UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105
SFD 8-3

August 21, 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

RE: **Draft Final Work Plan Chemical Oxidation Pilot Testing for Removal Actions at Installation Restoration Sites 9, 11/21, and 16, Alameda Point**

Dear Ms. Clark:

EPA has reviewed the above referenced document, prepared by IT Corporation, and submitted by the Navy on June 7, 2002. EPA's contractor, TechLaw Inc, assisted EPA in performing the review of the document and provides the enclosed comments. EPA has some significant concerns with regard to the implementation of the proposed chemical oxidation pilot testing.

EPA believes the Work Plan is critically deficient because it does not contain any description of the specific oxidation system that will be used at the four sites that are planned for the pilot studies. No results from the laboratory bench tests conducted by the IT/Shaw Group in their Tennessee laboratories are cited in this Work Plan. Furthermore, because of the recognized hazards of working with hydrogen peroxide and the potentially explosive conditions when hydrogen peroxide and catalytic agents are combined, the absence of specific information on the oxidation system in this Work Plan prevents any evaluation of the potential success of the pilot studies, and opens the possibility that a dangerous field condition will be generated. The Work Plan does not include a venting system or other system to accommodate off-gases (steam, oxygen, carbon dioxide, and products of reaction) and relieve pressure and build up of organics under pavement. The build up of off-gases can present a hazard to workers and building tenants and contribute to explosions and fire. Also, the design of the pilot test does not appear to take into account the hazards of the chemicals and the potential for vigorous uncontrolled reactions in the subsurface.

We believe that further discussions between the Navy, the Navy contractor, the vendor and the regulatory agencies should occur prior to initiation of field work. Please call me at (415) 972-3029 so that we can arrange a meeting or conference call to address our concerns.

Sincerely,

Anna-Marie Cook

Anna-Marie Cook
Remedial Project Manager

enclosure

cc: Michael McClelland, SWDiv
Andrew Dick, SWDiv
Marcia Liao, DTSC
Judy Huang, RWQCB
Elizabeth Johnson, City of Alameda
Lea Loizos, Arc Ecology
Karla Brasaemle, TechLaw Inc.

Review of the Draft Final Work Plan
Chemical Oxidation Pilot Testing for Removal Actions at
Installation Restoration Sites 9, 11/21, and 16
Alameda Point

GENERAL COMMENTS

1. This Work Plan is critically deficient because it contains no description of the specific oxidation system that will be used at the four sites that are planned for the pilot studies. No results from the laboratory bench tests conducted by the IT/Shaw Group in their Tennessee laboratories are cited in this Work Plan, and it is stated the results will be reported separately (page 5-2). The Work Plan also states that the vendor that will conduct the pilot study has not been selected but the work of the vendor will be directed by the Navy's contractor (page 6-10). If a vendor's proprietary mixture of reagents and injection system will be employed in the pilot tests, it is then unclear how the bench scale test results will be relevant to the actual design and implementation of the pilot test. Furthermore, because of the recognized hazards of working with hydrogen peroxide and the potentially explosive conditions when hydrogen peroxide and catalytic agents are combined, the absence of specific information on the oxidation system in this Work Plan prevents any evaluation of the potential success of the pilot studies, and opens the possibility that a dangerous field condition will be generated. Please provide information from the bench scale tests, provide details of the vendor's proposed mixture, and discuss whether the bench scale test is relevant. Also, please evaluate the potential that dangerous conditions may be generated.

2. The Work Plan presents groundwater data from previous investigations, but does not discuss vadose zone contamination. It is not clear whether shallow soil contamination exists at any of the sites or if any sampling of shallow soil was conducted during previous investigations. Since gasoline range organics in the upper soil were associated with pavement heaving, small explosions, and fire at a site where hydrogen peroxide and ferrous sulfate where injected into groundwater at 9-13 feet bgs (*Technology Status Review, In Situ Oxidation,* Environmental Security Technology Certification Program, November 1999), it is important to adequately characterize the upper soil zone. The presence of contaminants in the upper soil horizon should be taken into account during the pilot test design. Please revise the Work Plan to clarify whether the upper soil horizon has been characterized at Sites 9 11/21, and 16 and present any available data.

