Department of Toxic Substances Control

Edwin F. Lowry, Director
700 Heinz Avenue, Suite 200
Berkeley, California 94710-2721

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ALAMEDA POINT
SSIC NO. 5090.3

Winston H. Hickox
Agency Secretary
California Environmental
Protection Agency

Gray Davis
Governor

August 15, 2002

Glenna Clark
BRAC Operations, Code 06CA.GC/0718
Department of the Navy, Southwest Division
Naval Facilities Engineering Command
1230 Columbia Street, Suite 1100
San Diego, CA 92101

DRAFT FINAL WORKPLAN CHEMICAL OXIDATION PILOT TESTING FOR REMOVAL ACTIONS AT INSTALLATION RESTORATION SITES 9, 11/21 AND 16, ALAMEDA POINT, ALAMEDA, CALIFORNIA

Dear Ms. Clark:

The Department of Toxic Substances control (DTSC) is in receipt of the above referenced workplan, dated June 7, 2002, which was submitted by the Navy on June 9, 2002. The subject document describes the approach and field activities of a pilot-scale in-situ chemical oxidation (ISCO) as referenced in the Engineering Evaluation and Cost Analysis (EE/CA) dated January 5, 2001 and subsequently the Action Memorandum dated June 17, 2002.

DTSC has reviewed the ISCO pilot test workplan, but not the EE/CA or the Action Memorandum. It is our opinion that the workplan contains significant deficiencies in the development of the assumptions and evaluation parameters, specifically the safety of site workers and/or building occupants. Our comments are enclosed. Please call me at (510) 540-3767 if you have any questions.

Sincerely,

Marcia Y. Liao

Marcia Y. Liao, Ph.D., CHMM
Hazardous Substances Engineer

enclosure

cc: Michael McClelland, SWDiv
Andrew Dick, SWDiv
Steve Edde, Alameda Point
Anna-Marie Cook, EPA
Judy Huang, RWQCB
Elizabeth Johnson, City of Alameda
Peter Russel, Northgate Environmental
Michael John Torrey, RAB Co-Chair
Lea Loizos, Arc Ecology
Dan Shafer, IT Corporation

DTSC COMMENTS
DRAFT FINAL WORKPLAN
CHEMICAL OXIDATION PILOT TESTING FOR REMOVAL ACTIONS AT
IR SITES 9, 11/21 AND 16
ALAMEDA POINT
ALAMEDA, CALIFORNIA

PART I: COMMENTS BY DTSC OFFICE OF MILITARY FACILITY

GENERAL COMMENTS

1. The subject pilot testing workplan (Workplan) lacks results and details of the bench scale treatability study to support the idea that in-situ chemical oxidation (ISCO) using Fenton's Reagent is effective in reducing contaminant levels in soil and groundwater at Sites 9, 11/21 and 16. There have been concerns that ISCO as proposed may not be an effective treatment scheme for the subject sites. These concerns, based on the preliminary bench scale testing results seen in Appendix C of the Action Memorandum, include, but may not be limited to, the following:

   - The bench scale test involved TCE, DCA, chlorobenzene, methyl-t-butyl ether (MTBE), and benzene which is only a subset of the chemicals of concerns (COCs) identified in groundwater beneath Sites 9, 11/21 and 16. COCs such as DCE, PCE, 1,2-DCB, 1,3-DCB, 1,4-DCB and vinyl chloride were not included in the bench scale test.

   - For chemicals that were included in the bench scale test, Fenton's Reagent had only minimum effect on DCA, a chemical of concern identified for both Sites 9 and 11/21. The effect of Fenton's Reagent on MTBE was not reported.

   - Fenton's Reagent tests were conducted in vented bottles. It is unclear if the loss of volatile organic chemicals (VOCs) due to venting was properly accounted for.

   Please provide detailed results and methods of the bench scale treatability study to facilitate the review of the Workplan.

2. The Workplan indicates a treatment efficiency of 40% or less will be considered a demonstration of the success of ISCO at this site (see Table 8, Step 5). However, the overall carcinogenic risks for groundwater at Sites 9, 11/21 and 16 are calculated to be 5.4×10^{-3}, 2.5×10^{-3}, and 8.2×10^{-4}, respectively (see EE/CA, Section 2.5). Reducing the contaminant level by 40% means the carcinogenic risk after treatment, although 40% lower, will still be in the 10^{-3} to 10^{-4} range and still a significant health

risk. Please explain why a treatment efficiency of 40% or less should be considered a success.

