15			18-Feb-15			18-Feb-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	472-492 FT			460-480 FT			460-480 FT			454-474 FT			454-474 FT			484-504 FT			484-504 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L) Method 8015C/8015D	DIESEL RANGE ORGANICS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	400	N/A	N/A	N/A	952		377	N/A	N/A	N/A	4090		1850	N/A	N/A	N/A
	GASOLINE RANGE ORGANICS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	150	N/A	N/A	N/A	428		150	N/A	N/A	N/A	1170		150	N/A	N/A	N/A
VOCs (µg/L) Method 8260B	1,2-DIBROMOETHANE (Method 8011)	0.1	N/A	0.05	0.0075	N/A	N/A	N/A	**0.06**		0.0283	N/A	N/A	N/A	**0.108**	J	0.0282	N/A	N/A	N/A	**0.306**	J	0.0284	N/A	N/A	N/A
	1,1,1,2-TETRACHLOROETHANE	N/A	N/A	N/A	0.57	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,1,1-TRICHLOROETHANE	60	N/A	200	8000	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,1,2,2-TETRACHLOROETHANE	10	N/A	N/A	0.076	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,1,2-TRICHLOROETHANE	10	N/A	5	0.28	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,1-DICHLOROETHANE	25	N/A	N/A	2.7	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,1-DICHLOROETHENE	5	N/A	7	280	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,1-DICHLOROPROPENE	N/A	N/A	N/A	83000	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,2,3-TRICHLOROBENZENE	N/A	N/A	N/A	7	N/A	N/A	N/A	ND	UJ	2	N/A	N/A	N/A	ND	UJ	4	N/A	N/A	N/A	ND	UJ	4	N/A	N/A	N/A
	1,2,3-TRICHLOROPROPANE	N/A	N/A	N/A	0.00075	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A
	1,2,4-TRICHLOROBENZENE	N/A	N/A	70	1.1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A
	1,2,4-TRIMETHYLBENZENE	N/A	N/A	N/A	15	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,2-DIBROMO-3-CHLOROPROPANE	N/A	N/A	0.2	0.00033	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A
	1,2-DIBROMOETHANE	0.1	N/A	0.05	0.0075	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,2-DICHLOROBENZENE	N/A	N/A	600	300	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,2-DICHLOROETHANE	10	N/A	5	0.17	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	1.31	J	2	N/A	N/A	N/A	3.73		2	N/A	N/A	N/A
	1,2-DICHLOROPROPANE	N/A	N/A	5	0.44	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,3,5-TRIMETHYLBENZENE	N/A	N/A	N/A	120	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,3-DICHLOROBENZENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,3-DICHLOROPROPANE	N/A	N/A	N/A	370	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	1,4-DICHLOROBENZENE	N/A	N/A	75	0.48	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	2,2-DICHLOROPROPANE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	2-BUTANONE	N/A	N/A	N/A	5600	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A	ND	U	20	N/A	N/A	N/A
	2-CHLOROTOLUENE	N/A	N/A	N/A	240	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	2-HEXANONE	N/A	N/A	N/A	38	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A
	4-CHLOROTOLUENE	N/A	N/A	N/A	250	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	4-METHYL-2-PENTANONE	N/A	N/A	N/A	1200	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A
	ACETONE	N/A	N/A	N/A	14000	N/A	N/A	N/A	ND	U	10	N/A	N/A	N/A	24.8		20	N/A	N/A	N/A	57.8		20	N/A	N/A	N/A
	BENZENE	10	N/A	5	0.45	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	0.643	J	2	N/A	N/A	N/A
	BROMOBENZENE	N/A	N/A	N/A	62	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	BROMOCHLOROMETHANE	N/A	N/A	N/A	83	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	BROMODICHLOROMETHANE	N/A	N/A	80	0.13	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	BROMOFORM	N/A	N/A	80	9.2	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	BROMOMETHANE	N/A	N/A	N/A	7.5	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A
	CARBON DISULFIDE	N/A	N/A	N/A	810	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	0.609	J	2	N/A	N/A	N/A
	CARBON TETRACHLORIDE	10	N/A	5	0.45	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	CHLOROBENZENE	N/A	N/A	100	78	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	CHLOROETHANE	N/A	N/A	N/A	21000	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A
	CHLOROFORM	100	N/A	80	0.22	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	CHLOROMETHANE	N/A	N/A	N/A	190	N/A	N/A	N/A	0.472	J	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	CIS-1,2-DICHLOROETHENE	N/A	N/A	70	36	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	CIS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	CYCLOTETRASILOXANE, OCTAMETHYL-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBROMOCHLOROMETHANE	N/A	N/A	80	0.17	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	DIBROMOMETHANE	N/A	N/A	N/A	8	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	DICHLORODIFLUOROMETHANE	N/A	N/A	N/A	200	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A
	ETHANE, 1,1-DIFLUORO-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ETHYLBENZENE	750	N/A	700	1.5	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	26.7		2	N/A	N/A	N/A
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A
	ISOPROPYLBENZENE	N/A	N/A	N/A	450	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	4.04		2	N/A	N/A	N/A	27.1		2	N/A	N/A	N/A
	M,P-XYLENES	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	METHYL TERT-BUTYL ETHER	N/A	N/A	N/A	14	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	METHYLENE CHLORIDE	100	N/A	5	11	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	ND	UJ	2	N/A	N/A	N/A	ND	UJ	4	N/A	N/A	N/A	ND	UJ	4	N/A	N/A	N/A
	N-BUTYLBENZENE	N/A	N/A	N/A	1000	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	1.14	J	2	N/A	N/A	N/A
	N-PROPYLBENZENE	N/A	N/A	N/A	660	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	8.55		2	N/A	N/A	N/A
	O-XYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	P-ISOPROPYLTOLUENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	SEC-BUTYLBENZENE	N/A	N/A	N/A	2000	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	3		2	N/A	N/A	N/A
	STYRENE	N/A	N/A	100	1200	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	TERT-BUTYLBENZENE	N/A	N/A	N/A	690	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	TETRACHLOROETHENE	20	N/A	5	11	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	TOLUENE	750	N/A	1000	1100	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	TRANS-1,2-DICHLOROETHENE	N/A	N/A	100	360	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	TRANS-1,3-DICHLOROPROPENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	TRICHLOROETHENE	100	N/A	5	0.49	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	TRICHLOROFLUOROMETHANE	N/A	N/A	N/A	1100	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A	ND	U	4	N/A	N/A	N/A
	VINYL CHLORIDE	1	N/A	2	0.019	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A	ND	U	2	N/A	N/A	N/A
	XYLENES	620	N/A	10000	190	N/A	N/A	N/A	ND	U	3	N/A	N/A	N/A	ND	U	6	N/A	N/A	N/A	ND	U	6	N/A	N/A	N/A
Gases (µg/L) Method EPA RSK175	HYDROGEN (AM20GAX) (nM)	N/A	N/A	N/A	N/A	1.6	N/A	0.6	N/A	N/A	N/A	2.2		0.6	N/A	N/A	N/A	1.9		1.2	N/A	N/A	N/A	1.4	N/A	0.6
	ETHANE	N/A	N/A	N/A	N/A	1.2	N/A	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	0.29		0.2	N/A	N/A	N/A	0.44	N/A	0.2
	ETHYLENE	N/A	N/A	N/A	N/A	1.1	N/A	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	0.23	N/A	0.2
	METHANE	N/A	N/A	N/A	N/A	5.9	N/A	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	0.5		0.2	N/A	N/A	N/A	3.4	N/A	0.2

