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Mr. Tom Blaine, Manager
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Environmental Health Division
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Dear Mr. Blaine

Attached please find the Treatability Study Work Plan for performance of laboratory treatability testing related to remediation efforts at the Kirtland Air Force Base (AFB) Bulk Fuels Facility. This Work Plan describes the approach for performing the laboratory microcosm testing, including details related to sample collection, microcosm preparation and monitoring, analytical methods, reporting, and schedule.

Please contact Mr. L. Wayne Bitner at 505.853.3484 or at ludie.bitner@us.af.mil, or Mr. Scott Clark at 505.846.9017 or at scott.clark@us.af.mil, if you have any questions.

Sincerely

Heather Quingle

(FOR) TOM D. MILLER, Colonel, USAF
Commander

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40 CFR 270.11
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I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Heather L Pringle

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

This document has been approved for public release.

KIRTLAND AIR FORCE BASE
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April 23, 2014

Subject: Treatability Study Work Plan

I. Introduction

CB&I Federal Services, LLC (CB&I) presents this scope of work for performance of laboratory treatability testing related to remediation efforts at the Kirtland Air Force Base (AFB) Bulk Fuels Facility. Microcosm tests will be performed to assess the effectiveness of different amendments for enhancing removal of BTEX by biodegradation and EDB by biotic (biodegradation) and abiotic mechanisms. The primary focus of the treatability study will be anaerobic sulfate-enhanced degradation, and treatments designed to promote this activity will be evaluated, including (1) sulfate, (2) sulfate with ferrous iron, and (3) sulfate with ferrous iron and lactate. These treatments will be used to stimulate natural hydrocarbon degrading bacteria that can degrade both BTEX and EDB, and produce sulfide minerals to enhance abiotic EDB degradation (Kuder et al., 2012; Wilson et al., 2008). Other treatments evaluated during the study will include (4) augmentation with a known dehalogenating *Dehalococcoides* culture together with lactate to assess anaerobic degradation of EDB and (5) addition of oxygen to assess relative rates of anaerobic vs. aerobic degradation of plume constituents. Select treatments also will be evaluated with the addition of nitrogen and phosphorous to assess whether inorganic nutrients are required for enhanced biotreatment. These data will provide information on the most effective amendments for enhancing degradation of both BTEX and EDB in the NAPL zone and in areas adjacent to and downgradient of the NAPL zone that contain only dissolved BTEX and EDB. The following sections describe CB&I's approach for performing the laboratory microcosm testing, including details related to sample collection, microcosm preparation and monitoring, analytical methods, reporting, and schedule.

II. Sample Collection

Aquifer solids will be collected from two locations at Kirtland AFB. One site will be located ~ 50 ft upgradient of existing well KAFB-106079 which is in the center of the NAPL area and is expected to have high concentrations of BTEX and EDB. A new well (KAFB-106210) will be installed in this location. The second set of samples will be collected during the replacement of well KAFB-10612 with KAFB-10612R which, based on existing site data, is located on the edge of the existing BTEX plume and is expected to have been impacted by BTEX and EDB without the presence of NAPL. These latter samples will be used to evaluate the effect of amendments on dissolved phase BTEX and EDB without the potential confounding effects from NAPL materials that include repartitioning of BTEX and EDB from the NAPL into the dissolved phase.

Groundwater

Groundwater used for the laboratory testing will be collected from well KAFB-106079 for the NAPL-area microcosms and from well KAFB-10612R for the non-NAPL microcosms. The water will be collected using a Bennett pump according to procedures established in the Groundwater Investigation Work Plan (USACE, 2011) at Kirtland AFB and containerized in sterile stainless steel soda kegs (18.5 L) under a nitrogen headspace. CB&I routinely uses this type of soda keg for shipment and storage of its commercially produced anaerobic cultures. Collection of groundwater samples in these soda kegs will enable sufficient quantities of groundwater to be obtained and stored under anoxic conditions. During groundwater collection, field parameters (temperature, pH, dissolved oxygen, ORP, conductivity) will be recorded. Analysis of EDB , VOCs, dissolved gases, alkalinity and hardness, and anions will also be

conducted so that a comparison of contaminant concentrations in the well and in the soda kegs at the time of microcosm set-up is possible. Soda kegs will be filled to overflowing to eliminate headspace.

