IN SITU STABILIZATION

STATEMENT OF QUALIFICATIONS

CASCADE

EXECUTIVE SUMMARY

Cascade's in situ stabilization (ISS) technology is a premier solution for trapping and limiting the migration of contaminants in soils. Our treatment process effectively reduces the hazard potential of waste by transforming contaminants into their least soluble, mobile, and toxic form. This process not only enhances environmental safety by locking contaminants within a solid matrix but also paves the way for site redevelopment. The treated materials' robust strength makes them ideal for commercial and industrial subbases.

As one of the most experienced and successful ISS contractors in the United States, Cascade has performed many ISS projects over various industry sectors in diverse and challenging environments. Our comprehensive services include both ISS and chemical soil mixing, tailored to each site's specific needs. These services can be effectively combined with other technologies to address a variety of contamination issues.

Our commitment to excellence is further exemplified through rigorous bench-scale treatability studies and pilot-scale field testing, with the ability to perform this testing in-house. These crucial steps not only ascertain the technical and economic feasibility of potential ISS treatments but also refine methodologies for full-scale implementation. Our approach ensures the optimization of both treatment effectiveness and project economics, underlining our dedication to delivering high-quality, cost-effective solutions for our clients.

Cascade invites you to explore how our ISS expertise can transform your contaminated sites into safe, usable land, contributing to environmental sustainability and your project's success.

Cascade's ISS Excellence:

- A Decade of Leadership: Over 10 years at the forefront of implementing ISS and soil mixing services, setting industry standards for excellence and innovation.
- Expertise Tailored to your Needs: Our staff, renowned for their specialized skills in ISS, play a vital role in customizing solutions for each unique project. Their unparalleled knowledge and adaptability ensure successful outcomes tailored to specific site requirements.
- Proven Track Record: Proudly having completed many major ISS projects across the United States, each showcasing our commitment to quality, efficiency, and environmental safety.
- Dedicated Team of Specialists: A robust team of 20 dedicated professionals, each with extensive hands-on experience in ISS. This team not only brings you a wealth of knowledge to every project but also a passion for delivering solutions that exceed client expectations.

In Situ Stabilization – Effective and Sustainable Remediation

ISS, also known as chemical fixation, is a highly effective and environmentally friendly remediation process used to manage and mitigate the risks associated with contaminated sites.

What is ISS?

ISS is a treatment process designed to significantly reduce the hazard potential of waste materials. It achieves this by converting contaminants into forms that are less soluble, less mobile, and less toxic. The process effectively reduces hydraulic conductivity to below 1x10-6 cm/sec and unconfined compressive strength of 50 PSI. By decreasing both leachability and hydraulic conductivity, ISS locks contaminants within a monolithic matrix, thereby eliminating potential environmental exposure. This stabilization makes ISS-treated materials robust and durable, making them excellent choices for subsurface or subbase layers in commercial or industrial construction, thereby facilitating site redevelopment.

Advantages of ISS

The primary advantage of ISS lies in its in-place treatment of contaminated media. This approach eliminates the need for separate on-site treatment areas and removes the complexities and costs associated with ex situ material management, including transportation logistics and off-site treatment or disposal. ISS is particularly advantageous when the final disposition of the treated material remains on-site. It also reduces or eliminates the need to bring in fill materials.

ISS can be effectively combined with other remedial technologies, such as in situ chemical oxidation (ISCO). This combination allows for the destruction of contaminants before they are encapsulated in the solid matrix. The ISS-ISCO method offers an added level of treatment, reducing contaminant concentrations before stabilization reagents are introduced to bind residual and non-oxidizable contaminants.

Cascade's Approach to ISS

Cascade's expertise in ISS extends to both bench-scale treatability studies and pilot-scale field testing. These steps are crucial in determining the technical and economic feasibility of ISS solutions. Bench-scale studies help in formulating potential treatments, while pilot-scale testing refines the methods required for full-scale implementation, validating both the treatment formulations and their economic viability.

