Pompton Lakes Community Advisory Group
Technical Work Group
March 2, 2011

Summary of Review

TO: Pompton Lakes Community Advisory Group (CAG)

FROM: Pompton Lakes CAG Technical Work Group
(Dana Patterson, Bill Pendexter, Tim Troast and John Soojian)

DATE: March 2, 2011

RE: Raritan Arsenal Final Remedial Action Report Groundwater Treatment Pilot Systems

Introduction:

The Pompton Lakes Community Advisory Group (CAG) Technical Work Group has reviewed the Former Raritan Arsenal Final Remediation Action Report for Building 165 and Area 18C Groundwater Treatment Pilot Systems, located in Edison, New Jersey. The purpose of this review and summary is to provide information to the Community Advisory Group about groundwater treatment options that could potentially be used in the remediation of the existing TCE groundwater plume from the Pompton Lakes DuPont Works Site. The United States Army Corps of Engineers is performing the remediation of the Former Raritan Arsenal, and had success in significantly lowering the concentrations TCE in the groundwater plume during several recent pilot studies.

Summary of Report:

Groundwater pilot study activities were performed at the Raritan Arsenal site in Edison, New Jersey. There were two main Areas of Concern (AOC) known as Area 18C- Building 256 Ramp Area and 165 Fieldcrest Ave. The work spanned over three years from March 2007 to April 2010. Previous excavations of contaminated soil were performed in 1998 and 2002. There was a monitoring well (MW-114) where samples were taken and showed that from 1998 to 2007 TCE concentrations decreased from 2,900 micrograms per liter to 94.9 micrograms per liter. The soil remediation was a success in reducing vapor intrusion.

Studies were performed at Shaw's Knoxville laboratories to determine the most effective way to treat the groundwater in these two main AOC's. These studies tested ISCO, anaerobic biostimulation, anaerobic bioaugmentation, and co-metabolic (aerobic) biostimulation. The results from the laboratory studies showed that the best method for treatment at the Area 18C was bioaugmentation with pH adjustment and for the 165 Fieldcrest Avenue area the best method of treatment was ISCO with potassium permanganate. This method is a viable option for 165 Fieldcrest Avenue area because the soil oxidant demand (SOD) is much lower than that of the 18C area.

165 Fieldcrest Ave Pilot Study Section:

Before implementing the pilot study in this area there were six pre-design activities performed that were necessary for the continuation of the study. These pre-design activities that were put in place were the installation of monitoring wells, sampling groundwater and soils, completing topographical surveys, completing geophysical surveys, aquifer testing, and computer modeling. The valuable information gathered from these activities was used to design the operation of the pilot system. Then horizontal injection wells were installed to treat contaminants under the building and distribute the potassium permanganate into the relatively shallow aquifer. The installation of the pilot system took three months. However, there was a

problem; the proposed injection flow rates cause a rapid rise in the water table across the site bringing it close to ground level. There was a possibility the potassium permanganate would then be taken off site and into the stormwater system so a modified injection process needed to be created. Using this modified injection process from September to November 2008, 83,162 pounds of potassium permanganate was injected. After the injection period, a six month period of groundwater monitoring was implemented with the final sampling event performed in April 2010. Final conclusions will not be able to be derived until the potassium permanganate has dissipated and the sampling event can be conducted which could be for some time but eight of the eleven wells have been experiencing significant reduction anywhere from 57 to 99 percent.

Pre-Design Activities:

1. Geoprobe sampling was completed during April 2008 to optimize/ verify well screen intervals for the injection/extraction and monitoring wells, and confirm that injection/extraction wells were placed in the core of the TCE plume.
2. Topographic Survey was completed.
3. Geophysical Survey and a Subsurface Delineation Report.
4. Installation of monitoring wells
5. Aquifer testing was conducting and groundwater elevations and saturated thickness were determined for the treatment zone.
6. An aquifer pumping test was conducted.
7. Rising and falling head slug tests were performed.
8. Groundwater elevations and aquifer saturated thickness were measured in monitoring wells.
9. A groundwater flow model was constructed.
10. Baseline groundwater sampling was conducted.

Installation and Operation of 165 Fieldcrest Ave.:

1. Installation of four horizontal and six vertical injection wells
2. A utility and subsurface geophysical survey was completed
3. The pilot test system was constructed which included the electrical system component, and permanganate mixing and injection system.
4. The pilot system was testing using initial water injection and a stormwater video inspection.
5. Modifications to the operational design were made to keep the permanganate laden groundwater from reaching the stormwater piping.
6. The operation started in September 2008 with a partial injection of the first batch.
7. The pilot test called for injection of 30 cycle bins of permanganate which is equivalent to 99, 210 pounds exceeding the Department of Homeland Security's regulations so the DHS was notified and approved the material to be stored on the adjacent USEPA property. (A cycle bin is a reusable bulk container that provides simplified dust free material handling).
8. Flow totalizer readings were collected.
9. Overall, 83,162 pounds of permanganate were injected.
10. System was taken down and demobilized.

Area 18C Pilot Study Section:

Pilot testing pre-design activities in Area 18C included monitoring well installations, a topographic survey, hydro-geologic testing, laboratory buffer testing, groundwater sampling, and injection radius of influence testing. Pilot testing activities in Area 18C included the design and installation of a groundwater recirculation and amendment delivery system for the Lower Sand unit and the design of a direct-push injection program for the Upper Sand unit.

Pre-Design Activities

1. An additional five "deep" and "five" low monitoring wells were installed between June 2007 and May 2008.
2. Subsurface soil samples were collected from various depth intervals.
3. A topographic survey and a site topographic map were completed.
4. Aquifer testing was conducted.
5. Rising and falling head slug tests were performed.
6. An aquifer pumping test and step drawdown tests were conducted.
7. A constant rate pump test was performed.
8. A direct-push investigation was conducted.
9. Subsurface soil and groundwater samples were collected for laboratory pH adjustment and buffer testing.
10. Baseline groundwater sampling was conducted.

Installation and Operation of Area 18C Pilot Study

1. A groundwater flow model was used to construct a geologic and hydraulic model of Area 18C.
2. Particle tracking analysis was performed.
3. Installation and development of the nine extraction and nine injection wells was performed.
4. The groundwater recirculation system and amendment delivery systems were constructed.
5. Amendment metering pumps were installed.
6. The groundwater recirculation system was successfully tested.
7. Injection calculations for the injection radius were amended.
8. A 10-foot radius of influence was used in the final design.
9. Smaller amounts of potassium hydroxide were added to the injected solution to further aid in raising aquifer pH.
10. An eductor system allowed both solid and liquid amendments to be mixed into the injection solution.
11. Displacement of contaminants was minimized by injecting a small percentage of the calculated treatment area aquifer pore volumes.

Final Conclusions:

For 165 Fieldcrest Ave, it was difficult to distribute the permanganate to the northern and northeastern portion of the treatment zone. The presence of utility lines and heterogeneous fill material near the road made injection difficult. If the permanganate persists at these locations for an extended period of time, there is potential to sample and access the overall effectiveness, and to use it in other portions of the plume. They learned that utility lines and compromised storm sewer hinder the control of the injectant.

In Area 18C, the Upper and Lower Sand unit pilot tests indicated significant reduction of target contaminants and can be quickly accomplished through pH adjustment and bioaugmentation. Since the majority of the remaining contaminated portions of the plume reside within the shallow aquifer, the use of this direct-push injection approach has the potential to be cost effective for mass removal as well as a preventative measure to ensure that the contaminants do not leak outside of the treatment zone.