One soda keg of groundwater will be collected from each well. Upon collection, the soda kegs will be placed in coolers with ice and shipped overnight to CB&I's laboratory in Lawrenceville, NJ. Upon receipt, the soda kegs will be inspected and stored at 4°C.

Aquifer Solids

Aquifer solids used for the laboratory microcosm testing will be collected during construction of the new wells described above (KAFB-10612R and KAFB-106210). Soil samples will be collected using a coring device and preferably in acetate or aluminum sleeves depending on the recovery observed in the field. The core sleeves will be sectioned in the field to fit into shipping coolers, and the ends of each core will be labeled and sealed to limit intrusion of air during sample shipment and storage. A minimum of 4 kg of soil is required for this work, assuming processing losses that include sieving. Upon collection, the soil cores will be placed in a cooler with ice and shipped overnight to CB&I's laboratory in Lawrenceville, NJ, where the soil cores will be inspected and stored at 4°C.

III. Homogenization & Initial Characterization

Upon receipt of the samples, and prior to preparation of the microcosms, initial testing and characterization will be performed on the groundwater and soil from each location. This testing will be performed to evaluate baseline conditions, determine if non-aqueous phase liquid is likely present in the samples, and determine whether BTEX and EDB contaminant spikes will be required for microcosm testing.

Groundwater

Groundwater will be collected from each soda keg (1 per site) to perform the initial analyses. A nitrogen headspace will be maintained in the soda kegs during sample collection to limit aeration of the samples. Groundwater will be analyzed for the following (Table 1):

- Volatile organic compounds (VOCs)
- Dissolved gases
- EDB
- Alkalinity and hardness
- Anions

Analytical methods are provided in Table 1 and Section VI.

Aquifer Solids

To limit exposure to air, soil cores from each site will be transferred to a Coy anaerobic chamber filled with 5% $H_{2(g)}$ and 95% $N_{2(g)}$ prior to removing the end caps or sectioning. All subsequent soil preparation and sampling will be performed in the anaerobic chamber. Once removed from the sample sleeves, the soil will be visually inspected to describe mineralogy, texture, and type. Soil from each site will then be passed through a ¼" screen to remove stones and large particles. The sieved soil will next be thoroughly homogenized by hand using an iterative coning- and quartering-type technique. After homogenization is completed, soil samples for each site will be analyzed for the following (Table 1):

Table 1. Microcosm Treatments and Designation

Sample ID	Treatment	Replicates
Low Concentration		
Background L	None	2
1L (a-e)	*Killed Anaerobic Control*	5
2L (a-e)	*Killed Aerobic Control*	5
3L (a-e)	*Unamended Live Control*	5
4L (a-e)	*Oxygen*	5
5L (a-e)	*Sodium Sulfate:*	5
6L (a-e)	*Sodium Sulfate and Ferrous Chloride*	5
7L (a-e)	*Sodium Sulfate, Ferrous Chloride, and Sodium Lactate*	5
8L (a-e)	*Sodium Sulfate, Ferrous Chloride, Sodium Lactate, and SDC-9 Consortium*	5
9L (a-e)	*Anaerobic plus nutrients*	5
10L (a-e)	*Sulfate plus nutrients*	5
11L (a-e)	*Sodium Sulfate and Ferrous Chloride plus nutrients*	5
High Concentration		
Background H	None	2
1D (a-e)	*Killed Anaerobic Control*	5
2D (a-e)	*Killed Aerobic Control*	5
3D (a-e)	*Unamended Live Control*	5
4D (a-e)	*Oxygen*	5
5D (a-e)	*Sodium Sulfate:*	5
6D (a-e)	*Sodium Sulfate and Ferrous Chloride*	5
7D (a-e)	*Sodium Sulfate, Ferrous Chloride, and Sodium Lactate*	5
8D (a-e)	*Sodium Sulfate, Ferrous Chloride, Sodium Lactate, and SDC-9 Consortium*	5
9D (a-e)	*Anaerobic plus nutrients*	5
10D (a-e)	*Sulfate plus nutrients*	5
11D (a-e)	*Sodium Sulfate and Ferrous Chloride plus nutrients*	5

- VOCs
- EDB

Analytical methods are provided in Section VI.

