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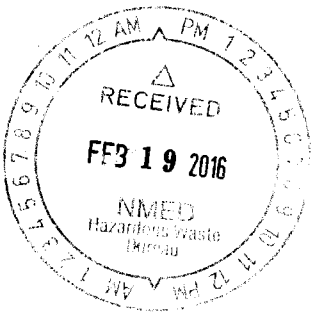

Mr. David Cobrain
New Mexico Environment Department (NMED)
Hazardous Waste Bureau
2905 Rodeo Park Dr. East
Building One
Santa Fe, NM 87505

RE: Evaluation of the *Development of Soil Screening Levels and Site-Specific Dilution Attenuation Factors for the Fort Wingate Depot Activity* dated January 2016 and the *Estimation of Recharge Rates Using Chloride Mass Balance* dated August 2014.

Dear Mr. Cobrain:

This letter serves as a deliverable and includes an evaluation of the *Development of Soil Screening Levels and Site-Specific Dilution Attenuation Factors for the Fort Wingate Depot Activity* dated January 2016 and the included reference document, *Estimation of Recharge Rates Using Chloride Mass Balance* dated August 2014.

Overall, the methodology for deriving a site-specific dilution attenuation factor (DAF) as outlined in the *Development of Soil Screening Levels and Site-Specific Dilution Attenuation Factors for the Fort Wingate Depot Activity* follows the NMED guidance. However, there are concerns with the recharge rate and how it is incorporated into the DAF equation. The following are comments specific to use of the DAF and how it was determined:

- Please clarify which specific areas of concern/solid waste management units/etc. are to be evaluated using the proposed site-specific DAF derived in this paper.

- The infiltration rate is the most sensitive of the input parameters in the derivation of the DAF. For this evaluation, the recharge rate was used as the infiltration rate and it was assumed that the difference between the infiltration rate and the recharge rate are negligible. Typically, this assumption is not valid in that infiltration is higher than recharge. Thus, use of the proposed recharge rate is likely resulting in an underestimation of the DAF.

  Further, as noted in the comments below on the derivation of the recharge rate, there are concerns that the rate does not reflect potential variability, ignores the groundwater chorine mass balance results, ignores potential recharge with depth, and it is the least conservative rate. The use of the proposed value for recharge may in fact underestimate infiltration and potential recharge. A range of values (minimum and maximum) should be provided for recharge resulting in a range of potential DAFs for the site. This would

allow the level of variability and uncertainty to be evaluated in assessing the potential for contamination to migrate to groundwater.

Two evaluations were conducted using the chloride mass balance: groundwater and unsaturated zone. For the groundwater chloride mass balance, an average recharge rate of 0.033 inches per year (in/yr) was estimated for the Fenced-up Horse (FUH) Canyon arroyo valley drainage. This estimated was based on seven wells (shown in Figure 2). The range of chloride concentrations detected in the wells indicated variability in recharge, which is anticipated since there are multiple drainages in the FUH area. However, the paper cautioned that the estimates may also be higher due to the potential of chloride being transported by the stream.

Using the unsaturated zone chloride mass balance, two soil borings were collected. However, reportable data were only available for Boring 1. All of the results (or most) for Boring 2 were non-detect. The paper concludes that the lack of chlorine in soil indicates that water is able to move through the unsaturated zone to the aquifer. This statement alludes that direct recharge is occurring in the area of Boring 2. However, only the data from the one boring for the upper part of the soil profile (first trace) was considered appropriate and a resulting recharge rate of 0.0007 in/yr was recommended.

Several factors can influence the evaluations of recharge using the chlorine mass balance approach to include spatial and temporal variability. In looking at the cumulative chloride plot in Figure 5, the recharge is calculated for three distinct zones. The upper zone, or first trace, may have increase chlorine concentrations as a result of concentration in the upper zone by evapotranspiration. The break in slopes may also be related to change in permeability or bulk density of soil. Because soil parameters vary in time and space, a range of values seems more appropriate for a region than the assignment of a single value.

There are several concerns with how the value of recharge was determined. Further, it is not clear that the selected value for recharge is representative or protective. The following outlines these concerns:

- The estimate of recharge using the chlorine mass balance for groundwater and the unsaturated zone differ by orders of magnitude. However, the paper does not discuss rationale for this difference nor does the paper provide lines of evidence to support using the recharge rate calculated using the unsaturated zone data over the groundwater data.

- The minimum recharge was selected for use in the DAF equations. Recharge can vary over a given area; however, the selection of the first trace data from a single borehole does not allow evaluation of the potential range for the FWDA northern areas. It is not clear that the selected value is representative (e.g., it does not consider changes in lithology). Further, the estimate of recharge is being applied to evaluation the protection of groundwater from residual contamination in soil. It is not clear that the selected recharge rate is protective or sufficiently conservative, allowing for spatial variability over the entire investigative area. Also, as shown with the groundwater data, the paper acknowledges that the data showed a variability in recharge over the FUH area.

- The data from Borehole 2 is not considered. The conclusion is that chlorine is moving through the soil column to groundwater. This statement allows that evapotranspiration is not occurring. It seems that possibly there may have been an issue with sample handling or the lab rather than the proposed conclusion.

- The data for only the first tracer was deemed relevant. Provide additional lines of evidence to support this assumption. Some studies have indicated that the change in slope is representative of historical climate changes, with periods of wetter climate.

If you or any of your staff have questions, please contact me at (801) 451-2864 or via email at paigewalton@msn.com.

Thank you,

Paige Walton

Paige Walton
AQS Senior Scientist and Program Manager

cc: Ben Wear, NMED (electronic)
Joel Workman, AQS (electronic)