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

ENTERED

JUL 2 3 2018

Colonel Richard W. Gibbs, USAF
Commander
377th Air Base Wing
2000 Wyoming Blvd SE
Kirtland AFB NM 87117

RECEIVED
JUL 26 2018
NMED
Hazardous Waste
Bureau

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

Dear Mr. Kieling

Please find attached the *Phase 3 Ethylene Dibromide In Situ Biodegradation Pilot Test Notification Letter, Bulk Fuels Facility, Kirtland Air Force Base, New Mexico*, dated July 2018. This notification letter outlines the updates to the third phase (Phase 3) of the pilot study in accordance with the approved *Ethylene Dibromide In Situ Biodegradation Pilot Test Work Plan, Bulk Fuels Facility, Kirtland Air Force Base, New Mexico*, dated October 2016.

If you have any questions or concerns, please contact Mr. Scott Clark at (505) 846-9017 or at scott.clark@us.af.mil.

Sincerely

Richard W. Gibbs

RICHARD W. GIBBS, Colonel, USAF
Commander

Attachment:
Phase 3 Ethylene Dibromide In Situ Biodegradation Pilot Test Notification Letter

cc:
NMED-OOTS (McQuillan), letter and CD
NMED GWQB (Hunter), letter and CD
EPA Region 6 (King, Ellinger), letter and CD
SAF-IEE (Lynnes), electronic only
AFCEC/CZ (Renaghan, Clark, Kottkamp), electronic only
USACE-Omaha District Office (Ellender), electronic only
USACE-ABQ District Office (Phaneuf, Dreeland), electronic only
Public Info Repository, Administrative Record/Information Repository (AR/IR) and File

KAFB4687

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July 19, 2018

Subject: Phase 3 Ethylene Dibromide In Situ Biodegradation Pilot Test Notification Letter, Bulk Fuels Facility, Kirtland Air Force Base, New Mexico

This Phase 3 Ethylene Dibromide (EDB) In Situ Biodegradation Pilot Test notification letter has been prepared by Aptim Federal Services, LLC (APTIM) for the U.S. Army Corps of Engineers (USACE), Omaha District, under Contract No. W9128F-12-D-0003, Task Order 0025. This notification letter outlines an update to the third phase (hereby referred to as Phase 3) of the pilot test, which was agreed upon during a technical meeting among APTIM, the New Mexico Environment Department (NMED), the Secretary of the Air Force (SAF), the Air Force Civil Engineer Center (AFCEC), and the USACE on June 7, 2018.

As discussed in the NMED-approved EDB In Situ Biodegradation Pilot Test Work Plan (Work Plan) (USACE, 2016), Phase 3 originally included a recirculation period that consisted of biostimulation and bioaugmentation. The Work Plan proposed that the biostimulation-portion of Phase 3 be similar to Phase 2 and that the SDC-9 bioaugmentation culture would be injected into Kirtland Air Force Base (KAFB)-106IN1 and distributed with the recirculation system. The approved Work Plan also states in Section 3.4.1 that implementation of each phase may be altered and/or skipped after evaluation of results from previous phases. After evaluating analytical data from the passive period for the second phase (Phase 2), it is evident that the rate of anaerobic biodegradation of EDB has been significantly enhanced as a result of biostimulation, and that bioaugmentation is not warranted at this time. Analytical results from the passive period of Phase 2 are discussed in the subsequent section.

Phase 2 Passive Period Analytical Results

The passive period of Phase 2 began in early February 2018. Three planned and one additional groundwater sampling event were conducted at the end of each month during the Phase 2 passive period. Analytical data for the first three sampling events have been validated and evaluated. There is strong evidence of anaerobic EDB biodegradation resulting from native dehalogenating organisms. Analytical results for the Phase 2 sampling events (including both recirculation and passive periods) are presented in Table 1 and are briefly summarized below. Table 1 also includes analytical data from baseline and Phase 1 passive period samples for comparison.

Concentrations of EDB have decreased significantly at two shallow groundwater monitoring (GWM) wells (KAFB-106MW2-S and KAFB-106064) and are no longer detectable at the injection well (KAFB-106IN1). EDB concentrations at KAFB-106MW2-S have decreased three orders of magnitude, from 77.7 to 0.033 (J-qualified) micrograms per liter (µg/L), since the period of active recirculation in Phase 2. This GWM well is located closest to the injection well at approximately 25 feet to the southwest. EDB concentrations in KAFB-106064 have decreased by one order of magnitude, from a maximum of 80.3 µg/L during active recirculation to 6.2 µg/L during the recent passive sampling event in May 2018.

