Department of Toxic Substances Control

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Winston H. Hickox
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October 8, 2003

Ms. Glenna Clark
Department of Navy
Southwest Division
Naval Facilities Engineering Command
1230 Columbia Street, Suite 1100
San Diego, CA 92101

DRAFT WORKPLAN, FULL-SCALE IN-SITU CHEMICAL OXIDATION AT INSTALLATION RESTORATION SITES 9 AND 16, ALAMEDA POINT, ALAMEDA, CALIFORNIA

Dear Ms. Clark:

The Department of Toxic Substances Control (DTSC) has reviewed the full-scale in-situ chemical oxidation (ISCO) draft workplan, dated August 8, 2003, in conjunction with relevant pilot scale test results contained in the Field Summary Report (FSR) dated July 4, 2003 for the above referenced sites. We believe the pilot test results as shown in the FSR are insufficient to support the full scale application of ISCO at sites 9 and 16, although ISCO is generally regarded as an effective technology in reducing the level of contaminant concentrations in saturated zone soil and groundwater,

In addition to the concerns on the effectiveness of the proposed action, we are concerned that the Navy pursues the ISCO full scale injection, estimated at $ 4 million or approximately one-fifth of the FY 1992-1993 budget allocated for Alameda Pont, as a non-time critical removal action before the site is adequately characterized and the efficacy of the technology firmly established. By doing so, the Navy encourages the use of removal action, rather than the traditional remedial investigation/feasibility study (RI/FS) and remedial action plan/record of decision (RAP/ROD) process, as the main vehicle of achieving site cleanup and limits the public involvement in an important cleanup undertaking at Alameda Point.

DTSC recommends a delay of the full-scale deployment of ISCO at Sites 9 and 16 until the issues raised in our comments can be adequately resolved. Enclosed are Parts I and II of our three-part comments. Part III comments pertaining to hydrogeological review will be forwarded as soon as they become available. Should you have any questions, please contact me at (510) 540-3767.

Sincerely,

Marcia Y. Liao

Marcia Liao, Ph.D., CHMM
Project Manager
Office of Military Facilities

Enclosure

cc: Michael McClelland, SWDiv
Andrew Dick, SWDiv
Mark Ripperda, EPA
Anna-Marie Cook, EPA
Judy Huang, RWQCB
Elizabeth Johnson, City of Alameda
Peter Russel, Northgate Environmental
Randolph Brandt, LHF
Bert Morgan, RAB Co-Chair
Lea Loizos, Arc Ecology

DTSC COMMENTS
DRAFT WORK PLAN
FULL-SCALE IN-SITU CHEMICAL OXIDATION
IR SITES 9 AND 16
ALAMEDA POINT, ALAMEDA, CALIFORNIA

PART I: COMMENTS FROM THE OFFICE OF MILITARY FACILITIES (OMF)

Purpose and Scope of the Full-Scale Testing

1. The purpose and goals of the proposed full-scale in-situ chemical oxidation (ISCO) appear to be those typical of a remedial investigation and feasibility study (RI/FS). For example, page 1-2 of the draft work plan (Workplan) states that the full-scale test will be conducted to evaluate: 1) nature and extent of dissolved phase, 2) effect the ISCO on the contaminants of concern (COC) concentrations, 3) effect of the oxidant on mass reduction of the contaminant plumes, and 4) radial influences. It continues to say, "Full-scale ISCO will be used to evaluate whether significant mass reduction of the COCs is feasible". Further down on page 1-2 it states that the goals of this project are to evaluate: 1) What is the plume definition at Site 9 and 16? 2) What are the baseline conditions in the treatment area that may potentially affect the ISCO treatment? 3) What is the effectiveness for COC mass reduction? 4) Is there a potential for production of undesirable by-products and off-gassing?

   While all these issues are important, they really ought to be addressed BEFORE the full-scale application. DTSC strongly recommends that the proposed work be re-titled and re-scoped to function as 1) a data gap sampling to complete the RI (see Comment #2) and 2) a follow-up treatability study to fully explore the feasibility of ISCO at Sites 9 and 16 (see Comment #3). We believe a well-conceived and executed RI/FS is critical to an effective remedial design and a timely and cost-effective site cleanup; incomplete RI/FS, by contrast, often leads to protracted and expensive cleanup.