3. The Workplan covers Sites 9, 11/21 and 16 but the Action Memorandum references Sites 9 and 16 only. Please explain the discrepancy. Also, please explain why the pilot test is designed to include all sites involved, namely Sites 9, 11/21 and 16. Why the test is not designed to deal with, for instance, just one site and have the results applied to the others?

4. For clarity please explain the following questions concerning well placement for the pilot test:

   - Why the proposed shallow zone pilot test location for Site 9 is east of Building 410 and outside of all the plumes delineated according to Figures 6 through 12. Why is it not co-located with the intermediate pilot test system or placed somewhat closer to the high COC concentration area?

   - Why at Sites 11/21 the pilot test is not carried out at areas that has COC concentrations at or near saturation?

5. The Workplan proposes to sample the soil prior to well installation (baseline or pre-test characterization) and after oxidant injection and analyze for VOCs, total organic carbon (TOC) and total metals. For clarity, please explain:

   - Will soil samples be composited for the VOC analysis? Page 7-3, last paragraph seems to suggest that the soil will be composited.

   - What reactions or chemical changes are expected to occur in the soil as a result of ISCO? Have they been factored in the design of the sampling and analysis plan? For example, are by-products being considered? Is oxidation of chromium (III) to Chromium (VI) a concern? What about by-products of partial oxidation?

6. The Workplan proposes to sample the groundwater prior to oxidant injection (baseline), following completion of the injection, and 1, 2, and 4 weeks after completion of the injection. The samples will be analyzed for VOC, TOC and total metals and field tested for indicator parameters such as pH, temperature, conductivity, ORP,and ferrous iron and hydrogen peroxide. For clarity, please explain:

   - Will the % VOC destruction be based on the baseline concentration or the concentration immediately following the injection? Page 6-11 of the Workplan seems to suggest that the concentration immediately following the injection will be used.

- Will 4 weeks be sufficient to monitor contaminant rebound and metal mobilization and attenuation? Should additional sampling be scheduled to prolong the monitoring period?

- Are the "site specific background monitoring wells" referenced on page 7-5 same as those listed on page 6-7? Will they be sampled for both baseline and post oxidant injection? Table 3 of Appendix A indicates that they will be tested for the same parameters, i.e., VOC, TOC and total metal. What are the intended uses of these "background" data?

- Is the possible creation of by-products factored in the sampling and analysis plan?

7. The soil and groundwater sampling proposed in this study is quite complex. For clarity, we recommend a table be prepared to help summarize the relevant information. We consider Table 3 of Appendix A (Sampling and Analysis Plan) a good summary table, but not necessarily Tables 13, 14 and 15 located in the main text.

8. Total petroleum hydrocarbons (TPHs) are also considered COCs at Sites 9 and 11/21. Why the effectiveness of ISCO on TPH is not measured in the Workplan?

9. The identities of some of the COCs may be in error. Discrepancies noted include the following:

   - Table 7 does not include data for MTBE. But page 1-4 states that MTBE is a COC for groundwater beneath Site 11/21.

   - Page 1-3 lists TCE as a contaminant of concern in Site 9 groundwater. But Table 2 shows ND for all TCE analyses.

   Please reconcile the difference.

10. The Workplan contains chemistry tables (Tables 2, 4 and 7) that use the notation "ND" without specifying the detection limits. As a standard practice, please indicate the detection limit whenever an analyte is not detected by the laboratory instrument.

11. Although a workplan does not always contain findings or details of previous investigations or site mitigation strategies, for clarity and ease to understand the proposed ISCO, please explain or provide pertinent references for the following:

- Sites 9, 11/21 and 16 are not contiguous parcels. Each site has its groundwater contaminant plumes that are more related with neighboring parcels than among themselves. The plumes at Sites 11/21, for example, have some of the same COCs (e.g. benzene, TCE, and vinyl chloride) as those present beneath Sites 3 and 4. Groundwater at Sites 9 and 16, on the other hand, contain COCs (e.g. vinyl chloride) that are also present in groundwater at Site 23.

  It is important to note that Sites 3 and 4 are generally upgradient from Sites 11/21 and Site 23 is generally upgradient from Site 9. The possibility that contaminants from upgradient sources such as Sites 3, 4 and 23 continually move into groundwater beneath Sites 9, 11/21 and 16 merits some consideration. Please explain why a rather localized approach focusing on Sites 9, 11/21 and 16 is proposed in this study.

