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LETTER REGARDING ADDITIONAL TECHNOLOGIES FOR TREATABILITY STUDY AT OPERABLE UNIT 4 (OU 4) NTC ORLANDO FL
6/6/1997
ABB ENVIRONMENTAL

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June 6, 1997

Commanding Officer
Southern Division, Naval Facilities Engineering Command
ATTN: Ms. Barbara Nwokike, Code 1873
P.O. Box 190010
2155 Eagle Drive
North Charleston, SC 29419-9010

SUBJECT: **Operable Unit 4, Groundwater Treatability Studies**
Bioremediation Treatability Tasks and Natural Attenuation Assessment
Naval Training Center, Orlando, Florida
Contract No. N62467-C-0317/135

Dear Barbara:

In the letter to SOUTHDIV from ABB-ES dated May 12, 1997, groundwater and source area treatment technologies were identified that may require treatability testing for possible future remedial implementation at OU 4. These technologies included natural attenuation/in-situ bioremediation. As we discussed in the telephone conference call on Thursday, May 29, 1997 ABB-ES is providing this scope for the proposed in-situ bioremediation treatability study tasks and natural attenuation assessment for your review. This scope includes the rationale and objectives for conducting the treatability tests, a discussion of how the data collected will be used in the remediation process, and a brief description of the study tasks. This work is included in the original CTO 135 POA and should be accomplished prior to starting the recirculation wells for the OU 4 interim remedial action (IRA).

Natural Attenuation Assessment

Objectives and Rationale Natural attenuation will be assessed as a remedial option for contaminated groundwater at OU 4. The assessment will be conducted in accordance with the recent USEPA Region IV and Air Force Center for Environment Excellence (AFCEE) Natural Attenuation Guidance Documents. This will help to ensure regulatory approval of the assessment approach. The data collected will be evaluated and the conclusions will be presented in a letter report. These results will then be considered in the OU 4 Feasibility Study, along with other available technologies.

Natural attenuation was selected for evaluation based on the type of contaminants present in the groundwater, (chlorinated solvents) and their ability to biodegrade. Degradation products of PCE, including TCE and cis 1,2-DCE, have been detected at significant concentrations indicating that natural unaided biodegradation is already occurring in-situ. The goal for assessing natural attenuation is to predict the future extent of the plume by evaluating if attenuation will occur at rates sufficient to allow reduction of contaminants to acceptable concentrations before reaching receptors. This is accomplished by comparing the rate of transport to the rate of attenuation. In other words, to be effective the rate of attenuation must exceed the rate of transport.

At NTC Orlando OU 4, the concentrations of chlorinated solvents entering Lake are an indication that under current conditions, natural attenuation is not effective enough to be protective of human health and the environment. However, if the concentration of VOCs in the source areas upgradient of the lake could be decreased, natural attenuation could be a viable alternative in the future.

If natural attenuation is selected as a remedial technology for OU 4, a long-term monitoring plan would be included in the OU 4 remedial design. The goal of long-term monitoring is to confirm predictions made about the future extent of the contaminant plume with site data.

Summary of Natural Attenuation Assessment Tasks The tasks required to conduct the natural attenuation assessment are listed below:

- Chlorinated solvent plumes attenuate at different rates depending on the electron-donor and electron-acceptor processes taking place. An understanding of these processes can be used to predict biodegradation rates and the future behavior of the plume. This understanding will be accomplished through characterization of the electron-donors present in the aquifer (e.g., oxygen, nitrate, iron, manganese, and sulfate) along with concentrations of VOCs, and various other water quality parameters (total organic carbon, oxidation reduction potential, pH and alkalinity, etc.). The assessment will include evaluation of existing site chemical data, evaluation of data gaps, and subsequent analytical data collection.

- A preliminary conceptual model has been developed for OU 4 groundwater. This model along with existing geologic and hydrogeologic data will be used to assess groundwater flow and transport. Data gaps will be identified and additional data will be collected, if required, to complete the conceptual model.