Need for RI/FS

2. According to Section 3.1, five investigations have been conducted within Site 9 and seven within Site 16 between 1991 and 2002. But to this date the RI has not been completed and the extent of groundwater contamination has not been fully characterized (see pages 3-1 and 4-1). Also appear to be lacking are:

   - Source zone identification/Explanation to low soil VOC concentrations: The baseline sampling at Sites 9 and 16 has shown little or no presence of volatile organic compounds (VOCs) in the soil. Based on the level of groundwater contamination documented in conjunction with the distribution coefficient, K_D, for some of the COCs, the lack of analytical

results above detection limits for baseline soil samples suggests that 1) the soil sampling technique had introduced errors and/or 2) the source area for associated groundwater contamination has not been positively located (see Part II Comment #1 prepared by DTSC Engineering Services Unit (ESU)). It is unclear if the volumes of soil to be injected with oxidants indeed constitute the source zone.

- Specific geologic and chemical data: Site-specific geochemical parameters important to ISCO include, but may not be limited to, contaminant mass, natural organic matter, chemical oxygen demand, pH of soil and/or groundwater, hydraulic conductivity, groundwater gradient, soil classification, vadose zone permeability, oxidation reduction potential, dissolved oxygen in groundwater, conductivity/resistivity of groundwater, lower explosive limit, carbon dioxide, oxygen, iron content of soil and/ore groundwater, alkalinity of soil and/or groundwater. It is unclear if adequate geochemical data specific to Sites 9 and 16 have been collected and properly interpreted for full-scale ISCO deployment.

DTSC believes adequate site characterization is a crucial step in effectively applying ISCO and recommends that the RI/FS be completed before the full-scale deployment.

3. Based on the data contained in the Field Summary Report (FSR) dated July 4, 2002, DTSC has concluded that the pilot test results available to date are not sufficient to support the full scale application of ISCO at Sites 9 and 16. Our rationales are detailed in Part II ESU comments and summarized as follows:

   - The FSR provides little or no data to demonstrate that contaminants in the saturated zone soil (adsorbed phase) have been reduced as a result of the ISCO treatment. Specifically, the FSR contains little or no discussion on the comparison of pre and post injection soil sampling results even though soil samples were reportedly collected before the injection (baseline) and immediately following completion of oxidant injection and at 1, 2, and 4 week intervals following completion of injection (see FSR Section 4.5).

   - There is a lack of sufficient data to establish the effectiveness of the injected oxidant on COC concentrations in the groundwater. Specifically, post-treatment groundwater analytical data as summarized in Appendix C of the FSR shows an increase, not decrease, in the levels of groundwater contamination in many post-treatment analytical results, suggesting the overall success of treatment may not be statistically significant.

   - Without saturated zone soil treatment data, long term (i.e. minimum of six months) groundwater monitoring is necessary to assure that there is no rebound of groundwater contaminant levels. The FSR, as it currently stands, does not provide long term groundwater monitoring data.

- Given that in-situ technology is proposed and the sites are close to the seaplane lagoon subject to tidal influences, it is essential that pertinent hydro-geological test data are analyzed and related to the results and viability of the ISCO pilot test. The FSR, despite a collection of hydro-geological data, does not provide such an analysis.

- The FSR contains no discussion to provide reassurance that all related parameters have been addressed in the development of the monitoring well pattern to evaluate the radius of influence.

DTSC does not recommend full-scale application of ISCO at Sites 9 and 16 until above RI/FS issues (i.e. Comments #3 and 4) can be adequately addressed.

Removal Action

4. Although not explicitly stated, the proposed full-scale ISCO is intended as a non-time critical removal action (NTCRA) by the Navy. The Engineering Evaluation/Cost Analysis (EE/CA) for the proposed action was completed in January 2001 and the Action Memorandum was published in June 2002. While the EE/CA presented Air Sparging/Soil Vapor Extraction (AS/SVE) as the preferred alternative, the Action Memorandum recommended ISCO instead. The public was invited for EE/CA review and comment between April and May 2001. But it is unclear if the public was given an opportunity to review and comment the switch of technology.