- Despite the numerous previous investigations referenced in Section 3 of the Workplan, characterization of Sites 9, 11/21 and 16 appears to be still incomplete and a number of plumes are yet to be defined to their respective maximum contaminant levels (MCLs). Examples include, but may not be limited to, 1,1-DCA, 1,2-DCE and vinyl chloride at Site 9, PCE, 1,2-DCE, 1,1-DCA, MTBE at Sites 11/21 and vinyl chloride, chlorobenzene and 1,2-, 1,3- and 1,4-dichlorobenzene at Site 16.

  With an incomplete site characterization, it can be generally assumed that a *remedial* action based on a complete site investigation and treatability study (i.e. RI/FS) will need to be phased in after the *removal* action (ISCO in this case) to achieve final cleanup of the subject sites. Please explain how the Navy envisions the proposed *removal* action (i.e. ISCO) transits into *remedial* action or how ISCO fits into the picture of final site cleanup.

- What are the criteria used in selecting chemicals of concern (COC) for this study? Are the COCs of this study identical to the COCs listed in the Remedial Investigation (RI) and consequently the risk assessment report?

- What are the "additional data" that have been used as the basis to switch from air sparge/soil vapor extraction to in-situ chemical oxidation? Where are these data reported?

SPECIFIC COMMENTS

1. The Workplan is the first plan of its kind received by DTSC regarding the in-situ chemical oxidation pilot test. Please explain why it is entitled *draft final*, rather than *draft*.

2. Page 6-6, last paragraph: Please clarify if tidal influence will also be monitored for tests at Site 16.

3. Page 6-7, bullets:

   - Background monitoring wells D10B-1 and D3-1 are not shown in any of the figures or tables in this Workplan. Please locate them.

   - For Sites 11/21 please make sure both Intermediate zone A and Zone B are monitored.

   - At the subject sites groundwater generally flows west. Please explain why MW 410-3 is chosen over MW 410-4 to be the shallow background monitoring well for Site 9. Also, why MWC2-1, rather than M16-04 , is the background well for Site 16?

4. Tables 4 and 7 are given incorrect titles. Table 4 should be for Site 16, and Table 7 should be for Sites 11/21.

5. Figure 19: MWC2-1 is incorrectly shown as a hydropunch point, not a monitoring well. Please correct it.

PART II: COMMENTS BY DTSC ENGINEERING SERVICE UNIT

Please refer to the attached memorandum prepared by Mr. Mark Bersheid.

Department of Toxic Substances Control

Edwin F. Lowry, Director
400 P Street, 4th Floor, P.O. Box806
Sacramento, California 95812-0806

Winston H. Hickox
Agency Secretary
California Environmental
Protection Agency

Gray Davis
Governor

MEMORANDUM

To: Marcia Liao
Project Manager
Office of Military Facilities
Berkeley Office

Via: John Hart, P.E
Chief, Engineering Services Unit

From: Mark Berscheid
Hazardous Substances Engineer
Engineering Services Unit

REGISTERED PROFESSIONAL ENGINEER
JOHN R. HART
NO. CH 4545
EXP. 9/2002
CHEMICAL
STATE OF CALIFORNIA

Date: August 7, 2002

Subject: WORK PLAN CHEMICAL OXIDATION PILOT TESTING FOR REMOVAL ACTIONS AT INSTALLATION RESTORATION SITES 9, 11/21, AND 16, REMOVAL, ALAMEDA POINT, ALAMEDA, CALIFORNIA

This letter addresses conclusions and recommendations related to my review of the Work Plan Chemical Oxidation Pilot Testing for Removal Actions at Installation Restoration Sites 9, 11/21, and 16 (WP), Alameda Point, Alameda California. The WP has been prepared for the Department of the Navy (DON) by IT Corporation, Concord California.

SUMMARY/ RECOMMENDATIONS

The WP contains essential elements of an in situ chemical oxidation pilot study to: 1. Evaluate the effectiveness of in situ chemical oxidation (ISCO) treatment on saturated zone groundwater; 2. Evaluate the effectiveness of ISCO treatment on soil; 3. Evaluate the radius of influence of treatment for a singular injection well at multiple depths; 4. Provide extraction/injection and monitoring wells with multiple injection and monitoring screens at vertical depths corresponding to site lithology; 5. Determine the optimum oxidant volume and oxidant concentration for each site; 6. Document baseline conditions in the treatment area in terms of contaminant distribution, and ambient soil

and groundwater chemistry that may affect the ISCO treatment.
The WP has developed appropriate data quality objectives (DQO) for the majority of the elements of the ISCO pilot test listed above.

