

PROJECT HIGHLIGHT

CLIENT: Industrial Facility

LOCATION: Newark, NJ

TECHNOLOGY: Pneumatic Emplacement

LITHOLOGY: Sands and silts

CONTAMINANTS: Chlorinated Solvents

Potassium Permanganate Injection Using Pneumatic Emplacement

Past practices at an industrial facility which operated since the early 1950s resulted in multiple contaminant source areas. Numerous site investigations identified chlorinated solvents contaminants in three distinct vertical intervals, designated Zone A (5 to 15 ft bgs), Zone C Upper (30 to 40 ft bgs), and Zone C Lower (40 to 45 ft bgs). Zone A consists of dense medium to fine red-brown sand with trace silts and sub-angular gravels. Zone C Upper

consists of dense, fine to medium red-brown silty sand. Zone C Lower consists of dense red-brown silts with trace to some clay and fine sand.

In situ injections were selected as the remedy, and multiple emplacement technologies were required to address lithologic variations. Cascade employed hydraulic injections in Zone A due to the higher permeability. Due to the tight silts, we used pneumatic emplacement to treat the two deeper source zones. Pneumatic emplacement was selected to increase contact between the amendment and the impacted media, resulting in fewer injection points and therefore reducing cost.

Challenges & Solutions

Cascade successfully addressed the following challenges at this site:

- Working inside an operating facility and maneuvering within tight spaces
- Staging large volumes of permanganate over 500 feet away from the nearest tanker access
- Mixing three different concentrations of permanganate onsite to treat three different depth intervals
- Penetrating multiple layers of concrete that varied in thickness from 5 inches to over 24 inches



Industrial Facility Post-Injection

Approach

Cascade injected permanganate into three treatment zones using 12 temporary injection points. Each vertical treatment zone required a different volume and concentration of oxidant:

- Zone C Lower: 9,000 gallons of 5% potassium permanganate (750 gallons per injection point)
- Zone C Upper: 18,200 gallons of 2.5% potassium permanganate (1,516 gallons per injection point)
- Zone A: 22,000 gallons of 10% potassium permanganate (1,833 gallons per injection point)

Cascade also installed permanent injection wells in select locations which have since been used in several additional injection events.

Results

Cascade delivered the design target volume of oxidant in all injection points. Where Cascade applied pneumatic emplacement, the initiation and maintenance pressure data supported the creation of a fracture network in most of the Zone C intervals. Initiation pressures ranged from 60 to 170 psi in Zone C intervals and maintenance pressures ranged from 50 to 130 psi. During pneumatic emplacement injections, we observed monitoring well pressure influenced data at distances more than 40 feet in multiple directions. Our approach maximized the radius of influence, decreasing the number of injection points needed and reducing costs. Performance data indicated a well-developed interconnected fracture network throughout the treatment zone and the site was advanced toward meeting the remediation closure goal.