



# Source Zone Treatment In Situ Stabilization

One Partner. Many Solutions.



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# CIVIL & ENVIRONMENTAL CONSTRUCTION SERVICES

**With so many moving parts on an environmental services project, it can be stressful trying to coordinate contractors for the hundreds of tasks that must be completed.**

That's why Cascade Environmental offers the resources for you to complete your project, from concept to completion. In addition to our drilling, site characterization, and remediation services, we also offer civil and environmental construction options, such as MGP management, in situ stabilization, ISS/ISCO, wetlands mitigation and bank stabilization, industrial cleaning, decommissioning, and landfill management.

## THE CASCADE ADVANTAGE

- **Simple** - Our integrated services reduce the complexities of managing multiple subcontractors.
- **Effective** - Our collaborative approach delivers project synergies for optimization of data collection and remedy design, saving you time and money.
- **Experience** - Our team of seasoned experts have the know-how to deploy the right tools at the right time to achieve the right outcome.
- **Assets** - Our clients have access to the most extensive fleet of mobile systems for on-site high resolution site characterization, injection, fracturing, and drilling in the United States.

**Ready to get started on your next project?**

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## CIVIL & ENVIRONMENTAL CONSTRUCTION SERVICES

- MGP Management
- In Situ Stabilization
- ISS/ISCO
- Wetlands Mitigation
- Bank Stabilization
- Industrial Cleaning
- Decommissioning
- Landfill Management

**COMBINED TECHNOLOGIES AVAILABLE**



# IN SITU STABILIZATION OVERVIEW

**When subsurface contamination is discovered, the property's future use is jeopardized.**

The contaminants must be addressed swiftly, ensuring they won't be leached away into other soils or groundwater, and that they won't pose any danger to the people utilizing the site in future. In situ stabilization (ISS) is often an ideal solution.

ISS, also known as chemical fixation, converts contaminants to their least soluble, mobile, and toxic forms. At the same time, the process contains and isolates the contaminants within a monolith matrix, which eliminates pathways to exposure to humans and surrounding environments.

The treated property becomes a prime candidate for redevelopment, as the strength of the ISS-treated materials can act as an exceptionally strong subsurface or subbase for commercial and industrial construction.

## INTEGRATED SERVICE OPTIONS

- Traditional or High Resolution Site Characterization
- Treatability Testing
- Pilot Testing
- Full Scale Testing
- In Situ Chemical Oxidation

## COMBINED TECHNOLOGIES AVAILABLE



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# PROJECT SNAPSHOT

## MGP ISS Project Sets Record for Client Health and Safety Audits

**Location:** Paulsboro, New Jersey

**Service:** In-Situ Stabilization, Demolition

**Client:** Utility Company

**Project Duration:** 30 field days

**Contamination:** MGP Residual, LNAPL, DNAPL

**Project Value:** \$4,500,000

### Project Approach

Cascade completed a 16,500 CY In Situ Stabilization (ISS) project at a former Manufactured Gas Plant (MGP) Site, subjacent to an active 45,000 SF warehouse building. The project involved abatement of asbestos containing roof materials, demolition of the warehouse building and segregation and handling of demolition debris and salvage. Following building demolition, 12,000 CYs of overburden soil were excavated and shipped offsite for transportation and disposal. During the course of excavation, Cascade performed subsurface demolition and removal of the former gas holders and other structures. Cascade developed and performed a treatability study and developed an approach to optimize the addition of powdered activated carbon for adsorption of LNAPL in highly impacted areas.

### WHAT MAKES THIS PROJECT UNIQUE?

This project was selected by the client's corporate EHS group to be the subject of an extensive, project long health and safety audit. Inspections by the client's team were conducted bi-monthly. All of the inspections resulted in no findings and satisfactory outcome. This was the first time in the client's over 100-year history with the result of no findings or compliance deficiencies.



### Project Results

Cascade's treatability study demonstrated that a 30% reduction in the reagent addition successfully treated all the impacted materials. 100% of the quality control sampling and analysis were passing for all performance criteria, for UCS, permeability and leachability (SPLP). Production goals were exceeded for both building demolition and ISS. Consequently, the project was completed 1.5 months ahead of schedule and significantly under budget. Using less reagents sped up the project and saved them overhead costs.

### CONTACT

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# PROJECT SNAPSHOT

## ISS to Sixty Feet Below Ground Surface at Former Industrial Manufacturing Site

**Location:** Mid-Atlantic

**Service:** In-Situ Stabilization

**Client:** Industrial Client

**Project Duration:** One year

**Contamination:** dowTHERM

**Project Value:** \$8,100,000

### Project Approach

Prior to the in-situ stabilization (ISS), the remediation areas required extensive preparation involving the removal of subsurface piping, utilities, deep piling, monitoring wells, surficial and underground reinforced concrete structures as part of the previous manufacturing facility at the site. ISS of 3,000 CY soils by excavator bucket was completed at a depth of ten feet below ground surface (bgs) at one location. At a second location, a retention pond onsite was dewatered by pumping two feet of pond water 700 feet to another retention pond located on site, followed by ISS of 2,000 CY of pond sediments by bucket excavator to a depth of six feet. ISS of 58,000 CY of soils by deep soil mixing (DSM) using large diameter augers was completed over two additional areas, distributed amongst 700 cells (8-foot diameter by 60-feet deep.)

