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**Subject:** Additional Information/Comment Re ISGS  
**Date:** Wednesday, March 25, 2015 9:15:38 AM  
**Attachments:** [Memo re DNAPL Displacement.pdf](#)  
[Untreated DNAPL Code 4&5.docx](#)

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Scott,

This email is to further elucidate some of our concerns and provide some additional information regarding the ISGS pilot and full-scale demonstration prior to our conference call Wednesday.

1. Our over-arching concern is that based on the data to date, the ISGS treatment is not meeting the performance goal of "Little to no DNAPL flow to wells" in the wells within the pilot study treatment area. We are concerned about the ability of ISGS to achieve these criteria after full-scale implementation.

Our technical evaluation indicates that the high injection pressures required to force reagent into the LHG would have resulted in fracturing of the low-permeability LHG sediments. Formation of fractures would lead to short-circuiting and incomplete sweep, and could accentuate DNAPL displacement. The attached document provides the technical basis for our concluding that fracturing of the UHG must have occurred as a result of the high injection pressures employed in the Former Process Area. The fact that DNAPL recovery continues in the pilot zone may be a reflection of fracturing.

We ask that TetraTech provide technical justification of why fracturing, with the unavoidable resulting poor sweep that would result, did not occur. We believe that, if fracturing of the target matrix can not be avoided, then ISGS can not succeed at providing adequate treatment at the Koppers Site.

The requirement for high pressures and likelihood of fracturing and resultant poor sweep and continued DNAPL recovery after the pilot test treatment, call into questions the viability of ISGS unless pressures are lower, or spacings closer, or target zones are expanded, or multiple rounds of "hot spot treatment" are employed, in any or all combinations.

2. We have reviewed the post-injection boring logs (provided in the Feb 13, 2015 Pre-final Design Report, Appendix C), and have identified zones that have DNAPL ratings of 4 or 5, many of which are "gravelly", that were not targeted by the ISGS. Some examples are:

PT-3

12 ft -14 ft (score = 4).

PT-6

54 ft – 55 ft (score = 4)

PT-9  
40 ft. – 44 ft. (score = 4 in two gravelly zones)

PT-12  
40 ft. - 45 ft. (score = 4 in two gravelly zones)

PT-13  
40 ft. - 45 ft. (score 3 & 4 in gravelly zones above treated zone)

PT-14  
27 ft. - 28 ft. (score 5 in gravelly zone)  
40 ft. - 44 ft. (two gravelly zones, thin, score 4)

On what basis were these high permeability zones containing presumably mobile DNAPL not treated?

### 3. Treatment of zones with DNAPL Rating of 3

The U.S. EPA letter stated the following:

"EPA does not agree with GRU's request that many of the areas field identified with a rating of 3 having a thickness of 4 feet or more or "elevated" PID readings should be considered for treatment. Per Tetra Tech's rating system, a DNAPL rating of 3 indicated elevated PID readings and/or limited residual staining, while a rating of 4 indicated elevated PID readings and heavy residual staining but minimal or no staining on the core sleeve. The areas that were assigned a rating of 3 did not generally appear to have continuous intervals of staining, but staining that was widely distributed over the length of the core. Further, many of the locations identified in GRU's comments did not exhibit any staining at all, but had only slightly elevated PID readings."

There are several parts of this statement that are factually incorrect. Firstly, GRU did not request the treatment should be considered for a DNAPL rating of 3 having a thickness of 4 feet or more, or elevated PID readings. As stated in the Phase 1 Characterization Report dated December 9, 2013 in Figure 2-5a, the DNAPL rating 3 referred to "limited DNAPL staining, elevated PID", i.e. staining and elevated PID. When only elevated PID readings were evident, a rating of 2 was assigned.

As a result, the listing of DNAPL rating 3 zones that were 4 feet or more in thickness provided in GRU's comments of March 16, 2015 were zones, which contained staining and elevated PID. DNAPL ratings were given for every 1 foot interval of the cores. The thick zones of DNAPL rating 3 identified by GRU, therefore, contained 4 or 5, or more contiguous notations of staining and elevated PID.

GRU considered such zones to be continuous intervals of residual DNAPL evidenced by the staining, which would contribute significantly to dissolved-phase contamination. Reduction of such dissolved-phase contamination by ISGS is a stated objective in the ISGS work plan of February 14, 2012 (p. 26).

Contrary to the statement by U.S. EPA shown above, none of the zones identified by GRU in the table (presented in our previous comments and not duplicated here) contained only elevated PID, because such zones would have been designated as rating 2. Excerpts from the boring logs (presented as an attachment to our previous comments) also illustrate the thick zones of DNAPL rating 3 listed in the table.

As GRU stated in its initial comments, we recommend that the EVS model be re-run to delineate the zones where the DNAPL rating is 3 or higher, representing the full zone of DNAPL impacts. This delineation should be used to determine the target intervals for treatment.

We recommend treatment of all residual DNAPL zones contiguous with free-phase DNAPL zones; all separate residual DNAPL zones having a thickness of 2 feet or more; high permeability zones above and below zones characterized with DNAPL scores of 4 or 5, and, all zones in which there are multiple (3 or more) thinner residual DNAPL zones.

GRU believes the treatment of thick zones of DNAPL rating 3 was the intent of the ISGS remedy – see our previous comments for detail.

Thank You

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