IV. Microcosm Preparation & Monitoring

This section describes the experimental methodologies for the microcosm testing. Microcosms will be prepared in 160-mL glass serum bottles with Teflon®-lined butyl rubber septa and aluminum crimp caps. A total of 114 bottles will each receive 30 g of collected soils (57 with soil from the low contaminant area and 57 with soil from the NAPL area). Groundwater collected from KAFB-106079 containing high concentrations of NAPL constituents will be added to the 57 bottles with sediment from the NAPL area until a small headspace of approximately 1 mL remains. Groundwater collected from KAFB-10612R will be added to the remaining 57 bottles with soils from the low concentration area in the same manner. With this approach, it is expected that each bottle will contain approximately 150 mL of groundwater. The soil/water ratio may be reduced if recovery of aquifer solids is inadequate for the original design. Table 1 shows the treatments to be evaluated and the number of replicate samples prepared for each treatment.

Prior to setting up the study, two of the microcosms from each location (termed Background; Table 1) will be shaken for ~ 24 hr to establish equilibrium of contaminants between the solid and aqueous phase, and samples will be collected from each set and analyzed for BTEX and EDB. Rapid turnaround will be requested on these analyses. A BTEX mixture and/or EDB may be spiked into the microcosms from the low concentration area depending on the equilibrium data. In order to clearly quantify losses of key compounds with time, and to simulate likely conditions during a potential push-pull test in the non-NAPL area, BTEX and EDB concentrations of ~300-500 µg/L (of each individual BTEX component) and 1-3 µg/L (EDB), respectively, will be established in the microcosms via spiking from stock solutions of each. After spiking, the microcosms will be gently shaken again for ~24 hrs and VOCs and EDB will again be measured. If the samples are within the expected range, all remaining microcosms will receive the same total spike volume as the background microcosms, allowed to equilibrate for ~24 hrs, and then sampled for baseline values.

Using the 55 remaining bottles for each groundwater/soil type (high and low contaminant concentrations), five replicates of the following eleven treatments will be prepared.

Treatment 1. Killed Anaerobic Control—Bottles will be amended with mercuric chloride to a final concentration of 1000 mg/L to inhibit microbial activity. This treatment will be used to evaluate abiotic losses of BTEX and EDB (e.g., leakage from bottles, adsorption/desorption from soil).

Treatment 2. Killed Aerobic Control—20 mL of solution will be removed and the resulting gas headspace will be flushed with oxygen. Oxygen is used rather than air as it contains approximately five times more oxygen for a given volume than air alone. This will increase the mass of oxygen provided to the bottles and help minimize volatile losses of compounds as the gas headspace can be smaller and replenished less frequently. Bottles will be amended with mercuric chloride to a final concentration of 1000 mg/L to inhibit microbial activity. This treatment will be used to evaluate abiotic losses of BTEX and EDB (e.g., leakage from bottles, adsorption/desorption from soil).

Treatment 3. Unamended Anaerobic Live Control—Bottles will be prepared with the collected soil and groundwater. This treatment will be 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—20 mL of solution from these microcosms will be removed and the resulting headspace will be flushed with oxygen. Oxygen is used rather than air as it contains approximately five times more oxygen for a given volume than air alone. This will increase the mass of oxygen provided to the bottles and help minimize volatile losses of compounds as the gas headspace can be smaller and replenished less frequently. These microcosms will be used to evaluate oxygen as a terminal electron acceptor coupled to the degradation of BTEX and EDB, in contrast to the use of sulfate as the terminal electron acceptor in the other treatments. These microcosms will also help evaluate whether the presence of oxygen inhibits any potential anaerobic EDB degradation observed in treatments 3 and 9. Diammonium phosphate will be added to these bottles at 50 mg/L as a supplemental source of N and P.

Treatment 5. Sodium Sulfate—Bottles will be amended with sodium sulfate (Na_2SO_4) to a final initial concentration of 100 mg/L. This concentration may be adjusted based on the characterization of soils and groundwater described in Section III, because enough sulfate must be present to support biodegradation of BTEX and NAPL components by sulfate-reducing bacteria. If sulfate is completely depleted, this process will stop. Concentrations of sulfate may need to be increased in samples with NAPL or additional sulfate added with time. These microcosms will be used to evaluate whether sulfate stimulates degradation of BTEX and EDB in the microcosms. We anticipate significant consumption of BTEX compounds as sulfate is consumed as a terminal electron acceptor.