Equipment and Implementation

A variety of common excavation and mixing equipment can be used for shallow ISS treatment, such as asphalt scarifiers, bulldozers, excavators, and tillers. For deeper applications, specialized equipment like augers suspended from cranes or drill rigs are employed. Cascade owns and maintains all the necessary equipment, including but not limited to:

- Batch Plants (Scheltzke and Bauer)
- Specialized Excavator for Deep Bucket Mixing
- Specialized Skeleton Bucket
- Multiple Augers
- Silos
- Custom Delivery Pumps

The choice of equipment is dependent on various factors including the waste's physical characteristics, contamination depth and extent, stabilized material performance criteria, and the required production rate. Studies comparing different ISS mixing methods have shown that the performance of treated material is consistent, regardless of the equipment used.

CASCADE'S SUSTAINABILITY PROGRAM

Cascade's sustainability vision is to integrate environmental stewardship, social responsibility, and economic prosperity into every action that drives our business. We believe that these three pillars are essential for creating long-term value and promoting a more sustainable future. To achieve this vision, we are focused on building resilience by prioritizing employee retention, fostering strong relationships with our suppliers and clients, conducting business ethically, and ensuring profitability. Our sustainability strategy includes policies and programs that promote quality execution in every aspect of our business, reinforcing our commitment to sustainable growth in the face of change.

To achieve this vision, we have set three strategic priorities.

- First and foremost, we prioritize the health and safety of our employees, customers, and communities. Our world-class CORE™ Health & Safety Program is a behavior-based program that emphasizes hazard recognition and mitigation before an incident occurs.
- We also recognize the importance of growth, which means investing in our people and equipment, increasing sales, and maintaining a healthy balance sheet. By investing in our business, we can create long-term value for our stakeholders and promote sustainable growth.
- Finally, we prioritize employee retention. We are committed to fostering a diverse and inclusive workplace and providing our employees with opportunities for growth and development. By focusing on these three priorities, we are creating a sustainable business model that will continue to deliver value for our stakeholders well into the future.

To learn more about our commitment to sustainability, please download our most recent Annual Sustainability Report:
https://www.cascade-env.com/about-us/sustainability/

RELEVANT PROJECT EXPERIENCE

At Cascade, our mastery of ISS is not just a claim – it's a well-established track record spanning over ten years. During this time, we have not only adopted ISS but also refined and perfected it, successfully remediating and completing many projects across the United States. These projects, each unique in its complexity and challenges, stand as testaments to our capability, innovation, and commitment to delivering environmental solutions of the highest standard.

Currently, Cascade is at the forefront of advancing ISS, with three major projects in various stages of design, construction, and operation. These ongoing projects reflect our dynamic approach to environmental remediation, continually pushing the boundaries of ISS applications and demonstrating our adaptability to diverse environmental challenges. Each project undertaken by Cascade is a step forward in our journey of environmental stewardship, showcasing our ability to not just meet but exceed the evolving demands of site remediation through ISS.

This section of our statement of qualifications is dedicated to sharing our rich experience through selected case studies. These studies not only highlight our technical expertise but also our collaborative approach, ensuring that each project we undertake is aligned with our clients' goals and environmental sustainability.

CASE STUDY #1

MGP ISS PROJECT

IN PAULSBORO, NEW JERSEY

Cascade completed a 16,500 CY 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 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 the adsorption of LNAPL in highly impacted areas.

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 the inspections resulted in no findings and satisfactory outcomes. This was the first time in the client's over 100-year history with the result of no findings or compliance deficiencies.

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 passed 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 fewer reagents accelerated the project and saved the client overhead costs.

CASE STUDY #2

ISS TO SIXTY FEET BELOW GROUND SURFACE AT FORMER INDUSTRIAL MANUFACTURING SITE

Before the ISS, the remediation areas required extensive preparation involving the removal of subsurface piping, utilities, deep piling, monitoring wells, and 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).

