Response to Weston Solutions of Michigan, Inc. Comments on Pall Life Sciences Maple Road Response Action

Background

As an interim response action, Pall Life Sciences (PLS) has proposed to extract 1,4-dioxane-contaminated groundwater along the longitudinal axis of the Unit E plume in an area near Maple Road. This water would be treated and injected back into the same aquifer using two injection wells. PLS has proposed an extraction rate of 200 gallons per minute (gpm) and an injection rate of 200 gpm (equally shared between two wells).

Weston Solutions of Michigan, Inc. (WESTON) raised potential concerns with this plan in their July 14, 2004, letter regarding the Feasibility Study. The concerns raised by WESTON are that the proposed interim response action could possibly:

- Split the plume.
- Push contaminated groundwater farther downgradient faster.
- Slow the migration of more contaminated portions of the plume.
- Extend the duration of remedial activities.

PLS Response

The proposed interim response in the Maple Village area will provide an additional level of protection for drinking water supplies (if any) and the Huron River by reducing mass in the aquifer and accelerating the rate at which the aquifer will meet target criteria.

Because water is put back into the aquifer at the same rate it is extracted, there is no net change in the flux of groundwater in the area. As such, it is wrong to assume the aquifer cannot accept water, or there will be significant changes to the plume (other than concentration reduction) as a result of the proposed interim response.

To demonstrate the general response of the groundwater-flow patterns to the proposed interim response, an analytical model was developed for the area using the model AquiferWin32 Version 3.01. The model was constructed using data from the area of the proposed interim response. Numerous borings/wells have been drilled in the Maple Village area. Water samples have been collected and analyzed, water levels have been measured, and two aquifer performances tests have been conducted in the area. Consequently, the local hydrogeological conditions are reasonably well documented and allow reasonable constraints on the model input parameters.

The model is a reasonable representation of how the aquifer will respond to the proposed interim response and incorporates appropriate site-specific conditions. Although the model relies on several simplified assumptions about the hydrogeology, PLS does not believe that a more complicated model that incorporates additional site-specific conditions would provide significantly different results than those provided in this analysis. In the end, the results of such complicated modeling efforts might show that proposed interim response is slightly more, or slightly less, effective than shown by the modeling presented. However, the overall result of incorporating these additional conditions is not expected to be much different from those presented in this analysis.

<u>Model Input Parameters:</u>

Aquifer Thickness (b) = 85 feet (ft) (from boring data)

Hydraulic Conductivity (K) = 2,300 gallons per day per foot squared (gpd/ft^2) = 307 feet/day (ft/d) (from the TW-16 aquifer test)

Hydraulic Gradient (i) = 0.0022605 feet per feet (ft/ft) (measured in the Maple Road area)

Injection Rate at Injection Wells = 100 gpm each (input as -19251.3 cubic feet per day (ft^3/d)

Extraction Rate at Purge Well = 200 gpm (input as 38502.7 ft^3/d).

Reference Head set at 871 feet near MW-72, with the groundwater-flow direction set at east-southeast (angle input as -6)

Line Particle traces were set perpendicular to the groundwater-flow direction slightly down gradient of the reference head. Circle particle traces were set at each injection well location.

Discussion

Figure 1 shows the particle traces during the proposed injection-extraction. Figure 1 also shows the approximate Capture Zone (CZ) for the proposed extraction well and the approximate Area of Influence (AOI) for the proposed injection wells. For reference, Unit E plume isoconcentration contours are shown on the map. These contours are not simulated by the model and are presented for reference to the reader.

Figure 1 shows that the model derived CZ of the proposed extraction well will effectively capture areas of high 1,4-dioxane concentrations as the contaminated groundwater moves toward the extraction well. The RI of the injection wells suggests that, while some groundwater will be displaced outward from the injection zones, it will not significantly affect the margins of the plume's outer boundary. This is logical since the water injected from the aquifer is being balanced by the water removed from the aquifer. Further, because the injected water is "cleaner" than the ambient groundwater into which it is injected, the resulting dilution by mixing of the injected water will provide a beneficial impact on the ultimate fate of the ambient water in the existing Unit E plume.

Response to Weston's Concerns

Split the Plume - WESTON suggested that the Unit E plume may be split. However, the model-simulated capture zone of the extraction well indicates that any expansion of the plume would be insignificant and that the majority mass of the 1,4-dioxane should be confined to areas west of Maple Road. This, combined with the anticipated general dilution and dispersion of 1,4-dioxane plume downgradient of the injection wells, will negate potential concerns for splitting the plume, as well as have the effect of shortening, rather than prolonging the duration of remedial activities.

Push Contaminated Groundwater Farther Downgradient Faster - We think this concern is unfounded. It suggests an overall displacement of the ambient groundwater by the injection waters. It seems more reasonable that the similarity of the overall physical-water properties (density, viscosity, etc.) between the injection and ambient groundwater should result in a mixing rather than a displacement. Even assuming that a minor displacement could occur, this effect should rapidly decrease with distance from the injection point, and dilution should be the primary causal effect. This result should benefit the water quality of the groundwater as a whole while it migrates downgradient.

Slow the Migration of More-Contaminated Portions of the Plume - FTC&H agrees that this interim response will actually stop the migration of the more-contaminated portions of the plume at the point of extraction. We interpret this to be a positive aspect of the proposed interim response. There is no basis, however, that the interim response will slow the migration of the plume

towards the Maple Road area. This will not occur because PLS is removing the same volume of water that it is injecting into the aquifer.

Extend the duration of Remedial Activities - There is no plausible way that extracting/treating 200 gpm of water from the Unit E plume and injecting the treated water will extend the duration of the remedial activities.