

**FINAL PROGRAM**



**October 19 – 22, 2015**  
University of Massachusetts  
Amherst, MA

**150 Presenters + 50 Posters + 12 Workshops + 41 Exhibitors**



Assessment, Remediation, Regulation  
and the Energy Environmental Interface

*presented by*

The Association for Environmental  
Health & Sciences Foundation, Inc.

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## Exhibit Hall Hours (CCA & CONCOURSE)

TUESDAY 9:00am – 7:00pm

WEDNESDAY 9:00am – 7:00pm

THURSDAY 9:00am – 12:00pm

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The AEHS Foundation attributes the success of this conference, in large part, to a very dedicated and hardworking Scientific Advisory Board (SAB). The SAB evaluates abstract submissions, recommends invited papers and presenters, advises with regard to session topics, and serves as conference ambassadors. The SAB is crucial to the conference development. Care is taken to create a board that represents philosophical, scientific, regulatory, and geographical balance.

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## WORKSHOPS

**All workshops are FREE to municipal, state, and federal REGULATORY personnel.  
Registration is required. See registration desk.**

**Workshop 1** 1:00pm – 5:00pm, Room 917

### Quantitative Evaluation for Greener Cleanups Using SEFA (Spreadsheets for Environmental Footprint Analysis)

Karen Scheuermann, US Environmental Protection Agency, San Francisco, CA

Thomas M. Potter, Chief, Clean Energy Development Coordinator, MassDEP, Bureau of Waste Site Cleanup, Boston, MA

SEFA is one of the tools identified for use in quantitative evaluation in the ASTM Standard Guide for Greener Cleanups and is US EPA's Excel-based system for estimating environmental footprint metrics at cleanup sites. SEFA follows the footprinting approach described in EPA's Footprint Methodology, in which the scope, data inputs, and metrics of a footprint analysis are described.

The workshop will begin with comments on the Greener Cleanups component of the Massachusetts Contingency Plan (MCP) and an introduction to the ASTM Standard Guide for Greener Cleanups. It will then provide a walk-through of the SEFA worksheets using a tutorial-style footprint analysis at a hypothetical site, followed by hands-on exercises in the SEFA worksheets. The workshop will be very technical, addressing detailed data entry requirements for a footprint analysis and the specifics of data management and footprint calculations within the SEFA worksheets. After completing the workshop, participants will have a solid understanding of SEFA, but may require additional practice prior to running footprint analyses using SEFA.

The potential audience includes environmental consultants interested in conducting footprint analyses at cleanup sites and project managers who would like a better understanding of the data inputs and resulting outputs of a footprint analysis. For best learning experience, participants should be familiar with concepts of Greener Cleanups and footprint analyses. References on these topics will be provided to participants in advance of the workshop. To participate in the hands-on exercises, participants must bring their own laptop computers equipped with Microsoft Excel, and should be comfortable working with the basic functions of Excel spreadsheets. Workshop materials will be provided to participants for uploading in advance of the workshop. **This workshop is limited to 20 participants. Discount codes do not apply (workshop fee applies for regulatory personnel).**

This course is approved for 4.0 LSP "DEP/Regulatory" continuing education credits (Mass LSP course #1538). This course is NOT approved for CT LEP credits.

**Workshop 2** 1:00pm – 5:00pm, Room 168

### Sustainable Remediation Principles and Practice

Dick Raymond, Terra Systems, Claymont, DE

Andrew Irwin, PE, LSP, IRWIN Engineers, Inc., Natick, MA

Rick Wice, PG, Tetra Tech, Pittsburgh, PA

Fritz Hostrop, LSP, Terra Systems, Minato-ku, Tokyo

Richard Cartwright, PE, CHMM (Fellow), CPIM (Fellow), USA Environment, East Amherst, NY

This workshop is a unique opportunity to provide sustainable remediation training for program and project managers including: Licensed Site Professionals (LSP's), Licensed Environmental Professionals (LEP's), Licensed Site Remediation Professionals (LSRP's), Professional Engineers (PE's), Certified Hazardous Materials Managers (CHMM's) and Professional Geologists (PG's).

Workshop will begin with an overview of the principles and practice of sustainable remediation. Immediately afterwards, specific Massachusetts Contingency Plan (MCP) regulations applicable to sustainable remediation will be presented. Next, a comparison of international and domestic green and sustainable remediation guidelines will be presented. This will be followed by a unique case history illustrating the application of sustainable remediation principles and practice. Workshop will conclude with interactive group participation designed to create feedback for development of a course outline for subjects to be covered during future 3-day professional workshops and semester long senior/graduate level college courses.

This course is NOT approved for CT LEP credits.

**Workshop 3** 1:00pm – 5:00pm, Room 174

### Evaluations of Metals in Groundwater at VOC-Impacted Sites

Karen Thorbjornsen, P.G., CB&I Federal Services, Knoxville, TN

Jonathan Myers, Ph.D., CB&I Federal Services, Albuquerque, NM

Join us as we figure out what's going on with metals in groundwater. Metals concentrations often exceed screening criteria, but they may be naturally elevated...or they may be locally elevated as an indirect effect of degrading VOCs or bioremediation activities. It's well known that trace elements naturally associate with specific suspended particulates in groundwater under a given set of environmental conditions. For example, in most groundwater samples from oxic, circumneutral-pH aquifers, arsenic and vanadium are almost exclusively associated with suspended iron oxide particulates at consistent ratios. These processes result in positive correlations between specific trace vs. major element concentrations, which are visualized with scatter plots. Contaminated samples are identified by their anomalously high elemental ratios relative to uncontaminated samples. In addition to particulates, other important factors to consider are pH, redox effects, aqueous complexation, salinity gradients, well construction materials, degrading VOCs, and in situ remediation techniques and reagents. Sites where metals are locally mobilized as a result of degrading VOCs have chemical fingerprints that are easily identifiable with these techniques.

Unlike a purely statistical approach, geochemical evaluation: greatly reduces the probability of falsely identifying metals contamination; doesn't require a statistically valid background data set; focuses remediation by identifying locations that actually are contaminated with metals; and provides mechanistic explanations for elevated concentrations.

In four hours you'll learn useful techniques to distinguish natural metals concentrations from potential contamination, using existing analytical data. We'll walk you through real-world examples selected from investigation sites across the U.S. The material is presented in an accessible style and prior knowledge of geochemistry isn't required. The material complements and builds upon our "Geochemical Evaluations of Metals" workshop, but attendance at that prior workshop isn't needed to understand and benefit from this groundwater-focused course. Recommended for regulatory personnel as well as consultants and site managers.

## WORKSHOPS

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Registration is required. See registration desk.

**Workshop 4** 1:00pm – 5:00pm, Room 164

### MassDEP VPH, EPH, and APH Methods Workshop

Elizabeth Denly, Senior QA Chemist, TRC, Lowell, MA  
Stephen Emsbo-Mattingly, Senior Scientist, NewFields Environmental Forensics Practice, LCC, Rockland, MA  
John Fitzgerald, MassDEP, Boston, MA  
James Occhialini, Alpha Analytical Laboratories, Westborough, MA  
Richard Rago, Vice President, Haley & Aldrich, Inc., Rocky Hill, CT

This workshop is designed to promote a better understanding of the selection, use, and review of the MassDEP petroleum analytical methods. With representatives from the Massachusetts Department of Environmental Protection (MassDEP) and the Licensed Site Professional Association (LSPA), this program is designed to be a comprehensive training program with the most up-to-date information available about the MassDEP methods for measuring volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH), and air petroleum hydrocarbons (APH). The presenters were selected based on their intimate knowledge of the methods and ability to answer real-world questions from the LSP community.

This workshop will provide a detailed description of the hydrocarbon composition in a variety of petroleum and tar products. It will also contain examples of non-petroleum interferences that appear in the VPH, EPH, and APH results with accompanying guidance from MassDEP about characterizing these interferences for the regulatory community. The program will provide detailed information on the latest VPH round robin using mass spectrometry methods. Attendees are encouraged to bring questions for discussion about the technical and regulatory challenges faced by the LSP community.

*This course is approved for 4.0 LSP "DEP/Regulatory" continuing education credits (MassDEP LSP course #1505).*

*This course has been offered previously.*

*This course is NOT approved for NJ LSRP credits.*

**Workshop 5** 1:00pm – 5:00pm, Room 908

### In Situ Thermal Remediation

Ralph Baker, Ph.D., Chairman and Chief Scientist, TerraTherm, Inc., Gardner, MA  
John LaChance, Global Lead for Thermal Remediation, ARCADIS U.S., Inc., Chelmsford, MA  
Steffen Griepke Nielsen, TerraTherm, Inc., Gardner, MA

This year, TerraTherm and ARCADIS are offering an updated workshop on In Situ Thermal Remediation (ISTR). ISTR comprises several robust technologies that over the last 20 years have been proven to be able to clean up DNAPL and other organic compound-contaminated source zones in a wide range of subsurface settings, including all soil types both above and below the water table, and in fractured rock.

ISTR is typically used to treat organic-contaminated source zones by heating the ground, causing the contaminants to mobilize into vapor and liquid phases, which are then extracted and treated on site. For volatile contaminants, the subsurface is heated to the boiling point of water, and the contaminants vaporize for removal. For less volatile contaminants (such as heavy oils, PCBs, and coal tar), complete treatment requires heating the soil to higher temperatures.

ISTR will be presented as a tool for contaminant source removal. By attending this workshop you will learn about the primary thermal removal mechanisms and the three major heating technologies being used commercially: Thermal Conductive Heating (TCH), Steam-Enhanced Extraction (SEE), and Electrical Resistive Heating (ERH). For complex sites, a combination of the technologies may be the best fit and provide the most cost-effective solution. These approaches and examples will be provided during the workshop. The workshop will also include a discussion of how to choose the right technology for your site, what factors go into the cost of ISTR, design approaches, data management, and relevant case studies and lessons learned.

The session will be interactive and filled with many examples. We will show a Model Simulation of a thermal site and demonstrate how input parameters describing site conditions affect design, heating duration, and power usage.

The information presented in the workshop is intended for consultants and end users/clients considering the use of thermal treatment. Importantly, it differs from other thermal workshops in that it covers all of the primary thermal technologies using a balanced "pros and cons" approach and provides both vendor and consultant perspectives on thermal project implementation.