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 near the areas with suspected ACM were fitted with personal air sampling pumps with samples analyzed for asbestos fibers.

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.

SAFETY

At Cascade, safety is not just a policy; it's a core value ingrained in every aspect of our operations. We prioritize the health and safety of our employees and subcontractors above all, ensuring it is never compromised for expediency or cost. Our comprehensive Health and Safety Program is thoroughly designed to not only comply with governmental regulations but also to exceed our client's specific health and safety requirements.

Core™ – Cultivating a Culture of Safety

Our innovative CORE™ Program is the backbone of our safety culture. This behavioral-based approach empowers employees to proactively engage in safe practices, fostering a self-sustaining safety environment. CORE™ encompasses seven key elements:

- Rigorous Training
- Compliance and Risk Management
- Inspections and Audits
- Effective Communication
- Recognition and Accountability
- Active Management Involvement
- Thorough Incident Investigation and Case Management

Every new Cascade employee undergoes comprehensive CORE™ training, ensuring an in-depth understanding of our safety processes and practices.

Project-Specific Health and Safety Planning

Before any field mobilization, we develop a detailed site-specific Health and Safety Plan (HASP) for each project. This plan covers critical safety aspects:

- Organizational responsibilities
- Site descriptions and histories
- Scope of work
- Chemical hazards and exposure control
- Physical hazards and controls
- Air monitoring
- Personal Protective Equipment (PPE)
- Site Control
- Decontamination processes
- Medical monitoring and training requirements
- Emergency response procedures

Daily Safety Engagement

We conduct daily field safety meetings (Tailgate meetings) for all field projects, adapting additional meetings as needed for changes in scope or conditions. Every Cascade team member, including supervisors and subcontractors, actively participates in these meetings, reinforcing our safety-first mindset.

A Record of Safety Excellence

Our commitment to safety is reflected in our exceptional experience modification rate (EMR) of 0.65, significantly lower than the industry average. This achievement underlines our dedication to maintaining a safe work environment amidst the technical challenges we face.

Year	EMR Rate
2023	0.65
2022	0.58
2021	0.55

COMPANY OVERVIEW

As the premier single-source provider of environmental and infrastructure drilling, site characterization, and environmental remediation services, Cascade stands at the forefront of the environmental services industry. Our expansive network of over 35 offices and a dedicated team of over 900 employees positions us uniquely to support projects of any scale and complexity across the nation.

At Cascade, we bring more than personnel to the table; we bring solutions. Our comprehensive supply of specialized equipment is tailored specifically for cutting-edge technologies in environmental remediation. This, coupled with our in-house team of experts, enables us to offer a full spectrum of integrated environmental services, enhancing efficiency and effectiveness for our clients.

Comprehensive Environmental Construction Services

Cascade's Environmental Construction team specializes in a wide area of services including, but not limited to:

- In situ and ex situ soil remediation
- Soil vapor extraction and groundwater recovery and treatment
- Manufactured Gas Plant (MGP) site remediation
- Wetlands restoration
- Landfill cell installation, capping activities, and other earthwork services

Additionally, we are at the cutting edge of implementing innovative technologies such as in situ chemical reduction (ISCR), chemical oxidation (ISCO), and bioremediation for soil and groundwater.

Our strength lies in our people. Cascade's team is a blend of licensed engineers, seasoned project managers, site superintendents, and skilled field staff, many of whom have been working together effectively for over two decades. This rich experience has led to the successful completion of numerous projects under diverse programs including private and municipal contracts, State, RCRA, CERCLA, and other government initiatives, particularly throughout the Northeast and across the United States.

As a full-service environmental and civil remediation services contractor, we at Cascade possess the in-house expertise, substantial resource capacity, and extensive equipment inventory to self-perform all major elements of complex projects, both large and small. To optimize productivity, reduce timelines, and minimize costs, we strategically incorporate the services of critical prequalified subcontractors when necessary. Our office and field personnel are not only seasoned in their fields but are also deeply committed to implementing projects safely, efficiently, and cost-effectively.