3. The Work Plan does not include a venting system or other system to accommodate off-gases (steam, oxygen, carbon dioxide, and products of reaction) and relieve pressure and build up of organics under pavement. The build up of off-gases can present a hazard to workers and building tenants and contribute to explosions and fire. Also, the design of the pilot test does not appear to take into account the hazards of the chemicals and the

potential for vigorous uncontrolled reactions in the subsurface. Please revise the Work Plan to include a venting system for off-gases and describe emergency procedures to stop or slow the reaction if necessary.

4. Without the results of the laboratory bench tests, it is impossible to assess the amount of Fenton reagents necessary to create a system that will oxidize the target chemicals. The data for several sites show that hydrocarbons and tetrachloroethene/trichloroethylene (PCE/TCE) reduction products are present, indicating that a chemical/microbial reducing system exists at the sites,which will be major sink for hydrogen peroxide and the oxidants generated by the Fenton reaction. The apparent existence of strongly reducing conditions, as evidenced by the presence of vinyl chloride, may require significant amounts of hydrogen peroxide to achieve the desired oxidation conditions to provide for optimum remediation of the dichloroethane (DCA) that is present in some mixtures. Large volumes of hydrogen peroxide, and/or high concentrations of hydrogen peroxide, are an additional concern for planning safe pilot tests. Please provide the results of the laboratory bench tests and discuss the implication of the presence of PCE/TCE reduction products and the strongly reducing conditions on the pilot tests before field work commences. Please also briefly discuss how safety will be addressed when large volumes and/or high concentrations of hydrogen peroxide are required.

5. The most common application of the Fenton chemistry is for removal of free phase chemicals, which in part may be facilitated by the temperatures generated by the exothermic reaction of hydrogen peroxide and catalysts. Several vendors indicate that their reagents have been formulated to control the exothermicity of the oxidation system, and therefore oxidation of chemicals in the aqueous phase. Please clarify if the exothermicity of the reaction will be controlled.

SPECIFIC COMMENTS

1. **Section 1.0, Introduction, Page 1-1:** The stated purpose of the in-situ chemical oxidation (ISCO) pilot tests is to oxidize the "dissolved-phase chlorinated and aromatic hydrocarbons," and there is no mention of the presence of the non-aqueous phase liquids (NAPL) that may be continuing sources of chemicals to groundwater. Because ISCO is most often applied for mass removal of NAPL, please discuss whether NAPL will also be considered in the design and implementation of ISCO in the pilot tests at the respective sites, noting that the concentrations of some chemicals (in the milligrams/Liter (mg/L) levels) indicate that NAPL may be present (also please see comment below on Section 6.0).

2. **Section 1.1, Purpose and Scope of the Work Plan, Page 1-1:** The first paragraph states that the technical and economic practicality of the ISCO system will be "determined by little or no reduction in VOC concentrations in response to injection of chemical oxidants;" however, since VOC concentrations may decrease due to dilution whether or

not oxidation of VOC is occurring, please revise this sentence to state that the levels that are technically and economically practicable will be determined by little or no reduction in VOC mass and no indication that further oxidation is occurring.

3. **Section 1.1, Purpose and Scope of the Work Plan, Page 1-1:** The second paragraph states that "the presence of layers of low conductivity clayey sands acting as hydrogeologic barriers between the hydrogeologic units at the sites...may preclude the efficacy of the AS/SVE technology," and therefore it was recommended that chemical oxidation technology be evaluated. However heterogenous layers and low conductivity units will also limit the effectiveness of ISCO. For clarity and completeness, please revise the Work Plan to provide specific details about the additional site data that indicated why ISCO may work while air sparging/soil vapor extraction (AS/SVE) may not.

4. **Section 1.1, Purpose and Scope of the Work Plan, Page 1-2:** The second of the three bulleted items states that the purpose of the Work Plan is to "summarize the bench test results and the preferred oxidant choice," but this information is not contained in the Work Plan. Please recognize that without this information the Work Plan cannot be fully evaluated because the potential effectiveness of the pilot tests or the safety of the tests cannot be assessed. Please include a summary of the bench test results when the document is revised.

5. **Section 1.1, Purpose and Scope of the Work Plan, Page 1-2:** The project goals listed in this section do not include an evaluation of potential problems with implementation of ISCO such as: ineffective mixing of oxidant and Contaminants of Concern (COCs) due to channeling, potential for developing hazardous conditions, production of undesirable byproducts and off-gases etc. Since the pilot test should identify any problems that may be encountered during full-scale implementation, please revise the Work Plan to include evaluation of these and any other potential problems as a project goal.