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-106082			KAFB-106088[f]			KAFB-106088			KAFB-106091[f]			KAFB-106091			KAFB-106094[f]			KAFB-106094		
					SAMPLE NO	GW2121			GW2076			GW2128			GW2079			GW2125			GW2082			GW2119		
					SAMPLE DATE	26-Feb-15			19-Feb-15			19-Feb-15			17-Feb-15			17-Feb-15			18-Feb-15			18-Feb-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	472-492 FT			460-480 FT			460-480 FT			454-474 FT			454-474 FT			484-504 FT			484-504 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
SVOCs (µg/L) Method 8270D/8270C	1,1-BIPHENYL	N/A	N/A	N/A	0.83	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	1,2-DIPHENYLHYDRAZINE	N/A	N/A	N/A	0.077	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	5.09		4.63	N/A	N/A	N/A
	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	1.59	J	4.63	N/A	N/A	N/A
	1-PROPENE, 1,2,3-TRICHLORO-, (Z)-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2,4,5-TRICHLOROPHENOL	5	N/A	N/A	1200	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	2,4,6-TRICHLOROPHENOL	5	N/A	N/A	4	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	2,4-DICHLOROPHENOL	5	N/A	N/A	46	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	2,4-DIMETHYLPHENOL	5	N/A	N/A	360	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A	ND	U	18.9	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A
	2,4-DINITROPHENOL	5	N/A	N/A	39	N/A	N/A	N/A	ND	U	46.3	N/A	N/A	N/A	ND	U	47.2	N/A	N/A	N/A	ND	U	46.3	N/A	N/A	N/A
	2,4-DINITROTOLUENE	N/A	N/A	N/A	0.24	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	2,6-DINITROTOLUENE	N/A	N/A	N/A	0.048	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	2-CHLORONAPHTHALENE	N/A	N/A	N/A	750	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	2-CHLOROPHENOL	5	N/A	N/A	91	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	2-METHYLPHENOL	5	N/A	N/A	930	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	2-NITROANILINE	N/A	N/A	N/A	190	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A	ND	U	18.9	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A
	2-NITROPHENOL	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	3,3'-DICHLOROBENZIDINE	N/A	N/A	N/A	0.12	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	N/A	N/A	930	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	3-NITROANILINE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A	ND	U	18.9	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A
	4,6-DINITRO-2-METHYLPHENOL	5	N/A	N/A	1.5	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A	ND	U	18.9	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A
	4-BROMOPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	4-CHLORO-3-METHYLPHENOL	5	N/A	N/A	1400	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	4-CHLOROANILINE	N/A	N/A	N/A	0.36	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	4-CHLOROPHENYL PHENYL ETHER	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	4-NITROANILINE	N/A	N/A	N/A	3.8	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A	ND	U	18.9	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A
	4-NITROPHENOL	5	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A	ND	U	18.9	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A
	ACENAPHTHENE	N/A	N/A	N/A	530	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	ACETOPHENONE	N/A	N/A	N/A	1900	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	4.01	J	4.63	N/A	N/A	N/A
	ANTHRACENE	N/A	N/A	N/A	1800	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	ATRAZINE	N/A	N/A	3	0.3	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BENZALDEHYDE	N/A	N/A	N/A	1900	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BENZIDINE	N/A	N/A	N/A	0.00011	N/A	N/A	N/A	ND	U	92.6	N/A	N/A	N/A	ND	U	94.3	N/A	N/A	N/A	ND	U	92.6	N/A	N/A	N/A
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BENZOIC ACID	N/A	N/A	N/A	75000	N/A	N/A	N/A	ND	U	92.6	N/A	N/A	N/A	ND	U	94.3	N/A	N/A	N/A	ND	U	92.6	N/A	N/A	N/A
	BIS(2-CHLOROETHOXY)METHANE	N/A	N/A	N/A	59	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BIS(2-CHLOROETHYL)ETHER	N/A	N/A	N/A	0.014	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BIS(2-CHLOROISOPROPYL)ETHER	N/A	N/A	N/A	0.36	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BIS(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	6	5.6	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	BUTANE, 2-METHOXY-2-METHYL-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BUTYL BENZYL PHTHALATE	N/A	N/A	N/A	16	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	CAPROLACTAM	N/A	N/A	N/A	9900	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	CARBAZOLE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	CHRYSENE	N/A	N/A	N/A	3.4	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	CYCLOHEXANE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	DIBENZOFURAN	N/A	N/A	N/A	7.9	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	DIETHYL PHTHALATE	N/A	N/A	N/A	15000	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	DIMETHYL PHTHALATE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	DI-N-BUTYL PHTHALATE	N/A	N/A	N/A	900	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	DI-N-OCTYL PHTHALATE	N/A	N/A	N/A	200	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	ETHANOL, 2-(2-ETHOXYETHOXY)-	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	HEXACHLOROBENZENE	N/A	N/A	1	0.049	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	HEXACHLOROBUTADIENE	N/A	N/A	N/A	0.3	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	HEXACHLOROCYCLOPENTADIENE	N/A	N/A	50	31	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A	ND	U	9.43	N/A	N/A	N/A	ND	U	9.26	N/A	N/A	N/A
	HEXACHLOROETHANE	N/A	N/A	N/A	0.9	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	ISOPHORONE	N/A	N/A	N/A	78	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	NITROBENZENE	N/A	N/A	N/A	0.14	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	N-NITROSO-DI-N-PROPYLAMINE	N/A	N/A	N/A	0.011	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	N-NITROSODIPHENYLAMINE	N/A	N/A	N/A	12	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	PENTACHLOROPHENOL	5	N/A	1	0.04	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A	ND	U	18.9	N/A	N/A	N/A	ND	U	18.5	N/A	N/A	N/A
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	PHENOL	5	N/A	N/A	5800	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A	ND	U	4.72	N/A	N/A	N/A	ND	U	4.63	N/A	N/A	N/A
	UNKNOWN[j]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PAHs (µg/L) Method 8270D Low Detection Limit	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ACENAPHTHENE	N/A	N/A	N/A	530	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-106082			KAFB-106088[f]			KAFB-106088			KAFB-106091[f]			KAFB-106091			KAFB-106094[f]			KAFB-106094		
					SAMPLE NO	GW2121			GW2076			GW2128			GW2079			GW2125			GW2082			GW2119		
					SAMPLE DATE	26-Feb-15			19-Feb-15			19-Feb-15			17-Feb-15			17-Feb-15			18-Feb-15			18-Feb-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	472-492 FT			460-480 FT			460-480 FT			454-474 FT			454-474 FT			484-504 FT			484-504 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
	ACENAPHTHYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ANTHRACENE	N/A	N/A	N/A	1800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)ANTHRACENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(A)PYRENE	0.7	N/A	0.2	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(B)FLUORANTHENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(GHI)PERYLENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BENZO(K)FLUORANTHENE	N/A	N/A	N/A	0.34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CHRYSENE	N/A	N/A	N/A	3.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	DIBENZO(A,H)ANTHRACENE	N/A	N/A	N/A	0.0034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Solvents (µg/L) Method 8321	2,2'-OXYBISETHANOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ETHYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PROPYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TETRAETHYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TRIETHYLENE GLYCOL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oil/Grease (mg/L) Method E1664	HEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SGT-HEM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L) Method 6010C	ALUMINUM	5	N/A	N/A	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ANTIMONY	N/A	N/A	0.006	0.0078	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ARSENIC	0.1	N/A	0.01	0.000052	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BARIUM	1	N/A	2	3.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	BERYLLIUM	N/A	N/A	0.004	0.025	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CADMIUM	0.01	N/A	0.005	0.0092	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	CALCIUM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	46.2		5	N/A	N/A	N/A	50.3		5	N/A	N/A	N/A	74.1		5	N/A	N/A	N/A
	CHROMIUM	0.05	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	COBALT	0.05	N/A	N/A	0.006	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	COPPER	1	N/A	1.3	0.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	IRON	1	N/A	N/A	14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	LEAD	0.05	0.01	0.015	0.015	N/A	N/A	N/A	ND	U	0.005	N/A	N/A	N/A	ND	U	0.005	N/A	N/A	N/A	ND	U	0.005	N/A	N/A	N/A
	MAGNESIUM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.79		5	N/A	N/A	N/A	6.49		5	N/A	N/A	N/A	10.4		5	N/A	N/A	N/A
	MANGANESE	0.2	N/A	N/A	0.43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	MOLYBDENUM	1	N/A	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NICKEL	0.2	N/A	N/A	0.39	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	POTASSIUM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.36	J	5	N/A	N/A	N/A	2.65	J	5	N/A	N/A	N/A	2.99	J	5	N/A	N/A	N/A
	SELENIUM	0.05	N/A	0.05	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SILVER	0.05	N/A	N/A	0.094	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SODIUM	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25.6		5	N/A	N/A	N/A	25.8		5	N/A	N/A	N/A	31		5	N/A	N/A	N/A
	THALLIUM	N/A	N/A	0.002	0.0002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	VANADIUM	N/A	N/A	N/A	0.086	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ZINC	10	N/A	N/A	6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	MERCURY (Method 7470A)	0.002	N/A	0.002	0.0057	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	IRON, DISSOLVED	1	N/A	N/A	14	N/A	N/A	N/A	ND	U	0.1	N/A	N/A	N/A	ND	U	0.1	N/A	N/A	N/A	0.653		0.1	N/A	N/A	N/A
	MANGANESE, DISSOLVED	0.2	N/A	N/A	0.43	N/A	N/A	N/A	ND	U	0.015	N/A	N/A	N/A	0.0865		0.015	N/A	N/A	N/A	**1.19**		0.015	N/A	N/A	N/A
Anions (mg/L) Method E300.0	BROMIDE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0761	J	0.25	N/A	N/A	N/A	0.174	J	0.25	N/A	N/A	N/A	0.325		0.25	N/A	N/A	N/A
	CHLORIDE	250	N/A	N/A	N/A	N/A	N/A	N/A	12		0.5	N/A	N/A	N/A	18.3		0.5	N/A	N/A	N/A	30.2		0.5	N/A	N/A	N/A
	SULFATE	600	N/A	N/A	N/A	N/A	N/A	N/A	36.5		2.5	N/A	N/A	N/A	43.1		2.5	N/A	N/A	N/A	58		2.5	N/A	N/A	N/A
	NITROGEN, NITRATE-NITRITE	10	4	10	N/A	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	ND	U	0.2	N/A	N/A	N/A	0.163	J	0.2	N/A	N/A	N/A
	AMMONIA (AS N)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.3	N/A	N/A	N/A	ND	U	0.3	N/A	N/A	N/A	ND	U	0.3	N/A	N/A	N/A
	SULFIDE, TOTAL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	0.948	N/A	N/A	N/A	ND	U	0.935	N/A	N/A	N/A	ND	U	0.943	N/A	N/A	N/A
Alkalinity (mg/L) Method SM2320B/A2320B	ALKALINITY, TOTAL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	ALKALINITY, BICARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	121		1	N/A	N/A	N/A	137		1	N/A	N/A	N/A	194		1	N/A	N/A	N/A
	ALKALINITY, CARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A	ND	U	1	N/A	N/A	N/A
Biological Parameters (cells/mL) Method QUANT ARRAY	APS	N/A	N/A	N/A	N/A	366000		4.9	N/A	N/A	N/A	79.3		4.9	N/A	N/A	N/A	106000		5	N/A	N/A	N/A	334000		4.7
	BVC	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5
	CFR	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	4.7
	DCA	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	4.7
	DCAR	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	4.7
	DCM	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	51		4.7
	DCMA	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	4.7
	DECO	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	4.7
	DHBt	N/A	N/A	N/A	N/A	30600		4.9	N/A	N/A	N/A	38.4		4.9	N/A	N/A	N/A	315		5	N/A	N/A	N/A	866		4.7
	DHC	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	1.5		0.5
	DHG	N/A	N/A	N/A	N/A	788		4.9	N/A	N/A	N/A	444		4.9	N/A	N/A	N/A	1610		5	N/A	N/A	N/A	12300		4.7
	DSB	N/A	N/A	N/A	N/A	861		4.9	N/A	N/A	N/A	59.1		4.9	N/A	N/A	N/A	837		5	N/A	N/A	N/A	2470		4.7
Biological Parameters (cells/mL) Method QUANT ARRAY	DSM	N/A	N/A	N/A	N/A	204		4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	134		5	N/A	N/A	N/A	247		4.7
	EBAC	N/A	N/A	N/A	N/A	2970000		4.9	N/A	N/A	N/A	216000		4.9	N/A	N/A	N/A	1340000		5	N/A	N/A	N/A	3650000		4.7
	EtnC	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	8.2		4.7
	EtnE	N/A	N/A	N/A	N/A	5.5		4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	19.7		4.7
	MGN	N/A	N/A	N/A	N/A	50.2		4.9	N/A	N/A	N/A	25.5		4.9	N/A	N/A	N/A	19.3		5	N/A	N/A	N/A	33.4		4.7
	PHE	N/A	N/A	N/A	N/A	4590		4.9	N/A	N/A	N/A	370		4.9	N/A	N/A	N/A	3030		5	N/A	N/A	N/A	3730		4.7
	PMMO	N/A	N/A	N/A	N/A	73.8		4.9	N/A	N/A	N/A	32.7		4.9	N/A	N/A	N/A	71.6		5	N/A	N/A	N/A	45.6		4.7
	RDEG	N/A	N/A	N/A	N/A	1420		4.9	N/A	N/A	N/A	485		4.9	N/A	N/A	N/A	2420		5	N/A	N/A	N/A	765		4.7

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
January - March 2015

					LOCATION CODE	KAFB-106082			KAFB-106088[f]			KAFB-106088			KAFB-106091[f]			KAFB-106091			KAFB-106094[f]			KAFB-106094		
					SAMPLE NO	GW2121			GW2076			GW2128			GW2079			GW2125			GW2082			GW2119		
					SAMPLE DATE	26-Feb-15			19-Feb-15			19-Feb-15			17-Feb-15			17-Feb-15			18-Feb-15			18-Feb-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	472-492 FT			460-480 FT			460-480 FT			454-474 FT			454-474 FT			484-504 FT			484-504 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
	RMO	N/A	N/A	N/A	N/A	9240		4.9	N/A	N/A	N/A	422		4.9	N/A	N/A	N/A	1890		5	N/A	N/A	N/A	107		4.7
	SMMO	N/A	N/A	N/A	N/A	680		4.9	N/A	N/A	N/A	696		4.9	N/A	N/A	N/A	775		5	N/A	N/A	N/A	591		4.7
	TCBO	N/A	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	4.9	N/A	N/A	N/A	ND	U	5	N/A	N/A	N/A	ND	U	4.7
	TCE	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5
	TOD	N/A	N/A	N/A	N/A	213		4.9	N/A	N/A	N/A	106		4.9	N/A	N/A	N/A	930		5	N/A	N/A	N/A	199		4.7
	VCR	N/A	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5	N/A	N/A	N/A	ND	U	0.5
Field Parameters	Temperature (°C)	N/A	N/A	N/A	N/A	14.96			18.65			18.65			17.88			17.88			18.45			18.45		
	pH (S.U.)	N/A	N/A	N/A	N/A	7.47			7.95			7.95			7.54			7.54			7.53			7.53		
	Spec Cond (µS/cm2)	N/A	N/A	N/A	N/A	651.5			366.2			366.2			397.8			397.8			568.5			568.5		
	DO (mg/L)	N/A	N/A	N/A	N/A	1.19			0.69			0.69			2.47			2.47			0.15			0.15		
	ORP (mV)	N/A	N/A	N/A	N/A	-187			-7			-7			110			110			-121			-121		
	Turbidity (NTU)	N/A	N/A	N/A	N/A	2.46			0.82			0.82			0.78			0.78			1.54			1.54		
	Alkalinity (mg/L as CaCO3)	N/A	N/A	N/A	N/A	180			140			140			144			144			200			200		

EPA MCL and tap water RSLs are from the EPA RSL Table, dated November 2014.

The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and

The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol,

Sample GW0998 for SVOC analysis was not performed due to laboratory errors.

Sample GW0886 for PAH analysis was not colllected due to an oversight.

KAFB-10612 not measured due to a non-operational corroded pump.

The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.

The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and

a. EPA analytical methods listed are for the most recent sampling event.

b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and

c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water. Concentrations

d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs), or if more stringent, New Mexico Water

e. Sample contained bubbles.

f. Sample was also collected for Quant Array, dissolved gases, and hydrogen. Hydrogen samples were collected using a

g. Used YSI instead of In-Situ to collect water parameter readings.

h. Well was damaged. Used YSI instead of In-Situ to collect water parameter readings. The following analytical methods were used to

i. Faulty water level meter.

j. "Unknown" compound is based on the SVOC tentatively identified compound search. The compound is tentatively present in the

k. Well was sampled for EDB only during the time-critical sampling event.

Shading indicates the analyte was detected.

Bold indicated analyte detected greater than regulatory standard.

°C = degrees Celcius

J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).

J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.

J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.

KAFB = Kirtland Air Force Base

µS/cm[2] = microsiemens per square centimeter

mg/L = milligram per liter

mV = millivolts

N/A = Not analyzed.

ND = Not detected.

NM = Not measured due to equipment malfunction.

No. = number

NR = Not recorded or reported due to operational error.

NR = not recorded

NTU = Nephelometric Turbidity Unit

R = Sample data rejected due to site contamination.

RSL = Regional Screening Level.

S.U. = Standard Unit

U = Analyte was not detected. The reported numerical value is at or below the LOQ.

