Department of Toxic Substances Control

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

Winston H. Hickox
Secretary for
Environmental
Protection

Gray Davis
Governor

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ALAMEDA POINT
SSIC No. 5090.3

October 26, 1999

Commanding Officer
Engineering Field Activity, West
Naval Facilities Engineering Command
Attn: Mr. Dennis Wong, Code 612
900 Commodore Drive, Building B-206(U)
San Bruno, CA 94066-5006

DRAFT SITE 5 ELECTROKINETIC PILOT-SCALE TREATABILITY STUDY OVERSIGHT REPORT, ALAMEDA POINT, ALAMEDA, CALIFORNIA (SEPTEMBER 1999)

Dear Mr. Wong:

The Department of Toxic Substances Control (DTSC) has reviewed the Draft Site 5 Electrokinetic Pilot-Scale Treatability Study Oversight Report, dated September 1999. It is DTSC's opinion that conclusions supported by the pilot test data are very limited. The data indicate that the electrokinetic process removed only a small amount of chromium from the contaminated soils, representing less than one per cent of the contamination present in the treatment zone. Implementation of a full-scale system to remediate cannot be recommended.

Specific comments by John Wesnousky of DTSC's Office of Pollution Prevention and Technology Development are enclosed. If you have any questions regarding this letter, please contact me at (510)540-3767.

Sincerely,

Mary Rose Cassa

Mary Rose Cassa, R.G.
Engineering Geologist
Office of Military Facilities

enclosure

cc: see next page

cc: Mr. Steve Edde
BRAC Environmental Coordinator
950 West Mall Square, Building 1, Room 245
Alameda Point, Alameda, CA 94501

Ms. Patricia McFadden, Code 612
Engineering Field Activity, West
Naval Facilities Engineering Command
900 Commodore Drive, Building B-206(U)
San Bruno, CA 94066-5006

Phillip Ramsey (SFD-8-2)
U. S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105

Brad Job, P.E.
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Ms. Dina Tasini
Alameda Reuse and Redevelopment Authority
950 West Mall Square
Alameda, CA 94501

Department of Toxic Substances Control

Edwin F. Lowry, Director
400 P Street, 4th Floor, P.O. Box 806
Sacramento, California 95812-0806

Winston H. Hickox
Agency Secretary
California Environmental
Protection Agency

Gray Davis
Governor

MEMORANDUM

TO: Mary Rose Cassa, R.G.
Office of Military Facilities

FROM: John Wesnousky, P.E.
Office of Pollution Prevention
and Technology Development

DATE: October 22, 1999

SUBJECT: ALAMEDA POINT ELECTROKINETIC PILOT-SCALE TREATABILITY STUDY

Per your request, I have reviewed the Site 5 Electrokinetic Pilot-Scale Treatability Study Oversight Report, September 1999 Draft, prepared by Tetra Tech EM Inc. for the U.S. Navy. This report includes the Geokinetics International, Inc. June 23, 1999 Final Report, Pilot-Scale Treatability Study, The Electrokinetic Removal of Chromium (VI) from the Subsoil of the Former Plating Shop, Building 5, Alameda Point. Following are my comments concerning the proposed in situ field demonstration project/treatability study.

Generally, I do not agree with the analyses and conclusions presented in the oversight report prepared by Tetra Tech EM Inc. Unfortunately, the pilot test did not demonstrate that technology was effective or commercially viable in removing chromium from contaminated soils. Only a small percentage of the chromium present in the contaminated soil was actually removed and recovered in collected solutions during the treatment. It is unknown what amount of hexavalent chromium was recovered. Based on pre-treatment soil data and the amount of chromium recovered in the recovery solutions, less than 1% of the total chromium, or 76 grams, was removed from the treatment grid. This contrasts greatly with the mass of total chromium calculated to have been removed from the treatment grid based on pre-treatment and post treatment soil data, which was less than 12%. Neither of these two numbers indicate that the treatment was very effective in removing chromium from the treatment grid.

Mass Balance

As noted above, there is poor closure of the mass balance (1% versus 12%). The report speculates that as a result of the treatment, chromium may have migrated toward the recovery wells and accumulations near the recovery wells would not have been detected with the post-treatment sampling locations. Confirmation samples were not taken in the vicinity of the recovery to determine whether or not treatment effected significant migration of chromium concentrations toward the recovery well. Without such data, any conclusions are speculative.

