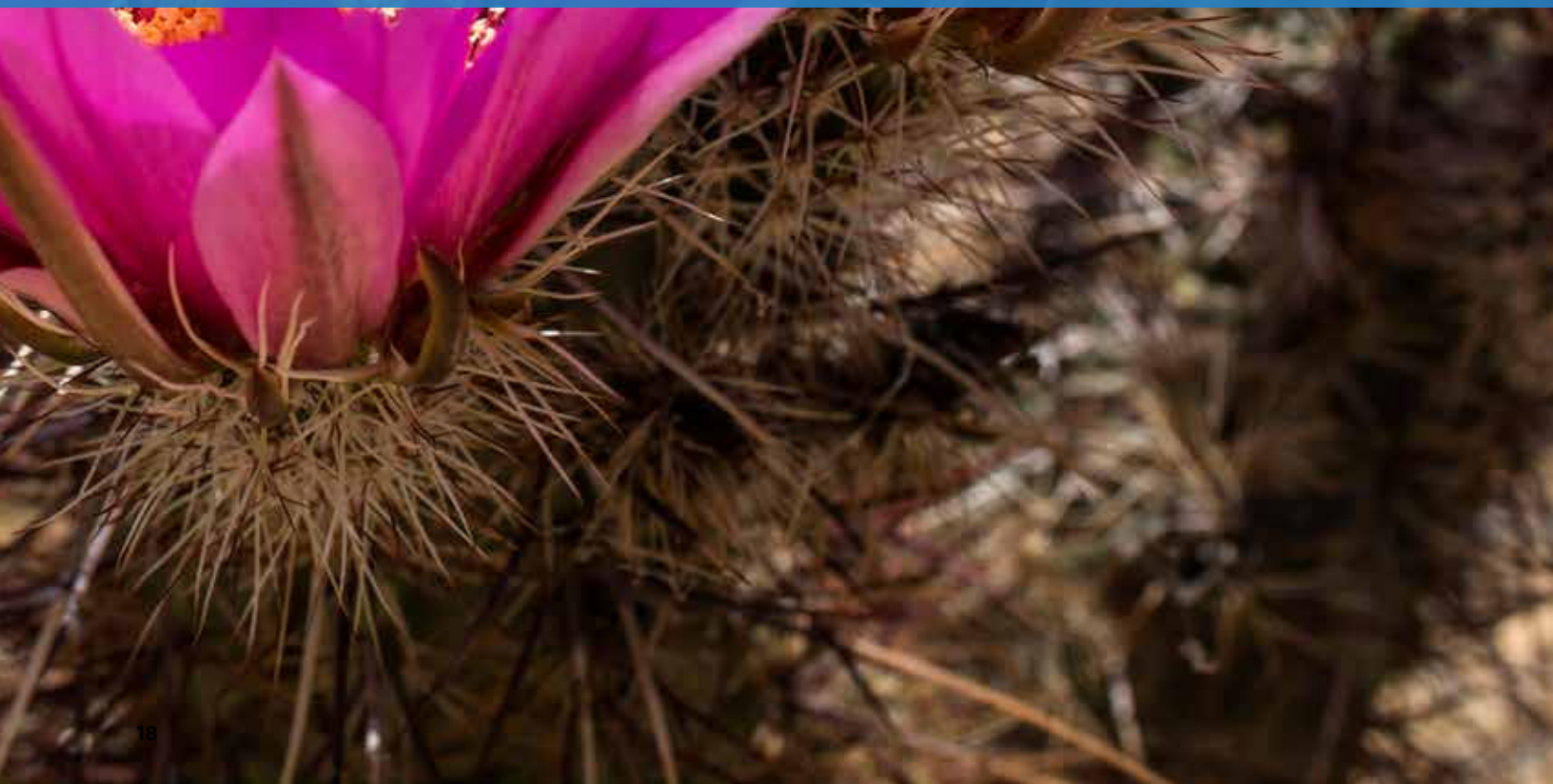




PRESENTATIONS



Plenary Session

Monday Morning

8:30–10:00 a.m.

