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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW
ATLANTA, GEORGIA 30303

June 1, 2000

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CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Ms. Katherine Landman
Department of the Navy - Atlantic Division
Naval Facilities Engineering Command
Code 1823
Norfolk, Virginia 23511-6287

SUBJ: MCB Camp Lejeune
Draft Natural Attenuation Evaluation Report
Operable Unit No.9-Site 73

Dear Ms. Landman:

The Environmental Protection Agency has partially completed its review of the above subject document. Comments are enclosed. Comments from the Office of Technical Services will be transmitted by the end of June.

If you have any questions or comments, please call me at (404) 562-8538

Sincerely,

Gena D. Townsend
Senior Project Manager

Enclosure
cc: David Lown, NCDEHNR
Rick Raines, MCB Camp Lejeune

General Comments

The Natural Attenuation Evaluation Report (NAE Report) presents compelling evidence that natural attenuation processes are well underway in the subsurface of Site 73 Amphibious Vehicle Maintenance Facility, Marine Corps Base Camp Lejeune, North Carolina. The site groundwater contamination data speaks for itself in that TCE has apparently never migrated substantially downgradient from the source area even though considerable concentrations are still apparent near the source as evidenced particularly in monitoring wells 73-DW03 and IR73-MW44DW. It appears that the natural, strongly reducing environment of the site subsurface coupled with adequate sources of carbon have created prime conditions for reductive dechlorination processes to proceed. Reductions in contaminant concentrations along the flow path down gradient of the source are noted along with the presence of daughter products. Many if not all of the individual chemical and geochemical screening parameters as outlined in the EPA Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water indicate that biodegradation of site contaminants is taking place. Taken as a whole, the screening parameters present a considerable body of evidence that biodegradation is occurring. This is best seen in Figures 5-19 and 5-29 that present screening scores as outlined in the EPA Technical Protocol for the upper surficial aquifer and the upper Castle Hayne aquifer, respectively. Screening scores for wells near the source area in both aquifers rank according to the EPA Technical Protocol as presenting strong evidence of biodegradation of chlorinated organics.

Although natural attenuation of site contaminants appears to be occurring, there is some uncertainty remaining as to whether natural attenuation alone is an adequate long-term remedial strategy for the site. Furthermore, even if natural attenuation is deemed an adequate strategy in terms of offering protection to the environment, it may not be a preferred strategy in terms of long-term cost. Portions of the NAE report are weak as currently presented. A discussion of these weaknesses is presented under the headings below.

Specific Comments

Modeling

The BIOCHLOR model used in the NAE report to predict fate and transport of site contaminants in groundwater has a number of inherent limitations described in the model documentation included in Appendix F of the NAE Report. According to descriptions on pages 5-27 and 5-28 of the NAE Report, the consultant appears to have taken certain steps to minimize the effects of the model limitations. However, they've used the model in a non-traditional way to back-calculate contaminant degradation rates that are normally used as input to the model after estimating or calculating the degradation rates from site data. They offer an explanation on page 5-24 as to why the normal methods of calculating biodegradation rates (by the Buschek and Alcantar method) are not compatible with the BIOCHLOR model. They then go on to explain their method of estimating degradation rates by calibrating the model to the

observed site chemical data. Finally, they conclude that their estimates of the degradation rates must be valid because they fit the site data and they use the model results based on these degradation rates to predict that site contaminants will not reach Courthouse Bay in harmful concentrations.

A shortcoming of this use of the model is that the model calculations are based on fixed estimates of other model input parameters such as effective porosity and transmissivity. Normal use of the model is to calibrate the model to these other parameters rather than to degradation rates (EPA Technical Protocol, page C3-23). This is accomplished by adjusting effective porosity (in conjunction with other input parameters) within the range of literature values or site estimates until the modeled and observed contaminant distribution patterns match. An important final step of proper modeling is to perform a sensitivity analysis of the input parameters to determine the effect of varying the parameters on numerical model results and evaluate the overall confidence in the modeling effort. It is not clear that any such sensitivity analysis was performed in the modeling work for Site 73 and it is therefore difficult to have much confidence in the modeling results.

