NAVY RESPONSES TO SUPPLEMENTAL AGENCY COMMENTS
DRAFT FINAL TREATABILITY STUDY WORK PLAN
OPERABLE UNIT I, SITE IR-3
NAVAL STATION, TREASURE ISLAND
SAN FRANCISCO, CALIFORNIA

JUNE 14, 1994

TRANSMITTAL

To: Distribution

From: David Leland, HLA

Date: June 14, 1994

Subject: Navy Responses to Supplemental Agency Comments
Draft Final Treatability Work Plan, Operable Unit I, Site IR-3
Naval Station Treasure Island, Hunters Point Annex, San Francisco, California

Project No.: 11400 0816

On behalf of the U.S. Navy, Western Division Naval Facilities Engineering Command, please find the enclosed subject document in accordance with the Naval Station Treasure Island, Hunters Point Annex Federal Facilities Agreement.

If you have any questions regarding this matter, please contact Mr. Dave Song, Code T4A1DS at (415) 244-2561.

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NAVY RESPONSES TO EPA COMMENTS

The following presents the Navy's responses to the Environmental Protection Agency's (EPA's) comments on the Draft Final Treatability Study Work Plan, Operable Unit I, Site IR-3, Naval Station Treasure Island, Hunters Point Annex, San Francisco, CA, as presented in EPA's letter from Alydda Mangelsdorf (undated) with attachments. Comments are reproduced exactly as submitted to the Navy.

I. GENERAL COMMENTS, EPA LETTER

Comment 1: **Surfactants frequently get clogged in the GC/MS column during the analysis for residual petroleum. As such, it is imperative that the Navy ensure that an approximate 100% analytical efficiency is obtained by performing appropriate QA/QC procedures with every column reading.**

Response: Analyses involving the use of GC/MS will be performed under appropriate QA/QC protocols by the laboratory. Communication with laboratory personnel indicates that clogging of the GC can be avoided by running dilutions to reduce bubbling (clogging) due to the presence of surfactants. In addition, the surfactants to be used in the study are low-foaming types; therefore, significant bubbling into the GC column is not anticipated.

Comment 2: **The Work Plan should provide reasonable stopping stages to allow for review of the study's progress. The Work Plan should at least include a brief review period before initiating Task 5.0 of the Work Plan.**

Response: After each task is completed, analytical data will be reviewed to evaluate the success of the task (e.g., hydrocarbon removal efficiency) and whether to proceed further. The results of the evaluation will be documented in a technical memorandum that will be submitted for agency review prior to implementation of the pilot study (Task 5.0). The Navy agrees that results of the flask and column tests may result in a conclusion to not perform the field test. As noted in the schedule (Plate 1), a meeting is planned with the agencies regarding the results of the flask and column tests. Once agency comments on these results are received, a decision regarding the field test will be made, in consultation with the agencies. If appropriate, an addendum to the work plan will be prepared for agency approval.

II. SPECIFIC COMMENTS, EPA LETTER DATED MARCH 29, 1994

Comment 1: **The long term effectiveness of this injection/extraction remediation system must be addressed by reference to previous studies and/or experience. The possibility and potential impact of channeling in heterogeneous fill, i.e., debris (plate 1-3), must be discussed in the work plan.**

Response: The purpose of the treatability study, as outlined in the work plan, is to evaluate the effectiveness of thermally/chemically augmented oil recovery. The long-term effectiveness of the remediation system will be assessed after careful study of the

results of the bench-scale and pilot-scale study tests. Several references to previous pertinent studies were provided in Sections 2.1 and 6.0 of the work plan. However, numerous reference articles exist, some of which are listed below.