   The proposed ISCO, according to the EE/CA, is expected to cost over $4 million which is approximately one-fifth of the total budget allocated for Alameda Point for FY 1992-1993. Given the monetary worth of the proposed action and the switch of preferred alternative from AS/SVE to ISCO, DTSC recommends a re-opening of public review and comment period to re-engage the community in this important cleanup effort at Alameda Point.

Definition of Success/Decision Criteria for Shutdown

5. Page 1-2 of the Workplan states, "The full-scale ISCO system will be shutdown when concentrations of volatile organic compounds in the groundwater are reduced to levels that are technically and economically practicable, as will be determined by little or no continued reduction in VOC mass and indications that no further oxidation is occurring".

   This definition or shutdown decision criterion needs some clarification. First, according to Section 6.5, the Navy has planned only three discrete oxidant injection events for each test site. With a pre-determined number of injection events, it is unclear how one can be certain that "little or no continued reduction in VOC mass" has been reached or "no further oxidation is occurring".

Secondly, Fenton's reagent is a non-specific oxidant which reacts with not only the COCs but also naturally organic matter and any other reduced species present in the media. It is unclear how many site-specific geochemical data are available to allow a good estimate of chemical dosage (see Comment #2).

Thirdly, the decision criteria as described do not take into account the contaminant rebound over time. With only one round of post-injection groundwater sampling proposed for one to two weeks following each injection, it is unclear how the potential rebound over time can be evaluated to determine the ultimate success.

We recommend the following:

- Establish quantifiable target cleanup levels for saturated zone soil and groundwater (e.g. PRG for the soil and MCL for groundwater) and use these target levels, rather than qualitative goals such as "little or no continued VOC reduction", as the decision criteria for shutdown;

- Institute long-term (six months or longer) performance monitoring to measure the success.

Potentially Harmful Intermediates and By-Products

6. For readers less familiar with the ISCO, please briefly describe the potential harmful reaction intermediates and by-products derived from the COCs identified for Sites 9 and 16. Please include pertinent references (see Comment #11). Please put the discussion in context with the proposed monitoring of hexavalent chromium and semivolatile organic compounds (SVOCs) stated in Section 6.6.

Health and Safety Concern

7. It is our understanding that inhabited buildings are present on, or in proximity to, Sites 9 and 16. Please clarify 1) if the field monitoring will be continued for additional time after the last application of the day and 2) if indoor air of the buildings will be screened before and during chemical dosage.

Regulatory Considerations

8. The proposed work involves injection fluids into wells which may trigger the Underground Injection Control (UIC) requirements. Please contact the Regional Water Quality Control Board (RWQCB) for UIC compliance issues.

9. The proposed work involves storage and handling of chemicals on site which may trigger Emergency Planning and Community Response Act (EPCRA). Please

review the threshold limits established by EPCRA and make sure the proposed action is in compliance with EPCRA.

10. It is our understanding that Sites 9 and 16 soil exhibits low permeability which was the primary reason the Navy decided to switch to ISCO from AR/SVE in 2002. However, ISCO, like AR/SVE, also prefers high permeability and the use of advanced oxidant delivery techniques, such as deep soil mixing and soil fracturing, may become necessary for sites exhibiting low permeability.

    Pending on the delivery technique used, it is possible that certain Resource Conservation and Recovery Act (RCRA) requirements may be triggered. To help determine RCRA applicability, please describe the delivery technique planned for this work.

Reference

11. The Workplan contains 30 references but none concerns the ISCO technology itself. Being a relatively new remediation technology, ISCO has produced mixed results across California and rest of the nation and certain issues such as the reaction intermediates and by-products remain not entirely understood.

    DTSC recommends that the reference section of this Workplan include pertinent literatures concerning the advantages and disadvantages of ISCO technology. The ISCO guidance document published by Interstate Technology and Regulatory Cooperation (ITRC), for example, is concise and informative and should perhaps be included.

PART II: COMMENTS FROM THE ENGINEERING SERVICES UNIT (ESU)

Please see the attached memorandum, dated September 30, 2003, prepared by Mr. Mark Bersheid.

PART III: COMMENTS FROM THE GEOLOGICAL SERVICES UNIT (GSU)

The GSU comments will be forwarded under a separate cover.