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
April - June 2015

					LOCATION CODE	KAFB-10610			KAFB-10627			KAFB-10628-510			KAFB-106059			KAFB-106064			KAFB-106067			KAFB-106075		
					SAMPLE NO	GW2159[e,f]			GW2192[f,g]			GW2215[f,g]			GW2209[f]			GW2214[f,g]			GW2219[f,g]			GW2227[e,f,g]		
					SAMPLE DATE	10-Jun-15			2-Jun-15			8-Jun-15			11-Jun-15			9-Jun-15			4-Jun-15			3-Jun-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	483-508 FT			481-501 FT			486-511 FT			483-503 FT			485-505 FT			485-505 FT			480-500 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L) Method 8015C/8015D	DIESEL RANGE ORGANICS	N/A	N/A	N/A	N/A	15400	J-	1960	ND	U	392	5740		1920	23100	J-	1920	22900		1890	2920		377	1020		370
	GASOLINE RANGE ORGANICS	N/A	N/A	N/A	N/A	15300		1500	ND	U	150	1870		150	91100		7500	15800		1500	1220		150	516		150
VOCs (µg/L) Method 8260B	1,2-DIBROMOETHANE (Method 8011)	0.1	N/A	0.05	0.0075	**12.7**		0.558	ND	U	0.0276	**0.687**		0.0279	**7.32**		0.281	**8.96**		0.282	**0.11**	J	0.0281	**0.166**		0.0281
	1,1,2-TRICHLOROETHANE	10	N/A	5	0.28	ND	U	20	ND	U	1	ND	U	2	ND	U	500	ND	U	50	ND	U	2	ND	U	2
	1,2,4-TRIMETHYLBENZENE	N/A	N/A	N/A	15	103		20	ND	U	1	3.23		2	389	J	500	82		50	ND	U	2	ND	U	2
	1,2-DIBROMOETHANE	0.1	N/A	0.05	0.0075	**9.48**	J	20	ND	U	1	**0.9**	J	2	ND	U	500	ND	U	50	ND	U	2	ND	U	2
	1,2-DICHLOROETHANE	10	N/A	5	0.17	ND	U	20	ND	U	1	1.64	J	2	ND	U	500	ND	U	50	0.968	J	2	1.1	J	2
	1,3,5-TRIMETHYLBENZENE	N/A	N/A	N/A	120	33		20	ND	U	1	1.2	J	2	137	J	500	38.3	J	50	4.94		2	ND	U	2
	2-BUTANONE	N/A	N/A	N/A	5600	83.8	J	200	ND	U	10	ND	U	20	ND	U	5000	ND	U	500	ND	U	20	ND	U	20
	2-CHLOROTOLUENE	N/A	N/A	N/A	240	ND	U	20	ND	U	1	ND	U	2	ND	U	500	ND	U	50	ND	U	2	ND	U	2
	2-HEXANONE	N/A	N/A	N/A	38	ND	U	100	ND	U	5	ND	U	10	ND	U	2500	ND	U	250	ND	U	10	ND	U	10
	4-METHYL-2-PENTANONE	N/A	N/A	N/A	1200	ND	U	100	ND	U	5	ND	U	10	ND	U	2500	62.6	J	250	ND	U	10	ND	U	10
	ACETONE	N/A	N/A	N/A	14000	2250	J+	200	ND	U	10	81.4	J+	20	ND	U	5000	ND	U	500	337		20	233		20
	BENZENE	10	N/A	5	0.45	**1520**		20	ND	U	1	**58.3**		2	**15300**		500	**2550**		50	**6.44**		2	ND	U	2
	CARBON DISULFIDE	N/A	N/A	N/A	810	ND	U	20	ND	U	1	ND	U	2	ND	U	500	ND	U	50	0.543	J	2	ND	U	2
	CHLOROMETHANE	N/A	N/A	N/A	190	ND	U	20	ND	U	1	ND	U	2	ND	U	500	19	J	50	ND	U	2	ND	U	2
	DICHLORODIFLUOROMETHANE	N/A	N/A	N/A	200	ND	U	40	ND	U	2	ND	UJ	4	ND	U	1000	ND	UJ	100	ND	U	4	ND	U	4
	ETHYLBENZENE	750	N/A	700	1.5	**862**		20	ND	U	1	17		2	**1450**		500	577		50	75.8		2	ND	U	2
	ISOPROPYLBENZENE	N/A	N/A	N/A	450	219		20	ND	U	1	5.53		2	ND	U	500	65		50	19.9		2	13.2		2
	METHYL TERT-BUTYL ETHER	N/A	N/A	N/A	14	ND	U	20	ND	U	1	0.775	J	2	ND	U	500	ND	U	50	ND	U	2	ND	U	2
	METHYLENE CHLORIDE	100	N/A	5	11	**17.4**	J	40	ND	U	2	1.51	J	4	ND	U	1000	**25.8**	J	100	1.99	J	4	ND	U	4
	NAPHTHALENE	30	N/A	N/A	0.17	ND	U	40	ND	U	2	2.24	J	4	**747**	J	1000	**57.6**	J	100	5.3		4	ND	UJ	4
	N-BUTYLBENZENE	N/A	N/A	N/A	1000	6.47	J	20	ND	U	1	ND	U	2	ND	U	500	ND	U	50	1.34	J	2	0.958	J	2
	N-PROPYLBENZENE	N/A	N/A	N/A	660	68.1		20	ND	U	1	2.65		2	ND	U	500	35.5	J	50	5.89		2	1.98	J	2
	P-ISOPROPYLTOLUENE	N/A	N/A	N/A	N/A	42.1		20	ND	U	1	0.873	J	2	ND	U	500	57.2		50	2.5		2	ND	U	2
	SEC-BUTYLBENZENE	N/A	N/A	N/A	2000	10.6	J	20	ND	U	1	1.83	J	2	ND	U	500	ND	U	50	2.16		2	1.52	J	2
	TERT-BUTYLBENZENE	N/A	N/A	N/A	690	ND	U	20	ND	U	1	ND	U	2	ND	U	500	ND	U	50	ND	U	2	ND	U	2
	TOLUENE	750	N/A	1000	1100	**2050**		20	ND	U	1	62.5		2	**19200**		500	**1500**		50	ND	U	2	ND	U	2
	TRICHLOROETHENE	100	N/A	5	0.49	**6.28**	J	20	ND	U	1	ND	U	2	**174**	J	500	ND	U	50	ND	U	2	ND	U	2
	TRICHLOROFLUOROMETHANE	N/A	N/A	N/A	1100	ND	U	40	ND	U	2	ND	U	4	ND	U	1000	ND	U	100	ND	U	4	ND	U	4
	XYLENES	620	N/A	10000	190	588		60	ND	U	3	16.4		6	**4590**		1500	574		150	ND	U	6	ND	U	6
Gases (µg/L) Method EPA RSK175	HYDROGEN (AM20GAX) (nM)	N/A	N/A	N/A	N/A	5.4	N/A	0.6	3.4		0.6	3.4	N/A	0.6	11	N/A	0.6	3.8	N/A	0.6	2.7	N/A	0.6	2.3		0.6
	ETHANE	N/A	N/A	N/A	N/A	5.4	N/A	0.2	ND	U	0.2	6.8	N/A	0.2	5.4	N/A	0.2	16	N/A	0.2	1.1	N/A	0.2	0.31		0.2
	ETHYLENE	N/A	N/A	N/A	N/A	6.6	N/A	0.2	ND	U	0.2	0.89	N/A	0.2	41	N/A	0.2	21	N/A	0.2	1	N/A	0.2	ND	U	0.2
	METHANE	N/A	N/A	N/A	N/A	330	N/A	40	ND	U	0.5	5.9	N/A	0.5	73	N/A	0.5	36	N/A	0.5	1.6	N/A	0.5	ND	U	0.5
SVOCs (µg/L) Method 8270D	1,1-BIPHENYL	N/A	N/A	N/A	0.83	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	1,2-DIPHENYLHYDRAZINE	N/A	N/A	N/A	0.077	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	2.6	J	4.63	ND	U	4.81
	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	12.7	J	49	ND	U	4.85	ND	U	24	**56**	J	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	2,4-DIMETHYLPHENOL	5	N/A	N/A	360	ND	U	196	ND	U	19.4	ND	U	96.2	ND	U	385	ND	U	943	ND	U	18.5	ND	U	19.2
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	ND	U	49	ND	U	4.85	ND	U	24	**65.7**	J	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	2-METHYLPHENOL	5	N/A	N/A	930	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	N/A	N/A	930	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	ACETOPHENONE	N/A	N/A	N/A	1900	580		49	ND	U	4.85	36.3		24	1200		96.2	2020		236	2.89	J	4.63	ND	U	4.81
	BIS(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	6	5.6	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	BUTYL BENZYL PHTHALATE	N/A	N/A	N/A	16	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	CAPROLACTAM	N/A	N/A	N/A	9900	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	DIBENZOFURAN	N/A	N/A	N/A	7.9	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	DIETHYL PHTHALATE	N/A	N/A	N/A	15000	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	FLUORANTHENE	N/A	N/A	N/A	800	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	FLUORENE	N/A	N/A	N/A	290	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	ISOPHORONE	N/A	N/A	N/A	78	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	NAPHTHALENE	30	N/A	N/A	0.17	20.4	J	49	ND	U	4.85	ND	U	24	**148**		96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	PENTACHLOROPHENOL	5	N/A	1	0.04	ND	U	196	ND	U	19.4	ND	U	96.2	ND	U	385	ND	U	943	ND	U	18.5	ND	U	19.2
	PHENANTHRENE	N/A	N/A	N/A	N/A	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	PHENOL	5	N/A	N/A	5800	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81
	PYRENE	N/A	N/A	N/A	120	ND	U	49	ND	U	4.85	ND	U	24	ND	U	96.2	ND	U	236	ND	U	4.63	ND	U	4.81

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
April - June 2015

					LOCATION CODE	KAFB-10610			KAFB-10627			KAFB-10628-510			KAFB-106059			KAFB-106064			KAFB-106067			KAFB-106075		
					SAMPLE NO	GW2159[e,f]			GW2192[f,g]			GW2215[f,g]			GW2209[f]			GW2214[f,g]			GW2219[f,g]			GW2227[e,f,g]		
					SAMPLE DATE	10-Jun-15			2-Jun-15			8-Jun-15			11-Jun-15			9-Jun-15			4-Jun-15			3-Jun-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	483-508 FT			481-501 FT			486-511 FT			483-503 FT			485-505 FT			485-505 FT			480-500 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
PAHs (µg/L) Method 8270D Low Detection Limit	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L) Method 6010C	CALCIUM	N/A	N/A	N/A	N/A	92.2		5	32.6		5	74.6		5	97.3		5	76.8		5	63.7		5	69.6		5
	IRON, DISSOLVED	1	N/A	N/A	14	0.271		0.1	ND	U	0.1	0.652		0.1	**2.76**		0.1	**4.61**		0.1	0.678		0.1	0.0686	J	0.1
	LEAD	0.05	0.01	0.015	0.015	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005
	MAGNESIUM	N/A	N/A	N/A	N/A	14.5		5	5.18		5	12		5	16.6		5	12.9		5	9.53		5	11		5
	MANGANESE, DISSOLVED	0.2	N/A	N/A	0.43	**2.15**		0.015	ND	U	0.015	**1.81**		0.015	**2.84**		0.015	**2.99**		0.015	**0.971**		0.015	**0.885**		0.015
	POTASSIUM	N/A	N/A	N/A	N/A	3.24	J	5	2.06	J	5	3.04	J	5	3.33	J	5	2.87	J	5	2.74	J	5	3.19	J	5
	SODIUM	N/A	N/A	N/A	N/A	33.3		5	21		5	31.7		5	32.7		5	30.5		5	27.6		5	28.1		5
Anions (mg/L) Method E300.0	BROMIDE	N/A	N/A	N/A	N/A	0.872		0.25	ND	U	0.25	0.33		0.25	0.576		0.25	0.18	J	0.25	0.147	J	0.25	0.737		0.25
	CHLORIDE	250	N/A	N/A	N/A	81.6		0.5	6.9		0.5	36.6		0.5	38.2		0.5	13.2		0.5	13.2		0.5	71.9		0.5
	SULFATE	600	N/A	N/A	N/A	32.6		2.5	28.2		2.5	40.9		2.5	3.65		2.5	0.433	J	2.5	21.2		2.5	55		2.5
	NITROGEN, NITRATE-NITRITE (Method E353.2)	10	4	10	N/A	ND	U	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2	0.105	J	0.2
	AMMONIA (AS N) (Method SM4500NH3BG)	N/A	N/A	N/A	N/A	0.11	J	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3
	SULFIDE, TOTAL (Method SM4500S2CF)	N/A	N/A	N/A	N/A	1.18		0.976	ND	U	0.962	ND	U	0.922	0.26	J	0.939	ND	U	0.948	ND	U	0.926	ND	U	0.966
Alkalinity (mg/L) Method SM2320B/ A2320B	ALKALINITY, BICARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	230		1	114		1	236		1	318		1	295		1	247		1	147		1
	ALKALINITY, CARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Biological Parameters (cells/mL) Method QUANTARRAY	APS	N/A	N/A	N/A	N/A	439000		4.9	ND	U	4.8	618000		5	1290000		4.8	140000		4.7	1310		4.9	508		5.1
	BVC	N/A	N/A	N/A	N/A	ND	U	0.5	ND	U	0.5	42.4		0.5	ND	U	0.5	1.7		0.5	ND	U	0.5	ND	U	0.5
	CFR	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	ND	U	5	178		4.8	ND	U	4.7	ND	U	4.9	ND	U	5.1
	DCA	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	ND	U	5	ND	U	4.8	ND	U	4.7	ND	U	4.9	ND	U	5.1
	DCAR	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	ND	U	5	ND	U	4.8	ND	U	4.7	ND	U	4.9	ND	U	5.1
	DCM	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	54.4		5	ND	U	4.8	ND	U	4.7	48.9		4.9	ND	U	5.1
	DCMA	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	ND	U	5	ND	U	4.8	ND	U	4.7	ND	U	4.9	ND	U	5.1
	DECO	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	ND	U	5	ND	U	4.8	ND	U	4.7	ND	U	4.9	ND	U	5.1
	DHBT	N/A	N/A	N/A	N/A	28800		4.9	ND	U	4.8	183000		5	12900		4.8	2850		4.7	330		4.9	ND	U	5.1
	DHC	N/A	N/A	N/A	N/A	3.7		0.5	ND	U	0.5	235		0.5	3		0.5	33		0.5	0.6		0.5	ND	U	0.5
	DHG	N/A	N/A	N/A	N/A	33600		4.9	10.5		4.8	7440		5	1040000		4.8	194000		4.7	10500		4.9	7640		5.1
	DSB	N/A	N/A	N/A	N/A	10000		4.9	ND	U	4.8	3460		5	24300		4.8	8240		4.7	733		4.9	ND	U	5.1
	DSM	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	400		5	ND	U	4.8	490		4.7	ND	U	4.9	136		5.1
	EBAC	N/A	N/A	N/A	N/A	3130000		4.9	69400		4.8	2040000		5	1.1E+07		4.8	3040000		4.7	1120000		4.9	964000		5.1
	ETNC	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	ND	U	5	ND	U	4.8	ND	U	4.7	4.4	J	4.9	ND	U	5.1
	ETNE	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	ND	U	5	ND	U	4.8	ND	U	4.7	25.1		4.9	3	J	5.1
	MGN	N/A	N/A	N/A	N/A	18200		4.9	5.1		4.8	1140		5	5980		4.8	8270		4.7	57		4.9	319		5.1
	PHE	N/A	N/A	N/A	N/A	1340		4.9	6.8		4.8	3340		5	135000		4.8	5130		4.7	1250		4.9	642		5.1
	PMMO	N/A	N/A	N/A	N/A	14.5		4.9	0.3		4.8	442		5	1.1	J	4.8	56		4.7	21.7		4.9	26.9		5.1
Biological Parameters (cells/mL) Method QUANTARRAY (continued)	RDEG	N/A	N/A	N/A	N/A	564		4.9	25.9		4.8	1440		5	145000		4.8	2920		4.7	375		4.9	596		5.1
	RMO	N/A	N/A	N/A	N/A	2550		4.9	ND	U	4.8	3820		5	260000		4.8	7450		4.7	972		4.9	244		5.1
	SMMO	N/A	N/A	N/A	N/A	6400		4.9	45.3		4.8	3630		5	319		4.8	5340		4.7	491		4.9	1120		5.1
	TCBO	N/A	N/A	N/A	N/A	ND	U	4.9	ND	U	4.8	ND	U	5	ND	U	4.8	16.5		4.7	ND	U	4.9	ND	U	5.1
	TCE	N/A	N/A	N/A	N/A	ND	U	0.5	ND	U	0.5	24.9		0.5	ND	U	0.5	3.4		0.5	ND	U	0.5	ND	U	0.5
	TOD	N/A	N/A	N/A	N/A	2720		4.9	33.3		4.8	3090		5	414		4.8	1930		4.7	136		4.9	463		5.1
	VCR	N/A	N/A	N/A	N/A	ND	U	0.5	ND	U	0.5	11.5		0.5	ND	U	0.5	0.7		0.5	ND	U	0.5	ND	U	0.5
Field Parameters	Temperature (°C)	N/A	N/A	N/A	N/A	21.05			19.51			18.81			19.75			19.4			19.52			18.69		
	pH (S.U.)	9	N/A	N/A	N/A	7.25			8.15			7.19			7.01			7.07			7.75			7.96		
	Spec Cond (µS/cm2)	N/A	N/A	N/A	N/A	763.3			308			711			759.4			643			566			601		
	DO (mg/L)	N/A	N/A	N/A	N/A	0			4.35			2.5[h]			0			2.4[h]			3.8[h]			0.32		
	ORP (mV)	N/A	N/A	N/A	N/A	-312			113.4			-226.4			-237			-144.9			-111.4			-75.5		
	Turbidity (NTU)	N/A	N/A	N/A	N/A	0.73			0.55			0.72			0.76			0.62			0.77			0.77		
	Alkalinity (mg/L as CaCO3)	N/A	N/A	N/A	N/A	176			110			240			192			260			228			160		

