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November 2, 2007

Via U.S. Mail

Ms. Sheila Gaston
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South, B2
Denver, CO 80246-1530

**Revised Letter Work Plan – Offsite Permanganate Injection
Main TCE Plume - Operable Unit 5
Phase 2 Corrective Action Plan Addendum
Former Lowry AFB
Denver, CO**

Dear Ms. Gaston,

This letter presents the work plan for the next phase of groundwater remediation efforts in the Main Trichloroethene (TCE) Plume of Operable Unit 5 (OU 5) at the former Lowry Air Force Base (Lowry). Specifically this letter addresses the Lowry Assumption, LLC (LAC) plan to implement a chemical oxidation injection event using a potassium permanganate (KMnO_4) solution to further reduce TCE concentrations in the northern offsite portion of the Main TCE Plume (Plate 1). This letter work plan is submitted as an Addendum to the Colorado Department of Public Health and Environment (CDPHE)-approved Phase 2 Corrective Action Plan for Groundwater Cleanup at Lowry (Phase 2 CAP).

Background

LAC is conducting groundwater remediation for OU5 at Lowry under the terms of the Consent Agreement 01-08-07-02 (Consent Agreement) between the CDPHE, LAC, and the Lowry Economic Redevelopment Authority (LRA). To date, two rounds of chemical oxidant groundwater treatment have been completed in the on-base portion of OU5 and one round of treatment has been completed in the off-base portion of OU5 (north of 11th Avenue). A second round of treatment for the off-base portion of the Main TCE Plume previously approved by CDPHE was not completed. Based LAC's review of the remediation performance monitoring data compiled thus far and discussions with the CDPHE, additional treatment of TCE-impacted groundwater in the offsite portion of the Main TCE Plume is necessary as a critical step toward achieving a No Further Action (NFA) determination from CDPHE. The goal of the injection program set forth in this letter work plan is to continue progress toward achieving concentrations in the plume that are acceptable to the CDPHE for regulatory closure. The plan outlined herein is intended to supersede the CDPHE-approved second phase of injections (*Initial Site-wide*



Potassium Permanganate Injection Report and Proposed Next Phase of Site-wide Injection Plan, August 2006) for the offsite area. LAC also recognizes that additional treatment is required in other areas of the site and in the carbon tetrachloride area; these areas will be the subject of future addenda to the Phase 2 CAP.

As noted above, the entire focus of this injection event will be to address remnant TCE concentrations in groundwater within the offsite portion of the Main TCE Plume. LAC anticipates that approximately 300 injection points will be installed between November and December 2007 with field work currently projected to begin the week of November 5, 2007. The approximately 300 injection points will be advanced at locations as shown on Figures 1 and 2; 100 injection points will be advanced into the Main TCE Plume in the area between 11th and 16th Avenues (Figure 1) and 200 injection points will be advanced into the Main TCE Plume in the area between 16th and 24th Avenues (Figure 2).

Mobilization

Prior to initiating invasive field activities, LAC will obtain a Rule Authorization from the U.S. Environmental Protection Agency (EPA) Region 8 Underground Injection Control (UIC) Section to allow the emplacement of KMnO_4 in the subsurface. The request for the Rule Authorization will be consistent with Title 40 Code of Federal Regulations Parts 144.12, 144.24 and 144.27. A copy of the request for the Rule Authorization will be forwarded to CDPHE.

Many of planned injection boreholes will be located within the City and County of Denver right-of-way (ROW) of residential roadways and alleys as well as on property currently being developed by Forrest City on the former Stapleton Airport property (Figures 1 and 2). LAC's contractors will be responsible for obtaining any and all necessary ROW permits from the City and County of Denver to perform this work. Similarly, LAC's contractors will be responsible for obtaining all necessary utility locates to facilitate the invasive field activities. Where necessary, a separate contractor will be hired to survey sewer lines in order to locate residential lateral lines. LAC's injection contractors will also be responsible for obtaining all required permits necessary to acquire potable water from the Denver Water Department.

