

## Course Descriptions

### **LSP Course #: 1656 and 1657 2.0 Technical Credits Each**

#### **COURSE DESCRIPTION:**

#### **ISCO/ISCR Permeable Reactive Barrier (PRBs) to Prevent Migration of Contaminant Plumes**

Permeable reactive barriers (PRBs) are designed to create an in situ permeable reactive treatment zone perpendicular to groundwater flow intercepting and remediating contaminant plumes. Contaminants may be treated through a series of physical, chemical and biological processes. Depending on the type of contaminants impacting the PRBs, the reactive zone may be created using reagents based on permanganate or persulfate to promote chemical oxidation (ISCO) of contaminants or substrates like Zero Valent Iron (ZVI) to promote chemical reduction (ISCR) or indirectly, using materials designed to stimulate secondary processes (e.g., adding carbon substrate and nutrients to enhance microbial activity).

This presentation will describe the basic concepts of designing an ISCO/ISCR PRB applied to address mass flux of organic contaminants migrating through a zone of concern with an emphasis on treatment of chlorinated organics.

#### **Remediation of Heavy Metals Using Insitu Approaches That Combine Multiple Mechanisms**

Trace metals constitute a significant class of groundwater contaminants originating from mining effluents, industrial wastewater, landfill leachate, agricultural wastes and fertilizers, and fossil fuels. Based on the chemical properties of dissolved species, trace metals can be divided into two distinctive groups: reducible metals and metalloids, which are present in natural waters as anions and oxyanions (e.g.; Cr, As, Se, Mo, U), and metal cations, which occur in aqueous environments as divalent cations (e.g.; Cu, Zn, Cd, Pb, Hg, Ni). Depending on their aqueous form, the mobility of trace metals in groundwater is affected by various chemical reactions, including dissolution-precipitation, oxidation- reduction, adsorption-desorption and complexation. Several different remediation technologies based on those reactions have been implemented for subsurface metal immobilization (e.g.; reactive zones containing zero valent iron (ZVI), organic carbon substrates, zeolite, limestone).

## **COURSE SCHEDULE:**

### **1:00-3:00pm: ISCO/ISCR Permeable Reactive Barrier (PRBs) to Prevent Migration of Contaminant Plumes**

1:00-2:00pm: Part 1

- Introduction and principles of PRBs
- ISCO technologies applied in a PRB configuration
- ISCR technologies applied in a PRB configuration
- Implementation methods

2:00-3:00pm: Part 2

- Bench scale data to evaluate ISCO/ISCR reagents
- Longevity of PRBs-enhancing its effectiveness
- Addressing mixed contaminant plumes
- Case studies and implementation

**BREAK 3:00-3:15pm**

### **3:15-5:15pm: Remediation of Heavy Metals Using Insitu Approaches That Combine Multiple Mechanisms**

3:15-4:15pm: Part 3

- Principles of heavy metal remediation
- Removal Mechanisms: for major heavy metals
- Chemistry: Solubility and Stability of Heavy Metal Hydroxides vs. Heavy Metal Sulfides vs. Heavy Metal Iron Sulfides
- A Detailed look at chromium, Arsenic and lead

4:15-5:15pm: Part 4

- Importance of Treatability studies to select the right reagent for field application
- Design Considerations and Key parameters for field applications
- Addressing comingled plumes
- Case studies and implementation

**INSTRUCTOR BIOGRAPHY:****Ravi Srirangam P.E., Ph.D.**

Dr. Ravi Srirangam is the Technical Manager for PeroxyChem covering the North Eastern United States region. Dr. Srirangam obtained a Bachelor of Science in Chemical Engineering and a Master of Science in Chemistry from BITS Pilani, India and Ph.D. in Civil (Environmental) Engineering from University of Illinois at Chicago. He is a registered Professional Engineer in the state of New Jersey. With over 9 years of experience, Dr. Srirangam has designed and implemented numerous field applications and bench scale tests involving ISCO, in situ bioremediation, in situ chemical reduction, and metals/NAPL stabilization. He has made over 25 presentations at national and international conferences and also published his research on bioavailability and biodegradation of PCBs in contaminated sediments.

**Fayaz Lakhwala, Ph.D.**

Dr. Lakhwala serves as the Technical Manager for North America at PeroxyChem Environmental Solutions. He received his M.S. and Ph.D. in Chemical Engineering with a minor in Environmental Engineering from the New Jersey Institute of Technology. Since 1991, he has held several positions at environmental consulting firms as well as environmental technology companies in the area of wastewater treatment, and soil, ground water and sediment remediation. During the last 13 years, his focus has been on the design and application of *in situ* chemical reduction (ISCR), *in situ* chemical oxidation (ISCO), enhanced reductive dechlorination (ERD), and NAPL / heavy metal stabilization technologies.