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
April - June 2015

					LOCATION CODE	KAFB-10610			KAFB-10627			KAFB-10628-510			KAFB-106059			KAFB-106064			KAFB-106067			KAFB-106075		
					SAMPLE NO	GW2159[e,f]			GW2192[f,g]			GW2215[f,g]			GW2209[f]			GW2214[f,g]			GW2219[f,g]			GW2227[e,f,g]		
					SAMPLE DATE	10-Jun-15			2-Jun-15			8-Jun-15			11-Jun-15			9-Jun-15			4-Jun-15			3-Jun-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	483-508 FT			481-501 FT			486-511 FT			483-503 FT			485-505 FT			485-505 FT			480-500 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ

EPA MCL and tap water RSLs are from the EPA RSL Table, dated June 2015.
The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.
The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 2-methylphenol, 2-nitrophenol, 3 and 4-methylphenol, 2,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-nitrophenol, and pentachlorophenol
Sample GW0998 for SVOC analysis was not performed due to laboratory errors.
Sample GW0886 for PAH analysis was not colllected due to an oversight.
KAFB-10612 not measured due to a non-operational corroded pump.
The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.
The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.
a. EPA analytical methods listed are for the most recent sampling event.
b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and 2-methylnapthalene.
c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water.
d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs).
e. Sample contained bubbles.
f. Sample was also collected for Quant Array, dissolved gases, and hydrogen. Hydrogen samples were collected using a bubble cell stripper.
g. Used YSI instead of In-Situ to collect water parameter readings.
h. Saturated dissolved oxygen (%) was recorded instead of mg/L of dissolved oxygen.
i. Turbidity reading was not accurate due to equipment malfunction.
Shading indicates the analyte was detected.
Bold indicated analyte detected greater than regulatory standard.
°C = degrees Celsius
J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).
J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.
J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.
KAFB = Kirtland Air Force Base
LOQ = Limit of Quantitation
µS/cm^2 = microsiemens per square centimeter
mg/L = milligram per liter
mV = millivolts
N/A = Not analyzed.
ND = Not detected.
No. = number
NR = Not recorded or reported due to operational error.
NTU = Nephelometric Turbidity Unit
R = Sample data rejected due to lab contamination.
RSL = Regional Screening Level.
S.U. = Standard Unit
U = Analyte was not detected. The reported numerical value is at or below the LOQ.

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
April - June 2015

					LOCATION CODE	KAFB-106076			KAFB-106076			KAFB-106079			KAFB-106082			KAFB-106088			KAFB-106091			KAFB-106094		
					SAMPLE NO	GW2228[e,f]			GW2229[e,f]			GW2232[f,g]			GW2235[f]			GW2242[e,f,g]			GW2245[e,f,g]			GW2248[f,g]		
					SAMPLE DATE	15-Jun-15			15-Jun-15			9-Jun-15			3-Jun-15			2-Jun-15			1-Jun-15			4-Jun-15		
					SAMPLE PURPOSE	REG			FD			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	480-500 FT			480-500 FT			484-504 FT			472-492 FT			460-480 FT			454-474 FT			484-504 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L) Method 8015C/8015D	DIESEL RANGE ORGANICS	N/A	N/A	N/A	N/A	51000		4000	43900		3700	28500		1850	3460		392	ND	U	388	495		400	2270		370
	GASOLINE RANGE ORGANICS	N/A	N/A	N/A	N/A	28000		7500	25600		7500	5140		750	1120		150	ND	U	150	358		150	848		150
VOCs (µg/L) Method 8260B	1,2-DIBROMOETHANE (Method 8011)	0.1	N/A	0.05	0.0075	**48.6**		2.82	**49.4**		2.79	**0.698**		0.0281	**0.174**		0.0281	**0.0818**		0.0282	0.0247	J	0.0279	**0.123**		0.0278
	1,1,2-TRICHLOROETHANE	10	N/A	5	0.28	ND	U	20	ND	U	20	ND	U	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	1,2,4-TRIMETHYLBENZENE	N/A	N/A	N/A	15	310		20	304		20	14.4	J	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	1,2-DIBROMOETHANE	0.1	N/A	0.05	0.0075	**76.2**		20	**69.5**		20	ND	U	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	1,2-DICHLOROETHANE	10	N/A	5	0.17	ND	U	20	ND	U	20	ND	U	20	2.62		2	ND	U	1	1.17	J	2	2.14		2
	1,3,5-TRIMETHYLBENZENE	N/A	N/A	N/A	120	89.3		20	85.4		20	10.7	J	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	2-BUTANONE	N/A	N/A	N/A	5600	96	J	200	113	J	200	ND	U	200	ND	U	20	ND	U	10	ND	U	20	ND	U	20
	2-CHLOROTOLUENE	N/A	N/A	N/A	240	ND	U	20	ND	U	20	ND	U	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	2-HEXANONE	N/A	N/A	N/A	38	300		100	304		100	ND	U	100	ND	U	10	ND	U	5	ND	U	10	ND	U	10
	4-METHYL-2-PENTANONE	N/A	N/A	N/A	1200	231		100	229		100	ND	U	100	ND	U	10	ND	U	5	ND	U	10	ND	U	10
	ACETONE	N/A	N/A	N/A	14000	337	J+	200	361	J+	200	132	J+	200	285		20	4.17	J	10	41.3		20	285		20
	BENZENE	10	N/A	5	0.45	**4010**		20	**4090**		20	**439**		20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	CARBON DISULFIDE	N/A	N/A	N/A	810	ND	U	20	16.4	J	20	ND	U	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	CHLOROMETHANE	N/A	N/A	N/A	190	ND	U	20	ND	U	20	ND	U	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	DICHLORODIFLUOROMETHANE	N/A	N/A	N/A	200	ND	U	40	ND	U	40	ND	UJ	40	ND	U	4	ND	U	2	ND	U	4	ND	U	4
	ETHYLBENZENE	750	N/A	700	1.5	530		20	539		20	51.7		20	5.75		2	ND	U	1	ND	U	2	17.2		2
	ISOPROPYLBENZENE	N/A	N/A	N/A	450	49.9		20	51.4		20	12.4	J	20	10.5		2	ND	U	1	3.62		2	20.1		2
	METHYL TERT-BUTYL ETHER	N/A	N/A	N/A	14	ND	U	20	ND	U	20	ND	U	20	0.527	J	2	ND	U	1	ND	U	2	ND	U	2
	METHYLENE CHLORIDE	100	N/A	5	11	ND	U	40	ND	U	40	**11.2**	J	40	ND	U	4	ND	U	2	ND	U	4	1.03	J	4
	NAPHTHALENE	30	N/A	N/A	0.17	**282**		40	**274**		40	19.7	J	40	ND	UJ	4	ND	U	2	ND	U	4	ND	UJ	4
	N-BUTYLBENZENE	N/A	N/A	N/A	1000	37.1		20	36.5		20	ND	U	20	0.632	J	2	ND	U	1	ND	U	2	1.26	J	2
	N-PROPYLBENZENE	N/A	N/A	N/A	660	55.2		20	55.3		20	ND	U	20	2.9		2	ND	U	1	ND	U	2	5.67		2
	P-ISOPROPYLTOLUENE	N/A	N/A	N/A	N/A	8.63	J	20	10.1	J	20	11.3	J	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	SEC-BUTYLBENZENE	N/A	N/A	N/A	2000	13.9	J	20	12.8	J	20	ND	U	20	1.32	J	2	ND	U	1	ND	U	2	2.69		2
	TERT-BUTYLBENZENE	N/A	N/A	N/A	690	ND	U	20	ND	U	20	ND	U	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	TOLUENE	750	N/A	1000	1100	**2300**		20	**2320**		20	328		20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	TRICHLOROETHENE	100	N/A	5	0.49	ND	U	20	ND	U	20	ND	U	20	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	TRICHLOROFLUOROMETHANE	N/A	N/A	N/A	1100	ND	U	40	ND	U	40	ND	U	40	ND	U	4	ND	U	2	ND	U	4	ND	U	4
	XYLENES	620	N/A	10000	190	**2240**		60	**2200**		60	171		60	ND	U	6	ND	U	3	ND	U	6	ND	U	6
Gases (µg/L) Method EPA RSK175	HYDROGEN (AM20GAX) (nM)	N/A	N/A	N/A	N/A	5.1	N/A	0.6	4.8	N/A	0.6	3	N/A	0.6	3.7		0.6	3.4		0.6	2.5		0.6	2.5	N/A	0.6
	ETHANE	N/A	N/A	N/A	N/A	14	N/A	1	10	N/A	0.2	10	N/A	0.2	0.84		0.2	ND	U	0.2	ND	U	0.2	0.78	N/A	0.2
	ETHYLENE	N/A	N/A	N/A	N/A	22	N/A	1	18	N/A	0.2	9.7	N/A	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2	1	N/A	0.2
	METHANE	N/A	N/A	N/A	N/A	12	N/A	2.5	8.3	N/A	0.5	17	N/A	0.5	4.5		0.5	ND	U	0.5	ND	U	0.5	4.6	N/A	0.5
SVOCs (µg/L) Method 8270D	1,1-BIPHENYL	N/A	N/A	N/A	0.83	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	1,2-DIPHENYLHYDRAZINE	N/A	N/A	N/A	0.077	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	**110**	J	245	**119**	J	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	2,4-DIMETHYLPHENOL	5	N/A	N/A	360	ND	U	980	ND	U	962	ND	U	943	ND	U	19.6	ND	U	19	ND	U	18.9	ND	U	19.2
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	**121**	J	245	**126**	J	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	2-METHYLPHENOL	5	N/A	N/A	930	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	N/A	N/A	930	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	ACETOPHENONE	N/A	N/A	N/A	1900	3090		245	3190		240	1690		236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	BIS(2-ETHYLHEXYL)PHTHALATE	N/A	N/A	6	5.6	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	BUTYL BENZYL PHTHALATE	N/A	N/A	N/A	16	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	CAPROLACTAM	N/A	N/A	N/A	9900	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	DIBENZOFURAN	N/A	N/A	N/A	7.9	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	DIETHYL PHTHALATE	N/A	N/A	N/A	15000	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	FLUORANTHENE	N/A	N/A	N/A	800	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	FLUORENE	N/A	N/A	N/A	290	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	ISOPHORONE	N/A	N/A	N/A	78	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	NAPHTHALENE	30	N/A	N/A	0.17	**191**	J	245	**201**	J	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	PENTACHLOROPHENOL	5	N/A	1	0.04	ND	U	980	ND	U	962	ND	U	943	ND	U	19.6	ND	U	19	ND	U	18.9	ND	U	19.2
	PHENANTHRENE	N/A	N/A	N/A	N/A	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	PHENOL	5	N/A	N/A	5800	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81
	PYRENE	N/A	N/A	N/A	120	ND	U	245	ND	U	240	ND	U	236	ND	U	4.9	ND	U	4.76	ND	U	4.72	ND	U	4.81

