DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

April 17, 2014

TO: Sybil Kolon, Gelman Sciences Project Manager, RRD
Jackson District Office

FROM: Jim Coger, Geologist, RRD
Jackson District Office

SUBJECT: Review of the PLS, January 30, 2014, Conceptual Site Model for 1,4-Dioxane at Monitoring Well MW-103

I have reviewed the subject submittal. The following comments address the six bullets in the Summary of Key Points section (in **bold** below) of the conceptual site model (CSM).

1.The MW-103 well cluster is positioned in a complex depositional environment consisting of fine-grained ice-marginal tills and coarse-grained outwash.

I agree that glacial outwash aquifer systems are very heterogeneous and complex generally, and especially so at this facility.

2. 1,4-Dioxane in the MW-103 well cluster area believed to migrate from the plume center positioned on the south side of the plume at its intersection with Maple Road (the plume center located near MW-87).

The CSM incorporates four hydrostratigraphic cross-sections that illustrate the generalized hydrostratigraphy in the Maple Village/Vets Park (MV/VP), and MW-103 area.

The monitoring well network and groundwater monitoring data from the MV/VP area indicates that the entire saturated interval is hydraulically connected and impacted with 1,4-Dioxane. The monitoring well network, in the immediate MV/VP area appears to identify two plume centers migrating east under Maple Road. The deeper plume in the TW-19 area appears to migrate east/northeast towards MW-81 and MW-91. The CSM's equipotential contouring for the shallow/intermediate plume, located in the MW-87/IW-5 area, represents that groundwater flows generally east at Maple Road.

The gradient becomes less steep and equipotential lines are oriented northwest/southeast in the MW-103s area. The CSM notes that the area proximal to MW-103, is the "Area where 1,4-dioxane plume boundary is not consistent with equipotential line." The equipotential lines depict a groundwater flow direction from southwest to northeast at MW-103. The equipotential contouring suggests that the source of contamination at MW-103 is originating from an area outside of the southern prohibition zone boundary. The primary reason for requesting submittal of a CSM was to review PLS's interpretations of the geologic conditions, and analysis of why groundwater flow contouring and contaminant distribution are not consistent.

3. The southern 1,4-dioxane plume boundary has widened slightly to the south in the area of MW-103. As a result, the MW-103 well cluster is located very close to the southern boundary of the plume.

East of the MV/VP area, the monitoring well network is widely spaced. There are no monitoring wells between MW-90 and MW-84s, north or south of the MW-76 nest, or north or south of the MW-103 nest that enable you to determine where the plume centerline is, and/or that define the lateral and vertical geometry of the shallow/intermediate plume. Due to the complex geology, and the limited number of monitoring wells in the MW-103 area, the southern plume boundary cannot be drawn with any certainty.

The Analytical Data Graphs (Graphs) for monitoring well MW-83s and MW-76s, located upgradient from MW-103s, reflects that the plume widening (expansion) in the vicinity of MW-103s, is likely associated with the upward trends observed at MW-83s and MW-76s in 2011/2012/ 2013. The Graphs for intermediate depth wells, MW-76i, and TW-15 (located immediately north of the MW-76 nest) also reflects that contaminant levels have generally increased over the same time period. It should be noted that TW-15 was installed as a potential groundwater extraction well with a 30 foot screen. Analytical results from TW-15 may or may not reflect contaminant concentration levels from a discrete depth interval, contingent on groundwater sampling methodology.

As depicted in the CSM's C-C' cross section, MW-76i and TW-15 are screened at an intermediate elevation in a 150' thick sand unit. The MW-103 nest does not have an intermediate well, screened at an elevation similar to TW-15 or MW-76i. The MW-103 location is therefore not capable of monitoring plume expansion to the south, at intermediate depth intervals.

If concentrations of 1,4-Dioxane in MW-103s exceed 85 ug/l in the future, it will not be possible to determine if plume expansion, south of the PZ, has occurred without the installation of additional monitoring well(s).