Welcome and Opening Remarks

Conference Program Chairs

Wendy Condit, PE (Battelle)

Ramona Darlington, Ph.D. (Battelle)

Presentation of Student Paper Awards

Plenary Address

Scott Fulton (Environmental Law Institute [ELI])



Environmental laws and regulations are the foundation and driver for the remediation industry worldwide. Join Scott Fulton of the Environmental Law Institute (ELI) as he discusses key regulatory developments/changes that will shape efforts to provide meaningful and sustainable solutions to environmental challenges that the world will face in the years ahead. In addition, the talk will explore the evolving roles of government at all levels, the private sector, and the public in ensuring environmental protection. Since 2015, Scott Fulton has served as President of ELI, which is the world's premier nonpartisan institute for building effective environmental governance and rule of law. ELI's vision focuses on a "healthy environment, prosperous economies, and vibrant communities founded on rule of law."

Prior to his leadership at ELI, Mr. Fulton was a Principal at the environmental law firm Beveridge & Diamond, and served as General Counsel of the U.S. Environmental Protection Agency (EPA). Mr. Fulton also served in a number of other key leadership roles in both Republican and Democratic Administrations, including Acting EPA Deputy Administrator, head of EPA's Office of International Affairs, Judge on the Environmental Appeals Board, and head of the Agency's enforcement program. He served as well as Assistant Chief of the Environmental Enforcement Section of the U.S. Department of Justice (DOJ) Environment and Natural Resources Division. Learn more about Scott Fulton and ELI at: <https://www.eli.org/bios/scott-fulton>

Breakout Sessions and Panels

The 80 sessions are grouped into 9 tracks (A–I). See the Platform and Panel Schedule tables (pages 14-15) for an overview of the sessions and the days each will be conducted.

See the Poster Schedule (pages 16-17) for the days each poster group display and presentation will be conducted.

Listed below are the presentations scheduled as of December 5, 2017. In each entry, the author list appears in *italics*, and the name and affiliation of the person scheduled to give the presentation follows the author list.

Each title beginning with an asterisk (*) is to be presented as a poster presentation.

The schedule is subject to revisions (changes of presenters, withdrawals) in the months leading up to the Conference.

A1. Insensitive Munitions

Platforms Monday | Posters (*) Monday Evening
Chairs: Mark E. Fuller (Aptim Federal Services) and
Mandy Michalsen (U.S. Army Corps of Engineers)

* **1,3-Dinitrobenzene Reductive Degradation by Alkaline Ascorbic Acid: Reaction Mechanisms, Degradation Pathways, and Reagent Optimization.** *C. Ciou and C. Liang.*

Chenju Liang (National Chung Hsing University/Taiwan)

* **Adsorption of Munitions Constituents via Cellulose, Cellulose Triacetate, Chitin, and Chitosan.** *L. Gurtowski, M.K. Shukla and C.S. Griggs.*

Luke A. Gurtowski (U.S. Army Engineer Research and Development Center/USA)

Cometabolic Degradation of Inensitive Munitions Constituents during Nitrification. *J.L. Johnson.*

Jared L. Johnson (U.S. Army Engineer Research and Development Center/USA)

Energetics Residue Deposition from the Detonation of U.S. Inensitive Munitions. *M.F. Bigl, S.A. Beal, and M.R. Walsh.*

Matthew F. Bigl (U.S. Army Cold Regions Research and Engineering Laboratory/USA)

* **Fenton Oxidation of Constituents with Inensitive Munitions Formulation IMX-101.** *L. Gurtowski, J.L. Johnson, D. Felt, and S. Larson.*

Luke A. Gurtowski (U.S. Army Engineer Research and Development Center/USA)

Incorporating Transformation Products into Models of the Environmental Fate of Inensitive Munition Constituents. *P.G. Tratnyek, T.L. Torralba-Sanchez, E.J. Bylaska, J. Hawari, and B.E. Johnson.*

Paul Tratnyek (Oregon Health & Science University/USA)

* **Inensitive Munitions are Different: Environmental Management and Cost Implications of IM Articles.**

J.L. Johnson, L. Gurtowski, D. Felt, and S. Larson.

