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MOFFETT FIELD
SSIC NO. 5090.3.A.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

March 9, 1999

Mr. Stephen Chao
Naval Facilities Engineering Command
Engineering Field Activity, West
900 Commodore Way, Bldg. 210
San Bruno, CA 94066-2402

Re: Comments on Draft ISRM Phase I Technical Memorandum

Dear Mr Chao:

The U.S. Environmental Protection Agency has reviewed the above referenced document, and find it generally well written and informative. However, we have a few concerns, which are presented in the attached comments. Our major concern is that further characterization of site-specific hydrogeologic and groundwater chemistry may be needed to support implementation of the pilot study.

If you have questions, please contact me at (415) 744-2396.

Sincerely,

Lynn Suer, Ph.D.
Remedial Project Manager

Attachment
cc: Joseph Chou, RWQCB
Tim Mower, TTEMI
Sandy Olliges, NASA
James McClure, RAB
Peter Strauss, RAB

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Attachment to 3/9/99 Letter

U.S. Environmental Protection Agency

Comments on

Moffett Federal Airfield
ISRM Phase I Draft Technical Memorandum

SPECIFIC COMMENTS

1. Executive Summary, page ES-1

Please quantify the "time frame" referred to in paragraph 2 for the remediation of the A-2 aquifer zone contaminant plume.

2. Section 2.2: MFA Hydrology, page 4

The range for hydraulic conductivity given appears extremely large (5.7 to 240 feet per day). Please provide discussion. How does this uncertainty affect the determination of groundwater velocity (5 feet/day is cited in Section 8.0)? This section should include a discussion of groundwater velocity.

3. Section 3.0: Technology Description, page 5

In this section, it is stated that the remaining injected reducing agent and dissolved reaction products are withdrawn from the well used for injection. This seems improbable, since the "remaining" injected reducing agent and products will be downgradient of the injection well. Please explain. Also, please define "remaining injected reagent."

The MFA Hydrogeology discussed in Section 2.2 is not included in any meaningful way in this Section 3.0. Discussion is needed to better understand what design measures will be taken to account for the heterogeneity in the geology.

4. Section 3.1.1: Sediment Reduction, page 6

This section indicates that a substantial mass of sulfite ion will be generated in the aquifer, and will migrate downgradient from the fixed reducing zone. The potential environmental effects of the sulfite ion generated should be discussed in this document. It is presumed that its ultimate effect will be to elevate sulfate levels downgradient. Equation (3) should show 2Fe(3+) on the lefthand side.

5. Section 3.1.2: Sediment Oxidation, page 7

It is correctly stated that the reduced structural iron will react with oxidized, redox-sensitive groundwater constituents, including chlorinated organic compounds, dissolved oxygen, and metals. Organic matter and bacteria present in the aquifer will also account for the oxidation of some of the ferrous ion, reducing the amount available for the reduction of the target analytes. Nowhere in this section is there any estimate of the percentage of ferrous ion consumed by non-target analytes. Please provide, or discuss.

6. Section 3.1.3: Organic Contaminant Degradation, pages 8 to 10

Equation (12), the reductive elimination of TCE, shows the formation of chloracetylene, which has the potential to further degrade (abiotically or biotically) to vinyl chloride. Vinyl chloride is also identified as a hydrogenolysis product of DCE (equation [19]). The potential for vinyl chloride production via either pathway is of great concern, since the MCL for vinyl chloride is less than that for TCE. This document should address the potential for reaction products other than acetylene, and their potential environmental impacts.

Please provide the citation(s) for the "previous studies" showing that sediment can be re-reduced with only a small loss in capacity.

7. Section 3.2: Geochemistry, pages 10 –11

Please provide further text to support the statement that: "The amount of sulfate remaining in the subsurface.....*can be economically removed during the withdrawing phase of the project.*" Please define fully "the withdrawing phase of the project."

Please provide further information regarding the concentrations of metals mobilized during injection and drift, as observed by Fruchter et al, in the cited field test.

