UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
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REPLY TO THE ATTENTION OF: SR-6J

November 22, 2005

Commander
Southern Division
Naval Facilities Engineering Command
Attn: Dan Owens, Code ES32
P.O. Box 190010
North Charleston, SC 29419-9010

Subject: Review of the Technical Memorandum on Preliminary Results for the Anoka County Park Organic Substrate Addition Pilot Test, October, 2005, Naval Industrial Reserve Ordnance Plant, Fridley, Minnesota

Dear Mr. Owens:

The United States Environmental Protection Agency, Region 5 (EPA) Federal Facilities Response Section has finished the review of the Technical Memorandum on Preliminary Results for the Anoka County Park Organic Substrate Addition Pilot Test, October, 2005, Naval Industrial Reserve Ordnance Plant.

Generally, the recommendations provided in the last section of the Tech Memo appear vague. The second paragraph on Page 21 recommends "organic substrate addition in general and vegetable oil injection specifically be considered as a future remedial option at the site." However, the Tech Memo goes on to identify permeable reactive barriers or injectable zero valent [sic] iron as possible remedial technologies. In addition, the Tech Memo indicates "it is unlikely that any remedial technology will be successful in significantly accelerating the time it will take to clean up the site." These recommendations appear to be contradictory.

The Final Vegetable Oil Pilot Test Report should include detailed discussions of specific recommendations. These recommendations should be developed only after addressing the concerns identified in the following Specific Comments regarding the analysis of potential applicability of the vegetable oil injection technology at the NIROP site and the impact of the diffusion of contaminants out of the fine grained sediments identified on site.

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SPECIFIC COMMENTS

1. Site Hydrology, Page 13: The Tech Memo states that "hydraulic conductivity measurements conducted in wells PES-MW-3, PES-MW-8, and PES-MW-9 indicate that a zone of low hydraulic conductivity is present down gradient of the immediate injection area." The geometric mean for the hydraulic conductivity values measured in these wells was reported to be 0.010 cm/sec. Such values of hydraulic conductivity represent relatively permeable materials. It does not appear appropriate to characterize the area surrounding these wells as "a zone of low hydraulic conductivity." Although unclear, the discussion appears to suggest that this is an area of reduced hydraulic conductivity relative to other nearby areas. Revise this statement to provide a more detailed discussion of the areas being compared and the nature of the comparison.

2. Volatile Organic Compound Analysis in Groundwater, Page 15: The Tech Memo utilizes the data presented in Tables 11A and 11B to support a conclusion that "TCE concentrations within the pilot test area decreased much more rapidly than TCE concentrations outside of the pilot test area as indicated by the average slope within the pilot test area." However, Table 11A, which presents data outside of the pilot test area, includes data from monitoring wells located outside of the core area of the plume that likely do not represent the portions of the plume directly impacted by the recent upgrades in the groundwater extraction system (i.e., monitoring wells 17-S, 19-S, 27-S, 41-S, 43-S, and 44-S). If the data from the low concentration portions of the core areas of the plume (e.g., concentrations lower than 790 ug/l TCE) are excluded from this assessment, the reductions in TCE concentrations outside the pilot test area appear similar to those within the pilot test area. In fact, the average percent reduction in TCE concentrations appears to be higher than in the pilot test area.

   The analysis of the data from within the pilot test area clearly indicates that injection of vegetable oil has resulted in significant reductions in chlorinated solvent concentrations in groundwater. Figure 8 clearly illustrates these decreases. Because of underlying background trends in contaminant concentrations, the comparison of reductions in contaminant concentrations within and outside of the pilot test area does not appear useful in demonstrating the effectiveness of the injection of vegetable oil in reducing contaminant concentrations in groundwater. It is recommended that analysis of data from within the pilot test area be used primarily for this purpose.

3. Summary, Page 18: The Tech Memo concludes that "any remedial strategies implemented in this (study) area should be targeted to the finer grained units present between approximately 30 and 40 feet bgs where the majority of the contaminant mass resides." However, this conclusion presumes that the object of any remedial strategy is to remove maximum amounts of contaminants from the subsurface. However, as indicated in the

recommendations presented in the Tech Memo, other remedial objectives have been evaluated, including the objective of reducing the potential impact to receptors and therefore reducing the environmental risk associated with contaminants remaining in the subsurface or migrating via groundwater from up gradient areas. These other remedial objectives may not necessarily target the removal of contaminant mass from the finer grained units. The Final Vegetable Oil Pilot Test Report should fully acknowledge these other potential remedial strategies.