However, the WP appears to contain some significant deficiencies with respect to incompleteness of the elements listed above and the absence of essential elements of an ISCO at this site.

The Engineering Services Unit (ESU) considers the following to be elements of the ISCO pilot test that should be addressed in the WP: A. Evaluation of the possibility of migration of fugitive emissions during treatment into the limited vadose zone above the proposed treatment zone and continued migration into buildings located on these sites; B. Providing the results and methods of the bench scale treatability study to evaluate the use of the ISCO process with site specific contaminated groundwater and soil; C. Evaluation of the effects of dispersion and dilution from the injection of the volume of materials proposed for treatment; D. A description of the specific type of fenton's reagent process proposed for this site; E. Monitoring of subsurface temperature as a means of evaluating the safety and effectiveness of the process; F. Evaluate the issue of the historical ineffectiveness of ISCO to treat COCs present at each site such as 1,1 Dichloroethane, 1,2-DCB, 1,3-DCB, 1,4-DCB, and Chlorobenzene; G. Evaluate the possible creation of toxic by-products as a result of partial oxidation of COCs.

With respect to incompleteness of the WP elements noted above, items #2 and #6 will deal with evaluation of soil contamination in the saturated zone for baseline and process effectiveness reasons. It appears the WP will deal with these issues solely on a composite soil sample basis.

The ESU recommends the accumulation of site specific data related to the level of organic carbon, f_{OC}, found at this site from past or future soil analysis. Site specific values of this parameter can allow the determination of the distribution co-efficient, K_D, for each COC based on the formula, $K_D = K_{OC} \times f_{OC}$. Based on the formula K_D = Contaminant $Concentration_{Soil}$/ Contaminant $Concentration_{Liquid}$, the concentration of each COC in soil can be estimated for a given groundwater concentration.

This information can be invaluable in estimating the mass of contamination present at the site corresponding to baseline groundwater data and can be used to evaluate the long term effectiveness of the process.

However, this type of evaluation would be based on the equilibration of the relationship between groundwater and soil contamination in the saturated zone based on the distribution coefficient, K_D, for each COC. For this reason, the ESU recommends the long term analysis (i.e., 12 months) of the success of ISCO based on groundwater contamination levels and corresponding soil contamination levels based on the

relationship described.

Also, the WP does not appear to address the need for baseline and pilot test data of carbon dioxide which as a by-product of the oxidation process can be a valuable monitoring parameter.

In addition, the WP indicates the field pilot test is based on assumptions noted on page 6-10 of Section 6, Pilot Testing Activities, which are: 1. Homogeneous subsurface conditions; 2; Uniform contaminant distribution; 3. Uniform treatment distribution in the subsurface; Laboratory bench scale samples and results are representative of site-specific subsurface conditions.

The lack of homogeneous subsurface conditions and the inability of in situ treatment technologies to uniformly treat these heterogeneous layers of the saturated zone are reasons given for the change from the evaluation of air sparging to ISCO. Yet these are given as assumptions in the WP. The subsurface lithology at this site is not homogeneous and historical evaluation of ISCO indicates an inability to uniformly disperse treatment compounds in the type of soils found at this site. The ESU does not consider these assumptions as valid based on the information provided in the WP as the basis for pilot test evaluation of ISCO.

Review of this document has indicated to ESU an apparent lack of detail in the development of the pilot test plan's assumptions and evaluation parameters, specifically the safety of site workers and/or building occupants. The ESU recommends the resolution of these issues prior to implementation of a pilot test of ISCO at this site.

SPECIFIC COMMENTS

1. The ESU recommends the inclusion of a saturated zone tracer study prior to initiating the first event of the pilot test to help assure appropriate injection parameters.

2. The WP indicates a treatment efficiency of 40 % or less, based on short term monitoring, will be considered a demonstration of the success of ISCO at this site. The ESU does not consider a reduction of 40 % as an indicator of success of ISCO.

The level of success effeciency is even more important since a high degree of signifigance appears to be attributed to groundwater samples taken at a maximum of four weeks following the completion of oxidant injection as indicated on page 6-11 of the WP.

Based on the possibility of long term rebound (i.e. 6 months - 1 year) of concentrations of COCs in groundwater based on histroical data and the relationship between levels of

contamination in groundwater and adsorbed to soil, the ESU considers the proposed monitroing duration and the ISCO success effeciency parameter of 40 % to be inappropriate.

If there are any questions please contact me at (916) 255-6672.