8. Section 4.2: Local Groundwater Characteristics, pages 15 to 16

It is stated that no vinyl chloride was detected in well W9-14. Has vinyl chloride been detected in any of the other wells shown in Figure 2 of this report?

On page 16 it is stated that the A-2 aquifer is in a reduced environment (based on Eh) and that it is anoxic (low dissolved oxygen). This appears to contradict Section 3.0, in which an oxidizing aquifer is a stated requirement for ISRM. Please explain/reconcile.

9. Section 5.0: Test Objectives, pages 16 to 17

The bulleted items should include:

- Identify all TCE degradation reaction products
- Determine whether vinyl chloride is produced.

10. Section 6.1: Sample Collection, pages 17 to 19

Please explain why well W9-14 was selected as the source for contaminated groundwater (presumably because this well exhibited the highest organic COC levels?). Please provide full VOC results list for the groundwater collected (e.g., SW 8260 result list or comparable) and full inorganic analysis results (metals and common ions). VOC and inorganic results should also be provided for the uncontaminated groundwater.

11. Section 6.3: Batch Tests, pages 19 to 20

Why was the uncontaminated groundwater sparged with helium prior to use, if the objective was to use groundwater representative of the formation? Would the pH buffering to maintain a pH between 10 and 11 be feasible in the field? Please specify the GC/MS analytical method used (page 20).

12. Section 6.4: Column Tests, pages 20 to 22

Please provide the rationale for the chosen column residence times (2 to 14 hours). It is stated that the water used in the experiments approximated the major ions found in the aquifer. Please provide the major ion analytical results for the formation water.

13. Section 7.1: Sediment Reduction and Oxidation, pages 23 to 30

On page 28, it is noted that the aquitard sediment contained approximately three times the reducible iron content of the sediment samples. Please further discuss the significance of this. Since the available reaction surface of aquitard material is greatly less than that of the sediment, it would appear that the higher reducible iron content of the aquitard would have little beneficial effect.

Please present a sample calculation showing the derivation of the 1 percent reducible iron stated for the aquifer sediments.

14. Section 7.2: Organic Contaminant Degradation, pages 30 to 37

The text states that the reaction products (chloracetylene, acetylene, and ethylene) for the presumed major reaction pathway (reductive elimination) were not analyzed for in this experiment. Please explain this apparent omission. Without these analyses, the TCE mass balance cannot be conducted. Twenty percent of the TCE mass loss is accounted for by the increase in DCE concentration, as is stated. A mass balance should be included in this report to account (as far as is possible) for all of the TCE mass loaded in the influent stream.

Since adsorption to the sediment may have accounted for 60% of the TCE removal (page 32), why was the sediment not subsequently analyzed by GC/MS to confirm this as part of the mass balance process?

Figure 9a should be modified to include a third line, mole fraction of TCE effluent plus mole fraction of acetylene effluent, in order to indicate the mole fraction of TCE in the influent not accounted for. Figure 9c clearly shows vinyl chloride production; the molar ratio of acetylene to vinyl chloride being 2,500 at 180 hours. Although this 2,500:1 ratio for the degradation products acetylene and vinyl chloride indicates that small quantities only of vinyl chloride are formed, this fact is not insignificant, and must be discussed in the summary section (Section 8.0).

It is stated that concentrations of ethylene and vinyl chloride were not statistically different from influent values; please provide both influent and effluent values for comparison.

15. Section 8.0: Summary, pages 38 to 39

The statement that only 70% of the TCE mass lost during testing was accounted for is troubling. Were there other reaction products that were not analyzed? Is the balance accounted for by adsorption to the sediment? Please provide further discussion.

Please provide the derivation of the groundwater velocity (5 feet/day) quoted in this section. Considering the large degree of uncertainty in the hydraulic conductivity stated in Section 2.2, it seems that a range of uncertainty should accompany the groundwater velocity.