Jared L. Johnson (U.S. Army Engineer Research and Development Center/USA)

* **Optimization of Blow-in-Place Procedures for the Effective Detonation of Inensitive Munitions.**

S. Thiboutot, P. Brousseau, E. Diaz, M.R. Walss, and M.E. Walsh.

Sonia Thiboutot (DRDC Valcartier/Canada)

Photodegradation of Inensitive Munitions Compounds.

M.K. Shukla.

Manoj Shukla (USACE/USA)

A2. Energetics, Perchlorate

Platforms Monday | Posters (*) Monday Evening
Chairs: Kate Kucharzyk (Battelle) and Kevin Morris (ERM)

* **Bioremediation of Perchlorate and Nitrate Using a Slow Release Electron Donor.** *S. Shrestha, J. Gonzales, J. Batista, and R. Britto.*

Jacimaria Batista (University of Nevada Las Vegas/USA)

Evaluation of Perchlorate Sources in a Southern California Aquifer Using Four Different Isotopic Measurements. *P.B. Hatzinger, L. Heraty, N.C. Sturchio, J.K. Bohlke, and J.A. Izbicki.*

Paul Hatzinger (APTIM Federal Services, LLC/USA)

Ex Situ Treatment of Perchlorate, Metals, VOCs, and Pesticides in Groundwater. *B. Robinson, T.J. Slater, K. Deeny, and J. Barnes.*

Jacob Barnes (ERM/USA)

* **Field-Scale Treatability Study to Evaluate In Situ Soil Mixing of EVO and ZVI to Reduce Nitroaromatics in Saturated and Vadose Zones.** *S. Downey, R. Mayer, and R. Meadows.*

Steven Downey (APTIM Federal Services, LLC/USA)

Impact of Microscale Energetic Residues on Range Contamination Issues. *M.E. Fuller, C.E. Schaefer, C. Andaya, and S. Fallis.*

Mark E. Fuller (Aptim Federal Services/USA)

Integrated Large-Scale Remediation of Chlorinated Volatile Organic Compounds and Perchlorate in Soil: Bermite Facility, Santa Clarita, California. *H. Amini and W.J. Weaver.*

Hassan Amini (Wood/USA)

Remediation of Perchlorate-Impacted Vadose Zone Hydraulically Upgradient of an Industrial Site.

M. Behrooz.

Mona Behrooz (California Regional Water Quality Control Board/USA)

* **Trade-Offs in Utilizing Zero-Valent Iron for Synergistic Biotic and Abiotic Reduction of Trichloroethene and Perchlorate.** *S. Mohana Rangan, A. Mouti, A.G. Delgado, R. Krajmalnik-Brown, G.V. Lowry, L. LaPat-Polasko, and H. Brenton.*

Srivatsan Mohana Rangan (Arizona State University/USA)

A3. Remediation of 1,4-Dioxane

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Alison Cupples (Michigan State University) and
William DiGuseppi (CH2M HILL)

* **1,4-Dioxane Biodegradation at Low Concentrations.**

C. Zhou, Y. Xiong, Y. Tang, and S. Dworatzek.

Chao Zhou (Geosyntec Consultants/USA)

* **Aerobic Degradation of 1,4-Dioxane in a Fixed-Film Bioreactor with Toluene, Other Volatiles and Phenolics as Co-Contaminants.** *P.W. Hare, M.R. Harkness, P.L. D'Annibale, D.F. Sauda, and L.S. Streeter.*
Paul Hare (OBG/USA)

* **Applied Research of Adsorptive Media: Troubleshooting the Impact of Hidden Organic Material.** *K. Foster, M. Nickelsen, M.D. Basel, and R.C. Luhrs.*
Michael D. Basel (Haley & Aldrich, Inc./USA)

* **Bench- and Pilot-Scale Testing of Aerobic Biological and Advanced Oxidation Process Treatment Methods for Chlorinated Constituents and 1,4-Dioxane in Steam-Enhanced Extraction Condensate.** *J. Bunton, R. Wenzel, R. Stuetzle, L. Cordone, T. Schoenberg, J. Fettig, K. King, O. Hrycyk, and A. Biniwale.*
Ted Schoenberg (Parsons/USA)