Treatment 6. Sodium Sulfate and Ferrous Chloride—Bottles will be amended with Na_2SO_4 to a final concentration of 100 mg/L and ferrous chloride ($FeCl_2$) to a final concentration of 100 mg/L. As with Treatment 5, these concentrations may be adjusted based on the characterization of soils and groundwater described in Section III. These microcosms will be used to evaluate whether ferrous iron (Fe^{2+}) aids the degradation of BTEX and EDB, either by protecting microorganisms by lowering potentially inhibitory concentrations of sulfide (S^{2-}) through the formation of FeS, or by abiotic degradation reactions from either S^{2-} or iron sulfide species (e.g., FeS).

Treatment 7. Sodium Sulfate, Ferrous Chloride, and Sodium Lactate—Bottles will be amended with Na_2SO_4 to final concentration of 100 mg/L, $FeCl_2$ to a final concentration of 100 mg/L, and sodium lactate to a final concentration of 100 mg/L. As with Treatment 5, these concentrations may be adjusted based on the characterization of soils and groundwater described in Section III. The addition of sodium lactate in this amendment will be used to evaluate whether stimulating organisms present in site soils with a high quality carbon and electron donor source enhances the degradation of BTEX and EDB. Diammonium phosphate will be added to these bottles at 50 mg/L as a supplemental source of N and P.

Treatment 8. Sodium Sulfate, Ferrous Chloride, Sodium Lactate, and SDC-9 Consortium—Bottles will be amended with Na_2SO_4 to final concentration of 100 mg/L, $FeCl_2$ to a final concentration of 100 mg/L, sodium lactate to a final concentration of 100 mg/L, and inoculated with SDC-9 consortium. As with Treatment 5, these concentrations may be adjusted based on the characterization of soils and groundwater described in Section III. The addition of SDC-9 will be used to evaluate whether augmenting site soils with a known dehalogenating consortium enhances the degradation of BTEX and/or EDB. Diammonium phosphate will be added to these bottles at 50 mg/L as a supplemental source of N and P.

Treatment 9. Anaerobic plus nutrients—Same set-up described for Treatment 3, but with diammonium phosphate added at 50 mg/L as a supplemental source of N and P.

Treatment 10. Sulfate plus nutrients—Same set-up described for Treatment 5, but with diammonium phosphate added at 50 mg/L as a supplemental source of N and P.

Treatment 11. Sodium Sulfate and Ferrous Chloride plus nutrients—Same set-up described for Treatment 6, but with diammonium phosphate as a supplemental source of N and P.

Three of the microcosms (designated replicate a,b, and c; Table 1) prepared for each treatment will be used to monitor BTEX, EDB, and dissolved gases, including ethane, ethene, and methane (anaerobic bottles only). The small volume of the microcosms will not allow measurement of TPH-GRO (which requires large sample sizes). Another of the treatment bottles (designated replicate d; Table 1) will be used to monitor electron acceptor (oxygen and sulfate) levels, dissolved iron, and pH. Volatile fatty acids (VFAs) will also be measured in the bottles with lactate added. Our experience has shown that the use of an extra microcosm for this purpose minimizes losses of contaminants in the treatment microcosms because the number of intrusions, either by piercing or removing the septa, is reduced. The fifth treatment bottle (designated replicate e; Table 1) will be used to collect split samples for VOCs to be analyzed by CB&I and an independent laboratory. Ten percent of samples will be split sampled in this manner. Initially, these split samples will focus on treatments 1, 3, 5, 9, and 10. While split sampling will complicate efforts at maintaining consistent solid/liquid ratios among all the microcosms, it will provide replicated laboratory analytical results as requested by NMED. Split samples will not be collected for EDB analyses as 100 % of these samples will be analyzed by an independent laboratory, as indicated in Table 2. Split samples will also not be collected for other parameters as they are not contaminants of concern and are intended solely to provide CB&I with information regarding the geochemical conditions of the microcosms. After all microcosm bottles have been prepared, the bottles will be placed on their sides in orbital shakers in a 15°C climate controlled walk-in incubator chamber.