The remaining shallow GWM well (KAFB-106MW1-S) and extraction well KAFB-106EX1 have also exhibited notable decreases in EDB concentrations, while relatively stable EDB concentrations have

been observed at the second extraction well (KAFB-106EX2). Concentration trends of EDB throughout the pilot test are presented in Figure 1.

Several dehalogenating bacteria are present in GWM, extraction, and injection wells, including *Dehalobacter* spp. (DHBt), *Desulfitobacterium* spp. (DSB), and *Dehalogenimonas* spp. (DHG). These dehalogenating organisms utilize molecular hydrogen as an electron donor and various halogenated compounds, including EDB, as electron acceptors, and are likely to be facilitating EDB degradation.

Due to the initial success of biostimulation, a second biostimulation phase will be performed rather than bioaugmentation as originally proposed in the Work Plan (USACE, 2016). Based upon the current field results, which indicate that native dehalogenating bacteria are effectively degrading EDB in the subsurface, bioaugmenting with an exogenous dehalogenating culture (SDC-9) does not appear necessary at this time.

This additional biostimulation phase (Phase 3) will be conducted similarly to Phase 2, which consisted of a recirculation phase in which sodium lactate and diammomium phosphate were injected into groundwater, and a subsequent passive monitoring period. Active recirculation is anticipated to take approximately 1 month. After active recirculation, groundwater will be monitored for approximately 3 to 4 months. The sample regimen for Phase 3 will be in accordance with the NMED-approved EDB In Situ Biodegradation Pilot Test Work Plan (USACE, 2016).

References

USACE. 2016. *Ethylene Dibromide In Situ Biodegradation Pilot Test Work Plan, Bulk Fuels Facility, Kirtland Air Force Base, New Mexico*. Prepared by CB&I Federal Services, LLC. for the USACE Albuquerque District under USACE Contract No. W9128F-12-D-0003, Task Order 0025. December.