**Workshop 6** 1:00pm – 4:00pm, Room 808

### Environmental Forensics - Utilization of Established and Evolving Techniques

Paul Philp, University of Oklahoma, Norman, OK

The concept of environmental forensics has evolved significantly over the years. Basically it is concerned with establishing the relationship between a contaminant in the environment and its suspected source(s), or point of release. Such contaminants will cover a wide range of compounds or mixtures of compounds. They may be volatile compounds such as benzene, chlorinated solvents, complex crude oil mixtures, or refined products. They may be present as free product, dissolved in water, adsorbed on soil particles, or present in the vapor phase. A wide variety of techniques exist to characterize and establish their potential relationship with possible sources. The standard EPA methods that many are familiar with are of little use for this purpose since those methods are directed towards obtaining concentration data for specific contaminants.

Forensic investigations typically use a tiered approach in terms of fingerprinting tools. Preliminary characterization is undertaken by gas chromatography (GC) followed by more detailed gas chromatography-mass spectrometry (GCMS) analyses. The fingerprints, or chromatograms, obtained in this manner often provide sufficient information to determine possible relationships between contaminant and possible release points. However, there are also many cases where the resulting GC and GCMS data are ambiguous and possibly misleading. In such cases it is possible to go to a more specialized tier of analyses and utilize the stable isotope composition of individual compounds in the contaminant. This is particularly valuable for single component contaminants, such as MTBE, BTEX, or PCE, where GC and GCMS are of virtually no use for correlation or source differentiation. There are many examples that have been published where GCIRMS has been used to both differentiate sources of PCE/TCE as well as study natural attenuation at the contaminated sites.

Early applications of stable isotopes to environmental problems were limited to carbon and hydrogen isotopes. Chlorine isotopes can now be routinely measured for most of the common chlorinated groundwater contaminants and in the not too distant future bromine isotopes will also be routinely available. This introduces the possibility of a 3D isotope approach for both source correlations and attenuation studies. Stable isotopes, including Cl, are well suited for use in the rapidly emerging area of vapor intrusion studies to differentiate indoor sources of contaminants vs. subsurface contaminants.

Finally, the use of the various fingerprinting techniques for monitoring attenuation at sites undergoing remediation will be discussed. The combined use of the stable isotopes, GC and GCMS can be extremely valuable tools for monitoring remediation as well as determination of the onset of natural attenuation. Methods being developed for the incorporation of the isotope data into reactive transport models will also be discussed.

PLATFORM SESSIONS

**Session 1:** 8:30am – 12:00pm, Room 164

**Contaminants of Emerging Concern – Challenges, Perspectives and Risk Considerations**



**Session Chair:** Russell Keenan, Integral Consulting, Inc., Portland, ME

Chemicals are being discovered in environmental media that previously had not been detected or are being detected at levels that may be significantly different than expected. These are often referred to as “contaminants of emerging concern” because the risk to human health and the environment associated with their presence, frequency of occurrence, or source may not be known. These knowledge-gaps present significant challenges for entities responsible for protecting human health and the environment.

This session will discuss the current challenges, perspectives, and approaches to addressing concerns of emerging contaminants with a particular focus on factors that have influenced risk management decision making for perfluoroalkyl compounds and 1,4 dioxane.

**8:30 What Makes the List? Regulatory Drivers for Emerging Contaminants – A State-by-State Assessment**

Philip Goodrum, Integral Consulting, Fayetteville, NY

**9:00 Overview of Regulatory Toxicology in the Development of Federal and State MCLs for Perfluoroalkyl Compounds**

Janet Anderson, Integral Consulting, Annapolis, MD; Philip Goodrum, Integral Consulting, Fayetteville, NY

**9:30 Bioaccumulation of PFOS in Freshwater Fish: Evolving Perspectives on an Emerging Contaminant**

Sarah LaRoe and Jennifer Benaman, Anchor QEA, Saratoga Springs, NY; Daniel Opdyke, Anchor QEA, Austin, TX; John Connolly, Anchor QEA, Woodcliff Lake, NJ

**10:00 BREAK**

**10:30 EPA’s UCMR3 Program – What Have We Learned in 2 Years of Monitoring?**

Scott Hogamier, Eurofins Eaton Analytical, Inc., Kittanning, PA

**11:00 Managing High Iron Levels While Removing 1,4-Dioxane from Groundwater**

Steven Woodard, ECT, Portland, ME; Daniel Samorano, Raytheon Company, Tucson, AZ

**11:30 Bioremediation of Comingled 1,4-Dioxane and Chlorinated Solvent Plumes**

Bilgen Yuncu, Jessica Keener, and Robert Borden, Solutions-IES, Inc., Raleigh, NC; Ed Alperin, EOS Remediation, LLC, Raleigh, NC; Stephen Richardson, GSI Environmental, Inc., Austin, TX; Kent Glover and Adria Bodour, U.S. Air Force, Lackland AFB, TX

**Session 2:** 9:00am – 12:00pm, Room 168

**Environmental Forensics**

**Session Chair:** Eric Butler, Gradient Corporation, Cambridge, MA

**9:00 Tools for Source Apportionment: Receptor Models and their Applications**

Jaana Pietari and Paul Boehm, Exponent, Maynard, MA; Kirk O’Reilly and Sungwoo Ahn, Exponent, Bellevue, WA

**9:30 The Importance of Correcting for Known Correlations or Seasonal Patterns in Groundwater Quality Trend Analysis**

Michael Brown, WSP Parsons Brinckerhoff, Boxborough, MA; Aaron Brown, University of Massachusetts-Amherst, Amherst, MA, and WSP Parsons Brinckerhoff, Boxborough, MA

**10:00 BREAK**

**10:30 On the Use of Chromatographic Evidence and Calculated Distillate Weathering Indices to Age-Date Multiple Co-Mingled Diesel Fuel Releases**

Michael Wade, Wade Research, Inc., Marshfield, MA

**11:00 LOQ, LOD, DL, RL, QL, SQL, MDL, PQL: What the “L”?**

Elizabeth Denly, TRC, Lowell, MA

**11:30 Review of a Comprehensive, Alternate Approach for PCB Congener and Homolog Analysis**

James Occhialini and Cynthia McQueen, Alpha Analytical, Mansfield, MA

**Session 3:** 8:30am – 12:00pm, Room 174



**Innovative & Sustainable Soil, Sediment, Water & Energy Solutions**

**Session Chair:** Richard Cartwright, USA Environment, East Amherst, NY

**8:30 A Framework for Cost Efficient Remediation Using Innovative Tools & Technologies**

Richard Raymond, Terra Systems, Claymont, DE

**9:00 Better Data for Better Site Conceptual Models**

Mark Eiseman, Geotech Computer Systems, Arvada, CO; David Rich, Geotech Computer Systems, Centennial, CO; James Cummings, US EPA, Washington, DC; Joseph Quinnan, ARCADIS, Brighton, MI

**9:30 Advances in the FROG-4000: An Innovative Approach to VOC Determination in the Field**

Patrick Lewis, Defiant Technologies, Albuquerque, NM

**10:00 BREAK**

**10:30 Waste to Energy: A Sustainability Perspective**

Bill Perkins, Covanta Energy, Ithaca, NY

**11:00 Engineered ISCO - Using Engineering Methods and Controls to Safely Optimize NAPL Destruction in the Subsurface**

Larry Rader and Isaac Aboulafia, MECX, Houston, TX

**11:30 Brownfield to Greenfield: Beyond Remediation to Ecological Restoration**

William Young, USA Environment, Edison, NJ

**Tuesday, October 20, 2015** 12:00pm – 1:30pm, Amherst Room, 10th Floor

**Assessment Informed Design: Innovative Examples from Water, Energy, and Material Systems**

**Julie Beth Zimmerman, Ph.D., Professor of Green Engineering, Department of Chemical and Environmental Engineering and School of Forestry and Environmental Studies, Yale University, New Haven, CT**

The design of sustainable products, processes and systems must be informed by rigorous assessments in order to minimize unintended consequences. By focusing on how to structure assessments to provide the necessary input, the resulting designs can achieve significant and measurable improvements in sustainability performance. Three case studies will be presented demonstrating the feedback between assessment and design including novel sorbents for removal of inorganic contaminants from aqueous systems; an improved process for the extraction, fractionation, and transformation of biobased feedstocks; and establishing dominant physiochemical properties leading to carbon nanotube toxicity. Each of these case studies will illustrate an integrative and iterative approach for sustainable design of engineered systems informed by systematic assessments.

LUNCHEON



## PLATFORM SESSIONS

**Session 1a:** 1:30pm – 4:00pm, Room 164

### Risk Assessment

**Session Chair:** Christopher Teaf, Florida State University, Tallahassee, FL

**1:30 Acceptable Risk: Who Are we Protecting and Did We Mean To?**

Paul Anderson and Kathleen Sellers, ARCADIS, Chelmsford, MA; Michelle Buonanduci, ARCADIS, Lakewood, CO

**2:00 Risk Reduction in Homes Sprayed with a Banned Pesticide**

Alex Sherrin and Tom Condon, US EPA, Boston, MA

**2:30 Toxicology & Environmental Significance of Benzaldehyde**

Christopher Teaf, Florida State University, Tallahassee, FL; Douglas Covert, HSWMR, Tallahassee, FL

**3:00 BREAK**

**3:30 The Relative Significance of Human PCB Sources: Prenatal, Diet and Inhalation**

James Okun, O'Reilly, Talbot & Okun Associates, Inc., Springfield, MA

**Session 1b:** 4:00pm – 5:00pm, Room 164

### Site Assessment/Field Sampling

**Session Chair:** Christopher Teaf, Florida State University, Tallahassee, FL

**4:00 Using Ultra-high Resolution Methods to Develop Conceptual Site Models for Delineating Contaminant Pathways to Waterways**

Mark Kluger, Dajak, Wilmington, DE; Todd Halihan, Aestus, Loveland, CO

**4:30 Next Generation Analytical Field Technologies for Site Characterization**

Jay Clausen, USACE ERDC CRREL, Hanover, NH

**Session 2:** 1:30pm – 5:30pm, Room 168

### Sustainability and Sustainable Remediation

**Session Chairs:** Michael E. Miller, CDM Smith, Cambridge, MA  
Kevin Finneran, Clemson University, Anderson, SC

**1:30 Using Sustainable Return on Investment (sROI) to Achieve Green and Sustainable Remediation**

Andrea Bohmholdt, AECOM, Germantown, MD

**2:00 The Social Aspect of Remediation: A SURF Initiative**

Melissa Harclerode, CDM Smith, and SURF Technical Team, Edison, NJ

**2:30 Developing Sustainability Safeguards for Woody Biomass Harvests**

Bernabas Wolde and Pankaj Lal, Montclair State University, Montclair, NJ; Janaki Alavalapati, Virginia Tech., Blacksburg, VA

