ISCO Soil Mixing Program: Source Area Treatment

Site

- Former Mastex Industries Site; Holyoke Massachusetts.

Contaminants of Concern

- PCE, TCE, cis-1,2-DCE and VC.
- PCE concentrations as high as 53,000 ug/l.

Geology/ Hydrology

- Site geology consists of very fine sand with intervals of silt.
- Depth to water is approximately 9-11 feet bgs.
- GW flow is from west to east.

ISCO Treatment Program

- Hydrated Lime Activated Sodium Persulfate (L-ASP).
- ~800 sq. ft area from 10-20 ft bgs within the saturated zone (296 cubic yards).
- Treatment approach included initial excavation and stockpiling of clean soils, removal of an existing concrete pad in the treatment area, soil mixing of the target area, temporary well installation and sampling, backfilling the excavated clean soils along with site restoration, and permanent well installation.
- Reagent included 17,600 lbs. sodium persulfate activated by 10,400 lbs. of hydrated lime.
- Performance monitoring from temporary wells was conducted by the client 3 days after mixing with results received the following day.

Results

- Post-treatment samples collected from the 3 temporary wells showed PCE concentrations ranging from 2,900-3,600 ug/l which were all below the performance criteria of 15,000 ug/l set forth for the site. In spring 2014, the overall project was awarded the Brownfields Project of the Year Award by the Environmental Business Council, New England, Inc.

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ISOTEC Case Study No. 68

ISCO Soil Mixing Program: Source Area Treatment Utilizing Hydrated Lime Activated Sodium Persulfate

Former Mastex Industries Site
Holyoke, Massachusetts

INTRODUCTION

ISOTEC, along with its subcontractors (Lang Tool and Tantara Corporation), were retained to implement a in-situ chemical oxidation (ISCO) soil mixing treatment program utilizing hydrated lime activated sodium persulfate (L-ASP) at a former manufacturing facility in Western Massachusetts to address chlorinated volatile organic compound (CVOC) source area soils and groundwater. Concentrations of CVOCs (primarily PCE) in site groundwater were as high as 53,000 micrograms per liter (ug/l) within the target source area well B-342R. Designation of the target treatment area was calculated by the site engineer and the reagent technology and dosage was determined by ISOTEC.

SITE BACKGROUND/GEOLOGY

Past business operations at the site have resulted in soil impacts with CVOCs, primarily tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC). The target treatment area is located in an open field area upgradient of a nearby canal and downgradient of a newly installed computing center. The area of concern (AOC) was an approximately 800 square feet (ft^2) area targeting the 10-20 feet below ground surface (bgs) aquifer interval (296 cubic yards).

Permitting for the injection activities was governed by the Massachusetts Department of Environmental Protection (MADEP) regulations.

Site geology consists of fine to very fine sand with intervals of silt within the target zone. Depth to groundwater is approximately 9-11 feet (ft) bgs and generally flows from west to east towards an adjacent canal.

ISCO TREATMENT PROGRAM AND IMPLEMEMENTATION

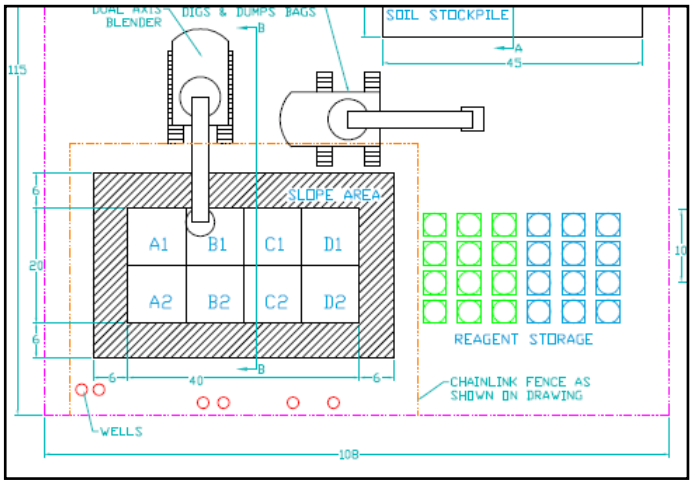
The ISCO soil mixing treatment program was implemented using the L-ASP process. Target treatment area consisted of an approximately 800 ft^2 area targeting the 10-20 ft bgs aquifer interval within the saturated zone. Prior to implementing the soil mixing program, the treatment area was delineated by ISOTEC/client and staked out to ensure that the impacted area was being treated.