- *Enhanced Recovery of Oily NAPL at a Wood Treating Site Using the CROW Process*, 1992, Fahy, et al., HMC/Superfund '92 Proceedings.
- *Surfactant Screening of Diesel - Contaminated Soil*, Volume 9, 1992, Peters, et al., Hazardous Waste and Hazardous Materials.
- *Surfactant and Subsurface Remediation*, Volume 26, 1992, West, et al., Environmental Science and Technology.
- *In Situ Remediation of Aquifers Contaminated with Dense Nonaqueous Phase Liquids by Chemically Enhanced Solubilization*, 1992, Wunderlich, et al., Journal of Soil Contamination.
- *A Pilot Scale Test of Surfactant Enhanced Pump and Treat*, 1993, Fountain, et al., Department of Geology, State University of New York, Buffalo
- *Removal of Non-Aqueous Phase Liquids Using Surfactants-Subsurface Restoration Conference*, June 1992, Third International Conference on Groundwater Quality Research.
- *Surfactant Scrubbing of Hazardous Chemicals from Soil*, May 1986, Rickabaugh, et al., Proceedings of the 41st Industrial Waste Conference, Purdue University, West LaFayette, Indiana.
- *Dynamic Underground Stripping Integrated Demonstration*, 1991, Lawrence National Laboratory, University of California, Berkeley.
- *Innovative In Situ Cleanup Processes - Surfactant Washing*, 1992, Hazardous Waste Consultant.
- *Interactions Between Nonionic Surfactant Monomers, Hydrophobic Organic Compounds, and Soil*, Volume 26, 1992, Edwards, et al., Water Science and Technology.
- *New Surfactant Washing Technique Cleans Heavy Fuel Oils*, 1992, Soils Magazine.
- *Design and Implementation of Pilot Scale Surfactant Washing/Flushing Technologies Including Surfactant Reuse*, 1992, Volume 26, Clarke, et al., Water Science and Technology.
- *Surfactant-Enhanced Remediation of DNAPL Zones in Granular Aquifer Systems*, 1994, Jackson, Remediation Magazine.
- *Pumping Difficult Fluids*, 1991, Doolin, et al., Chemical Engineering Magazine.

- *Surfactant Solubilization of Organic Compounds in Soil/Aqueous Systems*, 1994, Volume 120, Journal of Environmental Engineering.

- *Experimental Data and Modeling for Surfactant Micelles*, 1994, Volume 120, Journal of Environmental Engineering.

- *Feasibility of Hydraulic Fracturing of Soil to Improve Remedial Actions*, 1991, Murdoch, et al., EPA Risk Reduction Engineering Laboratory.

- *Chemically-Enhanced Solubilization of DNAPL: Advancing the State of Pump-and-Treat Remediation by Injection and Withdrawal of Biodegradable Surfactants*, 1992, Jackson, et al.

- *Surfactant Flushing of Groundwater Removes DNAPLs*, 1992, EPA Groundwater Currents.

Results presented in these articles generally support a conclusion that chemical and thermal augmentation can increase the in situ recovery of heavy oil. Copies of the articles are available upon request. Copies of the articles are available upon request.

Based on review of (1) the above-referenced published articles on various aspects of surfactant-enhanced and thermal recovery of organics, (2) site-specific geologic and hydrogeologic data, (3) research into laboratory protocols for performance of bench-scale and pilot-scale studies on oil recovery, and (4) groundwater remediation experience, the Navy believes that the potential exists for effective long-term remediation of oil-impacted soil and groundwater at HPA through the technique of chemically/thermally augmented recovery.

At each step of the proposed treatability study (e.g., after performing flask tests), the feasibility of implementing this technique will be reevaluated. If the treatability study proceeds to the pilot-scale stage, field data can be collected to assess the potential impacts of channeling in heterogenous fill. The potential impact of this phenomena at the pilot-scale level would be to limit the effectiveness of the extraction system due to flow through preferential pathways, i.e., recovery of oil would be less than anticipated. Although this possibility exists, knowledge of the amount of oil at well and confirmation boring locations will allow for an assessment of whether the system is effectively removing the oil.

The bench-scale and pilot-scale studies will provide data to address these concerns and, if successful, will quantify the long-term effectiveness of a full-scale system.

Comment 2: **The Navy should revise the work plan text as indicated in their response to Bechtel's specific comment number 3.**

Response: The text in Section 3.5.3 has been revised to address the comment. Changed pages reflecting the revision are attached to these responses.

Comment 3: **The work plan for pilot-scale testing must explicitly address anticipated effects of tidally influenced ground water level fluctuations and measures that will be used to counter or correct for these fluctuations.**

Response: Tidal fluctuations were measured at two A-aquifer wells at IR-3. Maximum fluctuations at IR03MW218A1 and IR03MW218A3 were approximately 1 foot (HLA, 1992). As shown on Plate 3-2, the pilot test configurations consists of four injection wells surrounding an extraction well. It is expected that head increases at and near injection wells will substantially exceed the 1-foot tidal fluctuation observed in this area. In addition, because injection will raise the hydraulic head at and between injection well locations, a high head barrier will be created between the pilot study area and surrounding parts of the oil ponds, thus hydraulically isolating the test cells from the surroundings.