Report Conclusions and Recommendations

On page 6-2 in section 6.3 (Chlorinated Solvent Plume B Upper Surficial Aquifer) the statement is made that it appears that the natural process are now able to stop migration of TCE to Courthouse Bay. Although this does appear to be correct, no mention of DCE or Vinyl Chloride is made. Vinyl Chloride was detected in groundwater sampled from one of the hydropunch sampling locations (IR73-IS22) located approximately 50 feet from the bay according to site maps. The vinyl chloride at this location is discussed in Section 5.2.4.11 (General Plume Behavior) and reasonable hypotheses for its presence at that location are offered along with the statement that it appears to be attenuated before reaching Courthouse Bay. This may in fact be true at the present time but the attenuation mechanisms in this case may not be entirely natural. The same section of the report describes a localized aerobic zone under and downgradient of the washdown area that may be responsible for the lack of vinyl chloride in the further downgradient portions of the plume. The localized aerobic zone is described in greater detail in section 5.2.4.1 (Dissolved Oxygen). The report theorizes that the area immediately downgradient of the washdown area is repeatedly exposed to an influx (via recharge) of oxygen-rich water that has been sprayed into the air while washing vehicles and other equipment. Indeed, a localized area of high DO is seen in this vicinity in Figure 5-10 (Dissolved Oxygen in Upper Surficial Groundwater). The report goes on in Section 5.2.4.11 to theorize on page 5-18 that the lack of VC downgradient of the washdown area could very well be an unintended benefit received from the ongoing activities at the site. If this theory is correct, it is critical to note that any changes in site activities related to operation of the washdown area that might unintentionally interrupt the recharge of oxygen-rich water in this vicinity may effect the rate of aerobic degradation of vinyl chloride in this area as it approaches Courthouse Bay. A recommendation should be made that this area be watched closely during long-term monitoring and that measures to supply an alternate source of dissolved oxygen (i.e. by chemical or mechanical means) may be required if there are changes in operation of the washdown area. Additionally, it should be noted that even with continued normal operation of the washdown area, supplemental dissolved oxygen may be required if increased concentrations of vinyl

chloride are detected in the vicinity of IR73-IS22 in the future.

No recognition was made in the report to yet another unintentional and unnatural site condition that may be contributing to the natural attenuation mechanisms of the chlorinated contaminants. This concerns the presence of BTEX in the vicinity of the TCE source area. The anthropogenic carbon source represented by the BTEX may be benefiting the rate of reductive dechlorination of the chlorinated contaminants by serving as an electron donor. The EPA Technical Protocol calls this Type 1 Plume Behavior when the primary substrate is anthropogenic carbon. However, since the BTEX appears to be decreasing rapidly in mass and concentration, as it is itself being degraded in the subsurface, it will not be present much longer. As the BTEX disappears, the reductive dechlorination process will become dependent upon natural carbon sources (termed Type 2 Plume Behavior in EPA Protocol). Generally, Type 2 behavior results in slower biodegradation rates of highly chlorinated solvents. It is unknown what effect the gradual disappearance of BTEX in the TCE plume vicinity may have on the future ability to naturally degrade the TCE particularly in the upper surficial aquifer. A long-term natural attenuation monitoring plan should be designed to watch for the disappearance of BTEX and for potential resulting changes in the chlorinated plume behavior. Remedial technologies that supply artificial carbon sources at sites with insufficient carbon are under development and may need to be considered for Site 73 if future monitoring results show significant undesirable changes in plume behavior.

1. **Pg. 2-2, Section 2.1.1:** Background sample location is not shown on Figure 2-1 as stated in this section. Please add location to Figure or explain in text where location is in relationship to site.

2. **Pg. 2-4, Section 2.1.5:** How many total water quality parameter readings were taken? The text suggests only three. A table listing the volume pumped and measured parameters should be included. A brief discussion of meters used and calibration performed should be included.

3. **Pg. 2-6, Section 2.2.4:** Same comment as #2 concerning water quality parameters.

4. **Pg. 2-7, Section 2.4:** It is not clear if the QA/QC was done for Phase I, Phase II, or both. Also, please explain how many of the QA/QC samples listed were for each Phase.

5. **Pg. 2-7&8, Section 2.5:** Were any PID readings recorded?

6. **Pg. 2-9, Section 2.7, last sentence:** Sentence is incomplete.

7. **Pg. 4-4, 1st full paragraph:** Do acetone or methylene

chloride exceed any regulatory limits? If yes, they should be addressed; if no, add a sentence stating this.

8. **Pg. 4-4, 2nd paragraph:** How widespread were the compounds listed in this paragraph?

9. **Pg. 4-7, 2nd paragraph:** Did methylene chloride exceed any regulatory limits? If yes, it should be discussed; if no, please state this.

Final General Comment

Although it appears that this may be a site for which natural attenuation may be a viable remedial alternative, it should be noted that monitoring would likely have to be carried out for a very long period of time. Relatively high concentrations of TCE are still being detected in groundwater near the source area indicating that TCE is being retained in the aquifer matrix through sorption. TCE will likely continue to be released slowly from the aquifer matrix as it desorbs from the soil partitioning into the dissolved phase in groundwater. This may result in the need to monitor the slow advance of the plume for a period of many decades. The cost of monitoring over such a long period of time can in some cases exceed the cost of a more active remedial alternative.