Prior to performing mixing activities within the 10-20 ft bgs target treatment interval, clean gravel borrow material from ground surface down to approximately 3 ft bgs had to be excavated and stockpiled (additional areas for proper sloping were also excavated). Further excavation within approximately half of the target treatment zone (Row 2) down to approximately 10 ft bgs (top of the water table) was then conducted and the excavated clean soils were stockpiled in a separate location from the gravel borrow material. Soil mixing was then performed in Row 2 first, followed by excavation of clean soils down to the water table in Row 1. An unknown concrete pad located at about 4-5 ft bgs in Row 1 had to be broken up using a 3,000 pound (lb) hammer/breaker and then excavated to allow full access to reach the target depth interval in Row 1. Once all soils and the concrete pad were removed, soil mixing was performed in Row 1.

Soil mixing activities in Row 2 began by making an initial pass throughout the entire area in an attempt to mix and homogenize all the impacted soils so that they would loosen up prior to introduction of reagents to allow for an easier and more thorough distribution of the powder reagent once they were introduced into the treatment zone. To begin the mixing process in Row 2, all of the hydrated lime designated for ROW 2 treatment cells was blended into the treatment area to raise the pH of the impacted soils in preparation for the sodium persulfate addition. Addition of the hydrated lime first also served as precautionary measure to protect the LTC

Dual Axis blender from any sulfuric acid produced from persulfate decomposition (low pH levels) that may have been corrosive to the blending equipment. When all of the hydrated lime was introduced into the treatment area, the LTC blender mixed the dry powder throughout the entire area to further homogenize all of the soils and ensure that the pH was properly elevated prior to adding in the sodium persulfate. Next, the dry powder sodium persulfate was introduced into the target area and mixed using the LTC blender in the same fashion as the previously mixed hydrated lime. Due to the unexpected nature of the existing soils continuously heaving in and becoming stable again, which made mixing of the soils down to required depth difficult, addition of water into the treatment area was required to help assist the LTC blender in being able to mix down to the target treatment depth of 20 ft bgs. Due to the difficulties encountered in trying to get down to the target depth interval in Row 2, it was decided to change the mixing approach in Row 1 slightly from the approach utilized in Row 2. Row 1 injections did not receive the initial pass through the cell area to loosen and homogenize the soils first, and both the hydrated lime and sodium persulfate were mixed in together so that only a single mixing attempt was required to get down to depth within each cell.

After all reagents were mixed into the target treatment area (2 rows consisting of 4, 10 x 10 ft cells), 3 temporary monitoring wells were installed within the treatment area. The wells were installed using 1.5-inch diameter pre-packed screens attached to custom made cast iron supporting beams. The wells were inserted into designated areas using the excavator bucket and LTC blender to clear out specific areas and push them into the subsurface. Before installation, a hose was connected to each well with enough excess length to reach the bank of the excavation so that sampling activities could safely be conducted.



A total of 17,600 lbs of dry powder sodium persulfate and 10,400 lbs of dry powder hydrated lime were mixed into the target treatment area over a 3-day period. Three days were utilized to excavate the overburden gravel borrow/clean soils and remove the concrete pad prior to initiating the soil mixing activities. Performance monitoring sampling was conducted over a single day by the client from the 3 temporarily installed monitoring points to gauge treatment program effectiveness. After receiving confirmation that the groundwater concentrations were below the performance criteria set forth for the site, restoration activities were initiated. An additional four days were utilized to remove the temporary wells, fill in and properly compact the excavated hole, and complete all of the other site restoration activities, including permanent well installation (3 wells installed in the same approximate locations as the temporary wells).

CURRENT PROJECT STATUS

The objective of the ISCO treatment program was to thoroughly blend L-ASP into the target treatment area in an effort to reduce VOC concentrations in site groundwater to levels below one-half of their applicable Method 1, GW-3 standard. This includes the reduction of PCE in site groundwater to below 15,000 ug/L (i.e. ½ the GW-3 standard of 30,000 ug/L) in the area of shallow well B-342R based on the samples collected from temporary wells installed immediately following in-situ mixing and prior to backfilling. Post-treatment data collected from the three wells (2 weeks later) showed concentration of PCE (primary COC) in the range of 2,900-3,600 ug/l, which is well below the performance criteria of 15,000 ug/l set forth for the site. Additional samples collected approximately 5 months following treatment showed further reduction had been achieved with concentrations of PCE in the range of 200-970 ug/l. In spring 2014, the overall project was awarded the Brownfields Project of the Year Award by the Environmental Business Council, New England, Inc. for recognition of the Remediation of the Former Mastex Industries Site and Development of the State–of–the–Art MGHPCC.

Site Figure