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
April - June 2015

Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
					LOCATION CODE	KAFB-106076			KAFB-106076			KAFB-106079			KAFB-106082			KAFB-106088			KAFB-106091			KAFB-106094		
					SAMPLE NO	GW2228[e,f]			GW2229[e,f]			GW2232[f,g]			GW2235[f]			GW2242[e,f,g]			GW2245[e,f,g]			GW2248[f,g]		
					SAMPLE DATE	15-Jun-15			15-Jun-15			9-Jun-15			3-Jun-15			2-Jun-15			1-Jun-15			4-Jun-15		
					SAMPLE PURPOSE	REG			FD			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	480-500 FT			480-500 FT			484-504 FT			472-492 FT			460-480 FT			454-474 FT			484-504 FT		
PAHs (µg/L) Method 8270D Low Detection Limit	1-METHYL NAPHTHALENE	30	N/A	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	N/A	N/A	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	N/A	N/A	N/A	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	N/A	N/A	N/A	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	N/A	N/A	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	N/A	N/A	N/A	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L) Method 6010C	CALCIUM	N/A	N/A	N/A	N/A	61.5		5	61.5		5	104		5	81.1		5	40.7		5	44.7		5	62.1		5
	IRON, DISSOLVED	1	N/A	N/A	14	0.448		0.1	0.448		0.1	**4.23**		0.1	0.355		0.1	0.048	J	0.1	ND	U	0.1	0.62		0.1
	LEAD	0.05	0.01	0.015	0.015	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005
	MAGNESIUM	N/A	N/A	N/A	N/A	11.7		5	11.5		5	18.9		5	12.1		5	5.73		5	6.3		5	9.59		5
	MANGANESE, DISSOLVED	0.2	N/A	N/A	0.43	**1.53**		0.015	**1.57**		0.015	**4.83**		0.015	**0.757**		0.015	ND	U	0.015	0.076		0.015	**0.901**		0.015
	POTASSIUM	N/A	N/A	N/A	N/A	2.66	J	5	2.62	J	5	3.62	J	5	3.43	J	5	2.26	J	5	2.61	J	5	2.8	J	5
	SODIUM	N/A	N/A	N/A	N/A	27.6		5	27.3		5	47.2		5	30.9		5	22.5		5	22.9		5	26.9		5
Anions (mg/L) Method E300.0	BROMIDE	N/A	N/A	N/A	N/A	ND	U	0.25	0.197	J	0.25	0.643		0.25	0.692		0.25	0.0585	J	0.25	0.116	J	0.25	0.171	J	0.25
	CHLORIDE	250	N/A	N/A	N/A	14.5		0.5	14.3		0.5	67.8		0.5	67.1		0.5	11.9		0.5	15.7		0.5	22.2		0.5
	SULFATE	600	N/A	N/A	N/A	5.12		2.5	4.4		2.5	17.2		2.5	70.1		2.5	34.6		2.5	38.2		2.5	50.9		2.5
	NITROGEN, NITRATE-NITRITE (Method E353.2)	10	4	10	N/A	ND	U	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2	0.209		0.2	ND	U	0.2	ND	U	0.2
	AMMONIA (AS N) (Method SM4500NH3BG)	N/A	N/A	N/A	N/A	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3
	SULFIDE, TOTAL (Method SM4500S2CF)	N/A	N/A	N/A	N/A	0.415	J	0.943	0.505	J	0.971	0.273	J	0.962	ND	U	0.922	ND	U	0.952	ND	U	0.962	ND	U	0.926
Alkalinity (mg/L) Method SM2320B/ A2320B	ALKALINITY, BICARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	240		1	233		1	355		1	191		1	134		1	146		1	198		1
	ALKALINITY, CARBONATE (AS CACO3) (Method SM2320B)	N/A	N/A	N/A	N/A	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Biological Parameters (cells/mL) Method QUANTARRAY	APS	N/A	N/A	N/A	N/A	591000		10.4	627000		9.3	899000		4.9	3590		4.8	4.8		4.7	46.2		4.8	868		4.8
	BVC	N/A	N/A	N/A	N/A	ND	U	1	ND	U	0.9	10.4		0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
	CFR	N/A	N/A	N/A	N/A	ND	U	10.4	ND	U	9.3	ND	U	4.9	ND	U	4.8	ND	U	4.7	ND	U	4.8	ND	U	4.8
	DCA	N/A	N/A	N/A	N/A	ND	U	10.4	ND	U	9.3	ND	U	4.9	ND	U	4.8	ND	U	4.7	ND	U	4.8	ND	U	4.8
	DCAR	N/A	N/A	N/A	N/A	ND	U	10.4	ND	U	9.3	ND	U	4.9	ND	U	4.8	ND	U	4.7	ND	U	4.8	ND	U	4.8
	DCM	N/A	N/A	N/A	N/A	ND	U	10.4	ND	U	9.3	95.6		4.9	ND	U	4.8	ND	U	4.7	ND	U	4.8	ND	U	4.8
	DCMA	N/A	N/A	N/A	N/A	ND	U	10.4	ND	U	9.3	ND	U	4.9	ND	U	4.8	ND	U	4.7	ND	U	4.8	ND	U	4.8
	DECO	N/A	N/A	N/A	N/A	ND	U	10.4	ND	U	9.3	ND	U	4.9	ND	U	4.8	ND	U	4.7	ND	U	4.8	ND	U	4.8
	DHBT	N/A	N/A	N/A	N/A	2250		10.4	613		9.3	13600		4.9	283		4.8	ND	U	4.7	ND	U	4.8	34.7		4.8
	DHC	N/A	N/A	N/A	N/A	1.2		1	1.2		0.9	62.1		0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	1.8		0.5
	DHG	N/A	N/A	N/A	N/A	109000		10.4	90400		9.3	50400		4.9	3940		4.8	360		4.7	248		4.8	3880		4.8
	DSB	N/A	N/A	N/A	N/A	1810		10.4	2600		9.3	7390		4.9	86.3		4.8	1.3	J	4.7	ND	U	4.8	285		4.8
	DSM	N/A	N/A	N/A	N/A	ND	U	10.4	126		9.3	ND	U	4.9	254		4.8	ND	U	4.7	ND	U	4.8	192		4.8
	EBAC	N/A	N/A	N/A	N/A	1370000		10.4	1120000		9.3	2810000		4.9	807000		4.8	333000		4.7	631000		4.8	1570000		4.8
	ETNC	N/A	N/A	N/A	N/A	ND	U	10.4	ND	U	9.3	ND	U	4.9	2.1	J	4.8	5.1		4.7	ND	U	4.8	ND	U	4.8
	ETNE	N/A	N/A	N/A	N/A	ND	U	10.4	ND	U	9.3	ND	U	4.9	12.2		4.8	38.7		4.7	3.4	J	5.1	5.4		4.8
	MGN	N/A	N/A	N/A	N/A	1320		10.4	130		9.3	78.5		4.9	214		4.8	51.4		4.7	49.3		4.8	72.5		4.8
	PHE	N/A	N/A	N/A	N/A	82500		10.4	26300		9.3	5970		4.9	3560		4.8	54.9		4.7	965		5.1	225		4.8
	PMMO	N/A	N/A	N/A	N/A	71.5		10.4	70.8		9.3	57.2		4.9	34.7		4.8	73.4		4.7	37.8		4.8	33.8		4.8
Biological Parameters (cells/mL) Method QUANTARRAY (continued)	RDEG	N/A	N/A	N/A	N/A	30500		10.4	36900		9.3	1250		4.9	875		4.8	61.4		4.7	1600		4.9	537		4.8
	RMO	N/A	N/A	N/A	N/A	73700		10.4	85300		9.3	5120		4.9	0.4	J	4.8	83.9		4.7	175		5.1	ND	U	4.8
	SMMO	N/A	N/A	N/A	N/A	6310		10.4	1200		9.3	2550		4.9	106		4.8	572		4.7	518		4.8	1040		4.8
	TCBO	N/A	N/A	N/A	N/A	ND	U	10.4	48.3		9.3	40		4.9	ND	U	4.8	ND	U	4.7	ND	U	4.8	ND	U	4.8
	TCE	N/A	N/A	N/A	N/A	ND	U	1	ND	U	0.9	8.6		0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	0.1	J	0.5
	TOD	N/A	N/A	N/A	N/A	1390		10.4	129		9.3	2390		4.9	1290		4.8	715		4.7	230		4.8	359		4.8
	VCR	N/A	N/A	N/A	N/A	ND	U	1	ND	U	0.9	1.5		0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
Field Parameters	Temperature (°C)	N/A	N/A	N/A	N/A	21.48			21.48			18.98			21.37			18.87			19.53			19.2		
	pH (S.U.)	9	N/A	N/A	N/A	7.16			7.16			7.09			7.43			8.31			7.97			7.87		
	Spec Cond (µS/cm2)	N/A	N/A	N/A	N/A	497.9			497.9			987			633.5			375			393			551		
	DO (mg/L)	N/A	N/A	N/A	N/A	0			0			2.6[h]			1.37			1.6			4.27			6.4[h]		
	ORP (mV)	N/A	N/A	N/A	N/A	-285			-285			-145.5			-85			30			121.3			-131.3		
	Turbidity (NTU)	N/A	N/A	N/A	N/A	2.2			2.2			1.91			0.95			0.57			0.26			1.7		
	Alkalinity (mg/L as CaCO3)	N/A	N/A	N/A	N/A	222			222			380			176			180			140			196		

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
April - June 2015

					LOCATION CODE	KAFB-106076			KAFB-106076			KAFB-106079			KAFB-106082			KAFB-106088			KAFB-106091			KAFB-106094		
					SAMPLE NO	GW2228[e,f]			GW2229[e,f]			GW2232[f,g]			GW2235[f]			GW2242[e,f,g]			GW2245[e,f,g]			GW2248[f,g]		
					SAMPLE DATE	15-Jun-15			15-Jun-15			9-Jun-15			3-Jun-15			2-Jun-15			1-Jun-15			4-Jun-15		
					SAMPLE PURPOSE	REG			FD			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	480-500 FT			480-500 FT			484-504 FT			472-492 FT			460-480 FT			454-474 FT			484-504 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ

EPA MCL and tap water RSLs are from the EPA RSL Table, dated June 2015.
The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.
The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 2-methylphenol, 2-nitrophenol, 3 and 4-methylphenol, 2,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-nitrophenol, and pentachlorophenol
Sample GW0998 for SVOC analysis was not performed due to laboratory errors.
Sample GW0886 for PAH analysis was not colllected due to an oversight.
KAFB-10612 not measured due to a non-operational corroded pump.
The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.
The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.
a. EPA analytical methods listed are for the most recent sampling event.
b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and 2-methylnapthalene.
c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water.
d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs).
e. Sample contained bubbles.
f. Sample was also collected for Quant Array, dissolved gases, and hydrogen. Hydrogen samples were collected using a bubble cell stripper.
g. Used YSI instead of In-Situ to collect water parameter readings.
h. Saturated dissolved oxygen (%) was recorded instead of mg/L of dissolved oxygen.
i. Turbidity reading was not accurate due to equipment malfunction.
Shading indicates the analyte was detected.
Bold indicated analyte detected greater than regulatory standard.
°C = degrees Celsius
J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).
J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.
J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.
KAFB = Kirtland Air Force Base
LOQ = Limit of Quantitation
$\mu S/cm^2$ = microsiemens per square centimeter
mg/L = milligram per liter
mV = millivolts
N/A = Not analyzed.
ND = Not detected.
No. = number
NR = Not recorded or reported due to operational error.
NTU = Nephelometric Turbidity Unit
R = Sample data rejected due to lab contamination.
RSL = Regional Screening Level.
S.U. = Standard Unit
U = Analyte was not detected. The reported numerical value is at or below the LOQ.