**3:00 BREAK**

**3:30 Successful TCE Bioremediation in a Low Permeability Formation Using Solar Powered Groundwater Recirculation**

Sami Fam, IESI, Walpole, MA; David Falatko, IESI, South Portland, ME

**4:00 (Un) Sustainable Water Practices in US Higher Education Residence Halls**

Nakisa Alborz, Wentworth Institute of Technology, Boston, MA

**4:30 Life Cycle Analysis Templates for Remediation Processes**

Brandt Butler, AECOM, Conshohocken, PA; Maureen McBride, AECOM, Newark, DE

**5:00 Changing Our Views on Old Ideas to Promote Sustainable Remediation: Fe(III) Reduction Does Not Inhibit the Complete Reductive Dechlorination of TCE**

Kevin Finneran, Clemson University, Anderson, SC

*Session 2 is NOT approved for CT LEP credits.*

**Session 3:** 1:30pm – 3:00pm, Room 174

### Bioavailability of Soil-Borne Contaminants – Updates on Arsenic, Lead and PAHs

**Session Chair:** Philip Goodrum, Integral Consulting, Fayetteville, NY



The bioavailability of soil-borne contaminants is recognized as an important factor in determining risk-based action levels. Numerous factors can influence the chemical composition of the soil matrix in the natural environment and in organisms that ingest or contact the soil.

This short session will discuss recent regulatory developments in quantifying the bioavailability of arsenic in soil and the key studies that are informing regulatory policy on developing in vitro methods for estimating the relative bioavailability of soil-borne arsenic. This session will also discuss study results from EPA-funded research on the fate and transport of arsenic, lead, and other metals following soil amendment protocols. The final presentation investigates oral and dermal bioavailability of PAHs at firing range sites.

**1:30 Advances in the Risk Assessment of Soil-Borne Arsenic: USEPA Perspective**

Mark Maddaloni, US EPA - Region 2, New York, NY

**2:00 Lead Stabilization and Arsenic Mobilization by Phosphate-bearing Amendments: Laboratory and Field Observations**

Zhongqi (Joshua) Cheng and Zulema Garcia, Brooklyn College, Brooklyn, NY; Mark Maddaloni, US EPA, New York, NY; Kirk Scheckel, US EPA, Cincinnati, OH; Anna Paltseva, Brooklyn, NY

**2:30 Oral and Dermal Bioavailability Studies on PAHs in Target Fragments from Range Sites**

Brian Magee and Norman Forsberg, ARCADIS U.S., Inc., Chelmsford, MA; Glenn C. Hoeger, ARCADIS U.S., Inc., Tucson, AZ

## CALL FOR ABSTRACTS 2016 SAVE THE DATE:

We invite you to submit an abstract for the  
**32nd Annual Conference,  
October 17-20, 2016**

Abstract deadline is  
**February 5, 2016**

**ONLINE SUBMISSION WILL  
OPEN IN DECEMBER!**

## POSTER SESSIONS

Authors will be available for individual discussion at their posters on both Tuesday & Wednesday from 3:00pm – 6:00pm  
CCA, Rm. 162, Rm. 165



## WORKSHOPS

**Workshop 7** 6:30pm – 9:30pm, Room 164**Environmental Forensics Workshop**

Stephen Emsbo-Mattingly, M.S., NewFields Environmental Forensics Practice, LLC, Rockland, MA

Katie Flanders, Ph.D., NewFields Environmental Forensics Practice, LLC, Rockland, MA

Eric Litman, B.S., NewFields Environmental Forensics Practice, LLC, Rockland, MA

The field of environmental forensics expands and evolves continuously. Consequently, our understanding about the fate and transport of man-made chemicals in soil, sediment, water, tissue, and air improves as well. This workshop reviews fundamental chemistry and forensic data analysis techniques used in the study of hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), trichloroethylene (TCE), and tetrachloroethylene (PCE). Illustrative case studies will be presented on subjects that include the release of petroleum products, crude oil, tar products, PCBs, and chlorinated solvent releases. The case studies will demonstrate source identification, age-constraining, and numerical techniques with an emphasis on differentiating point sources in mixed plumes and urban background. These real-world examples will illustrate a tiered data and site analysis approach that maximizes the use of historical and forensic data for chemical delineation and allocation purposes in high and low (background) level situations.

**Workshop 8** 6:30pm – 9:30pm, Room 168**The Biogeochemical Toolbox: Enhancing Natural Remedial Processes**

Tanya Justham, M.S., GZA GeoEnvironmental, Inc., Bedford, NH

Karen Kinsella, Ph.D., GZA GeoEnvironmental, Inc., Glastonbury, CT

Groundwater pollution is a serious problem throughout the world. Mother Nature can heal herself, but we can help her do it faster by enhancing natural remedial processes. All life forms get energy from electron transfer, or oxidation and reduction reactions. Chemicals that accept electrons are reduced, since electrons are negative. Chemicals that donate electrons are oxidized. We call this electron cycling "redox", for reduction/oxidation. Groundwater redox chemistry controls everything from bacteria eating oil spills to iron minerals capturing chrome from leaky plating baths. This workshop will teach you strategies to enhance natural biochemical and geochemical processes for groundwater protection and remediation.

One example of remediation by redox manipulation involves perchloroethylene (a.k.a. perc, PCE, or tetrachloroethene). Perc is a man-made chlorinated solvent used in dry-cleaning and metal degreasing. In oxygenated groundwater, some perc can evaporate, but very little can be degraded by bacteria. However, if there happens to be a leaky oil tank in the same area as the perc spill, bacteria eating the oil will use up oxygen and other electron acceptors in the groundwater. As the bacteria feed on the energy-rich oil, they lower the groundwater redox potential. Once redox conditions get low enough, other types of bacteria can eat the oil breakdown products and "breathe" the perc. The result is cleanup of both oil and perc. Any organic carbon source can create similar low redox conditions. Organic-rich sediments and peaty soils will naturally degrade perc. To speed up this natural degradation, we can inject food- or feed-grade additives like sugars and vegetable oils.

But what about heavy metals that can't be degraded like organic pollutants? Hexavalent chromium (Cr6+) is a highly toxic form of oxidized chromium widely used in pigments, wood preservatives, and metal finishing. Another example of groundwater cleanup by redox manipulation uses a trench-style permeable underground barrier filled with tiny iron filings mixed into sand or sawdust. When groundwater polluted with hexavalent chromium passes through these underground permeable reactive barriers, electrons from the iron are transferred to the chromium. The reduced chromium is not very water-soluble, and is immobilized in the trench. While it seems like the iron would eventually be used up, many iron barriers have lasted a lot longer than anticipated. The enhanced longevity is likely due to chemical and biological reactions between iron corrosion products, native bacteria, and native minerals that sustain chromium removal. This interaction between biology, geology, and chemistry is one of the many ways we can manipulate nature to accelerate groundwater remediation.

We believe you will leave this workshop with a greater understanding of some of the fundamental redox processes that help nature deal with common organic and inorganic contaminants in the environment. Attending this workshop will help you:

- Develop a greater appreciation for the myriad of biogeochemical processes that occur daily,
- Enhance your vocabulary for investigating and discussing such processes, and
- Overall be better equipped to ask the right questions about pollutant behavior in groundwater ecosystems

**Workshop 9** 6:30pm – 9:30pm, Room 174**Naphthalene: A Case Study - The Science, Impact, and Implications of Its Risk Assessment**

Patrick Beatty, Ph.D., American Petroleum Institute, Washington, DC (Moderator)

John Hinz, M.S., USAFSAM/OEC - Retired, Schertz, TX

Fred A. Reitman, Ph.D., DABT, Senior Toxicologist, Shell, Houston, TX

This workshop consists of four presentations which will inform attendees about the presence of naphthalene in jet fuels and petroleum-based products, and in environmental media in locations impacted by jet fuel use and accidental environmental discharges. The first of these presentations provides background information about naphthalene sources, focusing on transportation fuels and particularly jet fuel. The second presentation illustrates occurrence of naphthalene in key media spanning 1980 to the present and was assessed by querying the Air Force's central database ERPIMS, which consists of over 85 million analytical sampling results from over 200 installations. This report will describe and analyze naphthalene concentrations in environmental media at sites representative of military and industrial uses across the US.

The latter two presentations focus qualitatively and quantitatively on cancer risk posed by exposures to naphthalene at environmentally relevant concentrations. The first of these summarizes key findings of recent research into the mode of action by which inhalation exposure to naphthalene has caused nasal and lung tumors in rats and mice, respectively, and its implications for human risk assessment. The final presentation illustrates how this information is used to determine a naphthalene point-of-departure for use in quantitative site risk assessments, including comparison to estimated inhalation exposures to naphthalene at fuel release sites.