Bioaugmentation to Enhance Biodegradation of 1,4-Dioxane. *R. Mora, H. Holbrook, D. Chiang, S. Mahendra, Y. Maio, S. Dworatzek, K. Sublette, A. Bodour, and H. Anderson.*
Rebecca Mora (AECOM/USA)

* **Biodegradation of 1,4-Dioxane in a Moving Bed Bioreactor.** *C. Bell, J.C. Stanfill, and D. Favero.*
Caitlin Bell (Arcadis/USA)

* **Cometabolic Degradation of 1,4-Dioxane by a Novel Gram-Negative Propanotrophic Bacterial Isolate.** *D. Deng, F. Li, and M. Li.*
Mengyan Li (New Jersey Institute of Technology/USA)

Cometabolic Treatment of Emerging Contaminants including 1,4-Dioxane, 1,2-Dibromoethane, and N-Nitrosodimethylamine. *P.B. Hatzinger, D.L. Lippincott, and J.F. Begley.*
Paul Hatzinger (APTIM Federal Services, LLC/USA)

Comparison of Cometabolic Removal of 1,4-Dioxane by Different Methanotrophic Strains. *Y. Zhang, D. Deng, and M. Li.*
Mengyan Li (New Jersey Institute of Technology/USA)

* **Degradation of Cyclic Ethers by Microorganisms Isolated from Contaminated Groundwater.** *R. Thompson.*
Rowan Thompson (GEI Consultants, Inc./USA)

* **Delineating and Treating 1,4-Dioxane and VOCs at the Nuclear Metals, Inc. Superfund Site.** *B. Thompson, J. Hunt, D. Fuerst, D. Adilman, C. Arsenault, and C. Elder.*
Bruce Thompson (de maximis, inc./USA)

* **The Development of Microcosms to Achieve Anaerobic 1,4-Dioxane Biodegradation.** *V. Ramalingam and A.M. Cupples.*
Vidhya Ramalingam (Michigan State University/USA)

* **Enhancement of Intrinsic 1,4-Dioxane Biodegradation.** *A.S. Madison, T. Richards, R. Illes, Y. Miao, and S. Mahendra.*
Andrew Madison (Golder Associates, Inc./USA)

* **Evaluation of Multiple Remediation Strategies to Enhance Treatment of 1,4-Dioxane with Combined Oxidant Technologies.** *J. Byrd, E. Hollifield, and P. Dugan.*
Jennifer Byrd (ERM/USA)

* **Field-Scale Evaluation of In Situ Biodegradation of 1,4-Dioxane via Bioaugmentation with *Pseudonocardia dioxanivorans* CB1190.** *L. LaPat-Polasko, D. Taggart, S. Rosolina, K. Clark, B.R. Baldwin, A. Polasko, and S. Mahendra.*
Laurie LaPat-Polasko (Matrix New World Engineering/USA)

* **In Situ Propane and Oxygen Biosparging for Cometabolic Bioremediation of 1,4-Dioxane.** *C. Bell, M. Heintz, A. Krevinghaus, and D. Favero.*
Caitlin Bell (Arcadis/USA)

* **Investigation and Remediation of Groundwater Contaminated with the Emerging Contaminant 1,4-Dioxane in Glacial Till and Fractured Bedrock Associated with a Former Medical Waste Disposal Area in Hanover, New Hampshire.** *J.M. Wieck, S.R. Lamb, and M. O'Leary.*
James M. Wieck (GZA GeoEnvironmental, Inc./USA)

* **Isolation and Characterization of Bioaugmentation Strains for 1,4-Dioxane Bioremediation.** *J. Mathieu, Y. Yang, C. Schwarz, Y. He, and P.J.J. Alvarez.*
Jacques Mathieu (Rice University/USA)

* **Low-Temperature Heat Injection for 1,4-Dioxane Source Zone Remediation.** *G. Alexander, R. Logan, R. Strandberg, S. Crawford, and D. Keane.*
Gordon Alexander (Kennedy/Jenks Consultants/USA)

