

TECHNICAL BULLETIN: ISCO-ISS

COMBINED IN SITU CHEMICAL OXIDATION & STABILIZATION

INTRODUCTION

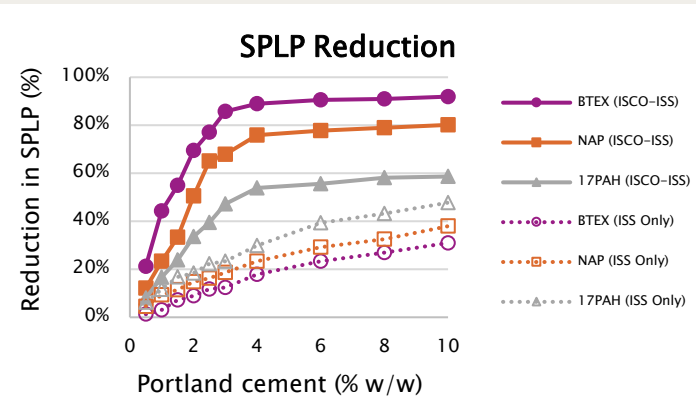
ISCO-ISS is a combination of two well established and successful remedial technologies: In Situ Chemical Oxidation (ISCO) and In situ Stabilization and Solidification (ISS). These two technologies can be combined into a single application to provide two distinct mechanisms to address contaminants of concern:

- ISCO is a contaminant mass reduction and destruction technology that uses powerful oxidants to break down contaminants of concern into benign end products.
- ISS solidifies and immobilizes the contaminants within the final solidified soil structure.

Synergistic benefits have been demonstrated when combining the two technologies, providing a cost-effective solution for many contaminated sites. These synergies include lower leachate concentrations, higher unconfined compressive strength (UCS), lower hydraulic conductivities (K), and less soil bulking.

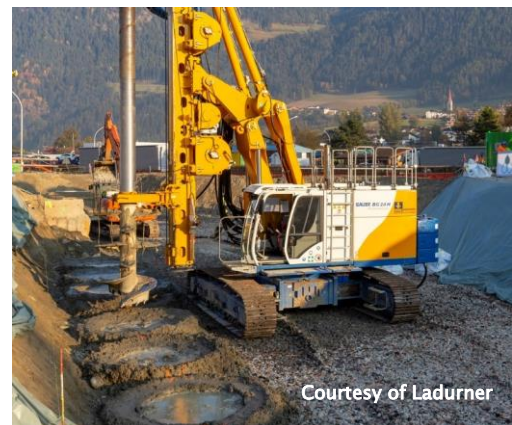
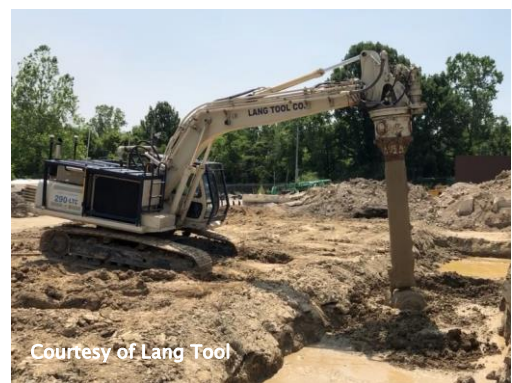
REDUCED LEACHING WITH COMBINED APPROACH

Benefits of combining two remedial mechanisms were observed by Srivastava et al (2016) that found leachate concentrations were substantially lower with ISCO-ISS compared to ISS only for the same soils and ISS reagent dosages.



Reference: Srivastava, V.J., Hudson, J.M., and Cassidy, D.P., (2016b) "Achieving Synergy between Chemical Oxidation and Stabilization in a Contaminated Soil," Chemosphere, 154, 590-598