**EVENING WELCOME & WINE RECEPTION****Tuesday** 5:00pm – 7:00pm **CCA** (auditorium) **and Concourse****Wine Bar (open), Refreshments, Light Hors d'Oeuvres**

Free to all registered conference attendees

## PLATFORM SESSIONS

### Session 1: 9:00am – 12:00pm, Room 164 Greener Cleanups

Session Chair: Susan Fessenden, Massachusetts Department of Environmental Protection, Boston, MA



#### 9:00 Greener Cleanups: Remediation with a Smaller Environmental Footprint

Deborah Goldblum, US EPA Region 3, Philadelphia, PA; Carlos Pachon, USEPA - OSRTI, Arlington, VA

#### 9:30 The Industry Standard for Greener Cleanups

Deborah Goldblum, US EPA Region 3, Philadelphia, PA

#### 10:00 BREAK

#### 10:30 Quantitative Analysis in Greener Cleanups

Karen Scheuermann, US EPA Region 9, San Francisco, CA

#### 11:00 Promoting Greener Cleanups in Massachusetts

Thomas Potter, MassDEP, Boston, MA

#### 11:30 Green Remediation: Application of ASTM's Greener Cleanup Guide during Alternatives Analysis

Michael E. Miller, CDM Smith, Boston, MA; Melissa Harclerode, CDM Smith, Edison, NJ

### Session 3: 8:45am – 12:00pm, Room 174

#### Combining Remediation Technologies for Optimal Results

Session Chairs: Jim Cummings, US EPA, Washington, DC  
Maureen Dooley, Regenesis, Wakefield, MA



#### 8:45 Introduction (15 min)

Jim Cummings, US EPA, Washington, DC

#### 9:00 Synergistic Tools for Site Remediation

Jay Romano, Redox Tech NE, Attleboro, MA

#### 9:30 Combining Multiple Remedial Technologies to Accelerate Property Transfer

Paul Dombrowski, AECOM, Wakefield, MA

#### 10:00 BREAK

#### 10:30 Coupling of Discrete Technologies to Optimize the Combined Remedy Approach for Dissolved VOC Treatment

Matthew Burns and David Carstens, WSP Parsons Brinckerhoff, Woburn, MA

#### 11:00 Design and Implementation of an Integrated Treatment Train to Address CVOCs in an Urban Setting

David Winslow, Brett Engard, and Marc Hudock, GZA GeoEnvironmental, Fairfield, NJ; Donald Kirkland, GZA GeoEnvironmental, Bedford, NH

#### 11:30 Sorption Coupled with Enhanced Biodegradation to Treat Petroleum and Chlorinated Contaminants in Groundwater

Maureen Dooley, Regenesis, Wakefield, MA; Ben Mork, Kristen Thoreson, and Craig Sandefur, Regenesis, San Clemente, CA

### Session 2: 9:00am – 12:00pm, Room 168 Sediments

Session Chair: Dawn Riley-Baptista, Prysmian Group, North Dighton, MA

#### 9:00 Contaminant Trends in the Lower Passaic River: Considerations of Data Sufficiency, Consistency and Relationships Among Historical Datasets

Timothy Iannuzzi and Jacqueline Iannuzzi, ARCADIS, Annapolis, MD; Melissa Beauchemin, ARCADIS, Chelmsford, MA; Clifford Firstenberg, Tierra Solutions, Inc., East Brunswick, NJ

#### 9:30 Use of Passive Flux Meters for Quantifying Groundwater Contaminant Discharge to Surface Water

Ernest Ashley, CDM Smith, Cambridge, MA

#### 10:00 BREAK

#### 10:30 Three Types of Reactive Cap Installation on the Grand Calumet River

James Wescott, TetraTech, Chicago, IL

#### 11:00 Real-Time Compliance Assessment for Construction Monitoring during Dredging

Christopher Yates, Anchor QEA, Saratoga Springs, NY

#### 11:30 Characterization of Riverbed Sediments Containing Linoleum Laden with Asbestos

Matthew Muzzy, Sevee & Maher Engineers, Inc., Cumberland, ME

### Session 4a: 8:30am – 11:00am, Cape Cod Lounge Remediation

Session Chair: Carol Bois, Bois Consulting Co., Inc., Framingham, MA

#### 8:30 Health-based Dioxin Cleanup Goal Based On Probabilistic Risk Assessment

Christopher Teaf, Florida State University, Tallahassee, FL; Douglas Covert, HSWMR, Tallahassee, FL; Gregory Council and Scott Simpson, Tetra Tech, Alpharetta, GA; Talaat Ijaz, Tetra Tech, Whitehouse, NJ

#### 9:00 Production of Iron Oxide with Soil Remediation Potential from Coal Mine Drainage

Robert Hedin, Iron Oxide Recovery, Inc., Pittsburgh, PA

#### 9:30 In-Pile Thermal Treatment of Agent Orange Contaminated Soil and Sediments at Danang Airport, Vietnam

Ralph Baker, James Galligan, Alyson Fortune, and Stanley Walker, TerraTherm, Gardner, MA; Glenn Anderson, TerraTherm, Inc., Danang, Vietnam; Kent Sorenson, CDM Smith, Denver, CO

#### 10:00 BREAK

#### 10:30 Utilization of the Bipolar Electrodes to Degrade Trichloroethylene in Groundwater - Preliminary Study

Ljiljana Rajic, Noushin Fallahpour, Roya Nazari, and Akram Alshawabkeh, Northeastern University, Boston, MA

### Session 4b: 11:00am – 12:00pm, Cape Cod Lounge Environmental Fate & Modeling

Session Chair: Carol Bois, Bois Consulting Co., Inc., Framingham, MA

#### 11:00 Arsenic Geochemistry in Groundwater beneath the Shepleys Hill Landfill, Fort Devens, MA

William Walker, Sovereign Consulting, Inc., Seattle, WA; Carol Stein, Stein-McTigue, Hydrogeochem LLC, New Ipswich, NH

#### 11:30 A Case Study for How Ethanol Affects the Mobility and Natural Attenuation of Benzene

Kristy Salafrio, NYSDEC, Stony Brook, NY; Daniel Cornacchiulo, Environmental Assessment and Remediations, Patchogue, NY

Wednesday, October 21, 2015 12:00pm – 1:30pm, Amherst Room, 10th Floor

## LUNCHEON

### Communicating Risk without Risk Communication: Involving Stakeholders Through Scientific Reasoning José Manuel Palma-Oliveira, Professor, University of Lisbon, Palma Consulting, Lisbon, Portugal

The way risk communication is usually conceptualized and implemented has stakeholder persuasion as a primary objective, either explicitly or implicitly. The focus is on the "proper" way of communicating risk information given the quality of the scientific evidence of risk through multiple ways of framing the information based on the psychometric, cultural or even mental models approaches. However, traditional approach to risk communication has failed in many cases, resulting in significant stakeholder unease and stress. Stakeholders can be profoundly distrustful in relation to the conclusions of science and technological "computations", but they are sensitive to scientific reasoning, particularly when integrated in formal hypothesis generation and testing, data collection and decision modeling. We will focus on alternative approaches of bringing stakeholders on board in projects where risk is a significant driver for decision. This was proven to be successful in sorting environmental conflicts. Tools of decision analysis and risk communications will be presented and discussed in the context of siting problems in Portugal and Tunisia where the communities strongly show their opposition (even with riots with military forces involved). These cases will show how they were able to overcome the opposition and radically diminish or eliminate the psychosocial stress.





PLATFORM SESSIONS

**Session 1:** 1:30pm – 4:00pm, Room 164

**Human Health Risk Assessment in a Contaminated Industrial Site: Regulatory and Technical Issues - The Case of Brindisi Petrochemical Plant (Italy)**

Session Chair: Rick Wenning, Ramboll Environ, Portland, ME

**1:30 The Legal Framework: Relationship between Political Science and Law**

Tommaso Dragani, Istituto Nazionale Tumori, Milan, Italy

**2:00 Occupational Exposure to Environmental Contamination**

Giuseppe Filauro, IGF Consulting Srl, Milan, Italy

**2:30 Assessment and Reduction of Pollutant Emissions from Flares**

Gennaro Russo, Professor, Department of Chemical Engineering, Materials and Industrial Production, University of Napoli Federico II, Napoli, Italy; Paola Russo, Sapienza University of Roma, Roma, Italy

**3:00 BREAK**

**3:30 Assessment of Health Effects in the Context of Complex Exposure Circumstances**

Paolo Boffetta, Ichan School of Medicine at Mount Sinai, New York, NY

**Session 3:** 1:30pm – 5:30pm, Room 174

**Nuclear Power Plant Closure and Decommissioning: Aging Plants, Ongoing Challenges, New Questions**

Session Chair: Randy Charbeneau, University of Texas, Austin, TX

**1:30 A Challenge Measured in Billions and Decades: Nuclear Power Plants, Unexpected Closures, and Community Impacts**

Jonathan Cooper, Institute for Nuclear Host Communities, Amherst, MA

**2:00 Nuclear Decommissioning from a Regional Public Agency Perspective**

Chris Campany, Windham Regional Commission, Brattleboro, VT

**2:30 Fuel Pools and Dry Cask Storage: Long Term On-Site Storage in the Absence of a National Solution**

Jay Tarzia, Radiation Safety and Control Services, Stratham, NH

**3:00 BREAK**

**3:30 Reuse of Retired Coal-Fired Power Plant Sites: Ensuring a Robust Community Process**

Bob Fitzpatrick and Sally Griffith, Massachusetts Clean Energy Center, Boston, MA

**4:00 Lessons Learned from Redevelopment and Reuse of Federal and Private Sector Industrial Sites**

Avram Frankel, Integral Consulting, San Francisco, CA

**4:30 Panel Discussion: Risks, Responsibilities, and Opportunities as Closure Numbers Increase**

José Manuel Palma-Oliveira, University of Lisbon, Lisbon, Portugal  
Trey Martin, Vermont Dept of Environmental Conservation, Montpelier, VT  
John Mullin, UMass Center for Economic Development, Amherst, MA  
Jim Hamilton, National Spent Fuel Collaborative, Washington, DC

Session 3 is NOT approved for CT LEP credits.

**Session 2a:** 1:30pm – 3:00pm, Room 168

**Environmental Justice**

Session Chair: Millie Garcia-Serrano, MassDEP Southeast Region, Lakeville, MA

**1:30 Emerging Issues in Environmental Justice: an EPA Perspective**

Jeff Norcross, U.S. EPA-Region 1, Boston, MA

**2:00 Integrating Environmental Justice in Massachusetts: A State Perspective**

Michelle Reid, Executive Office of Energy and Environmental Affairs, Boston, MA

**2:30 The Intersection of Environmental Justice and Brownfields - Case Studies from Connecticut**

Mark Lewis, Connecticut Department of Energy & Environmental Protection, Hartford, CT

**3:00 BREAK**

**Session 2b:** 3:30pm – 5:30pm, Room 168

**Climate Change Solutions: Think Global, Act Local**

Session Chair: Millie Garcia-Serrano, MassDEP Southeast Region, Lakeville, MA

**3:30 Cost-effective Solutions to the Climate Crisis Are Available Now – Why Do We Delay?**

Ellen Moyer, Greenviroment, Montgomery, MA

**4:00 MassDOT's Pilot Project for Climate Change and Extreme Weather Vulnerability Assessments for Central Artery, Boston, MA**

Steve Miller, MassDOT, Boston, MA

**4:30 Living with Water – Resilient Design for a Wetter Future**

Julie Wormser, The Boston Harbor Association, Boston, MA

**5:00 Climate Change Adaptation: Moving Forward in Massachusetts**

Kathleen Baskin, Executive Office of Energy and Environmental Affairs, Boston, MA

Session 2a and 2b are NOT approved for CT LEP credits.

