

October 8, 2020

Mr. Jason Wilson, Chief
c/o Mrs. Brandi Little
Governmental Hazardous Waste Branch Land Division
Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, Alabama 36130-1463

Subject: Response to ADEM Review and Evaluations dated August 24, 2020 for the
*Corrective Measures Effectiveness Report, January 2020 Monitoring Event Former
Chemical Laundry and Motor Pool Area 1500, Parcel 94(7)* dated August 3, 2020

Dear Mr. Wilson,

On behalf of the McClellan Development Authority (MDA), Matrix Environmental Services, LLC (MES) is pleased to submit responses to ADEM Evaluations dated August 24, 2020 for the *Corrective Measures Effectiveness Report, January 2020 Monitoring Event* for the Former Chemical Laundry and Motor Pool Area 1500, Parcel 94(7) dated August 2020.

Two hard copies and one electronic copy of the document have been provided to Mrs. Brandi Little. Please contact me at (256) 847-0780 (Anniston) or (770) 594-0331 (Atlanta) should you have any questions or comments.

Sincerely,

Matrix Environmental Services, LLC



Richard Satkin, P.G.
McClellan Program Manager

Enclosures

CC: Mrs. Brandi Little, ADEM (two paper copies and one electronic copy)
Mr. Jason Odom, MDA (transmittal letter only)
Lisa Holstein, U.S. Army (one paper copy)
MES Project Files

Response to ADEM Review and Comments dated August 24, 2020

RE: *Corrective Measures Effectiveness Report January 2020 Monitoring Event Former Chemical Laundry and Motor Pool Area 1500, Parcel 94(7);* dated August 3, 2020

Specific Comment 1

Page 5-1, Section 5.3. MDA states that trichloroethene (TCE) concentrations appear to increase when groundwater elevation are above 782 feet mean sea level and that the fluctuations in TCE concentrations suggest potential flushing of contaminants from a subsurface residual source. MDA also states that the type of variation of the concentration data is typical of the variation seen at many other chlorinated solvent sites where released materials are trapped or sequestered within the subsurface. According to the Environmental Protection Agency's Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater (1998), removal, treatment or containment of non-aqueous-phase liquids (NAPLs) may be necessary for monitored natural attenuation (MNA) to be a viable remedial option or to decrease the time needed for natural processes to attain site-specific remediation objectives. ADEM requests that MDA conduct an investigation to determine if a residual source is present at this site. The findings of this investigation should be submitted in a separate report. Depending on the results of the investigation, MDA may need to evaluate the need for additional or alternate corrective actions to address the exceeding/fluctuating groundwater concentrations at this site. Please discuss.

MDA Response:

The statement made in our response to comments dated August 3, 2020 was specifically “Instead, when groundwater elevations are above 782 feet, TCE concentrations appear to rise which suggests potential flushing of contaminants from a subsurface residual.”

We deliberately avoided using the word “source” in this statement because it can lead to confusion over the origin of the contaminants that are causing the observed increase in dissolved concentration. Specifically, in the case of dense non-aqueous phase liquids (DNAPL) contaminants at a site as long-standing as the former Chemical Laundry and Motor Pool, it is unlikely that there is a pocket or pool or “blob” of phase separate contamination remaining on site which is the anticipated condition when the word “source” is used. Instead, it is likely that there is some residual phase separated and absorbed contaminant present in and around the unknown location of the original release. To further explore this condition, it is helpful to briefly review what we know about the behavior of DNAPL.

When dealing with the challenges presented by DNAPL in the subsurface environment it is helpful to understand the physical and chemical behavior of DNAPL and the concept referred to as back diffusion. Friedrich Schwillie, PhD performed important research into the behavior of chlorinated hydrocarbons (CHC) during the 1970s and 1980s. The results of his experiments were translated to English and published in 1988 and helped formed the basis for our concepts of phase separate behavior of CHCs (Schwillie, F, Dense Chlorinated Solvents in Porous and Fractured Media, Model Experiments, Lewis Publishers, 1988). In summary, Schwillie demonstrated that phase separate CHSCs will distribute in the subsurface as a combination of pools and ganglia. The degree to which pools form versus ganglia is influenced by properties of the media and of the physical properties of the CHC. There was much other research being done around the world on this topic however a brief review of Dr Schwillie's work is very enlightening regarding the expected distribution of compounds such as the Trichloroethylene (TCE), Vinyl Chloride (VC) and Chlorobenzene (CB) found at Chem Laundry.