* **A Novel Putative Propane Monooxygenase Initiating Metabolism of 1,4-Dioxane.** *D. Deng, F. Li, and M. Li.*
Mengyan Li (New Jersey Institute of Technology/USA)

Optimizing a Mixed Microbial Community to Biodegrade Chlorinated Ethenes and 1,4-Dioxane. *A. Polasko, A. Zulli, S. Mahendra, S. Dworatzek, E. Mack, and C. Walecka-Hutchinson.*
Alexandra Polasko (UCLA/USA)

* **Overcoming Water Treatment Challenges for 1,4-Dioxane Using AMBERSORB™ Resin.** *P. Groff Robertson, R. Johnson, M. Kaplan, S. Kretschman, and S. Woodard.*
Pamela Groff (WSP USA/USA)

* **Performance Comparison of Three Different Treatment Technologies for In Situ Remediation of a 1,4-Dioxane Plume in a Heterogeneous Aquifer.** *P. Hsieh, Y. He, and M. Silva.*
Patrick Hsieh (Dalton Olmsted & Fugelvand, Inc./USA)

* **Phylogenetic and Functional Fluorescent Probes for Culture-Independent Identification and Cell Sorting of Indigenous 1,4-Dioxane Degraders.** *M. Li, Y. Yang, and P.J.J. Alvarez.*
Mengyan Li (New Jersey Institute of Technology/USA)

*** Propane Biostimulation for Effective 1,4-Dioxane Removal: Enrichment and Microbial Structure Analysis.**

M. Li, D. Deng, Y. Liu, Y. He, and P.J.J. Alvarez.
Mengyan Li (New Jersey Institute of Technology/USA)

*** Short-Chain Alkane Monooxygenase (SCAM) and Cometary 1,4-Dioxane Biodegradation by Gaseous Alkane-Oxidizing Bacteria.**

W. Chen and M. Hyman.

Weijue Chen (North Carolina State University/USA)

Single-Well Push-Pull Tests to Assess the Biostimulation of Isobutane-Utilizing Microorganisms and Their Potential for 1,4-Dioxane Cometabolism.

H.M. Rolston, M.F. Azizian, L. Semprini, and M.R. Hyman.
Hannah Rolston (Oregon State University/USA)

Treatment of 1,4-Dioxane and CVOCs by Bioaugmented Granular Activated Carbon and Bioaugmented Synthetic Zeolite.

N.W. Johnson, S. Mohanty, S. Mahendra, Y. Liu, P. Pornwongthong, E. Mack, and C. Walecka-Hutchison.

Nicholas Wade Johnson (University of California, Los Angeles/USA)

Treatment of Mixed Chlorinated Solvents and 1,4-Dioxane in Groundwater: Testing of Two Biodegradation Strategies.

C. Bucior, S. Dore, D. Pope, R. Thomas, A. Weston, and F. Blickle.
Sophia Dore (GHD/USA)

A4. Other Emerging Contaminants

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Paul Hare (OBG) and Shaily Mahendra (University of California, Los Angeles)

*** 1,2,3-Trichloropropane Regulatory Compliance Strategies and Treatment System Design Considerations.**

G. Graening, M. Goh, and A. Wilson.
Guy Graening (TRC Solutions, Inc./USA)

1,2,3-Trichloropropane: Insights from Data Mining of Occurrence and Cleanup Site Databases.

M. Gentile, E. Kalve, and S. Justicia-Leon.
Margaret Gentile (Arcadis/USA)

*** Adsorption of N-Nitrosodimethylamine onto Activated Carbons from Pecan Shells and Soft Wood Barks.**

G. Hernandez, E. Lopez, L. Derry, D. Ellis, C. Bianconi, P.K. Andersen, and C.E. Brewer.
Gustavo Hernandez (New Mexico State University/USA)

*** Challenges of Managing a Low Concentration 1,2,3-Trichloropropane Site in California.**

D. Croteau and C. Voci.
Darren Croteau (Terraphase Engineering, Inc./USA)

*** Emerging Contaminants: What's Next?**

R. Patel and J. Claypool.
Radhika Patel (Brown and Caldwell/USA)

Emerging Contaminants: What's Next? A Look at the Lautenberg Chemical Safety Act.