6. **Section 1.2.1, Installation Restoration Site 9, Page 1-3:** The final paragraph in this section states that fuel components have been identified in the groundwater at drain lines along Building 410; however, this plume is not shown in a figure and the data is not included in the Work Plan. Since unexpected levels of gasoline range organics in shallow soil has caused pavement upheaval, underground explosions, and fire during injection of Fenton's reagent at another site (*Technology Status Review, In Situ Oxidation*, Environmental Security Technology Certification Program, November 1999), it is essential that the fuel plume near building 410 be adequately characterized prior to implementation of ISCO. Please revise the Work Plan to provide the data related to the fuel plume and show this plume on a figure.

7. **Section 1.2.3, Installation Restoration Site 16, Page 1-5:** The final paragraph on this page refers to a total petroleum hydrocarbons (TPH) plume at Building 608; however, this

plume is not shown on a figure and TPH data for Site 16 is not included in the Work Plan. Since it is essential that the extent of TPH at the site be adequately characterized prior to implementation of ISCO (see previous comment on Site 9) please revise the Work Plan to include the TPH data for Site 16 and show the TPH plume on a figure.

8. **Section 2.3.1.3, Merritt Sand, Page 2-4:** This section refers to a paleochannel eroded into the Merritt Sand unit across the western and northern portions of Alameda Point but does not relate the information to sites 9, 11/21 and 16. To understand how the location of the paleochannel relates to the sites in this Work Plan, please show this feature on a figure or discuss whether the paleochannel is present beneath these sites.

9. **Section 2.4.1, Installation Restoration Site 9 Hydrogeology, Page 2-8:** This section discusses the occurrence of the bay sediment unit (BSU) at Alameda Point and indicates that the BSU is absent along the former Alameda Island shoreline. It is difficult to understand from the discussion in this and following sections, whether the BSU is present beneath all, part or none of Sites 9, 11/21, and 16. Please show the approximate extent of the BSU at Alameda Point and the former Alameda shoreline on a figure or discuss whether this unit is present beneath these sites.

10. **Section 2.4.3, Installation Restoration Site 16 Geology and Hydrogeology, Page 2-10:** This section states that only shallow boreholes have been advanced (15-ft depth) at the site; however, data in Table 4 indicates that boring DHP-S16 was installed to at least 36 feet and S16-DGS-DP01 was installed to 56 feet. Also, it appears that these two borings should provide information on the stratigraphy below 15 feet at Site 16. Please revise this section to accurately describe the investigations at Site 16 and to include the information provided by these borings.

11. **Section 2.4.3, Installation Restoration Site 16 Geology and Hydrogeology, Page 2-11:** This section states that the vertical gradient is based on nearby deep monitoring points; however, on the previous page, it states that the nearest deep borings are approximately 450 or 550 feet away. Please revise this section to clarify which monitoring points were used to evaluate the vertical gradient. Also, since the first water bearing zone (FWBZ) and second water bearing zone (SWBZ) are likely in direct contact at Site 16, please clarify which zones the vertical gradient applies to.

12. **Section 3.0, Summary of Previous Investigations, Page 3-1:** There are several problems with the information presented in this section. First, not all of the sample points listed in Tables 2, 4, and 7 are included on the figures. For example: at Site 9 DHP-S09 and SHP-S09 are not shown even though SHP-S09 was one of the three locations where benzene was detected at or above the maximum contaminant level (MCL). Second, some of the data included in the tables are not shown on the figures, and some data shown on the figures are not included in the tables. For example: Figure 6 shows that methyl tertiary butyl ether (MTBE) was detected at 20 ug/l at MW410-2 but

Table 2 indicates that MW410-2 was not analyzed for MTBE. Third, the information presented in the text is not consistent with the figures and tables. For example: the text states that a maximum concentration of benzene of 1.7 ug/l was detected at 15 feet at S09-DGS-DP04, but Figure 7 indicates that benzene was detected at 2.0 ug/l at S09-DGS-DP05. These problems occur in all three sections summarizing previous investigations (Sections 3.1, 3.1.1 and 3.1.2) and the corresponding tables and figures. Since the data presented is inconsistent, it can't be determined whether the plumes have been adequately characterized, or where additional data should be collected. Please revise Section 3.0 to present the data from previous investigations accurately and completely and revise the corresponding tables and figures to show all the data consistently. Also, it is not clear in which stratigraphic layer COCs were found or in which layer the maximum concentrations were detected. For clarity and completeness, and to better evaluate the pilot test approach, please revise this section to indicate which stratigraphic layer each sample was collected in and in which layer(s) the maximum concentrations were detected.