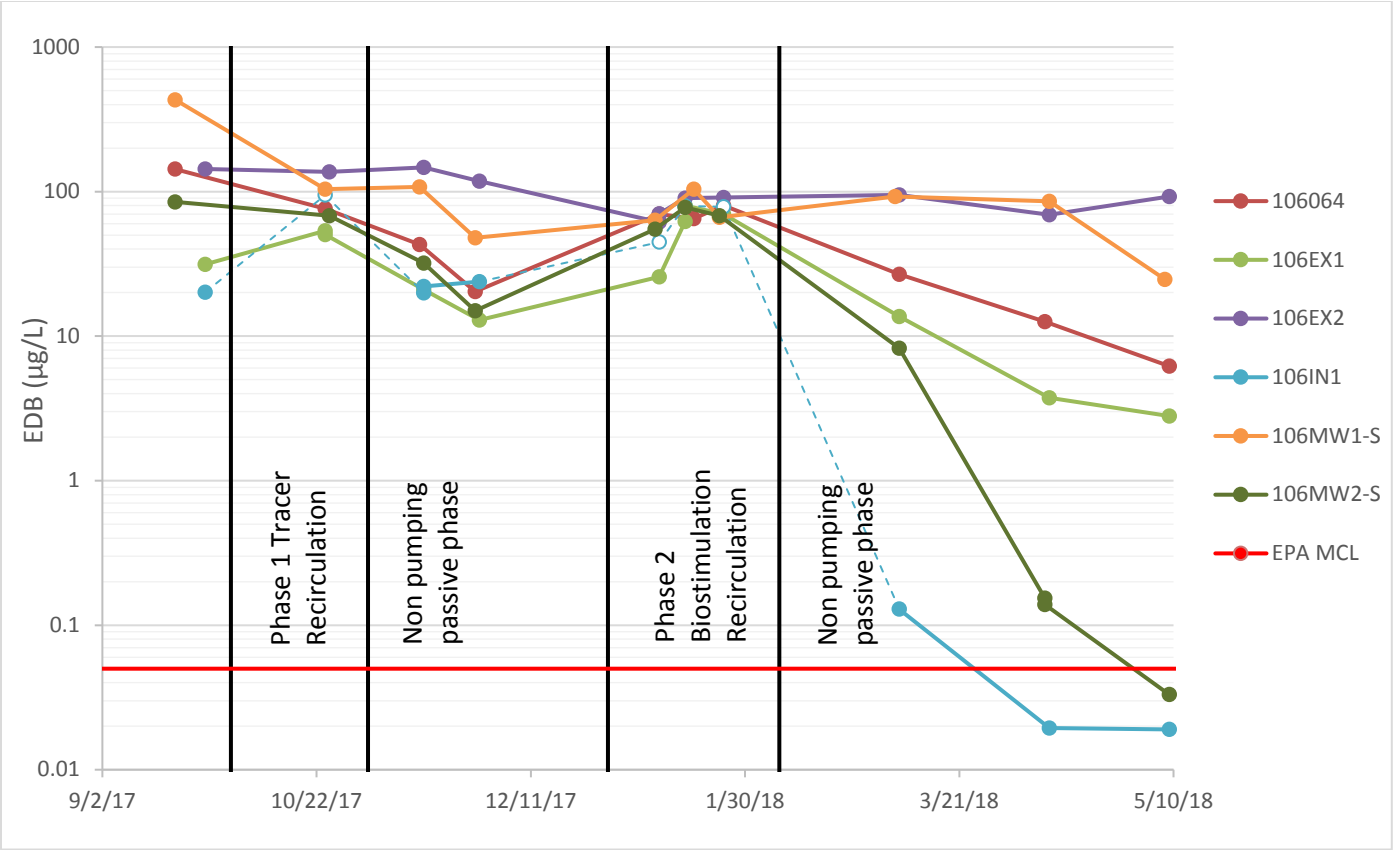

Figure 1. EDB Concentrations (Note: 106IN1 concentrations during recirculation phases are calculated from the flow-weighted average of the concentrations from 106EX1 and 106EX2)