4. Recommendations, Page 21: The Tech Memo states that "vegetable oil has also been shown to be effective at stripping contaminant mass from the soil matrix through its surfactant properties and immobilizing contaminant mass through its preferential partitioning properties." The Tech Memo does not appear to directly discuss these properties of vegetable oil or discuss how the data reported in the Tech Memo support such a conclusion. Consequently, the basis for this statement is not clear. In addition, it is not clear if this statement is intended to indicate that the injection of vegetable oil might provide a means of addressing the contaminant mass shown to be concentrated in the fine grained deposits in the study area. Any such statements included in the Final Vegetable Oil Pilot Test Report should be fully supported and their implications for the remediation of subsurface contaminant mass at the NIROP facility should be clarified.

5. Recommendations, Page 22: The Tech Memo states that "the rate at which contaminant mass diffuses out of the finer grained units could be increased slightly by removing the contaminant mass from the more transmissive units and thereby increasing the steepness of the contaminant concentration gradient." This statement is supported by citing the example of TCE concentrations measured in soil from the silt unit and underlying sand unit at Soil Boring SB-4. The significant differences in soil concentrations of TCE at this location are used to demonstrate that the soil data collected during the study "indicate that the contaminant concentration gradients from the finer grained units to the coarser grained units are already relatively steep." Based on this analysis, the Tech Memo concludes that "it is unlikely that any remedial technology will be successful in significantly accelerating the time it will take to clear up the site because contaminant mass will continue to diffuse out of the fine grained units for some time to come."

   However, it is important to note that TCE diffuses out of the finer grained materials into the coarser grained materials according to the contaminant concentration gradient in groundwater and not in soils. As the data collected during this study have clearly indicated, the finer grained materials contain significantly greater amounts of organic carbon than coarser grained materials found on site. Since the degree of adsorption of TCE is largely controlled by the organic carbon content of subsurface materials, a much greater amount of TCE will adsorb onto the finer grained soils than the coarser grained soils for an equivalent dissolved concentration of TCE. Consequently, it is not clear that the differences in soil concentrations of TCE observed between fine and coarse grained materials actually indicate significant gradients in the dissolved TCE concentrations in

groundwater between the fine and coarse grained materials. Thus, it is not clear that TCE concentration gradients between the fine and coarse grained materials could not be significantly improved through the application of vegetable oil injection in Anoka County Park.

There appears to be little basis provided in the Tech Memo for the above cited statement regarding the potential for increasing the rate of diffusion out of the fine grained materials through the injection of vegetable oil. Greater analysis of the factors that control diffusion out of the fined grained deposits found on site is required before such a statement can be fully evaluated.

6. Recommendations, Page 22: As indicated above in Specific Comment No. 5, the Tech Memo indicates that soil sampling results have shown that the majority of the contaminant mass observed in soils is retained in the finer grained materials. The Tech Memo also appropriately indicates that this contaminant mass may provide an ongoing source of groundwater contamination. However, it is not clear that such slow diffusion of contaminants out of fine grained deposits into the relatively fast moving groundwater in the more permeable strata in the study area could result in the contaminant concentrations currently observed in groundwater in the study area. Preliminary analysis of contaminant concentrations in groundwater in coarse grained materials underlying highly contaminated finer grained sediments was provided during the October 5, 2005 Technical Meeting on the Tech Memo. This analysis appeared to indicate that the diffusion of contaminants out of the fine grained materials into the more permeable strata did not necessarily result in significantly elevated contaminated concentrations in groundwater. The Final Vegetable Oil Pilot Test Report should provide full analysis of the available data to help determine the relative impact of the diffusion of contaminants out of fine grained on the quality of groundwater migrating away from the study area.

If you have any questions, call me at (312) 886-6450 or e-mail me at smith.thomasl@epa.gov

Sincerely,

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