13. **Section 3.1, Installation Restoration Site 9, Page 3-1:** The second paragraph refers to Table 5 for the MCLs; however, the MCLs are listed in Table 2; reporting limits are listed in Table 5. Please revise this paragraph to refer to the correct table.

14. **Section 3.1.1, Installation Restoration Sites 11/21, Page 3-3:** This section refers to Table 4 for Site 11/21 Groundwater Contaminants of Concern; however, Table 4 appears to contain data for Site 16. Similarly, Table 7 appears to contain the data for Sites 11/21. Please correct these discrepancies.

15. **Section 3.1.1, Installation Restoration Sites 11/21, Page 3-4:** The third paragraph on this page refers to the "practical remediation concentration" of 1,400 ug/l. It is not clear what is meant by "practical remediation concentration." Please define this expression and explain how it applies to ISCO.

16. **Section 5.0, Chemical Oxidation Bench Scale Testing, Page 5-1:** This description of the bench scale testing is not adequate to evaluate the selection of Fenton's reagent for use at the Alameda Point sites. Also, the locations of samples collected for the bench scale test are not shown and the depth intervals and target zones are not described. The Work Plan indicates that results of the bench scale testing will be provided under separate cover. Since the design of the pilot test is based on the bench scale testing results, the Work Plan can't be finalized until the results of bench scale testing have been reviewed and approved. Please indicate when the results of the bench scale testing will be provided and include depth intervals and target zones in the delivery package.

17. **Section 6.0, Pilot Testing Activities, Page 6-1:** This section states that at Sites 11/21 the pilot test area is not placed at the highest concentration area due to COC concentrations "at or near saturation" and also because the saturated "area is very close to the Seaplane

Lagoon." Since ISCO is considered most effective in removal of NAPL, please revise the Work Plan to clarify why concentrations at or near saturation are undesirable for a pilot test location. Also, it is not clear why proximity to the Seaplane Lagoon presents a problem. If high COC concentrations and proximity to the Seaplane Lagoon preclude conducting a ISCO pilot test in the area, it appear that a full-scale ISCO system would also be infeasible. Please revise the Work Plan to clarify why a pilot test can't be conducted in the area of highest concentrations at Sites 11/21 and clarify the relevance of the pilot test to full-scale remediation if ISCO is infeasible in this area.

18. **Section 6.0, Pilot Testing Activities, Page 6-1:** This section indicates that locations of NAPL will be intentionally avoided for the pilot tests, although it is not stated how the presence/absence of NAPL will be determined. Section 6.5.1.1 states that any "free-product" collected during pumping tests will be removed in an oil/water separator, so the possible presence of NAPL is acknowledged; please specify how the presence of NAPL that has a density greater than water will be detected in the oil/water separator. If NAPL is in close proximity to the pilot test location, then measurement of the rebound of chemical concentrations in groundwater will confound the assessment of the effectiveness of ISCO. Please discuss how the presence of NAPL will be addressed in the planning of the pilot studies and the interpretation of data from the studies.

19. **Section 6.1, Site-Specific Pilot Test Well Locations, Page 6-2:** The second paragraph discusses soil and groundwater samples collected from the intermediate and deep zones at Site 9 and 11/21; however, it is not clear at what depth the samples were collected or which hydrogeologic unit corresponds to the "intermediate" and "deep" zones (e.g., FWBZ, BSU, SWBZ, etc). Please revise the Work Plan to clarify how the shallow, intermediate, and deep zones correspond to the hydrogeologic units described in Section 2 and clarify the depths and locations from which the bench scale test samples were collected.

20. **Section 6.1, Site-Specific Pilot Test Well Locations, Page 6-2:** The third paragraph states that the well spacing was developed from analytical model drawdown prediction using estimated hydraulic conductivities from slug tests; however, the slug tests and resulting hydraulic conductivities are not discussed in the Work Plan. The development of well spacing using hydraulic conductivity estimates is also not presented. In order to evaluate the proposed placement of wells for the pilot test, please revise the Work Plan to discuss the slug tests that were conducted, present the estimated hydraulic conductivites and present the analysis that was performed to develop well spacing.