Session 2a and 2b ARE approved for NJ LSRP regulatory (not technical) credits.

**Session 4:** 1:45pm – 5:00pm, Cape Cod Lounge

**Petroleum Biodegradation Metabolites in Groundwater: New Insights and Their Significance**



Session Chair: Bob Wilkenfeld, Chevron Environmental Management Company, San Ramon, CA

**1:45 Introduction (15 min)**

Bob Wilkenfeld, Chevron Environmental Management Company, San Ramon, CA

**2:00 Comparison of Petroleum Biodegradation Metabolites in Groundwater at Service Stations vs Terminals**

Dawn Zemo, Zemo & Associates, Inc., Incline Village, NV; Catalina Espino Devine and Renae Magaw, Chevron Energy Technology Company (CETC), San Ramon, CA; Rachel Mohler, Chevron Energy Technology Company (CETC), Richmond, CA; Kirk O'Reilly and Sungwoo Ahn, Exponent, Bellevue, WA

**2:30 Exploratory Analysis of Petroleum Biodegradation Metabolites Using GCxGC**

Rachel Mohler, Chevron Energy Technology Company (CETC), Richmond, CA; Dawn Zemo, Zemo & Associates, Inc., Incline Village, NV; Catalina Espino Devine and Renae Magaw, Chevron Energy Technology Company (CETC), San Ramon, CA; Kirk O'Reilly and Sungwoo Ahn, Exponent, Bellevue, WA

**3:00 BREAK**

**3:30 Petroleum Biodegradation Metabolites: A Biochemist's Perspective**

Kirk O'Reilly and Sungwoo Ahn, Exponent, Bellevue, WA; Rachel Mohler, Chevron Energy Technology Company (CETC), Richmond, CA; Dawn Zemo, Zemo & Associates, Inc., Incline Village, NV; Catalina Espino Devine and Renae Magaw, Chevron Energy Technology Company (CETC), San Ramon, CA

**4:00 Potential Human and Aquatic Toxicity of Petroleum Biodegradation Metabolites**

Renae Magaw and Catalina Espino Devine, Chevron Energy Technology Company (CETC), San Ramon, CA; Kirk O'Reilly and Sungwoo Ahn, Exponent, Bellevue, WA; Rachel Mohler, Chevron Energy Technology Company (CETC), Richmond, CA; Dawn Zemo, Zemo & Associates, Inc., Incline Village, NV

**4:30 Life-Cycle of a "TPHd/DRO" Plume**

Dawn Zemo, Zemo & Associates, Inc., Incline Village, NV; Catalina Espino Devine and Renae Magaw, Chevron Energy Technology Company (CETC), San Ramon, CA; Rachel Mohler, Chevron Energy Technology Company (CETC), Richmond, CA; Kirk O'Reilly and Sungwoo Ahn, Exponent, Bellevue, WA

POSTER SESSIONS

Authors will be available for individual discussion at their posters on both Tuesday & Wednesday from 3:00pm – 6:00pm CCA, Rm. 162, Rm. 165

## WORKSHOPS

**Workshop 10** 6:30pm – 9:30pm, Room 164

### Vapor Intrusion Assessment: Developments and Advances

Eric Suuberg, Sc.D., P.E., Professor of Engineering and Superfund Research Program Associate Director, Brown University, Providence, RI

David Shea, P.E., Principal Engineer, Sanborn, Head & Associates, Concord, NH

Vapor intrusion (VI) of volatile organic compounds (VOCs) into residential, commercial, and industrial buildings from subsurface contamination continues to present various challenges to investigation and remediation professionals, regulators, responsible parties, and the affected community. In 2014, for example, the U.S.EPA issued new guidance for short-term indoor air exposure limits for trichloroethene (TCE), and several states are following suit with their own newly developed limits. As a result, demand continues for improved VI assessment tools and evidence-based approaches to support decision-making for protecting against potential VI exposure risks.

Topics to be covered in this workshop will include: 1) Latest U.S.EPA and State guidance on TCE inhalation exposure limits and their basis, 2) Fundamentals of VOC fate and transport, 3) Confounding effects of background sources, spatial/temporal variability, and building-specific alternate/preferential VI pathways, 4) Recent advances in sampling tools and investigation approaches, including real-time field sampling/analysis and high-resolution subsurface characterization, 5) Recent developments in transport modeling and mass flux approaches to characterize and predict VI risk, and 6) Implications for VI mitigation design.

**Workshop 11** 6:30pm – 9:30pm, Room 168

### DNAPL Investigation: The Evolving State-of-Practice Workshop

Nathan Hagelin, C.G., L.E.P., Amec Foster Wheeler, Portland, ME

Seth Pitkin, Vice President, Project Officer, Stone Environmental, Inc., Montpelier, VT

Dense Non Aqueous Phase Liquids (DNAPL) present some of the most complex and difficult sites to clean up. The conventional soil boring and monitoring well approach does not often lead to remedial success. High resolution site characterization (HRSC) methods have improved our ability to understand these sites and to focus the application of remedial technologies more surgically where source mass resides and where mass flux occurs. The HRSC methods are based on understanding the properties of the DNAPL and how it interacts in a highly heterogeneous subsurface environment. The workshop will provide the latest information on various aspects of characterizing sites with dense non-aqueous phase liquid (DNAPL) contamination, including:

- DNAPL Properties & Behavior in the Subsurface
- Determining Data Needs
- High Resolution Site Characterization
- Matrix Diffusion & Mass Flux Concepts
- Guidance & Tools Developed by the ITRC DNAPL Site Characterization Team

**Workshop 12** 6:30pm – 9:00pm, Room 174

### Practical Use of Environmental Molecular Diagnostics (EMDs) for Remediation and Forensics

Aaron Peacock, Ph.D., Pace Analytical Energy Services, Pittsburgh, PA

John Wilson, Principal Scientist, Scissortail Environmental Solutions, LLC, Ada, OK

Environmental molecular diagnostics, or EMDs, describes a collection of specialty techniques that are used in the analysis of environmental pollution and cleanup. There are two broad categories of EMDs. The first is compound-specific isotope analysis (CSIA), which measures the amount of stable isotopes (usually carbon, hydrogen or chlorine) in environmental contamination. As contaminants degrade, the ratio of stable isotopes in the contaminant can change. CSIA can be used to understand the extent of contaminant degradation and the mechanisms by which degradation is occurring. CSIA can also be used in a forensic capacity to discover if there are multiple sources of a contaminant to the environment (e.g. for groundwater or vapor intrusion).

The second category of EMDs is biology-based. Molecular-biology EMDs include genomic and other techniques and are used to determine the contaminant-degrading capabilities of the microbes that are present at contaminated sites. Other molecular-biology based EMDs can be used to determine if the microbes are currently actively degrading contaminants. The use of EMDs can provide relevant and actionable data for some of the most difficult sites.

This is a read, see, and do short course, for genomics and CSIA. Each of the two main EMD presentations (genomics and CSIA) will include the following five learning objectives.

- When and how the particular EMDs are deployed.
- What are the limitations of the EMDs.
- How to interpret EMD laboratory reports.
- How to analyze EMD data.
- How to integrate EMD results into final reports.

Attendees will learn the basics of these techniques and how they apply to different remediation or forensic situations.

## SOCIAL

**Wednesday** 5:00pm – 7:00pm

**CCA (auditorium)  
and Concourse**



**Host Bar (limited duration)  
Refreshments  
Light Hors d'Oeuvres**

Free to all registered conference attendees

## Continuing Education Credit Offered at this Conference

### Types of credits:

1. MA LSP Credits
2. CT LEP Credits
3. NJ LSRP Credits
4. NY PE Credits
5. NH PEs (select certificate of attendance)
6. Certificate of Attendance

ATTENTION NH PEs - Our Certificate of Attendance is accepted by the board of licensure and certification for NH PEs!

**All certificates are mailed by mid-November.**

**See registration desk to sign up.**

### Credits are awarded as follows:

- ½ credit per hour of session attendance (LSPs, LEPs, LSRPs)
- 1 credit per hour of session attendance (PEs)
- 1 credit per hour of workshop attendance
- Some workshops may be approved for DEP regulatory credit (see individual workshop descriptions)
- Some workshops or sessions may be excluded from receiving credit (will be noted in workshop or session description in program)

## PLATFORM SESSIONS

**Session 1:** 9:00am – 12:00pm, Room 168

### Vapor Intrusion

**Session Chair:** Janine Commerford, Haley & Aldrich, Boston, MA

**9:00 Improving VI Investigations in Fractured Sedimentary Rock Settings**

Erica Bosse, Sanborn, Head & Associates, Inc., Latham, NY; Daniel Carr, Sanborn, Head & Associates, Inc., Concord, NH

**9:30 In Flux – A Case Study of a Vapor Intrusion Site Transitioning from Active to Passive Sub Slab Depressurization Systems (SSDS)**

Lisa Campe, Lisa McIntosh, and Jiayang Chien, Woodard & Curran, Dedham, MA

**10:00 BREAK**

**10:30 Vapor Intrusion Pathway: An Update to State Guidance Documents**

Laurent Levy, Gradient, Cambridge, MA

**11:00 Mitigation of Vapor Intrusion by Passive Vapor Barrier**

Alice Blayney, GZA GeoEnvironmental, Norwood, MA; William Nineve, Trident Environmental Group, Marlborough, MA

**11:30 New Study of Background Indoor Air Levels of Volatile Organic Compounds (VOCs) and Air-Phase Petroleum Hydrocarbons (APH) in Office Buildings and Schools**

Richard Rago, Haley & Aldrich, Inc., Rocky Hill, CT; Andy Rezendes, Alpha Analytical Labs, Westborough, MA

**Session 2:** 8:30am – 12:00pm, Room 164

### Advancing the Practice of In-Situ Remediation

**Session Chair:** Paul Dombrowski, AECOM, Wakefield, MA

**8:30 Synergy of Trap&Treat BOS 100® and Enhanced Reductive Dechlorination Tackles Large TCE Plume**

Mike Mazzaresse, AST Environmental, Golden, CO

**9:00 Direct-Push High-Pressure Jet Injection for Rapid Amendment Delivery in Low-Permeability Zones: Full-Scale Demonstration**