ISCO & ISS REAGENTS APPLIED IN A SINGLE APPLICATION

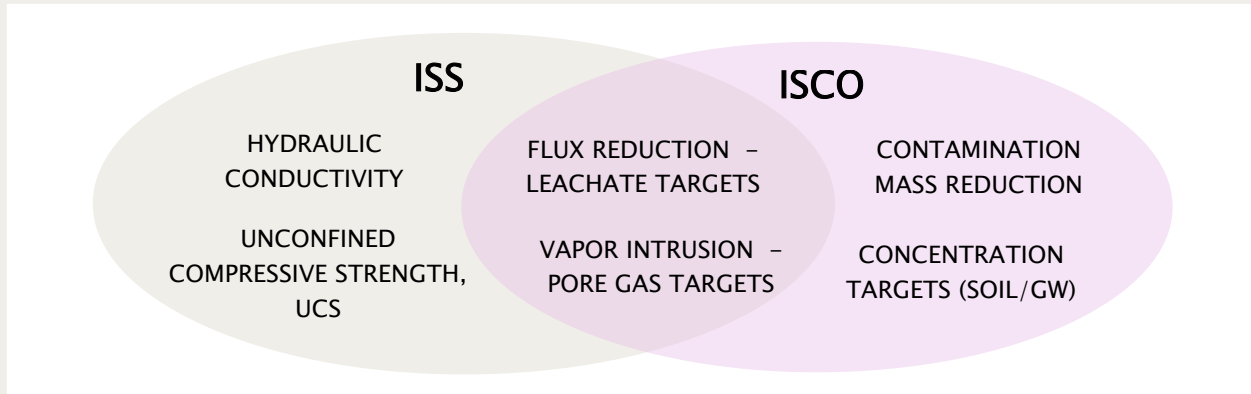


The two technologies work in synergy to reduce leaching:

- Klozur® SP (sodium persulfate) – Oxidizes the organic contaminant, reducing the mass available to leach and often preferentially treats more soluble (mobile) fractions.
- Portland Cement (PC) – Solidifies remaining contamination in a low permeable matrix.

COMMON REMEDIAL GOALS

With two distinct mechanisms used to address contaminants of concern (COCs), ISCO and ISS are often used to accomplish separate remedial goals or, where there is overlap in remedial goals between the two technologies, an enhanced combined effect.



In addition to the combined benefits, combining the two technologies can be beneficial even when ISS only or ISCO only remedial goals are scoped:

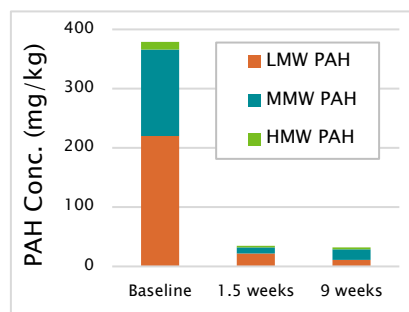
Benefits of adding ISS to ISCO applications:

- Addition of ISS reagents can be used to control geotechnical site characteristics following soil mixing, allowing for site activities and redevelopment soon after the application.
- Common ISS amendments can be used as low-cost alkaline activators for Klozur® persulfate.

Benefits of adding ISCO to ISS applications:

- Small additions of ISCO reagents can lower the amount of ISS reagents needed to reach UCS and K targets, resulting in either lower values or less soil bulking and disposal costs.
- Lower long-term risk due to contaminant mass reduction.
- Potential faster plume reduction due to reduced flux.

CASE EXAMPLE 1: FORMER MGP, SWEDEN

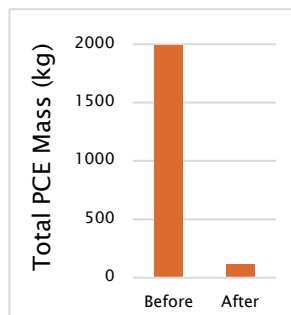


**1.8% Klozur® SP
4–8% Cement**

Higher % reduction in lower molecular weight PAH fractions:
 ~95% in light PAH
 ~90% in medium PAH
 ~80% in heavy PAH

Reference: Uppföljning av föroreningshalter i pelare efter stabilisering och kemisk oxidation av lera (ISS-ISCO), Golder, Jan 2022

CASE EXAMPLE 2: FORMER DRY CLEANERS, MICHIGAN



**1–2% Klozur® SP
4% Portland Cement**

- 94% reduction in PCE mass
- Achieved solidification goals
- Underlying GW conc. reduced by 90 to 99%

**Saved client >\$2.5 Million
compared to excavation**

Lead Consultant: J Parker, Hamp Mathews & Associates

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