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
July - September 2015

					LOCATION CODE	KAFB-10610			KAFB-10627			KAFB-10628-510			KAFB-106059			KAFB-106064			KAFB-106067			KAFB-106067		
					SAMPLE NO.	GW2309[f]			GW2342[f,g]			GW2365[e,f,g]			GW2359[e,f]			GW2364[e,f,g]			GW2368[e,f,g]			GW2369[e,f,g]		
					SAMPLE DATE	31-Aug-15			20-Aug-15			25-Aug-15			1-Sep-15			27-Aug-15			20-Aug-15			20-Aug-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			FD		
					SAMPLE DEPTH	483-508 FT			481-501 FT			486-511 FT			483-503 FT			485-510 FT			485-505 FT			485-505 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L)	DIESEL RANGE ORGANICS	NE	NE	NE	NE	21200		4000	ND	U	385	7130		392	42900		4000	31700		3920	2590		392	2670		392
Method 8015C	GASOLINE RANGE ORGANICS	NE	NE	NE	NE	17200		7500	ND	U	150	3970		1500	85600		7500	21600		7500	1370		300	1390		300
VOCs (µg/L)	1,2-DIBROMOETHANE (Method 8011)	0.1	NE	0.05	0.0075	**8.16**		0.28	ND	U	0.0281	**6.96**		0.28	**5.22**		0.282	**15.1**		0.561	0.0342		0.0283	0.0316		0.0281
Method 8260B	1,1,2-TRICHLOROETHANE	10	NE	5	0.28	ND	U	20	ND	U	1	ND	U	5	ND	U	200	ND	U	20	ND	U	2	ND	U	2
	1,2,4-TRIMETHYLBENZENE	NE	NE	NE	15	117		20	ND	U	1	13.5		5	493		200	83.2		20	ND	U	2	ND	U	2
	1,2-DIBROMOETHANE	0.1	NE	0.05	0.0075	**9.24**	J	20	ND	U	1	**6.99**		5	ND	U	200	**19.2**	J	20	ND	U	2	ND	U	2
	1,2-DICHLOROETHANE	10	NE	5	0.17	ND	U	20	ND	U	1	2.95	J	5	ND	U	200	ND	U	20	1.53	J	2	1.16	J	2
	1,3,5-TRIMETHYLBENZENE	NE	NE	NE	120	40.1		20	ND	U	1	4.56	J	5	152	J	200	39.1		20	5.59		2	5.1		2
	2-BUTANONE	NE	NE	NE	5600	54.8	J	200	ND	U	10	ND	U	50	ND	U	2000	67.1	J	200	ND	U	20	ND	U	20
	2-CHLOROTOLUENE	NE	NE	NE	240	ND	U	20	ND	U	1	ND	U	5	ND	U	200	ND	U	20	ND	U	2	ND	U	2
	2-HEXANONE	NE	NE	NE	38	ND	U	100	ND	U	5	ND	U	25	ND	U	1000	96.6	J	100	ND	U	10	ND	U	10
	4-METHYL-2-PENTANONE	NE	NE	NE	1200	62.6	J	100	ND	U	5	7.65	J	25	ND	U	1000	84	J	100	ND	U	10	ND	U	10
	ACETONE	NE	NE	NE	14000	175	J	200	ND	U	10	ND	U	50	ND	U	2000	195	J	200	55.6		20	258		20
	BENZENE	10	NE	5	0.45	**2170**		20	ND	U	1	**508**		5	**16000**		200	**2710**		20	2.05		2	1.84	J	2
	CARBON DISULFIDE	NE	NE	NE	810	ND	U	20	ND	U	1	ND	U	5	ND	U	200	ND	U	20	ND	U	2	ND	U	2
	CHLOROMETHANE	NE	NE	NE	190	ND	U	20	ND	U	1	ND	U	5	ND	U	200	ND	U	20	ND	U	2	ND	U	2
	DICHLORODIFLUOROMETHANE	NE	NE	NE	200	ND	U	40	ND	U	2	ND	U	10	ND	U	400	ND	U	40	ND	U	4	ND	U	4
	ETHYLBENZENE	750	NE	700	1.5	**748**		20	ND	U	1	64.8		5	**1550**		200	**818**		20	73.6		2	73.2		2
	ISOPROPYLBENZENE	NE	NE	NE	450	165		20	ND	U	1	11		5	97.2	J	200	91.6		20	18.7		2	17.4		2
	M,P-XYLENES	620	NE	10000	190	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	METHYL TERT-BUTYL ETHER	NE	NE	NE	14	ND	U	20	ND	U	1	ND	U	5	ND	U	200	ND	U	20	ND	U	2	ND	U	2
	METHYLENE CHLORIDE	100	NE	5	11	**12.9**	J	40	ND	U	2	**5.44**	J	10	ND	U	400	ND	U	40	ND	U	4	ND	U	4
	NAPHTHALENE	30	NE	NE	0.17	**35**	J	40	ND	UJ	2	6.87	J-	10	**190**	J	400	**54.8**		40	ND	U	4	ND	U	4
	N-BUTYLBENZENE	NE	NE	NE	1000	ND	U	20	ND	U	1	ND	U	5	ND	U	200	ND	U	20	1.11	J	2	1.24	J	2
	N-PROPYLBENZENE	NE	NE	NE	660	66.8		20	ND	U	1	6.51		5	123	J	200	51.4		20	7.03		2	6.68		2
	O-XYLENE	620	NE	10000	190	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	P-ISOPROPYLTOLUENE	NE	NE	NE	NE	49.5		20	ND	U	1	1.33	J	5	ND	U	200	77.9		20	2.3		2	2.44		2
	SEC-BUTYLBENZENE	NE	NE	NE	2000	13.1	J	20	ND	U	1	3.09	J+	5	ND	U	200	ND	U	20	2.48		2	2.37		2
	TERT-BUTYLBENZENE	NE	NE	NE	690	ND	U	20	ND	U	1	ND	U	5	ND	U	200	ND	U	20	ND	U	2	ND	U	2
	TOLUENE	750	NE	1000	1100	**2880**		20	ND	U	1	561		5	**21400**		200	**3250**		20	ND	U	2	ND	U	2
	TRICHLOROETHENE	100	NE	5	0.49	ND	U	20	ND	U	1	ND	U	5	ND	U	200	ND	U	20	ND	U	2	ND	U	2
	TRICHLOROFLUOROMETHANE	NE	NE	NE	1100	ND	U	40	ND	U	2	ND	U	10	ND	U	400	ND	U	40	ND	U	4	ND	U	4
	XYLENES	620	NE	10000	190	534		60	ND	U	3	132		15	**5120**		600	**895**		60	ND	U	6	ND	U	6
Gases (µg/L)	ETHANE	NE	NE	NE	NE	6.4		0.2	ND	U	0.2	6.6		0.2	7.4		0.2	16		0.2	1.4		0.2	1.4		0.2
Method	ETHYLENE	NE	NE	NE	NE	11		0.2	ND	U	0.2	2.3		0.2	47		0.2	24		0.2	0.85		0.2	1		0.2
EPA RSK175	HYDROGEN (AM20GAX) (nM)	NE	NE	NE	NE	8.4		0.6	5.2		0.6	4.8		0.6	10		0.6	11		0.6	4.5		0.6	5.9		0.6
	METHANE	NE	NE	NE	NE	1300		25	ND	U	0.5	5.7		0.5	100		0.5	48		0.5	2.3		0.5	2.2		0.5
SVOCs (µg/L)	1,1-BIPHENYL	NE	NE	NE	0.83	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
Method 8270D	1,2-DIPHENYLHYDRAZINE	NE	NE	NE	0.077	ND	U	46.3	ND	U	5	2.97	J	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	1-METHYL NAPHTHALENE	30	NE	NE	1.1	18.6	J	46.3	ND	U	5	5.62		4.9	**66.8**	J	245	12.4		4.76	ND	U	4.9	ND	U	4.9
	2,4-DIMETHYLPHENOL	5	NE	NE	360	ND	U	185	ND	U	20	ND	U	19.6	ND	U	980	ND	U	19	ND	U	19.6	ND	U	19.6
	2-METHYLNAPHTHALENE	30	NE	NE	36	ND	U	46.3	ND	U	5	1.61	J	4.9	**73.6**	J	245	8.44		4.76	ND	U	4.9	ND	U	4.9
	2-METHYLPHENOL	5	NE	NE	930	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	NE	NE	930	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	**61.1**		4.76	ND	U	4.9	ND	U	4.9
	ACETOPHENONE	NE	NE	NE	1900	903		46.3	ND	U	5	122		24.5	1980		245	2400		238	ND	U	4.9	ND	U	4.9
	BIS(2-ETHYLHEXYL)PHTHALATE	NE	NE	6	5.6	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	1.28	J	4.9
	BUTYL BENZYL PHTHALATE	NE	NE	NE	16	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	CAPROLACTAM	NE	NE	NE	9900	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	DIBENZOFURAN	NE	NE	NE	7.9	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	DIETHYL PHTHALATE	NE	NE	NE	15000	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	FLUORANTHENE	NE	NE	NE	800	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	FLUORENE	NE	NE	NE	290	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	INDENO(1,2,3-CD)PYRENE	NE	NE	NE	0.034	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	ISOPHORONE	NE	NE	NE	78	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	6.97		4.76	ND	U	4.9	ND	U	4.9
	NAPHTHALENE	30	NE	NE	0.17	25.1	J	46.3	ND	U	5	3.91	J	4.9	**171**	J	245	**39.3**		4.76	ND	U	4.9	ND	U	4.9
	PENTACHLOROPHENOL	5	NE	1	0.04	ND	U	185	ND	U	20	ND	U	19.6	ND	U	980	ND	U	19	ND	U	19.6	ND	U	19.6
	PHENANTHRENE	NE	NE	NE	NE	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	PHENOL	5	NE	NE	5800	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9
	PYRENE	NE	NE	NE	120	ND	U	46.3	ND	U	5	ND	U	4.9	ND	U	245	ND	U	4.76	ND	U	4.9	ND	U	4.9

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
July - September 2015

					LOCATION CODE	KAFB-10610			KAFB-10627			KAFB-10628-510			KAFB-106059			KAFB-106064			KAFB-106067			KAFB-106067		
					SAMPLE NO.	GW2309[f]			GW2342[f,g]			GW2365[e,f,g]			GW2359[e,f]			GW2364[e,f,g]			GW2368[e,f,g]			GW2369[e,f,g]		
					SAMPLE DATE	31-Aug-15			20-Aug-15			25-Aug-15			1-Sep-15			27-Aug-15			20-Aug-15			20-Aug-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			FD		
					SAMPLE DEPTH	483-508 FT			481-501 FT			486-511 FT			483-503 FT			485-510 FT			485-505 FT			485-505 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
PAHs (µg/L) Method 8270D Low Detection Limit	1-METHYL NAPHTHALENE	30	NE	NE	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	NE	NE	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	NE	NE	NE	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	NE	NE	NE	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	NE	NE	NE	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	NE	NE	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	NE	NE	NE	NE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	NE	NE	NE	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L) Method 6010C	ARSENIC	0.1	NE	0.01	0.000052	ND	U	0.0025	0.00097	J	0.0025	ND	U	0.0025	0.00229	J	0.0025	0.00162	J	0.0025	ND	U	0.0025	ND	U	0.0025
	CALCIUM	NE	NE	NE	NE	90.2		5	30.8		5	75.9		20	99		5	70.7		5	61.3		5	59.1		5
	IRON, DISSOLVED	1	NE	NE	14	0.249		0.1	ND	U	0.1	0.618		0.1	**4.1**		0.1	**4.67**		0.1	0.894		0.1	0.823		0.1
	IRON, DISSOLVED (Method 6020A)	1	NE	NE	14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	LEAD	0.05	0.01	0.015	0.015	0.00207	J	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005
	MAGNESIUM	NE	NE	NE	NE	13.4		5	4.74	J	5	11.7	J	20	16.6		5	11.4		5	9.18		5	8.77		5
	MANGANESE, DISSOLVED	0.2	NE	NE	0.43	**2.12**		0.015	ND	U	0.015	**2.08**		0.015	**3.47**		0.015	**3.25**		0.015	**1.23**		0.015	**1.16**		0.015
	MANGANESE, DISSOLVED (Method 6020A)	0.2	NE	NE	0.43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	POTASSIUM	NE	NE	NE	NE	3.11	J	5	2.08	J	5	2.86	J	20	3.26	J	5	2.62	J	5	2.81	J	5	2.65	J	5
	SODIUM	NE	NE	NE	NE	33.1		5	19.1		5	32		20	32.9		5	28.6		5	26.5		5	25.5		5
Anions (mg/L) Method E300.0	AMMONIA (AS N) (Method SM4500NH3BG)	NE	NE	NE	NE	0.136	J	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	0.126	J	0.3	ND	U	0.3	ND	U	0.3
	BROMIDE	NE	NE	NE	NE	1.09		0.25	ND	U	0.25	0.445		0.25	0.736		0.25	0.277		0.25	0.159	J	0.25	0.179	J	0.25
	CHLORIDE	250	NE	NE	NE	86.8		0.5	6.96		0.5	41.5	J+	0.5	43.6		0.5	13		0.5	13.5		0.5	13.3		0.5
	NITROGEN, NITRATE-NITRITE (Method E353.2)	10	4	10	NE	ND	U	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2
	SULFATE	600	NE	NE	NE	32.9		2.5	28.5		2.5	33.3		2.5	1.49	J	2.5	ND	U	2.5	19.1		2.5	18.6		2.5
	SULFIDE, TOTAL (Method SM4500S2CF)	NE	NE	NE	NE	0.563	J	0.939	ND	U	0.948	0.305	J	0.952	ND	U	0.943	ND	U	0.962	ND	U	0.952	ND	U	0.948
Alkalinity (mg/L) Method SM2320B	ALKALINITY, BICARBONATE (AS CACO3)	NE	NE	NE	NE	230		1	118		1	230		1	382		1	287		1	227		1	241		1
	ALKALINITY, CARBONATE (AS CACO3)	NE	NE	NE	NE	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Biological Parameters (cells/mL) Method QUANTARRAY	APS	NE	NE	NE	NE	272000		4.7	2.9	J	5	143000		4.9	1420000		4.9	367000		4.9	200000		4.9	253000		4.9
	BVC	NE	NE	NE	NE	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
	CFR	NE	NE	NE	NE	ND	U	4.7	ND	U	5	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9
	DCA	NE	NE	NE	NE	ND	U	4.7	ND	U	5	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9
	DCAR	NE	NE	NE	NE	ND	U	4.7	ND	U	5	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9
	DCM	NE	NE	NE	NE	ND	U	4.7	ND	U	5	40.4		4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9
	DCMA	NE	NE	NE	NE	ND	U	4.7	ND	U	5	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9
	DECO	NE	NE	NE	NE	ND	U	4.7	ND	U	5	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9	ND	U	4.9
	DHBT	NE	NE	NE	NE	8790		4.7	ND	U	5	30000		4.9	8840		4.9	11000		4.9	659		4.9	715		4.9
	DHC	NE	NE	NE	NE	82.4		0.5	ND	U	0.5	5.4		0.5	11.3		0.5	4.6		0.5	ND	U	0.5	ND	U	0.5
	DHG	NE	NE	NE	NE	26000		4.7	47.1		5	7850		4.9	751000		4.9	196000		4.9	8330		4.9	7280		4.9
	DSB	NE	NE	NE	NE	4350		4.7	ND	U	5	2130		4.9	22000		4.9	16700		4.9	1430		4.9	1180		4.9
	DSM	NE	NE	NE	NE	490		4.7	ND	U	5	68.1		4.9	ND	U	4.9	1000		4.9	ND	U	4.9	17.2		4.9
Biological Parameters (cells/mL) Method QUANTARRAY (continued)	EBAC	NE	NE	NE	NE	2040000		4.7	24200		5	3640000		4.9	7070000		4.9	3640000		4.9	1510000		4.9	1250000		4.9
	ETNC	NE	NE	NE	NE	ND	U	4.7	ND	U	5	ND	U	4.9	ND	U	4.9	ND	U	4.9	7.4		4.9	11.9		4.9
	ETNE	NE	NE	NE	NE	4	J	4.7	ND	U	5	2910		4.9	ND	U	4.9	ND	U	4.9	33.2		4.9	109		4.9
	MGN	NE	NE	NE	NE	38400		4.7	0.7	J	5	97.2		4.9	4110		4.9	93600		4.9	269		4.9	305		4.9
	PHE	NE	NE	NE	NE	382		4.7	15.5		5	2420		4.9	155000		4.9	11500		4.9	826		4.9	1060		4.9
	PMMO	NE	NE	NE	NE	0.7	J	4.7	0.4	J	5	1.9	J	4.9	18.2		4.9	65.3		4.9	16500		4.9	8.4		4.9
	RDEG	NE	NE	NE	NE	608		4.7	163		5	948		4.9	141000		4.9	5670		4.9	792		4.9	739		4.9
	RMO	NE	NE	NE	NE	378		4.7	ND	U	5	712		4.9	256000		4.9	8470		4.9	575		4.9	249		4.9
	SMMO	NE	NE	NE	NE	363		4.7	41.2		5	209		4.9	14300		4.9	18300		4.9	1150		4.9	1250		4.9
	TCBO	NE	NE	NE	NE	ND	U	4.7	ND	U	5	ND	U	4.9	ND	U	4.9	26.7		4.9	ND	U	4.9	ND	U	4.9
	TCE	NE	NE	NE	NE	1.4		0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
	TOD	NE	NE	NE	NE	153		4.7	1.9	J	5	98		4.9	4480		4.9	930		4.9	309		4.9	304		4.9
	VCR	NE	NE	NE	NE	0.2	J	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
Field Parameters	Temperature (°C)	NE	NE	NE	NE	19.84			18.83			18.12			20.20			18.62			18.78			18.78		
	pH (S.U.)	NE	NE	NE	NE	7.15			7.72			7.33			6.94			6.86			7.19			7.19		
	Spec Cond (µS/cm2)	NE	NE	NE	NE	792.0			345.0			676.0			827.8			722.0			548.0			548.0		
	DO (mg/L)	NE	NE	NE	NE	0.01			NR			NR			0.02			NR			0.00			0.00		
	ORP (mV)	NE	NE	NE	NE	-313			79.7			-221.4			-268			-91.2			-109.2			-109.2		
	Turbidity (NTU)	NE	NE	NE	NE	0.78			1.07			1.63			0.80			0.51			2.79			2.79		
	Alkalinity (mg/L as CaCO3)	NE	NE	NE	NE	252			120			196			364			292			200			200		

