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LETTER REGARDING U S NAVY RESPONSES TO REGULATOR COMMENTS ON DRAFT FINAL FEASIBILITY STUDY WORK PLAN FOR OPERABLE UNIT 3 (OU 3) NTC ORLANDO FL

4/20/1999

HARDING LAWSON ASSOCIATES

04.01.03.0003
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April 20, 1999

Commanding Officer
SOUTHNAVFACENGCOM
2155 Eagle Drive
North Charleston, SC 29419-9010

ATTN: Ms. Barbara Nwokike, Code 187300

Subject: **Operable Unit 3**
Final Draft Feasibility Study Report
Response to Comments
NTC, Orlando
Contract: N62467-89-D-0317

Dear Barbara:

On March 30, 1999, we received a three page FAX from David Grabka containing additional comments from Bill Neimes, Technical Review Section, FDEP. Mr. Neimes had reviewed our Response to Comments, dated March 12, 1999 and had some additional thoughts that he transmitted by internal memorandum to Mr. Grabka. HLA has reviewed the memorandum and provides the following responses to Mr. Neimes.

8. **Soil Remediation Alternative. No reply necessary.**

9. **Hazardous Waste. Soils excavated from SA 8 will be analyzed by the TCLP method to determine if they are a characteristic hazardous waste. All soils excavated from SA 9 will be identified as hazardous waste.**

   Agreed.

10. **Groundwater Remediation Alternatives. I do not want it to be understood that I am not in favor of innovative technologies. On the contrary, I am an advocate of and generally encourage the review and possible application of innovative technologies. However, all technologies, whether innovative or not, have their limitations and are appropriate for specific uses. Many times, innovative technologies also have the added risk of having no demonstrated performance record.**

    Noted.

    I believe that uncertainty factor of the two innovative technologies listed in this feasibility study (i.e., barrier treatment walls and ex-situ phytoremediation) is too high to specify either one of these technologies in the design. Even if pilot studies are performed, there will still be a high risk factor involved if either of these two innovative technologies is implemented. I don't believe that there is enough data available on any

long term treatment systems that have utilized either barrier treatment walls or ex-situ phytoremediation to demonstrate these treatment technologies over a long period of time. Are the authors aware of any other in-situ groundwater remediation technologies for the treatment of soluble arsenic than those listed in Section 4.1.8?

HLA agrees with the reviewer's concerns regarding high uncertainty of the permeable treatment wall and phytoremediation technologies (see Table 6-2, Summary of Comparative Analyses for Groundwater Alternatives). HLA has only recently become aware of an exsitu technology referred to as "Neutral Process System" which is being evaluated at Operable Unit 4 at NTC, Orlando to treat antimony (Draft Feasibility Study, Operable Unit 4, January 1999). HLA provided the Orlando Partnering Team a 21-page informational package on January 22, 1999 and indicated that the technology shows promise for remediation of arsenic at OU 3. Other in-situ technologies HLA reviewed, but subsequently rejected during the preliminary technology screening process included geochemical fixation, Colloid Polishing Filter Method, and Forager Sponge Technology. All these technologies were reported as demonstrated or pilot tested both in-situ and ex-situ.

11. **Permeable Treatment Alternative. I appreciate the author providing information on the reduction of pesticide (DDT) biodegradation through the use of zero valent iron filings. However, as reported later in this response, the primary contaminant of concern is not pesticides but arsenic. In their response to Comment 24, the author notes that much (80%) of the arsenic in the groundwater existed as arsenite (As^{+3} valence). What effects would iron filings have on the arsenic that is soluble in the groundwater? Is the purpose of the iron filings to reduce the arsenite in the +3 state to elemental arsenic? Have there been any demonstrations of this redox reaction occurring in a permeable barrier treatment wall and has this been successful? If elemental arsenic is formed by the redox reaction, what is the likelihood that elemental arsenic can be oxidized back to either soluble arsenite or arsenate later on?**

