

Large 1,4 Dioxane Plume Requiring Chemical Oxidation

Over a Million Gallons of Sodium Persulfate Injected into Wells

PROJECT DETAILS

PROJECT: Large Contamination Plume Remediation

CLIENT: National Consulting and Engineering Firm

LOCATION: West Texas

SERVICE: In situ chemical oxidation (ISCO)

CHALLENGE

Large Contamination Plume Needed Remediation

The client had a sizable contamination plume stretching over half a mile from the source. Elevated concentrations of 1,4-dioxane and volatile organic compounds (VOCs) were found in the groundwater.

Thanks to prior experience, the client knew Cascade's track record of working safely and delivering results and chose to bring them in to work on this project.



THE RIGHT APPROACH

Sodium Persulfate Injection at Four Treatment Zones

The project required three separate mobilizations. For all three zones, the crew used pre-existing injection wells. When the client expanded their remedial design, they added to the scope of work for Cascade, which included drilling new wells for the fourth zone.

The client selected in situ chemical oxidation (ISCO) as the remediation approach—in this case, using sodium persulfate as the reagent. The oxidant was delivered to the site in super sacks, weighing 2,200 pounds (lbs.) each. The bulk mixing of sodium persulfate—instead of using 55 lb. bags—optimized injection performance and limited exposure to Cascade operators.

Cascade off-loaded, staged, and inspected the quality of the sodium persulfate. In some instances, they needed to perform additional processing due to clumping in high humidity conditions.

The Cascade crew mixed a 5% concentration of sodium persulfate in water and then injected it into the wells. Cascade also managed the mass balance, tracking how much of the oxidant was used every day and how much went into each well, and reported the data to the client daily. The crew utilized two high flow pumps, one connected to the 10-point manifold, and the other to the 5-point manifold, to get the best gallons per minute (GPM) possible under design injection pressure limitations.

EXECUTION

Extensive Safety Measures Resulted in Incident-Free Project

Safe storage and handling of the sodium persulfate reagent was a major priority. Contact with the chemical can cause severe skin and eye irritation and burns, while inhaling it can cause coughing, wheezing, shortness of breath, and asthma attacks. Sodium persulfate can also react with combustible materials to ignite fires, will react explosively with fuels, and may also explode from heat, among other risks. The team posted “No Smoking” signs, kept incompatible materials at least twenty feet from the sodium persulfate, and managed ventilation.

To eliminate exposure during injection activities, crews donned not only standard level D Personal Protective Equipment (PPE) but also chemical Tyvek suits and, during chemical mixing, a full face respirator. Although the gear kept crew members safe, it was challenging to work in the suits and respirators during the summer months; the high humidity and temperatures in the 90s created another potential health and safety hazard. The crews covered this during the morning tailgate meetings, discussing how to avoid heat stress by taking more breaks, monitoring their intake of water and electrolytes, and using the buddy system.

The work zones were located at privately-owned active facilities. The crew set up exclusion zones to section off each area, protecting the public and facility employees. Necessary safety fencing, traffic cones, and “Do Not Enter” flagging was brought to the site and maintained throughout the project.

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The result of all these safety measures was zero safety incidents during the project.



RESULTS

Over a Million Gallons Injected Successfully and Safely

Due to the size of the plume, this was one of the largest injections Cascade has ever conducted. Over a million gallons of solution, containing 443,004 lbs. sodium persulfate in total, was effectively distributed on this project. And despite the potential hazards of the amendment chemistry and site conditions, more than 3,900 man hours were completed with zero safety incidents, and the work was executed on time and on budget.

Injection Volumes and Persulfate Dosing		
Site	Pounds of Reagent	Total Gallons of Solution
Area 1	125,628	357,000
Area 2	110,200	246,110
Area 3	74,936	174,289
Area 4	132,240	317,333
TOTAL	443,004	1,094,732