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
July - September 2015

					LOCATION CODE	KAFB-10610			KAFB-10627			KAFB-10628-510			KAFB-106059			KAFB-106064			KAFB-106067			KAFB-106067		
					SAMPLE NO.	GW2309[f]			GW2342[f,g]			GW2365[e,f,g]			GW2359[e,f]			GW2364[e,f,g]			GW2368[e,f,g]			GW2369[e,f,g]		
					SAMPLE DATE	31-Aug-15			20-Aug-15			25-Aug-15			1-Sep-15			27-Aug-15			20-Aug-15			20-Aug-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			FD		
					SAMPLE DEPTH	483-508 FT			481-501 FT			486-511 FT			483-503 FT			485-510 FT			485-505 FT			485-505 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ

EPA MCL and tap water RSLs are from the EPA RSL Table, dated June 2015.
The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.
The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 2-methylphenol, 2-nitrophenol, 3 and 4-methylphenol, 2,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-nitrophenol, and pentachlorophenol.
The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.
The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.
a. EPA analytical methods listed are for the most recent sampling event.
b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and 2-methylnapthalene.
c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water.
d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs), June 2015.
e. Bubbles were observed in water quality meter, tubing, and/or sample containers.
f. Sample was also collected for Quant Array, dissolved gases, and hydrogen. Hydrogen samples were collected using a bubble cell stripper.
g. Used YSI instead of In-Situ to collect water parameter readings.
h. Well was sampled for EDB only during the time-critical sampling event.
Shading indicates the analyte was detected.
Bold indicated analyte detected greater than regulatory standard.
°C = degrees Celcius
J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).
J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.
J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.
KAFB = Kirtland Air Force Base
µS/cm^2 = microsiemens per square centimeter
mg/L = milligram per liter
mV = millivolts
N/A = Not analyzed
ND = Not detected
No. = number
NR = Not recorded or reported due to operational error.
NTU = Nephelometric Turbidity Unit
RSL = Regional Screening Level
S.U. = Standard Unit
U = Analyte was not detected. The reported numerical value is at or below the LOQ.

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
July - September 2015

					LOCATION CODE	KAFB-106075			KAFB-106076			KAFB-106079			KAFB-106082			KAFB-106088			KAFB-106091			KAFB-106094		
					SAMPLE NO.	GW2377[e,f,g]			GW2378[e,f]			GW2382[e,g]			GW2385[e,f]			GW2392[e,f,g]			GW2395[e,f,g]			GW2398[f]		
					SAMPLE DATE	26-Aug-15			1-Sep-15			31-Aug-15			27-Aug-15			19-Aug-15			24-Aug-15			19-Aug-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	480-500 FT			480-500 FT			484-504 FT			472-492 FT			460-480 FT			454-474 FT			484-504 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
TPH (µg/L) Method 8015C	DIESEL RANGE ORGANICS	NE	NE	NE	NE	1020		392	16300		4000	42600		3850	2860		381	ND	U	400	529		400	2590		396
	GASOLINE RANGE ORGANICS	NE	NE	NE	NE	504		150	17100		7500	7100	J+	3000	1110		150	ND	U	150	275		150	578		150
VOCs (µg/L) Method 8260B	1,2-DIBROMOETHANE (Method 8011)	0.1	NE	0.05	0.0075	**0.106**		0.028	**6.58**		0.281	**0.241**		0.0282	**0.109**		0.0281	**0.062**		0.0279	0.0296		0.0281	**0.072**		0.0279
	1,1,2-TRICHLOROETHANE	10	NE	5	0.28	ND	U	2	ND	U	10	ND	U	10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	1,2,4-TRIMETHYLBENZENE	NE	NE	NE	15	ND	U	2	361		10	23.5		10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	1,2-DIBROMOETHANE	0.1	NE	0.05	0.0075	ND	U	2	**6.62**	J	10	ND	U	10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	1,2-DICHLOROETHANE	10	NE	5	0.17	1.05	J	2	ND	U	10	**5.52**	J	10	2.04		2	ND	U	1	0.947	J	2	1.94	J	2
	1,3,5-TRIMETHYLBENZENE	NE	NE	NE	120	ND	U	2	95.6		10	9.74	J	10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	2-BUTANONE	NE	NE	NE	5600	ND	U	20	42.1	J	100	28.8	J	100	ND	U	20	ND	U	10	ND	U	20	ND	U	20
	2-CHLOROTOLUENE	NE	NE	NE	240	ND	U	2	ND	U	10	ND	U	10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	2-HEXANONE	NE	NE	NE	38	ND	U	10	58.2		50	ND	U	50	ND	U	10	ND	U	5	ND	U	10	ND	U	10
	4-METHYL-2-PENTANONE	NE	NE	NE	1200	ND	U	10	52.8		50	57.5		50	ND	U	10	ND	U	5	ND	U	10	ND	U	10
	ACETONE	NE	NE	NE	14000	38.1		20	177		100	124		100	46.7		20	ND	U	10	173		20	32.6		20
	BENZENE	10	NE	5	0.45	ND	U	2	**1400**		10	**697**		10	0.544	J	2	ND	U	1	ND	U	2	ND	U	2
	CARBON DISULFIDE	NE	NE	NE	810	ND	U	2	ND	U	10	ND	U	10	ND	U	2	ND	U	1	4.7		2	ND	U	2
	CHLOROMETHANE	NE	NE	NE	190	ND	U	2	ND	U	10	ND	U	10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	DICHLORODIFLUOROMETHANE	NE	NE	NE	200	ND	U	4	ND	U	20	ND	U	20	ND	U	4	ND	U	2	ND	U	4	ND	U	4
	ETHYLBENZENE	750	NE	700	1.5	ND	U	2	423		10	79		10	6.79		2	ND	U	1	ND	U	2	5.69		2
	ISOPROPYLBENZENE	NE	NE	NE	450	10.1		2	54		10	26.4		10	10.2		2	ND	U	1	ND	U	2	9.87		2
	M,P-XYLENES	620	NE	10000	190	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	METHYL TERT-BUTYL ETHER	NE	NE	NE	14	ND	U	2	ND	U	10	ND	U	10	0.562	J	2	ND	U	1	ND	U	2	ND	U	2
	METHYLENE CHLORIDE	100	NE	5	11	ND	U	4	ND	U	20	ND	U	20	ND	U	4	ND	U	2	2.14	J	4	ND	U	4
	NAPHTHALENE	30	NE	NE	0.17	ND	U	4	**227**		20	**35.2**		20	ND	U	4	ND	UJ	2	ND	U	4	ND	UJ	4
	N-BUTYLBENZENE	NE	NE	NE	1000	0.734	J	2	12.7		10	ND	U	10	ND	U	2	ND	U	1	ND	U	2	0.635	J	2
	N-PROPYLBENZENE	NE	NE	NE	660	1.33	J	2	62.7		10	6.4	J	10	3.32		2	ND	U	1	ND	U	2	1.78	J	2
	O-XYLENE	620	NE	10000	190	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	P-ISOPROPYLTOLUENE	NE	NE	NE	NE	ND	U	2	10.2		10	33.5		10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	SEC-BUTYLBENZENE	NE	NE	NE	2000	1.1	J	2	ND	U	10	ND	U	10	1.54	J	2	ND	U	1	ND	U	2	1.49	J	2
	TERT-BUTYLBENZENE	NE	NE	NE	690	ND	U	2	ND	U	10	ND	U	10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	TOLUENE	750	NE	1000	1100	ND	U	2	**1760**		10	485		10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	TRICHLOROETHENE	100	NE	5	0.49	ND	U	2	ND	U	10	ND	U	10	ND	U	2	ND	U	1	ND	U	2	ND	U	2
	TRICHLOROFLUOROMETHANE	NE	NE	NE	1100	ND	U	4	ND	U	20	ND	U	20	ND	U	4	ND	U	2	ND	U	4	ND	U	4
	XYLENES	620	NE	10000	190	ND	U	6	**1520**		30	307		30	ND	U	6	ND	U	3	ND	U	6	ND	U	6
Gases (µg/L) Method EPA RSK175	ETHANE	NE	NE	NE	NE	0.44		0.2	4.6		0.2	14		0.2	0.87		0.2	ND	U	0.2	ND	U	0.2	0.57		0.2
	ETHYLENE	NE	NE	NE	NE	ND	U	0.2	11		0.2	10		0.2	0.49		0.2	ND	U	0.2	ND	U	0.2	0.24		0.2
	HYDROGEN (AM20GAX) (nM)	NE	NE	NE	NE	4.2		0.6	9.1		0.6	5.7		0.6	10		0.6	4.9		0.6	4.2		0.6	4.8		0.6
	METHANE	NE	NE	NE	NE	ND	U	0.5	4.6		0.5	45		0.5	3		0.5	ND	U	0.5	ND	U	0.5	5.8		0.5
SVOCs (µg/L) Method 8270D	1,1-BIPHENYL	NE	NE	NE	0.83	ND	U	4.85	12.9	J	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	1,2-DIPHENYLHYDRAZINE	NE	NE	NE	0.077	1.72	J	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	1-METHYL NAPHTHALENE	30	NE	NE	1.1	ND	U	4.85	**98.8**		50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	2,4-DIMETHYLPHENOL	5	NE	NE	360	ND	U	19.4	ND	U	200	ND	U	1000	ND	U	18.9	ND	U	19.2	ND	U	19.6	ND	U	18.9
	2-METHYLNAPHTHALENE	30	NE	NE	36	ND	U	4.85	**105**		50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	2-METHYLPHENOL	5	NE	NE	930	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	3-METHYLPHENOL AND 4-METHYLPHENOL	5	NE	NE	930	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	ACETOPHENONE	NE	NE	NE	1900	ND	U	4.85	796		50	2550		250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	BIS(2-ETHYLHEXYL)PHTHALATE	NE	NE	6	5.6	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	BUTYL BENZYL PHTHALATE	NE	NE	NE	16	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	CAPROLACTAM	NE	NE	NE	9900	8.42		4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	DIBENZOFURAN	NE	NE	NE	7.9	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	DIETHYL PHTHALATE	NE	NE	NE	15000	ND	U	4.85	ND	U	50	ND	U	250	1.43	J	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	FLUORANTHENE	NE	NE	NE	800	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	FLUORENE	NE	NE	NE	290	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	INDENO(1,2,3-CD)PYRENE	NE	NE	NE	0.034	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	ISOPHORONE	NE	NE	NE	78	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	NAPHTHALENE	30	NE	NE	0.17	ND	U	4.85	**142**		50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	PENTACHLOROPHENOL	5	NE	1	0.04	ND	U	19.4	ND	U	200	ND	U	1000	ND	U	18.9	ND	U	19.2	ND	U	19.6	ND	U	18.9
	PHENANTHRENE	NE	NE	NE	NE	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	PHENOL	5	NE	NE	5800	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72
	PYRENE	NE	NE	NE	120	ND	U	4.85	ND	U	50	ND	U	250	ND	U	4.72	ND	U	4.81	ND	U	4.9	ND	U	4.72