Table 1. Analytical Data

Well ID	Sample Date	Sample Name	EDB (µg/L)	Benzene (µg/L)	Ethyl-benzene (µg/L)	Toluene (µg/L)	Xylenes (µg/L)	Isopropyl-benzene (µg/L)	Methane (µg/L)	Ethane (µg/L)	Ethene (µg/L)	DHBt (cells/mL)	DHG (cells/mL)	DSB (cells/mL)
KAFB-106064	9/19/2017	106064-BL-091917	143	4,730	577	7,330	2,010	51.5	179	1.65 J	17.80	4.25E+04	ND	2.82E+04
	10/24/2017	106064-P1R-102417	76	3,140	894	7,540	3,350	77.9	1.9 J	ND	3.18 J	--	--	--
	11/15/2017	106064-P1P-111517	43.1	3,850	1,470	16,900	4,270	149	11.4	ND	3.46 J	--	--	--
	11/28/2017	106064-P1P-112817	20.3	3,680	2,040	19,500	5,730	192	20.5	ND	5.07	8.42E+04	ND	1.03E+05
	1/10/2018	106064-P2R-011018	69.9	3,950	1,010	9,200	3,180	97.4 J	15.0	2.01 J	6.46	--	--	--
	1/18/2018	106064-P2R-011818	65	3,700	956	9,850	3,020	89.1 J	16.5	1.82 J	ND	--	--	--
	1/25/2018	106064-P2R-012518	80.3 J+	4,070	1,180	11,300	3,740	96.8 J	25.3	2.86 J	9.47	1.19E+05	ND	8.97E+04
	3/7/2018	106064-P2P-030718	26.8	4,010	1,810	15,000	5,320	193 J	141	3.10 J	11.50	--	--	--
	4/10/2018	106064-P2P-041018	12.6	3,380	1,960	12,100	5,290	248	191	4.50	12.93	--	--	--
	5/9/2018	106064-P2P-050918	6.2	3,490	1,660	13,900	5,130	202	601	4.50	11.00	1.32E+05	1.11E+03	6.49E+04
KAFB-106MW1-S	9/19/2017	106MW1S-BL-091917	432	9,160	1,350	13,900	5,480	113	ND	2.48 J	6.35	1.29E+04	ND	1.22E+05
	10/24/2017	106MW1S-P1R-102417	104	3,630	1,130	9,330	4,380	93.2	1.01 J	ND	3.07 J	--	--	--
	11/15/2017	106MW1S-P1P-111517	108	4,720	1,120	11,700	3,910	84.4	ND	ND	ND	--	--	--
	11/28/2017	106MW1S-P1P-112817	47.8	3,800	1,100	11,100	4,060	92.6	ND	ND	ND	2.52E+05	ND	1.40E+06
	1/9/2018	106MW1S-P2R-010918	63.5	3,470	1,150	8,310	3,380	95.7	1.92 J	1.64 J	6.25	--	--	--
	1/18/2018	106MW1S-P2R-011818	104 J	3,530	974	8,480	3,250	85.0 J	2.13	1.63 J	6.20	--	--	--
	1/24/2018	106MW1S-P2R-012418	66.4	3,490	1,110	9,110	3,710	89.5 J	3.46	2.22 J	7.84	6.17E+04	3.45E+02	8.25E+04
	3/6/2018	106MW1S-P2P-030618	92.5	8,100	1,360	16,000	4,420	87.6 J	19.3	3.85 J	11.57	--	--	--
	4/11/2018	106MW1S-P2P-041118	85.5	8,920	1,360	14,900	4,260	114 J	25.4	4.70	18.57	--	--	--
	5/8/2018	106MW1S-P2P-050818	24.7	6,100	1,560	16,700	5,320	113 J	25.37	5.65	14.46	7.05E+04	2.76E+02	2.07E+04
KAFB-106MW2-S	9/19/2017	106MW2S-BL-091917	84.9	586	209	1,540	1,690	116	19.0	4.08	19.20	1.29E+05	ND	1.29E+05
	10/25/2017	106MW2S-P1R-102517	68.0	2,730	512	4,740	1,970	47.0	ND	ND	ND	--	--	--
	11/16/2017	106MW2S-P1P-111617	32.1	2,650	468	3,580	1,680	90.2	30.1	ND	9.56	--	--	--
	11/28/2017	106MW2S-P1P-112817	15.0	2,870	582	4,210	2,070	132	351	ND	6.53	1.50E+04	ND	4.31E+04
	1/9/2018	106MW2S-P2R-010918	54.9	3,240	729	6,070	2,240	77.5	11.3	2.02 J	6.34	--	--	--
	1/16/2018	106MW2S-P2R-011618	77.7	3,430	739	7,440	2,430	73.6 J	8.47	1.80 J	6.12	--	--	--
	1/24/2018	106MW2S-P2R-012418	68.1	3,820	912	8,920	2,900	101	12.4	1.59 J	5.73	6.72E+04	3.70E+02	3.98E+04
	3/7/2018	106MW2S-P2P-030718	8.25	3,240	677	6,980	2,160	139	3,110	1.70 J	8.90	--	--	--
	4/10/2018	106MW2S-P2P-041018	0.139	2,360	628	5,440	1,870	150	11,800	1.02 J	5.50	--	--	--
	5/9/2018	106MW2S-P2P-050918	0.0331 J	1,680	506 J-	3,600	1510 J-	134	11,800	0.95 J	3.45 J	5.85E+04	6.49E+03	2.33E+04
KAFB-106EX1	9/26/2017	106EX1-BL-092617	31.3	2,090	797	6,300	2,590	58.0	14.3	ND	3.08 J	8.74E+04	ND	3.70E+05
	10/24/2017	106EX1-P1R-102417	53.6	2,910	688	5,610	2,470	61.4	1.02 J	ND	3.07 J	--	--	--
	11/16/2017	106EX1-P1P-111617	21.0	1,950	437	4,230	1,490	40.2	0.81 J	ND	2.77 J	--	--	--
	11/29/2017	106EX1-P1P-112917	12.9	2,080	477	4,420	1,690	49.0	2.49	ND	5.17	1.25E+05	ND	3.31E+05
	1/10/2018	106EX1-P2R-011018	25.7	3,750	815	8,190	2,760	63.4 J	2.33	1.74 J	6.91	--	--	--
	1/16/2018	106EX1-P2R-011618	62.2	3,940	919	9,220	2,860	71.2 J	2.92	2.66 J	8.34	--	--	--
	1/25/2018	106EX1-P2R-012518	69.7 J+	3,950	963	9,550	3,190	76.1 J	3.51	2.36 J	9.04	1.18E+05	ND	1.61E+05
	3/7/2018	106EX1-P2P-030718	13.7	3,110	811	7,660	2,430	99.9 J	22.9	2.40 J	9.00	--	--	--
	4/11/2018	106EX1-P2P-041118	3.74	2,490	786	6,280	2,180	122	63.2	2.17 J	7.28	--	--	--
	5/9/2018	106EX1-P2P-050918	2.80	3,410	866	7,660	2,680	125	103	3.18 J	11.4	2.28E+05	3.47E+03	7.44E+04

