

# Environment Business



## **Environmental Chemistry for Site Reclamation and Remediation Made Easy A New Perspective on Water, Contaminant Solubility, Sorption, and New Innovative Tools For Your Remediation and Reclamation Toolbox**

---

### **Overview:**

This short course will introduce attendees to a new and easy to use set of principles regarding soil and groundwater contamination and hydrogeology, with a perspective not taught in High School or Universities. This is achieved through a visually driven and interactive hands-on presentation in which they learn: water is not H<sub>2</sub>O, what really affects contaminant solubility, and the important role of contaminant sorption (i.e., absorption and adsorption) in soil and groundwater hydrogeology, as this relates to characterization and remediation. Attendees with limited chemistry, biochemistry, microbiology or hydrogeology experience will learn a new set of principles to accurately predict the behavior of LNAPL and DNAPL contaminants in soil and groundwater include their water solubility, sorption potential, how to improve their physical and or chemical availability for in-situ or ex-situ remediation at most sites.

The presentation will challenge conventional understandings (Models) of what water and organic contaminants are, and provide three simple tools to predict their behavior in water, with each other, and with soils and bedrock. In doing so, this simplifies many contaminant hydrogeology principles through better understanding why some contaminants dissolve in water while others do not, and why some absorb or adsorb to soil while others do not, why some are less 'available' for remediation, while others are not. Attendees will leave the workshop with an applied ability to predict contaminant behavior as it affects site investigation and remediation action plans.

Over the course of the presentation attendees also learn the #1 factor limiting the effectiveness of all soil and ground water bioremediation technologies. They will also learn about the use of a new class of surfactants in remediation, surfactant types, their selection, application pros and cons, and how they can serve as an innovative tool in their soil and groundwater bioremediation toolbox.

Course handouts, case studies and related reference material are also provided.

### **Agenda:**

- Introduction and overview of workshop short course, with circulation of handouts, case studies and related reference materials. Workshop deliverables are also stated;

- Properties of water and introduction to water cluster theory, hydrogen bonding, and surface tension and how this affects the K value of water in soils and bedrock;
- CLASS DEMONSTRATION (How many drops of water can you get on a Penny - Class is polled to predict the number, than three individuals actually perform task). Results are reviewed and discussed as a set up for the workshop deliverables.
- Cohesion and adhesion between like and unlike molecules and or substances, what is it and its general environmental significance;
- Organics (LNAPL and DNAPL) and water, the rolls of hydrogen bonding and chemical structure in predicting contaminant solubility;
- Intermolecular forces and associated chemical properties as a function of their structure, functional groups, and potential to form hydrogen bonds;
- How the structure and functional group makeup of many LNAPL and DNAPL can allow you to predictive their water solubility;
- CLASS DISCUSSION-EXERCISE (Open class discussion regarding ten (10) common chemical soil and water contaminants and predicting their solubilities based on chemical structure and their potential for hydrogen bonding). Class members write down what they predict based on what they just learned and then instructor goes over in an open interactive manner;
- Basic introduction to organic chemistry from a function group perspective and the most common chemical classes (Visual verses theoretical approach is taken);
- Overview of the main organic chemical classes (With common examples we all know being cited);
- CLASS DISCUSSION-EXERCISE (How chemical structure and function groups can affect water solubility and sorption);
- Introduction to contaminant sorption and why this is the #1 limiting factor for all forms of in-situ and ex-situ remediation processes;
- CLASS DEMONSTRATION (View a short three-dimensional animation of contaminant transport and how sorption affects transport and recovery in a typical soil matrix);
- Overview on Retardation as a function of sorption and contaminant chemical structure, solubility, and availability for bioremediation;
- Overview of contaminant plume formation, shape and migration as a function of contaminant chemical structure, water solubility, sorption, and retardation;
- Introduction and overview of surfactant chemistry including the four (4) main classes, history, examples of, and their common commercial applications;
- How surfactants affect water chemistry, water cluster formations, and the associated properties and behavior of water when surfactants are present;
- How they act on LNAPL and DNAPL compounds as this affects sorption, retardation and water miscibility, as a function of chemical structure;
- Overview of surfactants use and applications for enhancing in-situ and ex-situ bioremediation;
- Overview of SER (Surfactant Enhanced Remediation) and SEB (Surfactant Enhanced Bioremediation);
- Examples of in-situ and ex-situ SER and SEB with associated case studies with associated graphical and statistical findings; and
- Question and Answer Period.

## BIOGRAPHY

**George A. Ivey, B. Sc., CES, CESA, P. Chem.  
President and Senior Remediation Specialist  
Ivey International Inc.**

---

Mr. Ivey is the President and Senior Remediation Specialist with Ivey International Inc. and has over 23 years environmental assessment and remediation experience working on more than 1,300 remediation projects worldwide.

His educational background includes: Organic Chemistry, Geological Engineering, and a Master's Certification in Project Management. He is a Professional Chemist in Alberta, and also holds National Environmental Certifications in Canadian and the USA. His multi-disciplinary background has provided him with a unique perspective for assessing and solving complex site remediation problems.

He is very active in remediation technology development, and is involved in several applied-research projects in North America, South America, Europe, and Australia.

Among some of his more notable accomplishments include:

- The Globe Award for Environmental Innovation and Application;
- The North American Frost & Sullivan Award for Technology Innovation;
- Two Environmental Business Journal Awards; and
- Several Remediation Technology Product and Process Patents.