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
July - September 2015

					LOCATION CODE	KAFB-106075			KAFB-106076			KAFB-106079			KAFB-106082			KAFB-106088			KAFB-106091			KAFB-106094		
					SAMPLE NO.	GW2377[e,f,g]			GW2378[e,f]			GW2382[e,g]			GW2385[e,f]			GW2392[e,f,g]			GW2395[e,f,g]			GW2398[f]		
					SAMPLE DATE	26-Aug-15			1-Sep-15			31-Aug-15			27-Aug-15			19-Aug-15			24-Aug-15			19-Aug-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	480-500 FT			480-500 FT			484-504 FT			472-492 FT			460-480 FT			454-474 FT			484-504 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ
PAHs (µg/L) Method 8270D Low Detection Limit	1-METHYL NAPHTHALENE	30	NE	NE	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2-METHYLNAPHTHALENE	30	NE	NE	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORANTHENE	NE	NE	NE	800	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	FLUORENE	NE	NE	NE	290	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	INDENO(1,2,3-CD)PYRENE	NE	NE	NE	0.034	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NAPHTHALENE	30	NE	NE	0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PHENANTHRENE	NE	NE	NE	NE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	PYRENE	NE	NE	NE	120	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/L) Method 6010C	ARSENIC	0.1	NE	0.01	0.000052	ND	U	0.0025	0.00163	J	0.0025	ND	U	0.0125	ND	U	0.0025	ND	U	0.0025	ND	U	0.0025	ND	U	0.0025
	CALCIUM	NE	NE	NE	NE	66.4		5	49.8		5	108		25	76.7		5	40.2		5	44.7		20	59.2		5
	IRON, DISSOLVED	1	NE	NE	14	0.0632	J	0.1	0.401		0.1	**4.56**		0.1	0.352		0.1	0.0384	J	0.1	ND	U	0.1	0.685		0.1
	IRON, DISSOLVED (Method 6020A)	1	NE	NE	14	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	LEAD	0.05	0.01	0.015	0.015	ND	U	0.005	ND	U	0.005	ND	U	0.025	ND	U	0.005	ND	U	0.005	ND	U	0.005	ND	U	0.005
	MAGNESIUM	NE	NE	NE	NE	9.82		5	9.47		5	18.9	J	25	10.8		5	5.42		5	6.12	J	20	8.99		5
	MANGANESE, DISSOLVED	0.2	NE	NE	0.43	**0.878**		0.015	**1.29**		0.015	**5.52**		0.015	**0.73**		0.015	ND	U	0.015	0.0309		0.015	**0.942**		0.015
	MANGANESE, DISSOLVED (Method 6020A)	0.2	NE	NE	0.43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	POTASSIUM	NE	NE	NE	NE	2.96	J	5	2.34	J	5	3.39	J	25	3.36	J	5	2.29	J	5	2.54	J	20	2.96	J	5
	SODIUM	NE	NE	NE	NE	27.7		5	26.5		5	46.8		25	31		5	23.5		5	23.6		20	28.2		5
Anions (mg/L) Method E300.0	AMMONIA (AS N) (Method SM4500NH3BG)	NE	NE	NE	NE	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3	ND	U	0.3
	BROMIDE	NE	NE	NE	NE	ND	U	0.25	0.0931	J	0.25	0.752		0.25	0.68		0.25	0.0682	J	0.25	0.155	J	0.25	0.176	J	0.25
	CHLORIDE	250	NE	NE	NE	75.9		0.5	10.5		0.5	65.8		0.5	59.5		0.5	12.1		0.5	17.2	J+	0.5	20.4		0.5
	NITROGEN, NITRATE-NITRITE (Method E353.2)	10	4	10	NE	0.176	J	0.2	ND	U	0.2	ND	U	0.2	ND	U	0.2	0.196	J	0.2	ND	U	0.2	ND	U	0.2
	SULFATE	600	NE	NE	NE	56.1		2.5	4.66		2.5	13.8		2.5	67.5		2.5	35.1		2.5	39.4		2.5	48.6		2.5
	SULFIDE, TOTAL (Method SM4500S2CF)	NE	NE	NE	NE	ND	U	0.952	0.269	J	0.962	ND	U	0.962	ND	U	0.948	ND	U	0.948	ND	U	0.962	ND	U	0.976
Alkalinity (mg/L) Method SM2320B	ALKALINITY, BICARBONATE (AS CACO3)	NE	NE	NE	NE	148		1	210		1	363		1	187		1	142		1	135		1	191		1
	ALKALINITY, CARBONATE (AS CACO3)	NE	NE	NE	NE	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1	ND	U	1
Biological Parameters (cells/mL) Method QUANTARRAY	APS	NE	NE	NE	NE	57000		4.9	359000		6.1	501000		4.8	251000		4.9	59.2		5.4	14400		4.9	91800		4.9
	BVC	NE	NE	NE	NE	ND	U	0.5	ND	U	0.6	30		0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
	CFR	NE	NE	NE	NE	ND	U	4.9	78.3		6.1	ND	U	4.8	ND	U	4.9	ND	U	5.4	ND	U	4.9	ND	U	4.9
	DCA	NE	NE	NE	NE	ND	U	4.9	ND	U	6.1	ND	U	4.8	ND	U	4.9	ND	U	5.4	ND	U	4.9	ND	U	4.9
	DCAR	NE	NE	NE	NE	ND	U	4.9	ND	U	6.1	ND	U	4.8	ND	U	4.9	ND	U	5.4	ND	U	4.9	ND	U	4.9
	DCM	NE	NE	NE	NE	ND	U	4.9	ND	U	6.1	404		4.8	ND	U	4.9	ND	U	5.4	ND	U	4.9	ND	U	4.9
	DCMA	NE	NE	NE	NE	ND	U	4.9	ND	U	6.1	ND	U	4.8	ND	U	4.9	ND	U	5.4	ND	U	4.9	ND	U	4.9
	DECO	NE	NE	NE	NE	ND	U	4.9	ND	U	6.1	ND	U	4.8	ND	U	4.9	ND	U	5.4	ND	U	4.9	ND	U	4.9
	DHBT	NE	NE	NE	NE	41.7		4.9	627		6.1	13100		4.8	1590		4.9	ND	U	5.4	ND	U	4.9	118		4.9
	DHC	NE	NE	NE	NE	ND	U	0.5	3.2		0.6	44.5		0.5	1.2	J	0.5	ND	U	0.5	ND	U	0.5	0.9		0.5
	DHG	NE	NE	NE	NE	4760		4.9	71100		6.1	111000		4.8	4900		4.9	3000		5.4	1480		4.9	4980		4.9
	DSB	NE	NE	NE	NE	146		4.9	1610		6.1	6500		4.8	1070		4.9	75.3		5.4	39.9		4.9	829		4.9
	DSM	NE	NE	NE	NE	509		4.9	164		6.1	ND	U	4.8	132		4.9	74.1		5.4	66.2		4.9	66.2		4.9
Biological Parameters (cells/mL) Method QUANTARRAY (continued)	EBAC	NE	NE	NE	NE	788000		4.9	4530000		6.1	4110000		4.8	1370000		4.9	139000		5.4	379000		4.9	1300000		4.9
	ETNC	NE	NE	NE	NE	16.9		4.9	ND	U	6.1	ND	U	4.8	4.7	J	4.9	10.4		5.4	ND	U	4.9	6.4		4.9
	ETNE	NE	NE	NE	NE	98.2		4.9	ND	U	6.1	ND	U	4.8	17.4		4.9	40.2		5.4	ND	U	4.9	30.8		4.9
	MGN	NE	NE	NE	NE	129		4.9	408		6.1	128		4.8	178		4.9	14.3		5.4	4	J	4.9	15.7		4.9
	PHE	NE	NE	NE	NE	1040		4.9	12400		6.1	3310		4.8	2710		4.9	105		5.4	1770		4.9	497		4.9
	PMMO	NE	NE	NE	NE	3.4	J	4.9	4.6	J	6.1	10.3		4.8	38.6		4.9	2.5	J	5.4	0.2	J	4.9	12.6		4.9
	RDEG	NE	NE	NE	NE	745		4.9	12000		6.1	2050		4.8	2040		4.9	374		5.4	1360		4.9	925		4.9
	RMO	NE	NE	NE	NE	202		4.9	14700		6.1	1840		4.8	253		4.9	216		5.4	274		4.9	20.9		4.9
	SMMO	NE	NE	NE	NE	362		4.9	5110		6.1	4070		4.8	3070		4.9	437		5.4	74		4.9	74.9		4.9
	TCBO	NE	NE	NE	NE	ND	U	4.9	44.2		6.1	47.6		4.8	ND	U	4.9	ND	U	5.4	ND	U	4.9	ND	U	4.9
	TCE	NE	NE	NE	NE	ND	U	0.5	ND	U	0.6	0.9		0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
	TOD	NE	NE	NE	NE	63.9		4.9	606		6.1	1870		4.8	68.1		4.9	8.7		5.4	125		4.9	25		4.9
	VCR	NE	NE	NE	NE	ND	U	0.5	ND	U	0.6	2.3		0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5	ND	U	0.5
Field Parameters	Temperature (°C)	NE	NE	NE	NE		18.50			20.65			18.97			19.88			19.06			19.39			20.63	
	pH (S.U.)	NE	NE	NE	NE		7.56			7.31			6.10			7.44			7.74			7.81			7.39	
	Spec Cond (µS/cm2)	NE	NE	NE	NE		702.0			430.2			984			679.4			357.8			414.0			495.5	
	DO (mg/L)	NE	NE	NE	NE		0.26			0.00			0.15			1.37			0.70			6.30			0.28	
	ORP (mV)	NE	NE	NE	NE		-39.1			-303			-138.2			-171			20			94.3			-141	
	Turbidity (NTU)	NE	NE	NE	NE		0.80			1.91			3.31			0.98			0.31			0.93			2.35	
	Alkalinity (mg/L as CaCO3)	NE	NE	NE	NE		144			200			368			184			100			124			200	

Appendix D
Groundwater Analytical Results – EDB Attenuation Evaluation
July - September 2015

					LOCATION CODE	KAFB-106075			KAFB-106076			KAFB-106079			KAFB-106082			KAFB-106088			KAFB-106091			KAFB-106094		
					SAMPLE NO.	GW2377[e,f,g]			GW2378[e,f]			GW2382[e,g]			GW2385[e,f]			GW2392[e,f,g]			GW2395[e,f,g]			GW2398[f]		
					SAMPLE DATE	26-Aug-15			1-Sep-15			31-Aug-15			27-Aug-15			19-Aug-15			24-Aug-15			19-Aug-15		
					SAMPLE PURPOSE	REG			REG			REG			REG			REG			REG			REG		
					SAMPLE DEPTH	480-500 FT			480-500 FT			484-504 FT			472-492 FT			460-480 FT			454-474 FT			484-504 FT		
Chemical Class and Analytical Method[a]	Parameter	NMED Ground Water Protection Standards (Sec. 20.6.2.3103)[b]	NMED Approved Background[c]	EPA MCLs[b,d]	EPA Tap Water RSLs	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ	Result	VAL QUAL	LOQ

EPA MCL and tap water RSLs are from the EPA RSL Table, dated June 2015.
The NMED requirement for naphthalene of 30 ug/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.
The NMED requirement for phenols of 5 ug/L is a total concentration of 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, 2,4-dimethylphenol, 2,4-dinitrophenol, 2-chlorophenol, 2-methylphenol, 2-nitrophenol, 3 and 4-methylphenol, 2,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, 4-nitrophenol, and pentachlorophenol.
The NMWQCC standard and EPA MCL for m,p-xylene and o-xylene is for total xylenes.
The NMED requirement for naphthalene of 30 µg/L is a total concentration of naphthalene, 1-methylnaphthalene and 2-methylnaphthalene.
a. EPA analytical methods listed are for the most recent sampling event.
b. The WQCC regulation for PAHs of 30 µg/L is a total of the concentrations of naphthalene, 1-methylnaphthalene, and 2-methylnapthalene.
c. NMED-HWB Approved Background Concentrations, SNL/Kirtland AFB, Chemical Constituents in Ground Water.
d. EPA National Primary Drinking Water Standards - Maximum Contaminant Levels (MCLs), June 2015.
e. Bubbles were observed in water quality meter, tubing, and/or sample containers.
f. Sample was also collected for Quant Array, dissolved gases, and hydrogen. Hydrogen samples were collected using a bubble cell stripper.
g. Used YSI instead of In-Situ to collect water parameter readings.
h. Well was sampled for EDB only during the time-critical sampling event.
Shading indicates the analyte was detected.
Bold indicated analyte detected greater than regulatory standard.
°C = degrees Celcius
J = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL).
J+ = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased high.
J- = Estimated value, concentration is less than LOQ but greater than laboratory method detection limit (DL); biased low.
KAFB = Kirtland Air Force Base
µS/cm^2 = microsiemens per square centimeter
mg/L = milligram per liter
mV = millivolts
N/A = Not analyzed
ND = Not detected
No. = number
NR = Not recorded or reported due to operational error.
NTU = Nephelometric Turbidity Unit
RSL = Regional Screening Level
S.U. = Standard Unit
U = Analyte was not detected. The reported numerical value is at or below the LOQ.