The information on pesticide treatment was provided in response to the original comment, which was "has there ever been a reactive wall that effectively treated pesticides and herbicides?" The remainder of Mr. Neimes' comment appears to focus on the discussion provided in Section 4.1.8 of the FS on Permeable Reactive Wall technology. The description, as provided in the FS is admittedly short on details, which perhaps requires some clarification. The basic concept of a permeable reactive wall is to provide an in-situ mechanism for some type of reaction (chemical, physical, or biological) to take place, resulting in the contaminant(s) of concern no longer being present or available in groundwater. The basic chemistry of reactive wall treatment technology depends on the desired reaction, which determines the appropriate reactive material and overall design of the wall. Although zero-valent iron was mentioned in our description of the technology, it would not be the most appropriate reactive material given the contaminants at this site. Zero-valent iron is currently being used most effectively at sites with halogenated organics and hexavalent chromium. The desired reaction to address soluble arsenic would include the following elements. If necessary, a carbohydrate source, such as molasses, would be injected to stimulate a local anaerobic environment near the reactive barrier, as well as to provide a source of sulfate. Under anaerobic conditions, sulfates convert to sulfide ions. The sulfide ions would react with available metals and form metal sulfide precipitates that should be incorporated into the soil matrix. HLA is also aware of a bench-scale study in Sweden that used B Horizon Spodic soils (i.e., iron and aluminum enriched with some organic content) as the reactive material specifically for treatment of arsenic (III) (Groundwater Monitoring Review, vol. 17, no. 4, 1997, pgs 125-130). A clearer discussion of the reactive wall technology will be provided in the final FS Report.

12. **Phytoremediation Alternative. In the response, the author notes that phytoremediation has demonstrated effective on removing arsenic (from) contaminated groundwater. I am aware that plants can remove soluble arsenic from the groundwater, however, has there ever been an ex-situ phytoremediation demonstration of arsenic removal? What was the efficiency of this treatment system?**

HLA identified no published results of ex-situ phytoremediation demonstrating arsenic removal. Removal or fixation of metals, including arsenic, has been demonstrated in bench studies of rhizofiltration and phytoextraction, and according to vendor information, is currently being evaluated in pilot studies at several sites. The appealing aspects of phytoremediation as a technology for OU3 were that it has shown potential for treatment of both organic and inorganic chemicals, particularly herbicides and heavy metals, and has been used to clean up both soil and groundwater contamination. As shown by the comparative analysis of technologies in the FS, it is not the most cost-effective and does carry a high level of uncertainty, and therefore, has not been selected as the preferred alternative.

13. **Pump and Treat Alternative. In my original comment my intention was to not infer that the two pump and treat alternatives included in this report were unproven technologies. I realize that technologies similar to these two have been and are being used at remedial sites. My primary concern was that when a relatively complex and delicate system is selected which requires significant pH adjustments, chemical additions, and high quality water free from turbidity (for UV/oxidation), there is a greater likelihood of operational problems to occur.**

In Appendix C, the estimated extracted concentration of arsenic is 0.134 mg/l from SA 8 and 0.086 mg/l from SA 9. Both of these concentrations are below the allowable Industrial User Disharge Permitted Limit of 0.250 mg/l set forth by the City of Orlando. Given that the expected influent concentration of arsenic and the expected influent concentration of combined pesticides are below the City of Orlando's permitted limit, can a design be selected that will pump groundwater directly to the City of Orlando's wastewater treatment plant without the treatment train? The Department has approved of remedial systems that recover groundwater and discharge water directly to a POTW without any pretreatment operations.

A design could be selected that would pump groundwater directly to the City's treatment plant. However, this is not a desirable remedial solution for a number of reasons. First, although the extracted arsenic concentrations are predicted to be below discharge permit requirements, the total organic concentration permit limits would likely be exceeded due to the presence of herbicides and pesticides. Second, such a design would require pumping indefinitely, representing a significant cost. Third, such a design assumes that the existing permit between the Navy and the City would be honored under future conditions. Fourth, concerns have already been raised about the effects on Lake Baldwin and the local water table by pump and treat remedies that would return treated water to the local environment. Removal of groundwater with no local replacement would likely raise serious concerns.

14. **Estimate Time for Groundwater Extraction. No reply necessary.**

15. **Arsenic-Contaminated Wetland. I misunderstood several quotes in this report where it states "The highest arsenic concentration is 10.4 mg/kg in this area." I agree that the arsenic concentration in the wetland is significantly less than outside the wetland area.**

Noted.