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The entire body of research performed on this topic is far too prolific and widespread to attempt to summarize here. The research has over the past three decades, confirmed that the pool and ganglia nature of DNAPL distribution is valid and that the CHC compounds present below the water table are distributed primarily in three phases, liquid (phase separate), adsorbed to soil particles and dissolved in groundwater. It is the CHC compounds that are dissolved in groundwater that we are most often able to directly observe with groundwater sampling. Occasionally the CHC compounds adsorbed to soil particles are sampled and detected but very rarely are we fortunate enough to obtain samples containing phase separate CHC. Research has also shown us that very small droplets of phase separate CHC can remain immobile in the saturated zone and along with CHC adsorbed to soil articles continue to contribute to the dissolved phase concentrations. This release from either adsorbed phase or the non-aqueous phase is sometimes referred to as back diffusion because it is largely a function of chemical gradients between phases. It is some combination of these processes that we believe results in the small but observable increase in CHC concentrations in some of the Chem Laundry monitoring wells under elevated water level conditions.

Because of this relationship between the three predominant phases of CHC contamination the EPA published a guidance outlining a process to identify when phase separate DNAPL is likely to be present in the subsurface. The initial indicator of the likely presence of DNAPL is a groundwater concentration of the CHC in question at or above 1% of the solubility of that CHC. For the TCE, VC and CB the solubility is 1,300 mg/L, 8,800 mg/L and 500 mg/L respectively as reported in the EPA RSL Calculator database. Using these values for solubility and the 1% rule of thumb recommended by EPA, the respective concentrations that would indicate the presence of phase separate TCE, VC or CB would be 13 mg/L, 88 mg/L and 5 mg/L respectively. Since the observed concentrations at this site are not currently nor have they ever been this high there is no evidence suggesting the presence of phase separate CHC residuals at this site.

Given that there is no indication of a phase separate “pool” of CHC present the task of locating any single source of the rebound we are observing when water levels are above 782 msl is very problematic. The US Army in their initial investigation and feasibility study work at this site tried to locate and identify dense non-aqueous phase contamination in the subsurface. These investigations included geophysical surveys in an attempt to locate underground structures that may have contained solvents, many soil samples of surface soil and subsurface soil along with construction and sampling of many groundwater monitoring wells. The result of these investigations was to identify the groundwater contamination that remains at measurable concentrations today but was unsuccessful in identifying the likely source of that groundwater contamination. Because the CHC mass has continued to be depleted by natural processes since the time of these investigations it is even less likely that any further investigations would yield better results.

Because of the dispersed ganglion nature of phase separate CHCs in the subsurface and the ability for adsorbed CHC molecules to partition back into groundwater from any location in the observed groundwater plume it is highly unlikely that the MDA can successfully locate or treat these residual CHCs. Further because there is no complete risk pathway, the generally low concentrations currently observed in the groundwater while not consistently below MCL concentrations do not represent a threat to human health or the environment. For these reasons

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the MDA believes that the approved remedy of Monitored Natural Attenuation along with the Environmental Covenant remains the most viable and cost-effective remedy for this site.

Specific Comment 2

Page 5-1, Section 5.3. Please provide the calculations and assumptions used to determine the attenuation rate discussed in MDA's August 3, 2020 letter.