As described earlier, a BTEX mixture and/or EDB may be spiked into microcosms if equilibration data from the initial background microcosms indicate this necessity. Time zero samples will be collected approximately 24 hrs after the microcosms are prepared. This 24-hr period allows for some initial equilibration among aqueous, vapor, and solid phases at the incubation temperature. Separate 8 mL (3 mL if higher concentrations allow) aqueous aliquots with no headspace will be collected from the triplicate bottles for the BTEX and EDB analyses. Samples will also be collected from the replicate d bottles for anions (2 mL), pH (3 mL) and for dissolved iron (2 mL). Sterile glass beads will be added to the anaerobic bottles after sampling so that a zero headspace is maintained.

BTEX, EDB, and dissolved gases in the triplicate bottles will be monitored monthly. This monitoring frequency may be adjusted pending observed rates of BTEX and EDB degradation in the bottles. To the extent possible, the monitoring schedule will be adjusted to capture the degradation kinetics of each compound. A total of up to 6 VOC and EDB sampling events over a 5-month period are planned (an interim update will be provided by conference call after 2 months), but the length of the incubations will be extended if necessary to fully evaluate the fate of VOCs and EDB.

The replicate bottles used for oxygen, iron, pH, and sulfate monitoring will initially be sampled bi-weekly to estimate sulfate and oxygen consumption rates in the treatments, respectively. The frequency of this sampling will be revised pending initial observations of decay rates. When oxygen concentrations in microcosm headspaces decrease below 6% or when sulfate concentrations decrease to approximately 25 mg/L or less, all bottles of the corresponding treatment will be re-amended with electron acceptor so that the appropriate conditions for biodegradation can be maintained. Amendment of additional lactate in appropriate bottles will also be considered if levels of lactate decline to < 25 mg/L based on VFA analysis. If electron acceptor decay rates are higher than anticipated, an increased electron acceptor dosage (i.e., greater than 100 mg/L) will be considered. Amendment with additional inorganic nutrients also will be considered in the NAPL-area microcosms over time. If pH in the samples decreases below 4.5, pH adjustment will be considered based on degradation data.

At the final sampling event, both soil and groundwater in the triplicate samples will be analyzed for EDB and VOCs to evaluate mass removal in the soil phase. If initial soil sampling results (Section IIIB) indicated that EDB and BTEX were not present in the soil phase, this final soil sampling event may not be performed. Final pH and anion concentrations will be determined for each sample.

V. Data analysis and decision making

The primary goal of this laboratory treatability test is to evaluate: 1) whether anaerobic degradation of BTEX and EDB is occurring at the site; and, 2) whether the addition of electron donors, nutrients, or other amendments can enhance biodegradation (or abiotic degradation) of BTEX and EDB. Consequently, the test design incorporates killed control samples to confirm that changes in contaminant concentrations are due to biological activity, and treatment replication to allow statistical comparison of the results. Thus, data will be compared by performing Student-t tests at the end of the testing to compare contaminant degradation in the control microcosms relative to the various treatment microcosms. A statistically supported difference ($P<0.05$) between the treatment and the control will demonstrate which treatment(s) enhanced contaminant degradation.

A second goal of this testing is to evaluate whether the BTEX compounds and EDB can be degraded to their respective MCL levels in the non-NAPL area. Thus, contaminant concentrations in these microcosms at the end of the test will be compared to their MCL level to determine whether this goal has been achieved. Minimum Detection Limits for BTEX may be higher in the NAPL area bottles because sample dilution may be required prior to analysis by GC-MS.

A third goal of the test is to evaluate BTEX and EDB degradation rates. Although degradation rates observed in microcosms may not correspond precisely to field degradation rates, they are useful for assessing the relative rates of degradation of the various contaminants, and they allow comparisons to rates measured in other similar studies and field applications. Thus, where possible, first-order or zero-order degradation rate constants will be calculated by regression analysis for the primary contaminants in the microcosms, and these rates will be statistically compared among the treatments using Students t-test and/or ANOVA tests.

The decision to transition the tested treatment approaches to the field will be made based on: 1) statistically significant evidence of enhanced biological removal of BTEX constituents and EDB (and/or abiotic removal of EDB) in treatments compared to the live and killed controls; or, 2) demonstrated ability to achieve MCL levels for the primary contaminants of concern in the non-NAPL area; or, 3) demonstration of BTEX and/or EDB degradation half-lives with timescales of years or faster, instead of decades or slower, that would indicate possible successful field treatments over longer time periods than can practically be evaluated in laboratory testing.