Chapman Ross and Dariusz Chlebica, Geosyntec Consultants, Acton, MA; Neal Durant, Geosyntec Consultants, Washington, DC; William Slack, FRx, Inc., Cincinnati, OH

**9:30 Real-Time Fourier Transform Infra-Red (FTIR) Monitoring of Extracted Vapors at an In-Situ Thermal Remediation Site**

Alyson Fortune, Derek LaRosee, Robin Swift, and Steffen Nielsen, TerraTherm, Gardner, MA; Kevin Crowder and John LaChance, ARCADIS, Chelmsford, MA; Kevin Ramazan, California Analytical Instruments, Orange, CA

**10:00 BREAK**

**10:30 Biosparging Study Demonstrates Metabolic and Cometabolic Degradation of BTEX and Preventing Migration across Site Boundary**

Assaf Rees, AECOM, Long Beach, CA

**11:00 Emulsion-based Delivery of Alkalinity for Control of Subsurface pH**

Andrew Ramsburg and Katherine Muller, Tufts University, Medford, MA

**11:30 Novel Method for Activating Kloxur Persulfate: Science and Key Characteristics**

Brant Smith, PeroxyChem, Philadelphia, PA

**Session 3:** 9:00am – 12:00pm, Room 174

### NAPL

**Session Chair:** Ellen Moyer, Greenenvironment, Montgomery, MA

**9:00 Remediation of Multi-Component DNAPL at a Chemical Manufacturing Facility by In-Situ Chemical Oxidation**

Brandt Butler, He Huang, and James Fenstermacher, AECOM, Conshohocken, PA; Daniel Cassidy, Western Michigan University, Kalamazoo, MI

**9:30 Novel CO2-based Efflux Methods to Assess and Support Monitoring Natural Source Zone Depletion**

Trevre Andrews, CH2M Hill, Mendota Heights, MN; Ellen Porter, CH2M Hill, Calgary, AB, Canada; Tom Palaia, CH2M Hill, Kittredge, CO

**10:00 BREAK**

**10:30 LNAPL Mobility Assessment in Risk Based Site Closure**

Patrick Sheehan, Albert Ricciardelli, and Kathleen Kerigan, GZA GeoEnvironmental, Norwood, MA

**11:00 LNAPL Transmissivity Revisited – Background, Evaluation, Estimation, and Progress (BEEP) Program**

Rangaramanujam Muthu and Michael Hawthorne, H2A Environmental, Ltd (A Subsidiary of GEI Consultants, Inc.), Keller, TX

**11:30 Measurement of Hydrocarbon Natural Source Zone Depletion Rates in Soils Using Passive CO2 Flux Traps**

Julio Zimbron, E-Flux, Fort Collins, CO

## DRAWING

**Enter to win a free registration to one of our next two conferences!**

Entry and drawing will take place during each of the Thursday morning sessions.

**ONE WINNER IN EACH SESSION!**



Must be present to win. Second place winners will receive free 2016 AEHS Foundation Membership. Members receive reduced registration! Drawings will take place at the conclusion of each session.



# POSTER PRESENTATIONS

October 20 & 21, 2015

Posters may be viewed throughout the day on Tuesday, October 20th and Wednesday, October 21st. Authors will be available for individual discussion at their posters from 3:00pm – 6:00pm each day. Refreshments and hors d'oeuvres will be served during the poster sessions. Poster Locations: *CCA (auditorium), Room 162, Room 165 (as assigned below)*

## The following posters are located in the Campus Center Auditorium (CCA):

### Utilization of Phosphogypsum to Reduce Greenhouse Gases Emissions Form Liquid and Solid Wastes

Saud AL Oud, King Saud University, Riyadh, Saudi Arabia

### Highly Successful ERD Pilot Evaluation Utilizing a Simple Additive Delivery Approach

Kent Armstrong, BioStryke Remediation Products LLC, Andover, NH; James Romeo, ITB, Inc., Merritt Island, FL

### A Proposed Study of Phytodegradation and Enhanced Microbial Degredation of Trenbolone Metabolites in Wetland Systems

Charlotte Atti and Lee Newman, SUNY - College of Environmental Science and Forestry, Syracuse, NY

### Peroxone Activated Persulfate Treatment of 1,4-Dioxane in the Presence of Chlorinated Solvent Co-Contaminants

Raymond Ball, EnChem Engineering, Inc., Newton, MA

### Selection of Remedial Alternatives for Landfill - Mobilized Arsenic in Downgradient Wetlands

Nicholas Castonguay, CDM Smith, Boston, MA; Roger Olsen, CDM Smith, Denver, CO

### Reducing Emissions from Lower Permeability Zones to Groundwater flowing Through More Permeable Zones using Sodium Persulfate

Bridget Cavanagh, XDD, LLC, Stratham, NH

### High Resolution Site Characterization in a Complex Deltaic Setting

Richard Desrosiers and Gordon Brookman, GZA GeoEnvironmental, Glastonbury, CT

### Increasing pH at a Site Where Successful Reductive Dechlorination Occurring at pH Less than 6

Paul Dombrowski, AECOM, Wakefield, MA

### Ecological Risk and Identification of Risk-Reduction Measures in an Urban Stream with Heterogeneous Zinc Contamination

Kristen Durocher, AECOM, Manchester, NH; Tim Verslycke, Gradient, Cambridge, MA; Patrick Haskell, AECOM, Providence, RI

### Vapor Intrusion: Navigating the Path Forward

Kate Engler, Apex Companies, South Windsor, CT

### Modeling of pH Changes During the Electrochemical Remediation Process

Shirin Hojabri, Ljiljana Rajic, and Akram Alshawabkeh, Northeastern University, Boston, MA

### Use of a Real-Time Computer Model to Facilitate Risk-Based Cleanup for PCBs during Soil Excavation

Gina Houck and Serese Marotta, ARCADIS, Syracuse, NY

### PCBs: The New Lead Paint?

Marc Hudock, GZA GeoEnvironmental, Fairfield, NJ

## The following posters are located in Room 162:

### Chemical Analysis and Toxicity Assessment of Sediments from Southern Taiwan

Chi-Ying Hsieh, Chun-Hung Liu, and Meng-Chun Wu, Neipu, Pingtung, Taiwan; Ching-Jen Ho, Environmental Protection Administration, Taipei, Taiwan; Xi-Nan Yang, Zhongli, Taoyuan, Taiwan

### Identifying the Causes of Sediment-Associated Contamination in Er-Jen River Basin Using Sediment Toxicity Identification Evaluations

Chi-Ying Hsieh, Nian-Jhen Jhuo, and Meng-Chun Wu, Neipu, Pingtung, Taiwan; Chang-Ling Miaw, Dept. of Nursing, Tajen University, Yangpu, Pingtung, Taiwan; Ching-Jen Ho, Environmental Protection Administration, Taipei, Taiwan

### An Evaluation of Soil Gas Results for 35 Qualified Sites Across Three States

Cheryl Kehres-Dietrich, Paul Glasser, and Paul Roberts, SME, Plymouth, MI

### Adaptation and Planning Strategies to Mitigate the Impact of Climate Change Induced Sea Level Rise, Flooding and Erosion at Selected Defence Sites

Allan Klindworth, AECOM, Chelmsford, MA

### Exploring Green Peas and Blanket Roll Habitat Remediation Technology with Sorbent Amendments

Thomas Kryzak, Air & Earth, Altamont, NY

### Implications of EPA's Proposed Dermal Slope Factor on Human Skin Cancer Risk Estimates

Brian Magee, Janet Keating-Connolly, and Norman Forsberg, ARCADIS, Chelmsford, MA

### Coupling Thermal Treatment with Microbial Reductive Dechlorination for the Enhanced Remediation of Chlorinated Ethenes

Tyler Marcet, Natalie Cápiro, and Kurt Pennell, Tufts University, Medford, MA; Yi Yang and Frank Löffler, University of Tennessee, Knoxville, TN

### Incorporating Vadose Zone Modeling into the Site Assessment and Remediation Project Lifecycle

Kristina Masterson, Robert Fitzgerald, William Glynn, and Nathan Jones, CDM Smith, Boston, MA

### Evaluation of Site Specific Background for NRDA Investigations at Refinery Sites

Yoko Masue-Slowey, Exponent, New York, NY; Linda Cook, Tarek Saba, and Paul Boehm, Exponent, Maynard, MA

### The Privatization of the Cleanup Decision Making Authority: The Massachusetts MCP

Raimundo Matos, AECOM, Chelmsford, MA

### The Use of Organoclay Mats to Address MGP

Ryan McCarthy, AECOM, Manchester, NH; Mark McCabe, AECOM, Chelmsford, MA

### Erodibility Parameters Derived from Jet Erosion Tests on Root-Permeated Soils

Bailey McNichol, University of Connecticut, Boalsburg, PA; Garey Fox, Oklahoma State University, Stillwater, OK

### Combined ISCO and ISCR Approach for DNAPL Brownfield Redevelopment in New Jersey

Will Moody, Geo-Cleanse International, Inc., Matawan, NJ

### Establishment of a Baseline Porewater Data Set for Long Term Monitoring of In-Situ Treatment

James Occhialini, Alpha Analytical, Mansfield, MA; Keir Cragie, Tetra Tech, Bothell, WA

### Polyurethane Composite Adsorbent, Characterisation and Application in Removal of Humic Acid (HA) from Aqueous Solution

Oluwasayo Olorundare and N Mabuba, University of Johannesburg, Doornfontein, Johannesburg, Gauteng, South Africa; Oluwaseun Popoola, Yaba College of Technology, Dept. Of Chemistry, Yaba, Lagos, Nigeria

### Investigation of Elemental Component of E-Waste Dumpsites in Alaba International Market Nigeria

Oluwasayo Olorundare and N Mabuba, University of Johannesburg, Doornfontein, Johannesburg, Gauteng, South Africa; Oluwaseun Popoola, Yaba College of Technology, Dept. Of Chemistry, Yaba, Lagos, Nigeria