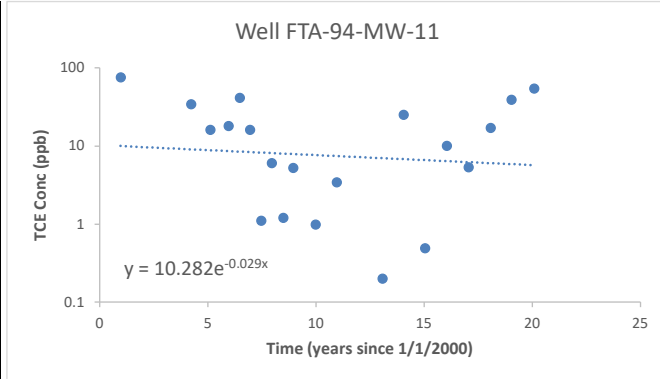
MDA Response

The calculations and data used to determine the attenuation rate in the correspondence are included in Attachment 1. The attenuation rate in this analysis reflects the combined effects of all attenuation processes that are occurring at the site (biodegradation, dispersion, dissolution, etc.) and assumes a steady state rate of attenuation. Attenuation rate estimates are of limited value at this site because of the nature of the residuals and episodic flushing observed when water levels are above 782 msl.

Attachment 1. Calculations and Data for Attenuation Rates Discussed in MDA's August 3, 2020 Letter

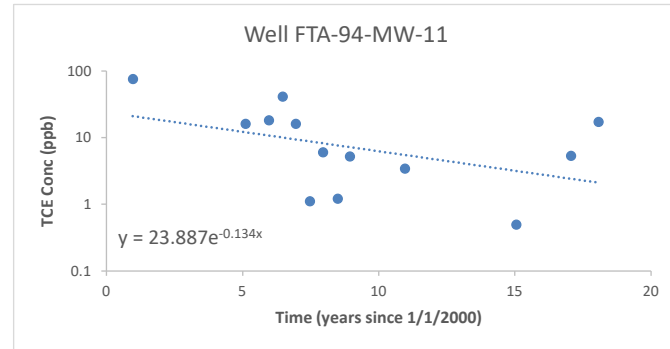
FTA-94-MW11

Date	Yrs Since 1/1/2000	TCE (ppb)	GW Elev (ft msl)
12/18/00	0.96	75	780.6
3/23/04	4.23	34	782.07
2/8/05	5.11	16	781.98
12/15/05	5.96	18	781.68
6/19/06	6.47	41	780.7
12/11/06	6.95	16	781.08
6/18/07	7.47	1.1	780.12
12/13/07	7.95	6	780.29
6/24/08	8.48	1.2	780.72
12/8/08	8.94	5.2	781.12
12/22/09	9.98	0.98	782.21
12/14/10	10.96	3.4	780.99
1/22/13	13.07	0.2	783.3
1/15/14	14.05	25	784.43
1/14/15	15.05	0.49	781.71
1/12/16	16.04	10	782.3
1/17/17	17.06	5.3	780.97
1/23/18	18.07	17	781.27
1/9/19	19.04	39	784
1/28/20	20.09	54	783.85



TCE conc (ppb) = $10.282 * \exp [-0.029 \text{ yrs since } 1/1/2000]$ where $k_{\text{point}} = +0.029$ per year
 Time (years since 1/1/2000) = $-\text{Ln} [\text{Conc. TCE (ppb)} / 10.282] / 0.029$
 Cleanup goal is 5 ppb TCE half-life - 23.8 years
 Time to attain TCE cleanup goal = $\text{Ln} [5 / 10.282] / 0.029$
 25 years

Date	Yrs Since 1/1/2000	TCE (ppb)	GW Elev (ft msl)
12/18/00	0.96	75	780.6
2/8/05	5.11	16	781.98
12/15/05	5.96	18	781.68
6/19/06	6.47	41	780.7
12/11/06	6.95	16	781.08
6/18/07	7.47	1.1	780.12
12/13/07	7.95	6	780.29
6/24/08	8.48	1.2	780.72
12/8/08	8.94	5.2	781.12
12/14/10	10.96	3.4	780.99
1/14/15	15.05	0.49	781.71
1/17/17	17.06	5.3	780.97
1/23/18	18.07	17	781.27



TCE conc (ppb) = $23.887 * \exp [-0.134 \text{ yrs since } 1/1/2000]$ where $k_{\text{point}} = +0.134$ per year
 Time (years since 1/1/2000) = $-\text{Ln} [\text{Conc. TCE (ppb)} / 23.887] / 0.134$
 Cleanup goal is 5 ppb TCE half-life 5.2 years
 Time to attain TCE cleanup goal = $\text{Ln} [5 / 23.887] / 0.134$
 12 years