VI. Analytical Methods

The analytical method, sample matrix and volume, and performing laboratory for the analytical methods employed in this study are presented in Table 2. Microcosms will be sampled for VOCs, EDB, dissolved gases, oxygen (select bottles only), VFAs (select bottles only), anions, and dissolved iron (select sampling points).

Table 2. Analytical Methods

Analysis	Method	Matrix	Approx. Sample Volume	Lab
VOCs	GC-MS (EPA Method 8260)	Aqueous Soil	8 mL 20 – 40g	CB&I 10 % of aqueous samples split and analyzed by Empirical Laboratories, LLC
EDB	EPA Method 8011	Aqueous	8 mL	100 % Empirical Laboratories, LLC
Oxygen	TCD	Headspace	10 – 200 µL	CB&I
Dissolved gases	EPA Method 3810, RSK-175	Aqueous	2 mL	CB&I
VFAs	EPA 300m	Aqueous	1 mL	CB&I
Anions (includes sulfate)	IC (EPA Method 300)	Aqueous	2 mL	CB&I
Dissolved iron (in microcosms)	Hach Kit	Aqueous	2 mL	CB&I
pH	probe	Aqueous	3 mL	CB&I
Hardness	EPA Method 130.2	Aqueous	50 mL	CB&I
Alkalinity	EPA Method 310.1	Aqueous	100 mL	CB&I

GC Gas Chromatograph
IC Ion Chromatography
MS Mass Spectrometer
TCD Thermal Conductivity Detector

VII. Reporting

An interim report will be provided two months after the start of the testing and a detailed final report will be prepared and submitted within one month after the laboratory testing is complete, and after all analytical data has been attained. The report will be in the form of a technical memorandum, and will consist of the following:

- A full descriptions of the actual sample collection and processing
- A description of the experimental approach and methods, including microcosm testing procedures and data evaluation that is conducted
- Tables and/or figures summarizing results (it is assumed that detailed analytical reports and data packages will not be required)
- Calculation of biodegradation rates, if appropriate
- Conclusions and recommendations and laboratory analytical reports with a discussion of any data quality exceptions.

VIII. Final Workplan Development

To accelerate the project schedule, CB&I proposes to submit the draft Work Plan to NMED, Kirtland AFB and USACE simultaneously, and to have a technical meeting while the Work Plan is under review. Following the meeting and receipt of comments, CB&I will address any questions, comments, or concerns regulators or other reviewers may have with the proposed scope of work. Two local meetings/phone conferences with NMED, Kirtland AFB and USACE are assumed.

IX. Schedule

An estimated schedule for microcosm study is provided in Table 3. Upon receipt of the selected soil and groundwater samples at CB&I's Laboratory in Lawrenceville, New Jersey, we anticipate that the microcosms will be prepared within approximately 4 weeks. This 4-week period will be used to perform initial soil and groundwater analyses, homogenize the soil, and obtain any necessary supplies and materials needed for the study. As discussed in Section IV, up to a five month duration is planned for the microcosm testing. However, extension of the study beyond this 5 month period may be necessary to fully evaluate the fate of BTEX and EDB. CB&I expects to receive all final analytical results within 4 weeks of the end of the study. Allowing one month for preparation of the final report, final report submission is expected within 8 months of receipt of samples. CB&I will communicate preliminary data with NMED and other parties via conference call after the 2-month sample results are available and as required to make relevant decisions concerning follow-on push-pull testing.

Table 3. Estimated Project Schedule

Event	April				May				June				July				August				September				October				November				December			
Collect samples			■	■	■	■	■	■																												
Prepare and set-up microcosms					■	■	■	■	■																											
Collect t=0 samples/spike								■																												
Monthly sampling									■				■				■				■				■				■							
Interim project update - phone																				■																
Final project report																																				■

X. References

Kuder, T., J. T. Wilson, P. Philip, and Y. T. He. 2012. Carbon isotope fractionation in reactions of 1,2-dibromoethane with FeS and hydrogen sulfide. Environ. Sci. Tehcnol. 46:7495-7502.

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

Wilson, J.T., K. Banks, R.C. Earle, Y. He, T. Kuder, and C. Adair. 2008. Natural attenuation of the lead scavengers 1,2-dibromoethane (EDB) and 1,2-dichloroethane (1,2-DCA) at motor fuel release sites and implications for risk management. Office of research and Development, National Risk Management research Laboratory, Ada, OK. EPA 600/R-08/107.