### Understanding the Role of Enterobacter sp. 638 STUDENT in the Growth Enhancement of Poplar and Willow Trees

Ashley Pirovano and Lee Newman, SUNY - College of Environmental Science and Forestry, Syracuse, NY

### Heptachlor and its Metabolite: Accumulation and Degradation in Mae Klong River of Central Thailand

Toemthip Poolpak, Prayad Pokethitiyook, and Maleeya Kruatrachue, Mahidol University, Bangkok, Thailand; Suchart E. Upatham, Faculty of Allied Health Sciences, Mueang, Chonburi, Thailand

## The following posters are located in Room 165:

### The Role of Underground Storage Tank Regulations in Soil and Groundwater Protection

Gary Roberts and David Horowitz, Tighe & Bond, Inc., Westfield, MA

### Evaluating Vapor Suppression Mechanisms of Two Non-Ionic Emulsifying Agents STUDENT

Andrew Robinson and Andrew Ramsburg, Tufts University, Medford, MA

### Hydraulic Fracturing: Data Analysis Methods to Identify Compound Sources in Drinking Water Wells

Tarek Saba, Exponent, Bedford, MA

### The Implications of Setting Groundwater Remedial Goals based on Methods used to Protect Human Health

Shawn Sager, ARCADIS, Raleigh, NC; Julie Gillespie, ARCADIS, Fair Lawn, NJ

### Trends in Exposure and Risk in a Small Tidal Creek Food Web in Response to Sediment Remediation

John Schaffer, Tetra Tech, Morris Plains, NJ

### ERD of TCE DNAPL Achieving Non Detect from a Single Injection Mobilization

Richard Schaffner and Crystal Leavey, Pennoni Associates, Inc., Haddon Heights, NJ; Dan Takoushian and Kevin Davis, Pennoni Associates, Inc., Philadelphia, PA

### The Influence of Indoor Air Exchange Rate Variations in Vapor Intrusion

Rui Shen and Eric Suuberg, Brown University, Providence, RI

### Jeeban's (HH1) Model Development for Kitchen Waste Management and Bio-gas Generation

Jeeban Shrestha, Nepal Science and Technology Research Center, Kathmandu, Bagmati, Nepal

### Surfactant Enhanced Remediation Technologies

Dan Socci, Jennifer Holcomb, and Geeta Dahal, EthicalChem, South Windsor, CT

### Surfactant-Enhanced Product Recovery (SEPR™) for Creosote Remediation

Dan Socci, Jennifer Holcomb, and Geeta Dahal, EthicalChem, South Windsor, CT

### Evidence of Multiple Reductive Dechlorination Pathways post ISCR in a DCE Stalled Shallow Aquifer

Ravikumar Srirangam and Fayaz Lakhwala, PeroxyChem, Philadelphia, PA; Damian Vanetti, GHD, Cazenovia, NY

### Moving Window Analysis for Site Characterization

William Stiteler and Russell Aicher, ARCADIS, Syracuse, NY; Marianne Batchelder, ARCADIS, Lakewood, CO

### Strategies for a More Accurate Mass Removal Calculation During Thermal In-Situ Remediation

Nikole Stone, Robin Swift, and Steffen Nielsen, TerraTherm, Gardner, MA; Bruce Thompson and Jessie McCusker, De Maximis, Inc., Windsor, CT; John LaChance and Kevin Crowder, ARCADIS, Chelmsford, MA

### In-Situ Anaerobic Biodegradation for Remediation of Petroleum Hydrocarbons, former Wurtsmith Air Force Base, Oscoda, Michigan

Curt Varner and Debra MacDonald, ECC, Marlborough, MA; Sheila McGroddy and Robert Zimmer, Geovation Engineering, P.C., Slate Hill, NY

### Adaptation of Long-Term Monitoring Plan to Assess Remedial Effectiveness: A Case Study of a Northeastern PCB Sediment Site

Jason Vogel, ARCADIS, Syracuse, NY; David Rigg, ARCADIS, Clifton Park, NY

### Differences in Stream Flow Estimations from Precipitation Data Products with Different Spatial and Temporal Resolution in Puerto Rico STUDENT

Harshi Weerasinghe, Akram Alshawabkeh, and Edward Beighley, Northeastern University, Boston, MA

### Programmatic Approaches to Ensure Environmentally Responsible Solar Energy Development on Public Lands

Konnie Wescott, Mike Dwyer, Laura Fox, Mark Grippo, Heidi Hartmann, Karen Smith, and Lee Walston, Argonne National Laboratory, Argonne, IL

### Analytical Method to Determine the Influences of Building Footprint Size on Subslab Oxygen Shadow

Yijun Yao, Zhejiang University, Hangzhou, Zhejiang, China

### A Biosurfactant-Enhanced, Green Remediation of Heavy Hydrocarbon Contaminated Sediment

Christian Zeigler, GreenStract, LLC, New York, NY; Albert Robbat, Tufts University, Medford, MA

### Can Air Pollution Sources Adversely Affect Soil and Vegetation?

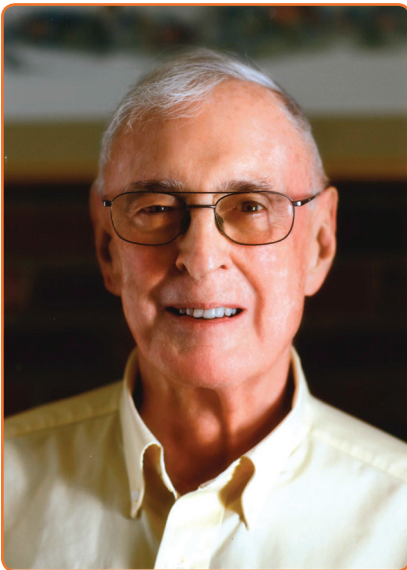
Stephen Zemba, CDM Smith, Boston, MA



# LIFETIME ACHIEVEMENT AWARDS

The Annual International Conference on Soils, Sediments, Water, and Energy is pleased to announce the recipients of the Lifetime Achievement Award. This award is presented to individuals who have shown significant contributions to the field as well as outstanding environmental stewardship. This year's winners are **Dominic Di Toro, University of Delaware, Newark, DE** and **Leigh Short, Woodward Clyde (retired), Williamstown, MA.**

**Dominic M. Di Toro** is the Edward C. Davis Professor of Civil and Environmental Engineering at the University of Delaware. He was elected to the National Academy of Engineers in February, 2005. His other awards include the Institute of Scientific Information Highly Cited Researcher, 2003, The Founders Award of the Society of Environmental Toxicology and Chemistry, 1997, and a SETAC Fellow in 2014. Dr. Di Toro has specialized in the development and application of mathematical and statistical models to stream, lake, estuarine and coastal water and sediment quality problems. He has published over one hundred technical papers, as well as *Sediment Flux Modeling*, published by J. Wiley & Sons. He has participated as Expert Consultant, Principal Investigator and Project Manager on numerous water quality studies for industry, research foundations and governmental agencies. His work has focused on the development of water and sediment quality criteria, sediment flux models for nutrients and metals, and integrated hydrodynamic, sediment transport and water quality models. His latest research area is developing mechanistic models of metal and organic chemical partitioning and toxicity that can make predictions from the molecular structure only. Dr. Di Toro received his B.E.E. in Electrical Engineering with honors from Manhattan College in 1963, his M.A. in electrical engineering in 1965 and his Ph.D. in Civil and Geological Engineering in 1967, both from Princeton University. He joined the faculty of Manhattan College and became the Donald J. O'Connor Professor of Environmental Engineering in 1999. In 2003, he joined the faculty at the University of Delaware. Dr. Di Toro also served as a Senior Research Consulting Engineer at Hydrosience, Inc. from 1969-1980 and was a founding partner of the successor firm HydroQual, Inc., a consulting firm that specializes in water quality modeling, where he was Principal Consultant from 1980 to 2004.



**W. Leigh Short** graduated from the University of Michigan in 1963 with a Ph.D. in Chemical Engineering. He worked for California Research Corporation (Chevron) from 1962-1967 as a Senior Process Engineer. During that time he received several patents for a new wastewater treatment process which has been employed in several refineries. From 1967-1979 he was a professor in the Chemical Engineering Department at UMass Amherst. During this time frame he was appointed to NIH's air pollution panel and in 1976 to the Science Advisory Board (engineering panel) of EPA. From 1979 to "retirement" in 2000 he was employed in the consulting sector working mostly with commercial clients. He was employed by three companies: Environmental Research and Technology (Vice President Engineering), Radian Corporation (Senior Project Manager) and Woodward Clyde Consultants (Vice President, Principal). After retirement from Woodward Clyde he started a small consulting business focusing on litigation support and expert witness assignments (four employees). The company was asked to assist in about twenty separate cases. His consulting assignments focused on selection of remediation technologies particularly for manufactured gas plants and PCB contaminated sites. He has also served on many EPA review panels for contracts and centers of excellence and has been a member of the NRC panels focused on destruction of chemical weapons. He has served as a consultant to EPA (fugitive emissions from refineries), Arthur D Little (petroleum refining) and SAIC (destruction of chemical weapons containing mercury). While at UMass he chaired the University Academic Policy Committee and was one of the original directors of the BDIC program.

## STUDENT COMPETITION/AWARD PROGRAM

We are proud to announce the 12th Annual Student Competition for best platform or poster presentations, sponsored by Calgon Carbon Corporation. One \$1000.00 cash prize and two \$500.00 cash prizes will be awarded to the three best student presentations. Winners will be announced on Wednesday evening.



Must be entered prior to the conference in order to compete.  
Open to all full and part-time students (post-docs excluded).