### WHAT MAKES THIS PROJECT UNIQUE?

The contaminants were extremely odorous and required careful management as the site was bordered by residential properties. In addition, asbestos containing materials (ACM) were known to be present, thus Cascade provided full time asbestos monitoring oversight with requisite ambient air sampling collected daily during the intrusive work. Engineering controls were also implemented to mitigate the ACM exposure hazard. Workers in close proximity to the areas with suspected ACM were fitted with personal air sampling pumps with samples analyzed for asbestos fibers.

### Project Results

ISS of 63,000 CY of soils to depths of up to 60 feet. 20,000 man-hours of safe work, without an OSHA incident or recordable injury. On multiple occasions, the crew achieved up to 1,200 CY of DSM daily. The team developed and employed unique tooling to complete the deep soil mixing in dense, highly cemented lithologies (ferric sands), which maximized mixing energy, as well as, reagent distribution and completed the DSM program ahead of schedule. Quality Control Performance Sampling was conducted at a frequency of 1/500 CY and tested for Unconfined Compressive Strength (ASTM D1633) and Permeability (ASTM D5084) at 7-, 14-, and 28-day intervals with all results exceeding performance criteria.



### CONTACT

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# PROJECT SNAPSHOT

## ISS/ISCO at Small Former Dry Cleaners

ISCO/ISS

**Location:** Seattle, Washington

**Reagent:** Klozur SP & Sodium Hydroxide

**Client:** Confidential Client

**Value:** \$175,000

**Contamination:** CVOCs

**Project Duration:** 2 Weeks

### Project Approach

Cascade performed in-situ chemical oxidation (ISCO) and in-situ stabilization (ISS) on the site of a former dry-cleaning business. A total of 1,172 cubic yards (CY) of soil, impacted by chlorinated volatile organic compounds (cVOCs), were treated using Klozur® SP (KSP), sodium hydroxide (NaOH) and Portland cement (PC). The site was prepped prior to Cascade's arrival, with soil removed to two feet below ground surface (bgs). The total treatment area, 38 feet by 98 feet by 8 feet deep, was divided into 15 separate cells, each approximately 265 square feet. Working cell by cell, the soil was treated in two four-foot lifts. The top four feet from 2 to 6 feet bgs was removed and placed adjacent to the cell. Soil from ten feet bgs to six feet bgs was then blended with 2.1 tons of PC, 7.3 gallons of NaOH and 1,100 pounds of KSP, using an excavator-mounted Alpine rotating mixing head. The previously excavated soil was then replaced and soil from six feet bgs to two feet bgs was mixed with an additional 2.1 tons of PC, 7.3 gallons of NaOH and 1,100 pounds of KSP. Water for the mixing was sourced from a nearby church hose bib, and then from a municipal water fire hydrant.

### WHAT MAKES THIS PROJECT UNIQUE?

The site was very small, within a mixed residential and small business neighborhood. Field crews had to be extremely cognizant of surroundings, to minimize noise, dust and traffic impact on the neighborhood. Since both the work site and mixing area were limited, a stand-alone batch plant on site for the Portland cement was not feasible. The field crew coordinated with a local cement supplier to deliver pre-mixed and appropriately sized loads cement since the area provided minimal storage and pre-mixed PC reduced the potential for nuisance dust.



### Project Results

Over 200 man-hours were logged without incident. Cascade provided additional, out of scope services including disposal of the packaging materials (i.e., pallets, bags and drums) from the reagents as well as trees and stumps that were left on-site from previous site preparation activities - at the client's request. The project was completed on time and within budget.

CONTACT

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**Location:** Yuma, Arizona

**Reagent:** Portland Cement & ORC

**Client:** Confidential Consultant

**Service:** Soil Mixing & Injections

**Contamination:** TPH & BTEX

**Project Duration:** 2 Months

### Project Approach

Cascade performed in-situ chemical oxidation (ISCO) mixing project followed by in-situ stabilization (ISS) of 3,000 CY of TPH/BTEX - impacted soils with Portland cement. Track excavator mounted mixing equipment was utilized across a treatment area of 11,000 sf to an ultimate depth of 22' below ground surface (bgs). Initial work included the removal of an 8" thick concrete surface prior to excavation of clean overburden soils down to 12' bgs using a 1:5 to 1 sloping design based on existing soils and OSHA requirements. Clean overburden soils were staged on site for later re-use as backfill above the mixing and stabilized zone. In-situ chemical oxidation (ISCO) mixing using a 3-part mixture of oxidizing chemicals was completed from 12' to 22'bgs. Following mixing activities, in-situ stabilization (ISS) of the upper 3' of the mixing zone was performed through the addition of Portland cement and mixed with a rotating mixer head attached to an excavator.

### WHAT MAKES THIS PROJECT UNIQUE?

Based on the small site and layback required during excavation of overburden soils, the sequencing of the mixing cells was critical to insure tracked excavation equipment, concrete trucks, mixing hoses and other support equipment would be able to complete the work safely and without getting trapped inside the treatment area prior to stabilization with Portland cement.



### Project Results

The ISS/ISCO work was completed over a 10-day continual work period. In addition, hot spot soil excavation, transportation and disposal was completed during the work without delay or impact to the ISCO/ISS work. Backfilling and site restorations were completed in a second 10-day work period.

### CONTACT

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