16. **Pumping Rate. I agree with the authors' remarks.**

To conclude, if a pump and treat alternative is selected for groundwater remediation, I would like to have a pump test performed on areas SA 8 and SA 9. I also believe that the groundwater concentrations are at a low enough magnitude in both of these areas that the recovered groundwaters can be discharged directly to a City of Orlando treatment plant without any treatment. Thus avoiding unnecessary capital and operational expenditures.

Agreed. A pump and treat alternative would almost certainly require pumping tests at both SAs to properly design extraction wells. However, the long term costs of this alternative are estimated to be in the order of $11,500,000 (Table 6-2 of the FS), with operational times measured in decades. Arsenic concentrations are likely low enough at present to discharge directly, but total organic concentrations would not likely meet the criteria (See response to 13 above). It seems a more prudent way of avoiding unnecessary expenditures is to focus resources on a permanent solution for soil remediation, and evaluate the effect that essentially complete source removal will have on groundwater.

In addition, we received a two page letter from David Grabka on April 13, 1999 (letter was dated April 2), containing his own additional comments on our Response to Comments, dated March 12, 1999. HLA has reviewed the memorandum and provides the following responses to Mr. Grabka.

1. **FDEP Comment 1: I have spoken with our Quality Assurance Section concerning detection limits for the herbicides MCPA and MCPP. They concur that no standard, cost effective EPA method exists that can achieve the leachability SCTL for MCPA. However, they**

did state that using the EPA Method 8151 (December 1996) revision), may be able to reach detection limits for soil of approximately 43 ug/kg, which is substantially lower than the detection limits reported in the Remedial Investigation Report. The method uses a gas chromatography/ electrolytic conductivity detector (GC/ECD) to achieve the lower detection limit.

Noted. CLP analytical methods were used for data presented in the RI, per Navy protocol. The elevated detection limits reported in the RI were also at least in part the result of matrix interferences in the samples themselves (likely organic material). The same interferences could impact results using Method 8151 as well. HLA would recommend all confirmatory or monitoring samples be analyzed using Method 8151. As clarification, Method 8151 uses an ECD (electron capture device), not an electrolytic conductivity detector (also known as a Hall detector and appropriate for halogenated organic analyses).

2. **FDEP Comment 2: I have attached the University of Florida's Center for Environmental & Human Toxicology's calculated SCTLs for MCPP for the residential, industrial, and leachability.**

Noted, with appreciation. As stated in the human health risk assessment (chapter 6 of the RI), we assumed that published SCTLs for MCPA would be similar to, and likely, more conservative than calculated values for MCPP. This appears to be true. The risk assessment will not be further revised at this point, given that the values used are more protective than the calculated values.

3. **FDEP Comment 3: Response Acceptable**

4. **FDEP Comment 4: Response Acceptable**

5. **FDEP Comment 5: Response Acceptable**

6. **FDEP Comment 6: Response Acceptable**

7. **FDEP Comment 7: My comment concerning the calculated retardation factor for arsenic was not meant to dismiss the number calculated, but to stress the need to derive a site specific retardation number for arsenic to determine the length of time groundwater would need to be extracted. In the absence of site specific numbers, I feel the use of a range of retardation factors taken from the literature would give a broader picture of the best case and worst case scenarios for the groundwater remediation option.**

Use of retardation factors derived from a literature search would add the additional uncertainty of whether the literature values represented site conditions similar to those at OU 3. By calculating a site-specific value, using reasonable published values for soil bulk density and moisture content, and the average value for published arsenic (III) distribution coefficients, to approximate conditions at OU 3, we believe that the range of published values is taken into account, at least for arsenic (III). Additional site-specific data could be gathered to support a design effort if necessary.

8. **EPA Region IV Comment 19: I have attached Steven M. Roberts', Ph.D., University of Florida Center for Environmental & Human Toxicology, January 10, 1999, letter that addresses EPA Region 4's comment and Harding Lawson Associates' response.**

Clarification of FDEP's position on this matter is greatly appreciated. Remedial goals for soil will be evaluated using the protocol outlined in the referenced letter. It is anticipated that the result will be a reduction in the total volume of soil to be removed.

If you have any questions or need additional information, please call me at (904) 772-7688.

Very Truly Yours,

Harding Lawson Associates

Rick Allen

Richard P. Allen
Project Technical Lead

cc: Wayne Hansel, Southern Division
Nancy Rodriguez, USEPA Region IV
David Grabka, FDEP
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