Comment 4: **In response to Bechtel's specific comment number 10 the Navy specifies that surfactants will be tested at their respective, manufacturer provided, critical micelle concentrations (CMCs). The manufacturer provided CMCs were likely determined in pure water, not salty ground water. If the Navy wishes to have surfactants present in these tests at concentrations sufficient to form micelles, they will have to determine the CMC for each surfactant in ground water from the site. A CMC determined in pure water is not applicable to salty ground water.**

Response: Several surfactant manufacturers have indicated that solutions with high ionic concentrations do not interfere with the surfactant's performance because they have a high electrolyte tolerance. For example, one brand that will be used in the bench-scale test can tolerate up to 25% sodium chloride or other salts in solution. Where available, manufacturer-provided CMCs for each surfactant will be used as a guideline for determining approximate surfactant concentrations to be used in the tests. As described in the work plan, several different concentrations will be tested in the bench-scale study, and the two solutions that result in the greatest improvement in hydrocarbon recovery efficiency will be tested further in the pilot study.

Comment 5: **The Navy should quantitatively specify acceptable recovery efficiencies. How will the success or failure of this testing be determined? Quantitative measures of success should be provided.**

Response: The Navy will quantify the recovery efficiency of each surfactant and alkaline water in the bench scale surfactant screening flask test. Two solutions exhibiting the highest hydrocarbon recovery efficiencies in the surfactant screening test will be evaluated in a second bench scale flask test. This second test will evaluate the effect of parameters such as temperature and surfactant concentration on the hydrocarbon removal efficiency. The Navy will quantify the recovery efficiency for each set of test parameters. The solutions and parameters that result in the highest hydrocarbon recovery efficiencies will be evaluated in the column displacement tests. The success or failure of the testing process will be evaluated at the conclusion of each series of bench scale tests. Conceptually, the Navy estimates an acceptable range of hydrocarbon removal efficiency to be 50 to 99 percent in order to proceed with pilot-scale testing. The ultimate goal of the hydrocarbon removal process is to produce a soil with residual petroleum hydrocarbon concentrations that is protective

of human health and the environment or may be further reduced to a protective level by an additional treatment technology.

Comment 6: **As previously commented, Task 5.0 should be deleted from the work plan. A separate work plan describing field testing should be prepared, if necessary, after Agency review of the bench-scale test results.**

Response: Please see Response to General Comment Number 2.

Comment 7: **EPA guidance clearly states treatability studies shall use sound statistical techniques including analysis of variance testing to evaluate the effects of different treatment regimes. A statistical test plan should be developed and incorporated in the work plan.**

Response: EPA guidance for the performance of pre Record of Decision (ROD) treatability studies presents a three-tiered approach to treatability testing. The three tiers are:

- Remedy Screening
- Remedy Selection
- Remedial Design/Remedial Action (RD/RA)

Each of these tiers of treatability testing is defined by its particular purpose: remedy screening, to determine potential feasibility; remedy selection, to develop general performance and cost data; and RD/RA, to develop detailed design and cost data and to confirm full-scale performance. The proposed laboratory treatability studies involve remedy screening and selection testing.

The bench scale flask tests will be performed in duplicate and the data will be evaluated in terms of standard deviation, range, or relative percent difference. The percent oil recovered will be calculated based on the difference between the initial and final oil concentrations.

The column displacement tests will be performed to simulate a field pilot scale study. Although these tests will not be performed in duplicate data analysis will include the determination of hydrocarbon recovery efficiency versus pore volume, water and oil flow rates versus pore volume, and column cell temperature versus pore volume to evaluate the hydrocarbon recovery efficiency. The level of data analysis is consistent with EPA guidance for remedy screening and remedy selection treatability testing as stated in *Guide for Conducting Treatability Studies under CERCLA* (EPA, October 1992).

ATTACHMENTS

ATTACHMENTS

NAVY RESPONSES TO SUPPLEMENTAL AGENCY COMMENTS ON DRAFT FINAL TREATABILITY STUDY WORK PLAN

THE ABOVE IDENTIFIED ATTACHMENTS ARE NOT AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY SOUTHWEST DIVISION TO LOCATE THESE ATTACHMENTS. THIS PAGE HAS BEEN INSERTED AS A PLACEHOLDER AND WILL BE REPLACED SHOULD THE MISSING ITEMS BE LOCATED.

QUESTIONS MAY BE DIRECTED TO:

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