

TECHNICAL BULLETIN: ISCO-ISS

COMBINED IN SITU CHEMICAL OXIDATION & STABILIZATION

INTRODUCTION

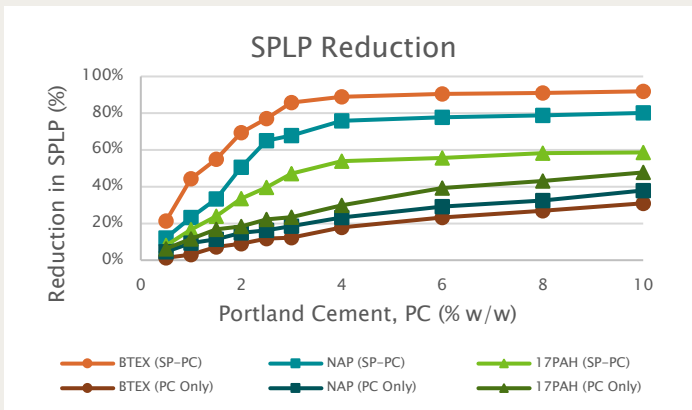
ISCO-ISS is a combination of two well established and successful remedial technologies: In Situ Chemical Oxidation (ISCO) and In situ Stabilization and Solidification (ISS). These two technologies can be combined into a single application to provide two distinct mechanisms to address contaminants of 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 more complete and cost-effective solution compared to applying either technology alone at many heavily contaminated sites.

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 in ISCO-ISS (SP-PC) compared to ISS only (PC only) for the same soils and ISS reagent dosages.

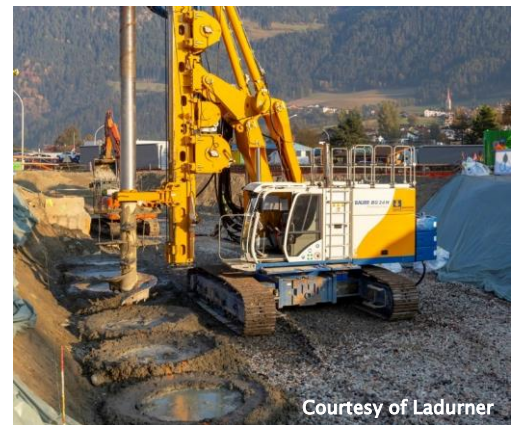


Reference: Srivastava, V.J., Hudson, J.M., and Cassidy, D.P., (2016b) "Achieving Synergy between Chemical Oxidation and Stabilization in a Contaminated Soil," Chemosphere, 154, 590-598

ISCO & ISS REAGENTS APPLIED IN A SINGLE APPLICATION



Courtesy of Lang Tool



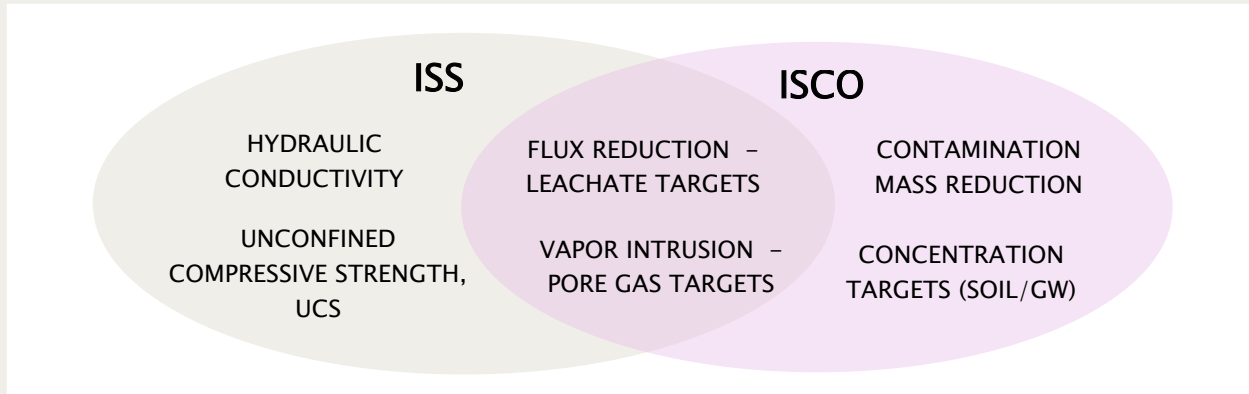
Courtesy of Ladurner

The two technologies work in synergy to reduce leaching:

- Klozur® SP (sodium persulfate) – The more soluble (mobile) fraction of the contamination is rapidly and preferentially removed via chemical oxidation.
- Portland Cement, PC – The remaining heavier (less mobile) contaminant fractions are stabilized / cemented in place.

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:

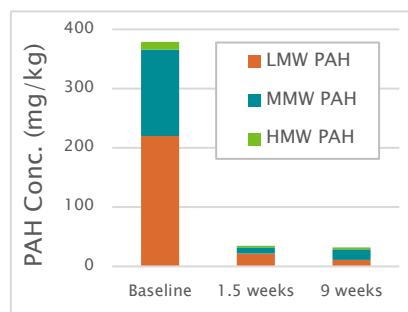
Benefits of adding ISS to ISCO applications:

- 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, improving its efficiency and reaction kinetics.

Benefits of adding ISCO to ISS applications:

- Smaller additions of ISCO reagents can lower the amount of ISS reagents needed to reach UCS and K targets → Less soil bulking and disposal.
- Lower long-term risk due to contaminant mass reduction.
- Faster plume reduction due to reduced flux.

CASE EXAMPLE 1: FORMER MGP, STOCKHOLM

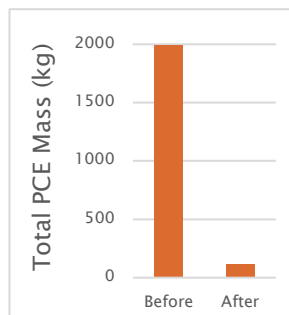


1.8% Klozur® SP
4–8% Cement

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: KENT CLEANERS, MICHIGAN



1–2% Klozur® SP
4% Portland Cement

- 94% reduction in PCE mass
- UCS of 25–50 psi (Day 60)
- 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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