Table 1. Analytical Data

Well ID	Sample Date	Sample Name	EDB (µg/L)	Benzene (µg/L)	Ethyl-benzene (µg/L)	Toluene (µg/L)	Xylenes (µg/L)	Isopropyl-benzene (µg/L)	Methane (µg/L)	Ethane (µg/L)	Ethene (µg/L)	DHBt (cells/mL)	DHG (cells/mL)	DSB (cells/mL)
KAFB-106EX2	9/26/2017	106EX2-BL-092617	143	3,270	692	6,600	2,350	52.5	4.08	2.63 J	2.54 J	1.17E+05	ND	6.69E+04
	10/25/2017	106EX2-P1R-102517	137	3,370	597	6,890	2,310	51.4	ND	ND	ND	--	--	--
	11/16/2017	106EX2-P1P-111617	147	3,250	594	6,480	2,120	47.3	ND	ND	ND	--	--	--
	11/29/2017	106EX2-P1P-112917	118	3,660	689	6,940	2,330	56.9	1.46	1.76 J	1.81 J	6.15E+04	ND	7.59E+04
	1/10/2018	106EX2-P2R-011018	61.4	4,260	882	8,070	2,870	66.3 J	1.60 J	1.56 J	3.10 J	--	--	--
	1/16/2018	106EX2-P2R-011618	90.1	4,070	855	8,410	2,680	66.4 J	2.15	2.25 J	3.92 J	--	--	--
	1/25/2018	106EX2-P2R-012518	90.9 J+	4,250	994	9,530	3,020	74.4 J	2.64	2.41 J	4.70 J	3.21E+05	ND	4.14E+05
	3/7/2018	106EX2-P2P-030718	94.8	4,180	923	8,630	2,850	91.7 J	6.94	3.20 J	5.30	--	--	--
	4/11/2018	106EX2-P2P-041118	69.0	3,940	954	7,640	2,910	109	15.2	5.10	7.05	--	--	--
	5/9/2018	106EX2-P2P-050918	92.5	4,170	898	7,640	2,950	104	30.4	6.80	9.60	1.40E+05	1.11E+03	5.70E+04
KAFB-106IN1	9/26/2017	106IN1-BL-092617	20.1	1,930	696	2,730	1,640	49.5	1.49 J	0.94 J	4.36 J	1.55E+05	ND	1.37E+06
	11/16/2017	106IN1-P1P-111617	19.9	2,950	576	6,210	1,790	57.5	18.0	ND	4.04 J	--	--	--
	11/29/2017	106IN1-P1P-112917	23.8	2,970	601	5,540	1,930	70.2	354	1.54 J	6.02	4.59E+04	ND	8.40E+04
	3/7/2018	106IN1-P2P-030718	0.129	3,660	1,750	8,330	2,620	147	8,200	1.90 J	5.00	--	--	--
	4/11/2018	106IN1-P2P-041118	ND	2,880	976	6,460	2,590 J-	194	12,400	0.66 J	2.50	--	--	--
	5/9/2018	106IN1-P2P-050918	ND	2,990	1,270	6,840	2,750	238	10,800	0.65 J	1.73 J	1.38E+06	1.28E+04	3.92E+05

Notes:
-- = sample was not analyzed for parameter
µg/L = micrograms per liter
BL = indicates a baseline sample
cells/mL = cells per milliliter
EDB = ethylene dibromide
EX = extraction well
ID = identification
IN = injection well
J = estimated value, concentration is less than LOQ but greater than laboratory method detection limit
J+ = estimated value, concentration is less than LOQ but greater than laboratory method detection limit; biased high
J- = estimated value, concentration is less than LOQ but greater than laboratory method detection limit; biased low
KAFB = Kirtland Air Force Base
LOQ = limit of quantitation
MW = monitoring well
ND = result was not detected
P1P = indicates a Phase I Passive sample
P2P = indicates a Phase 2 Passive sample
P2R = indicates a Phase 2 Recirculation sample