D. Nelson, K. Sellers, and N. Weinberg.
Denice Nelson (ERM/USA)

*** Fate of 17 α -Ethinylestradiol in the Presence of Vegetable Wastes.**

R.M. Zayyat and M.T. Suidan.
Ramez Zayyat (American University of Beirut/Lebanon)

*** Implications of the California MCL for 1,2,3-Trichloropropane for Existing Remedial Systems and Future Site Remediation Strategy.**

H. Gupta and J.E. Claypool.

Hari Gupta (Brown and Caldwell/USA)

*** A Novel Quantification Method for N-Nitrosodimethylamine for Laboratory-Scale Research Applications.**

D.A. Amidei, J. Rodriguez, S. Macklin, K. Sanchez, A. Torres, P.K. Andersen, and C.E. Brewer.

David A. Amidei (New Mexico State University/USA)

Pharmaceuticals and Other Emerging Contaminants in Sewage: An Overview of Current Cleanup Techniques, R&D Approaches, and Needs.

F. Langschwager, C. Schütt, H. Burmeier, and V. Birke.

Fanny Langschwager (Wismar University/Germany)

Reduction of 1,2,3-Trichloropropane and Other Chlorinated Propanes.

A.J. Salter-Blanc, P.G. Tratnyek, Y. Lan, and E.J. Bylaska.
Alexandra Salter-Blanc (CH2M HILL/USA)

*** Re-Emergence or Have They Emerged? Same Old Contaminants but New Tricks.**

P.J. Dugan.
Pamela Dugan (Carus Corporation/USA)

*** There's Too Much in the Water: VOCs, APIs, Polar Solvents and Many Unknowns.**

B. Eccarius.
Bernd Eccarius (ERM/Germany)

*** Treatability Testing and Remedial Design for In Situ Remediation of Chloropicrin.**

C.S. Martin, C.M. Ross, R.E. Scott, C.M. Greene, J. Roberts, and A. Przepiora.

Chris Martin (Geosyntec Consultants/USA)

*** Widespread Distribution of Herbicide Safeners Benoxacor and Furlazole and Assessment of Environmental Biodegradation Potential.**

S. Poudel Acharya and J. Weidhaas.

Jennifer Weidhaas (University of Utah/USA)

Zinc Oxide as a Promising Photocatalyst for Emerging Contaminants Removal.

M. Hwangbo, Y. Shi, B.S. Abada, and K.H. Chu.
Myung Hwangbo (Texas A&M University/USA)

Panel Discussion—Wednesday, Track A

PFAS Precursors: Is It Too Early or Too Late to Worry About Them?

Moderators

Dora Chiang (AECOM)
Ginny Yingling (Minnesota Department of Health)

Panelists

Chris Higgins (Colorado School of Mines)
Jennifer Guelfo (Brown University)
Rachel Casson (AECOM)
Richard Grace (SGS AXYS)
Nathan Hagelin (Wood)

Per- and polyfluoroalkyl substances (PFAS) have been manufactured and used for the past fifty years as surfactants, processing aids, oil and water repellent coatings, and firefighting foams. Perfluoroalkyl acids (PFAAs), which include perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), are persistent and recalcitrant and have been widely detected in the environment and human sera. Some polyfluorinated precursors to PFAAs can biotically and/or abiotically transform into PFAAs. Although no regulatory criteria have been established for PFAA precursors, concerns regarding their migration and transformation into PFAAs is growing. PFAA precursors include compounds that were the original compositions of PFAS-containing products or intermediate transformation products.

The number of precursors measurable with standard analytical methods (typically LC-MS/MS) is very limited. However, several analytical methods have been developed to estimate total fluorine concentrations and results suggest significant mass of PFAA precursors may be present at some sites. This has implications for how the PFAS signature and potential ecological or human health risks at a site may evolve over time. It is important to understand how and at what rates PFAA precursors are transformed and transported once released into the environment, what ecological and health risks they may pose, and what challenges they may present for site remediation. The panel will discuss what a practitioner should know about PFAA precursors and what research priorities are essential BEFORE we can properly and reliably determine the data needed for site investigation and remediation.