Department of Toxic Substances Control

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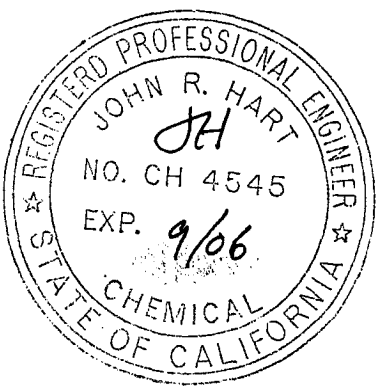
MEMORANDUM



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

Date: September 30, 2003

Subject: FIELD SUMMARY REPORT FOR IN SITU CHEMICAL OXIDATION PILOT TESTS 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 Field Summary Report (FSR) for In Situ Chemical I Oxidation Pilot Tests at Installation Restoration Sites 9, 11/21, and 16 , Alameda Point, Alameda California. The FSR, dated July 4, 2003, has been prepared for the Department of the Navy (DON), Southwest Division, Naval Facilities Engineering Command, Environmental Division, by Shaw Environmental, Inc., Concord, California.

The FSR provides a summary of the results of multiple in situ chemical oxidation (ISCO) pilot tests performed at Alameda Point Sites 9, 11/21. And 16. The Engineering Services Unit (ESU) has evaluated these results and provides the following:

SUMMARY/ RECOMMENDATIONS

The ESU's experience with previous Department of Toxic Substances Control (DTSC) ISCO projects and review of published literature relating to the application of ISCO to treat contaminants of the type found at these sites indicate this in situ technology can be successful in reducing the level of contaminant concentration in saturated zone soils

and groundwater.

However, the ESU does not consider the pilot test data found in the FSR for these sites sufficient to support the full scale application of this technology to treat saturated zone contamination at the sites indicated in the FSR. The ESU does not consider the following issues related to pilot test objectives of: 1. Determining the effect that the injected oxidant has on the constitutient concentrations in the subsurface soil and groundwater; and 2. The viability of the ISCO technology for full-scale application, to be adequately addressed by the FSR:

1. The ESU concurs with the need to address the ability of ISCO to treat not only saturated zone groundwater but also the soils in the saturated zone that can contribute to re-contamination of groundwater if the level of adsorbed phase of soil contamination is not adequately reduced during ISCO treatment.

The FSR indicates in Section 3.5.2, Collection of Baseline Soil Samples, that appropriate discrete soil samples were collected from the center depth of the proposed injection well screen and analyzed for VOCs by EPA Method 8260B.

The FSR indicates in Section 4.5, Post-Oxidant Injection Sampling, that soil and groundwater samples were collected immediately following completion of oxidant injection, and at 1, 2, and 4 week intervals following completion of injection. To adequately compare these soil samples to pretest soil samples, the post oxidant samples were to be collected from the same depth and location as pretest soil characterization sampling activities.

However, the FSR does not discuss the results of a comparison of pre and post-test soil sampling in the text of the FSR. A review of the attached soil characterization data and a review of Appendix C, In Situ Oxidative Technologies, Inc. Draft Pilot Test Program Report, indicates only one post treatment soil sample had been collected from each area.

In addition, Table 7 of Appendix C indicates the absence of recordable data for site contaminants of concern (COCs) allows for pre and post-treatment comparison of only one contaminant at one location, Site 9 Intermediate, the location at which pilot test activities were postponed due to technical difficulties.

This would appear to indicate that the FSR can provide no data to support the success of ISCO treatment to reduce the level of adsorbed phase contamination in saturated zone soils at any of the pilot test locations. Based on the level of groundwater contamination documented in conjunction with the distribution coefficient, K_D, for some of the contaminants of concern (COCs) at these sites, the lack of analytical results above detection limits for baseline soil samples does not support the implementation of

ISCO in these volumes of soil.

For instance, Section 2.1.4, Release or Threatened Release into the Environment of Contaminants of Concern, of the Draft Cercla Sites 9 and 16 Dissolved Phase Groundwater Contaminants Non-Time Critical Removal Action Memorandum, dated June 17, 2002, indicates that at Site 16 South, between 5 and 15 feet BGS, the maximum concentration of PCE in groundwater was found to be 610 ug/l. Based on the formula $K_D = f_{OC}$ (soil organic carbon content) x K_{OC} (published contaminant specific organic carbon partition coefficient) = C_S (concentration of the contaminant in soil) / C_L (concentration of the contaminant in liquid), it is possible to use site specific soil parameters to determine the level of PCE soil contamination that is the basis for a groundwater sample result.