4. The widening of the plume was not predicted by the potentiometric surface (equipotential contours). The most likely explanation for any apparent discrepancy of the plume boundary and groundwater flow in the MW-103 well cluster area is dispersion associated with anisotropy in the aquifer which causes the plume to refract in this area.

As noted above, the complex geology, combined with the widely spaced monitoring well network, upgradient and downgradient from the MW-103 nest, makes assumptions regarding plume geometry, contaminant flow path(s), transverse dispersion and plume refraction difficult to resolve.

There are also no monitoring wells located proximal to the topographic channel feature, referenced in the CSM (between MW-76 and MW-103), for the assessment of anisotropy, and/or plume refraction. At a minimum, several piezometers would be required north and south of the channel feature to assess hydraulic conductivity values and geologic boundary conditions.

Irrespective of the CSM's discussion on transverse dispersion and/or anisotropic refraction, the Consent Judgment defines groundwater contamination as 1,4-dioxane above 85 ug/l. There are no monitoring wells south of MW-103s that define the extent of contamination (plume widening) when contaminant concentration levels exceed 85 ug/l at MW-103s. In my opinion, MW-103 should be designated as a compliance monitoring well due to proximal location to the PZ and documented upward trends in the analytical data graphs.

5. It is plausible that the 1,4-dioxane concentrations at MW-103s may exceed 85 ug/L before stabilizing and declining consistent with upgradient concentration trends.

As documented by the Graphs from monitoring wells MW-87s, 83s, and 76s, 1,4-Dioxane, at concentration levels ranging between 1,500 ug/l and 320 ug/l, is continuing to migrate to the east, from the MV/VP Area. Monitoring wells MW-83s, MW-76s, and MW-103s are screened at similar elevations.

The Graph for MW-103s generally depicts an upward trend in 1,4-Dioxane contaminant concentration levels since installation in April 2006. The Graph for MW-76s, located approximately 750 feet northwest of MW-103s, also depicts a similar upward trend since installation in April 2002. 1,4-Dioxane levels ranged between 242 ug/l in April 2013, to 350 ug/l in December 2013 at MW-76s.

The graphs for upgradient wells depict increasing or variability in the concentration levels, and do not reflect that the plume is stable or shrinking. The data clearly suggests that contaminant mass with concentration levels significantly higher than 85 ug/l, will continue to migrate and expand to the east and south, in the vicinity of MW-103.

6. Further widening of the plume south of the MW-103 well cluster will be limited and is not expected to extend to the PZ boundary. The MW-112 well cluster is an excellent monitoring location to determine if the plume will approach the PZ.

The CSM concludes that the regional hydraulic gradient to the east will prevail over contaminant migration to the south resultant from dispersion and/or plume refraction. The current monitoring well network is not capable of assessing dispersion or refraction in the MW-103 area.

I do not agree with the CSM's statement that the MW-112 nest is in a good location for monitoring potential plume expansion south of the MW-103 cluster.

1,4-Dioxane has not been detected in MW-112s. MW-112s is screened in the shallow aquifer at elevations consistent with MW-76s and MW-103s. It would be expected that if MW-112s was located in the downgradient flow path from MW-103s, contaminant detections would mirror trends and contaminant concentration variability observed at upgradient locations. The anisotropic conditions in the MW-103 area could result in 1,4-Dioxane contamination above 85 ug/l migrating south of the PZ without being detected at MW-112s.

Recommendations:

PLS should continue to monitor monitoring wells MW-76s/i, MW-103s, and MW-112s/i on a monthly basis.

If 1,4-dioxane concentrations in MW-103s exceed 85 ug/l for two consecutive months, response activities must be assessed, including additional monitoring wells, and changes to the prohibition zone boundary or hydraulic control measures.

If you have any questions or comments, please let me know.

cc: Mr. Mitchell Adelman, DEQ