A5. Advances in the Analysis of Per- and Polyfluorinated Alkyl Substances (PFAS)

Platforms Wednesday | Posters (*) Monday Evening
Chairs: Bharat Chandramouli (SGS AXYS) and Kavitha Dasu (Battelle)

The Analysis of PFAS in AFFF Products: Application of Isotope Dilution Mass Spectrometry and TOP.

B. Chandramouli, R. Grace, M. Woudneh, and M.C. Hamilton.
Bharat Chandramouli (SGS AXYS/Canada)

Analyte Loss in PFAS Analysis: Evidence from Internal Standard, Spiked Analyte, and Interlaboratory Split Sample Recoveries.

S.F. Gormley, A. Bernhardt, M.L. Bevier, C. Larsen, J. Wetmore, N. Perry-Freer, and S. Thomas.
Sean Gormley (Wood/USA)

* **Application of a PFAS Mobile Laboratory Enables Dynamic Work Strategies at PFAS Site.** *M. Rossi, H. Korb, S. Pitkin, J. Quinnan, P. Curry, and A. Villhauer.*
Michael Rossi (Cascade/USA)

* **Closing the PFAS Mass Balance: The Total Oxidizable Precursor (TOP) Assay.** *K.S. Buechler and E.W. Redman.*
Karla Buechler (TestAmerica Laboratories, Inc./USA)

* **Evaluation of TRIZMA as a Preservative for the Analysis of Per- and Polyfluoroalkyl Substances in a Variety of Aqueous Matrices.** *A. Patterson, M. Maier, and A. Clarke.*
Andrew Patterson (Vista Analytical/USA)

* **A Holding-Time Evaluation Study for the Analysis of PFAS in Aqueous Samples.** *C.J. Neslund.*
Charles Neslund (Eurofins Lancaster Laboratories Environmental, LLC/USA)

* **PFAS Analysis by Total Oxidizable Precursor (TOP) Assay.** *M. Hall, J. Tennant, C. Muller, and L. Portwood.*
Jeff Grindstaff (ALS Environmental/USA)

* **PFAS Detection in Laboratory and Equipment Blanks: Implications for Data Usability and Control of Cross Contamination.** *S.F. Gormley, A. Bernhardt, M.L. Bevier, H. Mariska, C. Larsen, J. Wetmore, N. Perry-Freer, and S. Thomas.*
Sean Gormley (Wood/USA)

Quantification of Perfluorinated Compounds in Environmental Water Samples by Matrix-Assisted Laser Desorption Time-of-Flight Mass Spectrometry.

R. Stewart, P. Hoffmann, B. Dilmetz, and M. Condina.
Richard Stewart (Ziltek Pty., Ltd./Australia)

Recent Advances in the Analysis of Poly- and Per-Fluoroalkylated Substances (PFASs). *K. Dasu.*
Kavitha Dasu (Battelle/USA)

*** A Technique for Determining Total Oxidizable Precursors (TOPs) of Perfluoroalkyl Compounds.**

C.J. Neslund.

Charles Neslund (Eurofins Lancaster Laboratories Environmental, LLC/USA)

*** Testing Commonly Used Insect Repellents for 17 PFAS.** *S. Bartlett, K. Davis, and R. Kennedy.*

Sam Bartlett (AECOM/USA)

A6. PFAS Site Characterization

Platforms Wednesday | Posters (*) Monday Evening
Chairs: Dora Chiang (AECOM) and Ravi Naidu (University of South Australia)

*** Case Study: Identification of Perfluoroalkyl Acids and Source Trackdown in the Metedeconk River Watershed, New Jersey.** *N. Procopio, S. Goodrow, L. Lippincott, J. Louis, R. Karl, J. Maggio, and J. Rouse.*

Sandra Goodrow (New Jersey Department of Environmental Protection/USA)

*** A Case History of PFAS at Historical Fire Training Area OU1, Ellsworth Air Force Base, South Dakota.** *L.W. Todd and M. Jensen.*

Levi Todd (Ayuda Companies/USA)

*** Conceptual Site Model for PFAS Release, Occurrence, and Migration.** *J. Hatton and W. DiGuseppi.*

James W. Hatton (CH2M HILL/USA)

Detailed Site Investigation of Unsaturated and Saturated Zones of a Fire Training Area for Per- and Polyfluoroalkyl Substances (PFASs) Using Advanced Analytical Tools. *E.F. Houtz, A. Horneman, A.G. Christensen, I. Ross, J. Burdick, J. Hurst, and J. Miles.*

Erika Houtz (Arcadis/USA)

Detection of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) following Firefighting Foam Deployment during the Lac-Mégantic Railway Accident.