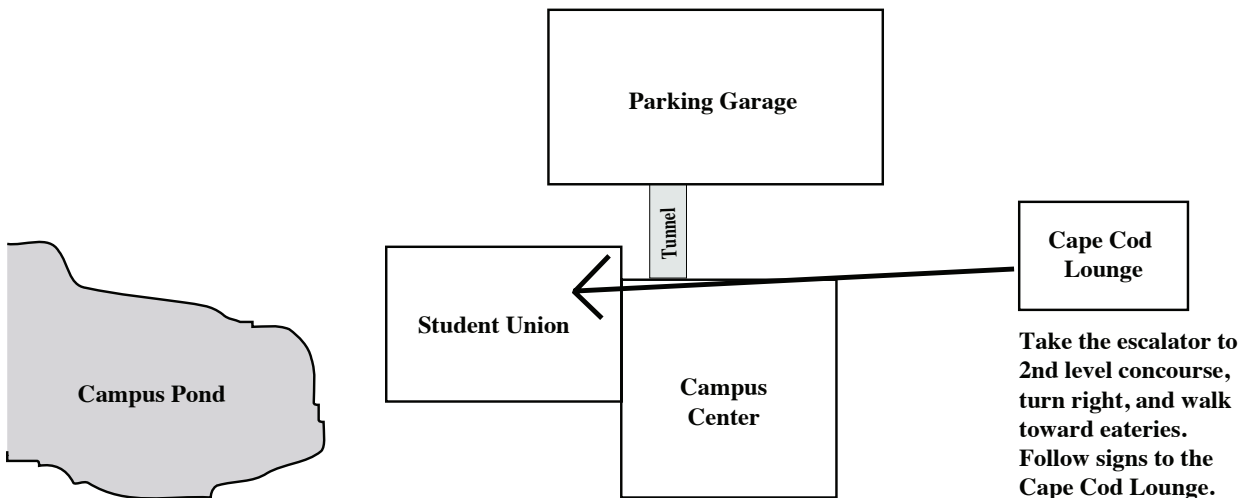
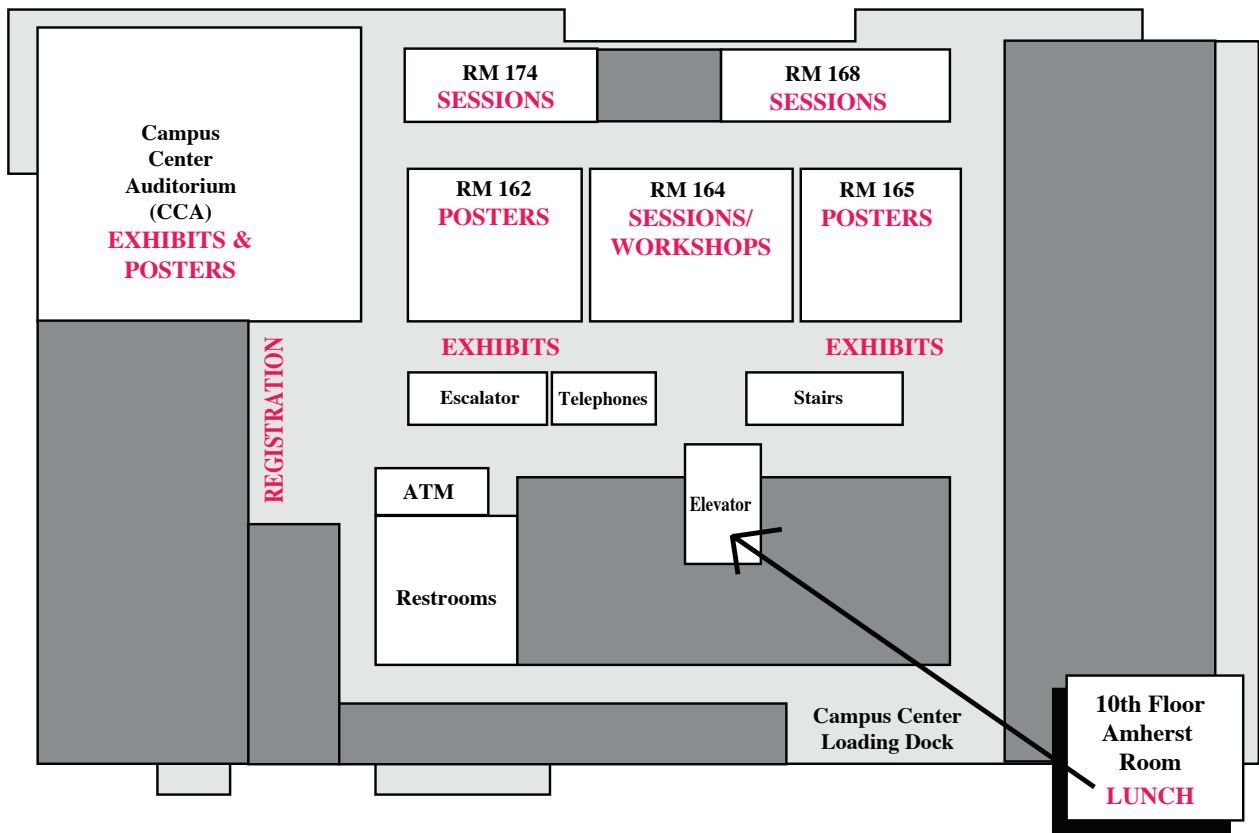
See [www.AEHSFoundation.org](http://www.AEHSFoundation.org) for full details and previous winners.



# CONFERENCE MAP



1st Floor Campus Center



# CONFERENCE at a GLANCE

## Monday, October 19, 2015 (Monday is workshops only)

Registration: 10:00am – 4:00pm

**Workshop 1** (1:00pm – 5:00pm) Quantitative Evaluation for Greener Cleanups Using SEFA, *Rm. 917*

**Workshop 2** (1:00pm – 5:00pm) Sustainable Remediation Principles and Practice, *Rm. 168*

**Workshop 3** (1:00pm – 5:00pm) Evaluations of Metals in Groundwater at VOC-Impacted Sites, *Rm. 174*

**Workshop 4** (1:00pm – 5:00pm) MassDEP VPH, EPH, and APH Methods Workshop, *Rm. 164*

**Workshop 5** (1:00pm – 5:00pm) In Situ Thermal Remediation, *Rm. 908*

**Workshop 6** (1:00pm – 4:00pm) Environmental Forensics - Utilization of Established and Evolving Techniques, *Rm. 808*

## Tuesday, October 20, 2015

Registration: 7:30am – 7:00pm | Exhibit Hall Hours: 9:00am – 7:00pm

### Morning Platform Sessions

8:30/9:00am – 12:00pm, *Sessions are concurrent*

**Session 1:** Contaminants of Emerging Concern, *Rm. 164*

**Session 2:** Environmental Forensics, *Rm. 168*

**Session 3:** Innovative & Sustainable Soil, Sediment, Water & Energy Solutions, *Rm. 174*

### Afternoon Platform Sessions

1:30pm – 3:00/4:00/5:00/5:30pm, *Sessions are concurrent*

**Session 1a:** Risk Assessment, *Rm. 164*

**Session 1b:** Site Assessment/Field Sampling, *Rm. 164*

**Session 2:** Sustainability and Sustainable Remediation, *Rm. 168*

**Session 3:** Bioavailability of Soil-Borne Contaminants, *Rm. 174*

**Poster Session** 3:00pm – 6:00pm, *CCA, Rm. 162, Rm. 165*

**Wine/Welcome Reception** 5:00pm – 7:00pm, exhibit areas, 1st floor

### Evening Workshops

**Workshop 7** (6:30pm – 9:30pm) Environmental Forensics Workshop, *Rm. 164*

**Workshop 8** (6:30pm – 9:30pm) The Biogeochemical Toolbox: Enhancing Natural Remedial Processes, *Rm. 168*

**Workshop 9** (6:30pm – 9:30pm) Naphthalene: A Case Study - The Science, Impact, and Implications of Its Risk Assessment, *Rm. 174*

## Wednesday, October 21, 2015

Registration: 7:30am – 7:00pm | Exhibit Hall Hours: 9:00am – 7:00pm

### Morning Platform Sessions

8:30/9:00am – 12:00pm, *Sessions are concurrent*

**Session 1:** Greener Cleanups, *Rm. 164*

**Session 2:** Sediments, *Rm. 168*

**Session 3:** Combining Remediation Technologies for Optimal Results, *Rm. 174*

**Session 4a:** Remediation, *Cape Cod Lounge*

**Session 4b:** Environmental Fate & Modeling, *Cape Cod Lounge*

### Afternoon Platform Sessions

1:30pm – 4:00/5:00/5:30pm, *Sessions are concurrent*

**Session 1:** Human Health Risk Assessment in a Contaminated Industrial Site, *Rm. 164*

**Session 2a:** Environmental Justice, *Rm. 168*

**Session 2b:** Climate Change Solutions: Think Global, Act Local, *Rm. 168*

**Session 3:** Nuclear Power Plant Closure and Decommissioning, *Rm. 174*

**Session 4:** Petroleum Biodegradation Metabolites in Groundwater, *Cape Cod Lounge*

**Poster Session** 3:00pm – 6:00pm, *CCA, Rm. 162, Rm. 165*

**Social** 5:00pm – 7:00pm, exhibit areas, 1st floor

### Evening Workshops

**Workshop 10** (6:30pm – 9:30pm) Vapor Intrusion Assessment: Developments and Advances, *Rm. 164*

**Workshop 11** (6:30pm – 9:30pm) DNAPL Investigation: The Evolving State-of-Practice Workshop, *Rm. 168*

**Workshop 12** (6:30pm – 9:00pm) Practical Use of Environmental Molecular Diagnostics (EMDs) for Remediation and Forensics, *Rm. 174*

## Thursday, October 22, 2015

Registration: 7:30am – 12:00pm | Exhibit Hall Hours: 9:00am – 12:00pm

### Morning Platform Sessions

8:30/9:00am – 12:00pm, *Sessions are concurrent*

**Session 1:** Vapor Intrusion, *Rm. 168*

**Session 2:** Advancing the Practice of In-Situ Remediation, *Rm. 164*

**Session 3:** NAPL, *Rm. 174*

### LUNCHEON:

12:00pm – 1:30pm  
Amherst Room, 10th Floor

**Speaker:** Julie Beth Zimmerman, Ph.D., Professor of Green Engineering, Department of Chemical and Environmental Engineering and School of Forestry and Environmental Studies, Yale University, New Haven, CT

**Assessment Informed Design: Innovative Examples from Water, Energy, and Material Systems**

### LUNCHEON:

12:00pm – 1:30pm  
Amherst Room, 10th Floor

**Speaker:** José Manuel Palma-Oliveira, Professor, University of Lisbon, Palma Consulting, Lisbon, Portugal

**Communicating Risk without Risk Communication: Involving Stakeholders Through Scientific Reasoning**

## Exhibit Hall Hours:

### TUESDAY

9:00am – 7:00pm

### WEDNESDAY

9:00am – 7:00pm

### THURSDAY

9:00am – 12:00pm

### CCA & CONCOURSE

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