Injection of Potassium Permanganate

LAC will provide technical field oversight for each injection rig to oversee the injection activities, ensure compliance with the work plan, and address any site conditions that require alterations of the plan. Any significant alterations to the plan will be promptly discussed with CDPHE in order to ensure the continuity of field operations. The field scientist will record all daily activities in a field log including, but not limited to, a detail of all site activities, general observations, depth to the water table, injection location identification number, injection pressures and volumes, injection interval, injection depth, flow rates, and any problems encountered. GPS coordinates will also be recorded for each injection location.

Each borehole will be advanced using direct-push rigs. In the remediation area shown on Figure 1, the estimated saturated alluvial thickness is 3 to 6 feet. The injection interval will include the entire saturated alluvial thickness plus the upper 4 feet of the underlying bedrock formation. The upper bedrock interval is being included within this area based on historical groundwater data that indicate higher TCE concentrations in the underlying bedrock. For example, the concentration at bedrock well MWOB04D was 100 parts per billion (ppb) in July 2007 versus 27 ppb in alluvial well MWOB04. For the area shown on Figure 2, the estimated



saturated alluvial thickness is 10 to 20 feet. The injection interval will include the entire saturated alluvial thickness. Before initiating invasive activities in the remediation area, a field geologist will measure the depth to groundwater at the closest existing monitoring wells in order to refine the injection interval.

Direct push tubing will be advanced in each borehole to the top of saturated alluvium as indicated by field water level measurements in nearby monitoring wells. Upon reaching the target depth, injection of a 4 percent KMnO_4 solution will begin at field specified pressures and anticipated minimum flow rates of approximately 30 gallons per minute. Injections will proceed in a top-down sequence approximately every 2 vertical feet until the top of the weathered Denver Formation is encountered. Approximately 1,000 gallons of the 4 percent KMnO_4 solution will be injected into the saturated alluvium. The vertical spacing and the injection volume in each borehole may be modified depending on actual subsurface conditions encountered at each location. At the completion of injection in each borehole, the direct push rods will be removed, and the borehole will be backfilled with hydrated bentonite and cement or asphalt patch at the surface, as required under the ROW permit conditions with the City and County of Denver.

LAC estimates that as much as 100,000 pounds of KMnO_4 will be injected into the groundwater along the axis of the offsite Main TCE Plume during the implementation of this work plan. All dry form KMnO_4 will be stored in a locked and secured onsite location at Lowry; none will be stored in the actual working areas.

Reporting

LAC will prepare a weekly progress report detailing the injection location identification number, date, injection time, gallons injected, pounds of KMnO_4 injected, total depth of borehole, and depth of the injection interval. This report will be conveyed to the CDPHE in spreadsheet format via electronic mail.

At the completion of field activities, LAC will prepare a completion report for CDPHE detailing the field activities for the injection program. This report will summarize the injection program; and will provide detail regarding the total volumes and mass of KMnO_4 injected; a map showing the injection locations; and a description of any variances from the approved plan.

If you have any questions regarding the planned activities set forth in this work plan, please contact me at (303) 972-6633

Sincerely,
Lowry Assumption, LLC

A handwritten signature in black ink, appearing to read "Paul H. Weaverling", is written over a faint, circular stamp or watermark.

Paul Weaverling
Senior Project Manager

Attachments



- 1) Plate 1 – Main TCE Plume, July 2007 GMP
- 2) Figure 1 – OU5 Offsite Groundwater Treatment Proposed Injection Plan (North of 11th Avenue)
- 3) Figure 2 – OU5 Offsite Groundwater Treatment Proposed Injection Plan (North of 16th Avenue)

cc: Joe Aiken – LAC
Paul Carroll (2) – AFRPA
David Erickson – CCD DEH
Monty Force – LRA
Roger Pennifill – AIG
Jim Schrack - Aurora
Pat Smith – EPA Region 8
Elizabeth Sopher (2) – IRGA
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Lowry Project Files