Total Chromium Soil Sample Results

In the pre-treatment soil sampling, the upper surface soil layer (1.5 to 2.0 feet below ground surface) was found to be the most contaminated (855 mg/kg). This layer represented only about 6% of the soil volume in the treatment grid yet contained about 1/3 of the mass of contaminants (3.33 kg ÷ 9.76 kg), but for some reason was not sampled after treatment. The comparison of pre- and post-treatment soil sample results should not have assumed that the post-treatment soil concentration of the upper layer is the same as the lower 2.0 - 2.5 feet layer. There is no reason to believe this to be true. If the upper surface layer is excluded from the analyses, the data would indicate more chromium in the treated than untreated soil. Tables 5 and 6 indicate that below the top layer, there were 6.43 kg before treatment yet 8.62 kg after treatment. An explanation is not given on why the upper layer was not sampled after the treatment. Also, there is no discussion given on whether there were any visible differences in this upper layer before and after treatment to suggest that some change had occurred. The post-treatment sampling should have included the upper layer, knowing that this layer contained a third of the mass of the contaminants present. Therefore, the estimate of treatment effectiveness (12% total chromium reduction) based on soil data appears flawed.

Hexavalent Chromium Soil Sample Results

Similarly, there is concern with the conclusions reached for the hexavalent chromium soil sample results. The Tetra Tech EM report includes a mass balance for hexavalent chromium based on pre- and post-treatment soil sample results which indicates that approximately 39% of the hexavalent chromium was removed. However, the pre-treatment soil samples were collected from only the upper layer (1.5 to 2.0 feet deep), while the post-treatment samples were obtained from the layers between 2 and 9 feet deep, and not from the upper layer. Apparently, the lower soil layers were not sampled for hexavalent chromium prior to treatment based on visual observations that hexavalent chromium was not present. Because hexavalent chromium was found in the upper layer in high concentrations before treatment and this layer was not sampled

after treatment, no conclusions can made regarding treatment effectiveness for hexavalent chromium. Unfortunately, the amount of hexavalent chromium actually recovered in the process solutions could not be determined because it is easily reduced and would not be detected.

Costs

Geokinetics reports that the cost of the four month pilot project, not including disposal costs, was $194,291 or $4,318 per yard. For the same amount of electric charge delivered over a one year period (presumed to be the same level of treatment), the cost per yard is estimated to be $5,555. These per yard costs are prohibitively high. Geokinetics claims that without the bentonite seals around the electrodes and extending the operation time to one year, costs could be reduced to $90 per yard. This projected cost estimate is based on assumptions that are not supported by the pilot demonstration data. It appears to assume an order of magnitude more charge will be delivered using the same level of power delivered per cubic meter as in the pilot demonstration (see Table 12, Tetra Tech report or Table 3 of Geokinetics report). It further assumes that the rate of reduction in concentration of chromium using their technology is a first order process, and that the optimal specific rate constant determined during the bench test on discrete core samples is applicable to a full-scale in situ process. This was not validated in the pilot test, since the treatment was not carried out to any significant degree (less than 1% recovered in solutions). In order to support such a cost estimate, it would be necessary to conduct further pilot tests where nominally 50% of the contaminants are removed and recovered, using the equipment and operational parameters associated with cost estimate. It is unlikely that the specific rate constant determined for a discrete sample (if concentration reduction really is a first order process) is applicable to the stratified and heterogeneous conditions that would be encountered in the in situ full scale operation. An additional concern with the cost estimate, as noted in the Tetra Tech EM report, is that the projected cost does not include electrode installation, waste disposal, or confirmation sampling costs.

Achievement of Preliminary Remediation Goals (PRG)

The statement that PRGs were achieved in the pilot demonstration is not accurate and misleading (see Tetra Tech EM report, Conclusions). Total chromium concentrations were all below the PRG in the untreated soils except for the upper surface layer, which was never sampled after treatment. Similar sampling design problems occurred with hexavalent chromium. Hexavalent chromium was only sampled in the upper layer before treatment, but not sampled after treatment. Therefore, the data do not show that the treatment reduced total or hexavalent chromium from levels above the PRGs to below the PRGs for any of the soil layers.

In summary, conclusions that pilot test data can support are very limited. The data only indicate that the electrokinetic process removed only a small amount of chromium from the contaminated soils (76 grams), which was a small percentage of the contamination present in the treatment zone (less than 1%). Implementation to a full-scale system to remediate the site should not be recommended based on the pilot scale results. Please call me at (916) 322-2543 if you have questions or concerns regarding the above comments.

cc: Chein Kao
Office of Military Facilities