21. **Section 6.5.1, Aquifer Pumping Test, Page 6-5:** One of the objectives stated for the aquifer test is to evaluate vertical hydraulic communication between hydrostratigraphic layers; however, it is not clear which layers are referenced as layers of concern at each site. According to Table 11, the extraction/injection well at Site 9 is screened across the FWBZ, the BSU and the SWBZ so it is not clear how communication between the FWBZ

and SWBZ can be evaluated at Site 9. The BSU appears to be assumed absent at Sites 11/21 and 16. Please revise the Work Plan to clarify which hydrostratigraphic layers are to be evaluated for vertical hydraulic communication at each Site.

22. **Section 6.5.1.7, Data Interpretation and Evaluation, and Section 6.5.2, Chemical Oxidant Injection Tests, Pages 6-8 through 6-11:** These sections are too general to be evaluated or to be useful, and the incompleteness is evident by the statement that the "details of the vendor's equipment and injection process will be provided under separate cover" once the subcontractor has been selected. Once this information is available, the Navy should address how the site conditions will be monitored for temperature and gas evolution/production that are critical for safety assessments as well as to describe reaction conditions for planning future remediation. The Navy must also address how dilution of the groundwater concentrations will be affected by injection of hydrogen peroxide solutions. Please provide a schedule for submittal of a complete Final Work Plan, as sufficient information that would allow confidence that the ISCO pilot tests will be optimized to meet remediation needs has not been provided. Also, please provide information to demonstrate that the pilot tests will conducted safely and without the adverse results that have been encountered in other aggressive, innovative field treatability studies.

23. **Section 6.5.2, Chemical Oxidant Injection Tests, page 6-10:** The assumptions listed for the design of the pilot test include homogeneous subsurface conditions and uniform contaminant distribution in the subsurface, but neither of these conditions are true for any of the three sites. Since aquifer testing and sampling is to be conducted in order to delineate contaminant distribution and identify and analyze subsurface heterogeneities, it appears that this information should be used to design the pilot tests. Please revise the Work Plan to indicate that the information collected from aquifer testing and sampling will be incorporated into the design of the pilot test.

24. **Section 6.5.2, Chemical Oxidant Injection Tests, page 6-10:** The list of factors affecting the injection rate and volume does not include the presence of natural organic matter in the subsurface or a reducing environment which may consume large amounts of oxidant. Please revise the list to include the presence of natural organics and the reducing environment in the subsurface.

25. **Section 6.5.2, Chemical Oxidant Injection Tests, page 6-10:** The first sentence on this page states that injection test groundwater samples will be collected; however, the Work Plan does not state what analyses will be performed. Please specify what analyses will be performed to demonstrate destruction of COCs by oxidation (other than reduction in concentration which will occur due to dilution).

26. **Section 7.6, Plume Delineation Samples, Page 7-4:** This section indicates that the 1,1-DCA, 1,2-Dichloroethene (1,2-DCE), and vinyl chloride plumes at Site 9 and the

benzene, dichlorobenzene, PCE and TCE plumes at Site 16 are not defined to their respective MCLs. However, it can't be determined from the information presented in the Work Plan whether or not the other plumes are defined to their MCLs. For examples, it appears that the MTBE plume at Site 9 is also not defined since there are no samples to the northwest of S09-DGS-DP08 (40 ug/l). Please revise the Work Plan to accurately show all the data on the figures so it is clear that the plumes are adequately defined.

27. **Section 7.9, Post Oxidant Injection Sampling, Page 7-6:** The sampling and analysis listed here does not include analysis of groundwater for chloride either during or after oxidant injection. Since chloride ion concentrations provide an indication that oxidation of chlorinated VOCs is occurring, it is not clear why analysis for chloride is not included. Please revise the Work Plan to include analysis of groundwater for chloride concentrations pre and post oxidant injection. Also, this section states that post oxidant injection soil and groundwater samples will be used to determine whether there are any adverse impacts to the soil or groundwater; however, it is not clear what adverse impacts are possible and how adverse impacts will be identified with the analyses listed. Please revise the Work Plan to clarify what adverse impacts to soil and groundwater might occur during the ISCO pilot test.