N60211_000834
CROWS LANDING
SSIC NO. 5090.3.A

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MEMORANDUM

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DATE: 10 December 2010

SUBJECT: Crows Landing Technical Memorandum, Bioremediation Treatability Study, Aquifer Test Results

DOCUMENTS REVIEWED OR CITED

1) *Draft Phase 3 Bioremediation Treatability Study Report, Site 17 Administration Area Plume, NASA Crows Landing Flight Facility, Crows Landing, California* (Draft Phase 3 Report), dated November 1, 2010, and prepared by Oneida Total Integrated Enterprises.

2) *Final Addendum 03 to Final Work Plan Bioremediation Study, Site 17 Administration Area Plume, NASA Crows Landing Flight Facility, Crows Landing, California*, (Work Plan Addendum) dated September 16, 2009 and prepared by Oneida Total Integrated Enterprises.

INTRODUCTION

At your request, the Geological Services Unit (GSU) has reviewed the Draft Phase 3 Report which documents the efficacy of enhanced in-situ bioremediation (EISB)

technologies. The review examined compliance with the Work Plan Addendum and technical consistency. The Draft Phase 3 Report documents work which conforms to the Work Plan Addendum.

Overall, the Draft Phase 3 Report documents apparently efficacious treatability technologies as evidenced by declining ground water concentrations of benzene, carbon tetrachloride, and1,2-dichloroethane (DCA). These contaminants are cited as the primary compounds of potential concern (COPCs) in the Work Plan Addendum. The EISB technologies used to reduce COPC ground water concentrations were compressed-air biosparging, injection of oxygen-releasing compounds, and introduction of carbon-donor substrates to ground water.

The Work Plan Addendum Section 1.2, Project Objective, describes the objectives for reducing COPCs at three treatment areas using the EISB technologies:

UST Cluster 1:
Reduce benzene and DCA ground water concentrations by compressed-air injection through biosparge injection points into shallow and mid-shallow monitoring zones to enhance aerobic processes. A second objective is to remove residual source mass.

UST Site 117:
Reduce ground water benzene and DCA concentrations by release of aqueous-phase oxygen-releasing compound into the shallow and mid-shallow monitoring zones.

IRP Site 17:
Reduce ground water carbon tetrachloride concentrations by injecting aqueous-phase carbon-donor substrates in ground water via temporary direct-push borings and injection wells.

The following comments with recommendations address specific portions of the Draft Phase 3 Report text or appendices.

COMMENTS WITH RECOMMENDATIONS

COMMENT 1: UST Cluster 1: Biorsparge Injection Methodology, Equipment and Injection Depths

Draft Phase 3 Report Section 2.0 describes activities and results of the UST Cluster 1 biosparging remedial efforts for shallow and medium-shallow wells. However, the report lacks descriptions of the injection methodology and equipment. Injection points or depths are not included on the UST Cluster 1 cross-section depicted in Figure 5.

Injection points are provided in Figures 17 and 26 for UST Site 117 and IRP Site 17, respectively.

Recommendation
GSU recommends that the final report documents biosparge injection methodology, equipment, and inclusion of injection depths on the Figure 5 cross-section.

COMMENT 2: UST Cluster 1: Water Level Changes During Biosparge Injection

Draft Phase 3 Report Figure 7 depicts water-level trends at UST Cluster 1 during the course of sampling between January, 2007 and July, 2010. During the period, shallow-zone ground water levels dropped 5 feet or more. In the mid-shallow zone, well CL-MW-21(MS) experienced a drop of 44.97 feet which exposed the entire screened interval. Draft Phase 3 Report Section 2.1.2, Rebound Test, describes that decreasing water levels were observed across the site throughout the duration of the project, likely in response to regional agricultural well pumping.

Reduction of residual mass in the vadose-zone is an objective for UST Cluster 1. The declining water levels may de-water or isolate residual mass in the vadose-zone above the well screens, causing contaminants to remain in soil rather than disperse into ground water if levels were higher. The declining water levels which isolate the residual mass may mask the effects reduced contaminant dispersion to ground water as the biorsparging event progressed.

If a follow-up biosparge injection period is repeated, the event would be best scheduled when water levels are at their highest over a stable period. This would allow assessment of whether partial vadose-zone isolation experienced during typical summer and early autumn periods resulted in lower contaminant entry into the wells.

Recommendation
GSU recommends that a follow-up biosparge event, if performed, be scheduled for a season when shallow-zone water levels are at their maximum over a stable period to preclude water level drops induced by extraction well pumping.

COMMENT 3: Site 117 Damaged Wells

Draft Phase 3 Report Section 3.2.1, first paragraph, describes damage to surface completions with loss of top-of-casing survey reference points at "some" of the wells which precluded construction of potentiometric surface maps. Based on review of past potentiometric data, GSU observes that the long-term ground water flow direction data has been steady and that for the current investigation, the assumption that the flow directions remain the same is supportable. However, the loss of top-of-casing

elevations should be corrected as soon as possible as ground water monitoring at this site will likely continue into the foreseeable future.

Recommendation
GSU recommends that the damaged wells described in Draft Phase 3 Report Section 3.2.1 be repaired followed by a UST Site 117 re-survey and establishment of new reference point elevations at all wells.

COMMENT 4: Dead Rodents in Wells 17-MP-01D, 17-MP-03D, 17-MP-05B, and 17-MW-14D.

Draft Phase 3 Report Appendix B, Ground Water Sample Collection Logs, documents the presence of dead rodents in the wells cited above during the sampling events of 29 and 30 September, 2009. Well 17-MW-14D is a pilot test monitoring well. There is no follow-up explanation of how these wells were purged of the expired rodents or their decay products. The water quality impacts of decaying mammals can be substantial, impacting pH, suppressing dissolved oxygen and eH values, introducing organic compounds, sulphates, nitrates, and increased turbidity. Also, the fact that animals fell into these wells indicates that protective caps are required.

Recommendations
GSU recommends that documentation be included in an addendum which describes:

1) the method for removing dead rodents from wells 17-MP-01D, 117-MP-03DB, 17-MP-05G, and 7-MW-14D,

2) the purge methods for restoring well water quality to ambient values, and

3) the installation of adequate well protection including caps and covers.

Please contact me at (916) 266-6538 or wrowe@dtsc.ca.gov if you have any questions.