The ESU has used area specific soil data from the Draft Final Remedial Investigation Report IR Site 26, dated July, 2003, to obtain soil carbon content, $f_{OC} = 0.0036$, porosity, $n = 0.356$, and soil density, $p = 1.75$ g/ml. Using this data in conjunction with the published PCE K_{OC} of 660 ml/g, the ESU has estimated the level of PCE contamination in the adsorbed phase in saturated zone soils associated with a PCE groundwater contaminant level of 610 ug/l to be 2.538 mg/kg. Therefore, based on the area specific porosity of 0.356, for every liter of volume in the saturated zone there will be approximately 217 ug of dissolved phase PCE contaminant and 1,630 ug of PCE contaminant adsorbed to soil.

The ESU considers this analysis significant in that it would appear to support: a. The importance of ISCO's ability to treat the adsorbed phase of contamination in the saturated zone based on the level of contamination found in the dissolved phase versus the adsorbed phase; b. The importance of the need for the comparison of baseline soil samples to post-treatment soil samples as a means to evaluate the effectiveness of ISCO to treat contamination in the saturated zone; and c. The possibility that additional site characterization activities are required to better define the volume of soil in which the injection of oxidant will be most effective in reducing the adsorbed phase on contamination.

The absence of recordable levels of analytical results for COCs in baseline soil sampling indicated in Table 7 in conjunction with the dates of baseline sampling indicated in the attached data (i.e., June-July, 2002) would appear to indicate that additional sampling activity could have been performed to locate subsurface soils that may have more adequately reflected a source area for associated groundwater contamination in time for the pilot test activities performed in November and December of 2002.

2. A lack of saturated zone soil treatment data necessitates a dependence on groundwater treatment data as a means of the assessment of the success of ISCO to

treat the saturated zone by reducing the level of contamination in soil and groundwater. In order to acquire adequate groundwater monitoring data necessary to assess the success of this technology without associated soil data, the ESU recommends long term (i.e., minimum of six months) groundwater monitoring to assure that there is no rebound of groundwater contaminant levels related to the equilibration of groundwater contaminant levels associated with the distribution coefficient (K_D) of vadose zone soils.

In addition, although the text of the FSR indicates a significant reduction in levels of groundwater contamination due to pilot test activities, the results of limited post - treatment groundwater analytical data summarized in Tables 8-14 of Appendix C do not appear to support this assessment. The data in these tables indicates an increase in the levels of groundwater contamination in many post-treatment analytical results indicating the overall success of treatment may not be statistically significant.

3. Although the FSR provides a description and associated data relating to the performance of various hydro-geologic tests (i.e., aquifer pump test. step-drawdown test) and the tidal influences on the subject sites, the FSR does not appear to relate the results of these tests to the results and viability of the ISCO pilot tests. The ESU recommends the review of the FSR by a DTSC hyro-geologist to assess this issue.

4. The FSR provides the location of observation or monitoring wells that will be used to assess the radius of influence of the singular oxidant injection well at each of the pilot test locations. It would appear that the monitoring wells are arranged in a manner (i.e., perpendicular to the direction of groundwater flow) and at sufficient distances from the centerline of flow to be capable of adequately assessing the ability of the injection well to provide sufficient volumes of oxidant for complete treatment.

However, there is no discussion in the FSR to assure DTSC that all related parameters have been addressed in the development of the monitoring well pattern to evaluate the radius of influence. The ESU recommends the review of this objective of the FSR by the Geologic Services Unit (ESU).

The ESU does not recommend the full-scale application of ISCO at these sites until the above issues can be fully resolved.

SPECIFIC COMMENTS

1. The FSR indicates the results of soil sampling are shown in the first five tables. Although the analytical results shown in these tables are in mg/kg, the headings for the specific table appear to indicate groundwater analytical results in some cases. For instance, Table 3 refers to plume delineation groundwater, which would mean the analytical results would be in ug/L.

analytical results would be in ug/L.

Another apparent mismatch would be Table 7 which refers to field parameters (ie., pH, temp, etc) while the table contains VOC analytical results in mg/L.

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