- An analytical model, such as BIOPLUME III from the AFCEE guidance document, will be used to compare the rate of transport to the rate of attenuation. Using site-specific biodegradation rates this analytical model can be used to predict the future extent of the contaminant plume given estimated reductions in VOCs (source control). The results from the model will also help provide target VOC concentrations to aid in the selection of source control technologies.

Enhanced In-Situ Bioremediation

Objectives and Rationale

In-situ bioremediation is accomplished by the addition of nutrients and/or electron-donors to the aquifer to enhance bacterial activity and degradation of organic contaminants. Enhanced in-situ bioremediation is warranted if measurements indicate that natural biological degradation is occurring, but the extent of the plume migration is unacceptable, as is currently the case at OU 4. Therefore, this technology should be evaluated in addition to natural attenuation.

Enhanced bioremediation may significantly increase the rate and extent of biodegradation over rates that would be observed under unaided conditions. This can lead to less accumulation of vinyl chloride, and a reduction in the long-term monitoring costs required for natural attenuation. Enhanced bioremediation may also be an option if source control technologies are not completely effective.

Laboratory bench-scale screening tests will be required to evaluate the effectiveness and aid in selection of groundwater amendments (nutrients and electron-donors). The bench-scale tests will be used to establish biodegradation rates under enhanced conditions, nutrient and electron-donor loading requirements, and capitol and O&M costs for a pilot-scale or full-scale treatment system. It has been our experience that the effectiveness of various groundwater amendments (such as electron donors) depends on the indigenous bacterial populations present in the aquifer, and that bench-scale testing is an essential and cost-effective step in developing remedial recommendations.

Summary of Enhanced In-situ Bioremediation Tasks

- A quantity of site soil and groundwater will be required during the bench-scale tests as a source of site bacteria so that enhanced biodegradation can be evaluated using indigenous bacteria. The quantity and activity of various types of indigenous bacterial populations will likely change during operation of the recirculation wells as oxygen is introduced to the treatment zone. Sampling must be conducted before the IRA recirculation wells are turned on to assess the current aquifer and biological conditions, as these would be the conditions expected to redevelop after shutdown of the recirculation wells. Collection of samples for enhanced bioremediation bench-scale tests can be performed in conjunction with sampling for natural attenuation.

- Enhanced in-situ bioremediation can include both anaerobic and aerobic biodegradation processes depending on the contaminants present and aquifer conditions. Initial chemical and microbiological tests will be performed to evaluate bacterial populations and aquifer conditions prior to initiating the biodegradation tests.

- Biodegradation screening tests will be conducted in glass serum bottles using bacteria isolated from site soil and groundwater. Nutrients, methane (aerobic tests only), various electron donors (anaerobic tests only) and site groundwater will be added to the bottles. Site-specific enhanced biodegradation rates will be estimated from the results of these serum bottle tests.

- If the bench-scale results indicate enhanced in-situ bioremediation is a feasible remediation technology for OU 4 groundwater, recommendations for a pilot-scale or full-scale treatment system will be made. These recommendations will be evaluated in the OU 4 feasibility study, and if appropriate, incorporated in the OU 4 remedial design.

We will contact you to further discuss the natural attenuation studies for OU 4. In the interim, we will evaluate our existing data and begin preparation of the natural attenuation assessment workplan. This is necessary to ensure field sampling will occur before the recirculation wells begin operation. Consideration of bench-scale tests for enhanced bioremediation will be suspended until we have an opportunity to discuss our proposal with you. However, we recommend that enhanced bioremediation be evaluated concurrent

with the natural attenuation assessment to take advantage of economies associated with preparing a single workplan. All necessary field sampling could also occur in a single event.

Likewise, we recommend that any additional treatability studies (such as in-situ chemical oxidation and air sparging, if appropriate) be selected this month, so that a single workplan could be prepared. This would allow Navy and regulator approvals of the treatability approaches to occur once, and the technologies could be implemented in time to support the OU 4 feasibility study currently scheduled for 1998.

If you have questions or comments, please contact me at (617) 245-6606, extension 1052.

Very truly yours,

ABB ENVIRONMENTAL SERVICES, INC.

Mark J. Salvetti

Mark J. Salvetti, P.E.
Task Order Manager

Enclosures

cc: Cliff Casey, Southern Division
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