MEET OUR ISS TEAM

Our approach to ISS is not just reliable and proven; it is also the most adaptable and safe, ensuring the elimination of risk pathways for contaminants, thus protecting human health and the environment.

Our team comprises a diverse group of professionals whose collective experience in ISS remediation spans over 50 years. This pool of knowledge includes:

- **Technical and engineering experts** who bring a blend of practical know-how and innovative problem-solving skills.
- **Data management specialists** dedicated to precision and accuracy in tracking and reporting.
- **Quality control professionals** who ensure that every project meets the highest standards.
- **Health and safety experts** who are reliable in their commitment to practices that ensure both security and environmental sustainability.

Our commitment to safety and protecting the environment is embedded in every project we undertake.

Central to this commitment is our exceptional team, a diverse group of professionals whose combined experience in ISS remediation exceeds 50 years. Allow us to introduce some of our key experts who have been instrumental in shaping our approach to ISS and delivering outstanding results for our clients.

Dr. Paul Lear

Dr. Paul Lear, a nationally recognized expert in stabilization/solidification (S/S) technology, has over 30 years of experience in full-scale remediation activities and serves as one of Cascade's technical experts for ISS. Known for pioneering numerous firsts in the field, Dr. Lear led the first application of in situ chemical oxidation and thermal treatment using auger mixers, established the first CAMU for waste treatment in CA, and implemented the first full-scale S/S treatment for dioxin and explosive-contaminated soils. His innovative projects extend internationally, including the first S/S of organic wastes in Australia and ground breaking work on ISS technologies at a manufactured gas plant site in NJ. Dr. Lear's career is marked by his commitment to developing innovative solutions to complex environmental challenges, significantly advancing the capabilities of environmental remediation technologies.

Deborah Shaffer (Schnell), P.E.

Deborah Shaffer Schnell is the Vice President of Operations and General Manager of Cascade's environmental construction services. She has nearly 30 years' experience, specializing in innovative technologies at Cascade. She is a leading national expert on permeable reactive barriers (PRBs), hydraulic and pneumatic fracturing, and in situ technologies such as in situ chemical oxidation (ISCO) and in situ chemical reduction (ISCR), with a focus on amendment distribution. Deborah works with clients to select the best remedial technology for their sites, based on data presented in their conceptual site model (CSM), project timelines, and budget. Clients know her broad skillset and experience enable her to adapt and optimize in the field when the unexpected happens, and that she is still available for questions or reviews after project implementation.

Edward Zielianski, P.E.

Ed Zielanski, P.E., is the VP of Operations at Cascade's Civil & Environmental Construction division in Westampton, NJ. With 25+ years in environmental consulting, project delivery, and remediation, he has expertise in brownfield redevelopment, landfill design, and soil stabilization. His career path through the "Consultant-Client-Contractor" triangle gives him valuable stakeholder insight. At Cascade, he leads 45+ experts, ensuring project excellence for private, commercial, industrial, and energy clients. Passionate about mentoring, collaboration, and safety, Ed is dedicated to effective project delivery. Ed has extensive ISS experience managing in situ and ex situ soil stabilization projects and pilot studies for industrial and energy industry clients. He is well versed in auger mixing and bucket mixing techniques, various reagents and admixtures, and process quality control.

CONTACT US

Your journey towards efficient and sustainable environmental solutions begins here. At Cascade, we are committed to delivering exceptional remediation services and our team of experts is ready to assist you with any inquiries or specific needs you may have regarding ISS or our wide range of environmental services.

Whether you're seeking expert advice, need detailed information about our capabilities, or want to discuss potential projects, our door is always open. Reach out to us through the contact details below, and let's explore how we can collaborate to achieve your environmental goals.

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