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August 3, 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 Comment dated June 30, 2020 for the *Corrective Measures Effectiveness Report, January 2020 Monitoring Event Former Chemical Laundry and Motor Pool Area 1500, Parcel 94(7)* dated March 2020

Dear Mr. Wilson,

On behalf of the McClellan Development Authority (MDA), Matrix Environmental Services, LLC (MES) is pleased to submit revisions for the *Corrective Measures Effectiveness Report, January 2020 Monitoring Event* for the Former Chemical Laundry and Motor Pool Area 1500, Parcel 94(7) dated March 2020, revised August 2020 incorporating response to ADEM comment dated June 30, 2020 for your review.

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 June 30, 2020

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

Specific Comment 1

Page 5-1, Section 5.3. MDA states that it is likely that the process to restore groundwater concentrations of contaminants of concern and degradation products to below maximum contaminant levels (MCLs) may take several decades. Please clarify if this estimate is based on a natural attenuation process rate. In accordance with the second line of evidence outlined in the Environmental Protection Agency's, data characterizing the nature and rates of natural attenuation processes at the subject sites should be provided. Please revise the text to include the rates of natural attenuation processes at the subject site.

MDA Response:

Our estimate of likely timeframe for attaining the MCL groundwater quality goals is based on twenty years of observed fluctuations of TCE and vinyl chloride concentrations. The data clearly show concentrations going from above MCLs to below MCLs and then back again several times since we began collecting data at this site. While it is possible to use historical concentration data to evaluate both the overall attenuation rate and the biodegradation rate as described in the *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater* (EPA, 1998) that calculation requires that the data exhibit a consistent behavior compatible with the science underlying the mathematics. The data for this site do not exhibit a consistent and expected pattern that support evaluation of an attenuation rate. Instead, when groundwater elevations are above 782 feet, TCE concentrations appear to rise which suggests potential flushing of contaminants from a subsurface residual. This type of variation in 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.

In order to evaluate an additional line of evidence for natural attenuation at this site we derived a first-order attenuation rate constant from the TCE concentration versus time plot at well FTA-94-MW11. This type of first order decay evaluation of data from a single well measured over time is referred to as a point decay rate (Newell et al., 2002) and provides a measure of attenuation that includes source depletion, advection, dispersion, adsorption and biodegradation. Using a starting point of January 1, 2000 and following the protocol recommended in Newell et al. (2002), the attenuation rate point constant at FTA-94-MW11 is 0.029 per year (half-life of 23.9). Using this rate, the time to achieve the remediation goal of 5 ug/L for TCE from the starting year of 2000 is estimated to be 25 years (2025). It is important to note that this calculation is based upon a curve fitting procedure that can be evaluated for reliability using a reported correlation coefficient. The correlation coefficient for this data is poor suggesting that the results are unreliable.

Understanding that the increases observed in the TCE data are the result of processes that add mass to the observed plume and therefore counteract the ongoing biologically mediated dechlorination it is reasonable to remove the sample events that exhibit this increased concentration behavior and evaluate only the decreasing trend in observed data. Therefore, in order to further evaluate an additional line of evidence for natural attenuation at this site we derived a first-order attenuation rate constant for TCE at well FTA-94-MW11 after removing data collected when groundwater elevations were above 782 MSL. The same methodology was used for this attenuation rate estimate as was used for the complete data set and the resulting point attenuation rate is 0.134 per year (half-life of 5.2 years.) This value equates to 12 years for the concentrations to reach the MCL concentration value (2012). The correlation coefficient for

this modified data set is somewhat improved compared to the complete data set however the resulting estimate of point attenuation remains unreliable.

As explained above these estimates are based on two important assumptions. First that the source is exhibiting decay at a steady state rate and second that biodegradation contributes significantly to the observed concentration decreases. Given the effects of flushing contaminants from a residual mass located above 782 ft MSL the site conceptual model for this site includes a non-steady state source and therefore an indeterminate amount of biodegradation as a component of attenuation. Both underlying assumptions are violated by the site conditions and the results of the point attenuation rate calculations suggest the plume should either already be below the MCL or within 5 years of falling below the MCL. Since concentrations remain above the MCL and are not steadily decreasing neither attenuation behavior predicted by the rate constants we derived are verified. In fact, comparison of the two estimates of point attenuation illustrate the impact of the non-steady state source conditions. The sporadic addition of TCE mass to the plume decreases the estimated point attenuation rate from 0.134 per year to 0.029 per year effectively slowing the attenuation. In summary, the site conditions and the overall unreliability of the attenuation rate calculations clearly indicate that the estimate of time to reach MCL concentrations at FTA-94-MW11 provided by these point attenuation rates is underestimated. In addition, we note that TCE is converted to the daughter products cis-1,2-dichloroethene and then to vinyl chloride through biodegradation further extending the time to achieve the remediation goals when concentration of daughter products are compared to their respective MCL values.

MDA will add the following language to the text in Section 5.3:

5.3 Conclusions and Recommendations

The presence of methane, low concentrations of electron acceptor sulfate and dissolved oxygen, as well as negative ORP in groundwater at the Site indicate that conditions are still favorable for biologically-mediated MNA at the Site. The low magnitudes of the horizontal hydraulics gradients indicate limited groundwater movement at the Site. Past and present groundwater monitoring sample events have shown there is no significant migration of the groundwater contaminant plume from the source area at the Site, i.e., bedrock monitoring well FTA-94-MW11. The concentrations for COCs in bedrock monitoring well FTA-94-MW11 continue to fluctuate over time, with TCE and vinyl chloride levels greater than the MCLs in January 2020. These data have been used to estimate a range of values for a first-order point decay rate for TCE concentrations which results in a point attenuation rate between 0.029 per day (half-life of 23.9 years) and 0.134 per day (half-life of 5.2 years.) These rates result in a range of estimated time to reach MCL concentration of 5 ppb for TCE between 8 years ago (2012) and 5 years from now (2025.) These TCE concentration data also provide evidence that there is likely contaminant present in the subsurface at an elevation that is sporadically exposed to saturated conditions and therefore only occasionally actively attenuated. This condition introduces significant uncertainty in the point attenuation rate estimates and provides an explanation for the obvious inaccuracy in the estimates. Based on this evaluation of past behavior and demonstration that developing reliable point attenuation rates is problematic it is likely that the process to restore groundwater concentrations of COCs and degradation products to below MCLs may take several decades. Based on the results of the January 2020 monitoring event, the MDA recommends continued groundwater monitoring at the Site.