J. Liu, S. Mejia-Avenidaño, G. Munoz, S. Sauv , M. Desrosiers, and P. Beno t.

Jinxia Liu (McGill University/Canada)

*** Developing Interactive Site Models to Overcome Challenges Associated with PFAS Site Investigation and Characterization.** *B.R. Hoye and C. Gepner.*

Brian Hoye (Burns & McDonnell Engineering Company, Inc./USA)

*** First Evaluation of PFOA and PFOS Flux Measurement Using Passive Flux Meters.** *D. Pohlmann, A. Stawowy, R. Morrish, M. Annable, J. Cho, and M. Marrs.*

Dirk Pohlmann (Bay West LLC/USA)

*** Non-Traditional Sources of Per- and Polyfluorinated Alkyl Substances (PFAS).** *R. Bennett, A.P.T. Macdonald, and S. Marconetto.*

Ross Bennett (Golder Associates Inc./USA)

Per- and Polyfluoroalkyl Substances: From Operational Use of AFFF to Impacted Water Supply to Class Action Lawsuit. *S. Richards and F. Lauzon.*

Sasha Richards (Stantec Consulting Ltd./Canada)

*** PFAS Passive Sampler.** *E.M. Kaltenberg and F. Pala.*

Eliza Kaltenberg (Battelle/USA)

*** PFAS Site Investigations: Danish Guidelines.**

J.A. Falkenberg, D. Harrekilde, and N.I. Thomsen.
Dorte Harrekilde (Ramboll/Denmark)

*** Trends in PFAS in Fish from Pool 2 of the Upper Mississippi River.** *J.L. Newsted and R. Holm.*

John Leslie Newsted (Natural Resource Technology, Inc./USA)

The U.S. Air Force Enterprise-Wide Response to PFASs: Presentation of All Meta-Data to Date.

R.H. Anderson.

Hunter Anderson (U.S. Air Force/USA)

*** Use of Composite Sampling to Characterize PFAS Impacts for Health Risk Assessment in Commercially Important Seafood Species.** *R. Smit.*

Roisin Smit (AECOM/Australia)

A7. PFAS: Risk Assessment and Toxicity

Platforms Wednesday | Posters (*) Monday Evening
Chairs: Meredith Frenchmeyer (Arcadis) and Shalene Thomas (Wood)

*** Australian Case Study of Perfluoroalkyl and Polyfluoroalkyl Substances: Human Health and Ecological Risk Assessment Using an "Outside-In" Approach.** *A.M. Rodolakis and A.R. Quintin.*

Antony Rodolakis (Wood/USA)

*** Empirical Bioaccumulation Factors for PFAS: Establishing Trends for Guiding Site Assessments.**

V. Lazenby.

Victoria Lazenby (Arcadis Australia Pacific Pty Ltd/Australia)

*** Estimating Safe Level of PFOA/PFOS in Human Blood Using Clinical Margins of Safety.** *S.R. Clough and J. Peters.*

Stephen Clough (Haley & Aldrich, Inc./USA)

*** Evolution of PFAS in Australia: Investigation, Risk Perception, Communication, and Management.**

R. Edwards.

Ross Edwards (Jacobs Group (Australia) Pty Ltd/Australia)

*** Guidance on Managing PFAS Contamination in Australia.** *J.N. Jit, B.P. Kennedy, and R. Naidu.*

Joytishna Jit (CRC CARE / UniSA/Australia)

Per- and Polyfluoroalkyl Substances (PFAS): Addressing Limited Toxicity Data for Site Characterization. *L. Hall.*

Linda C. Hall (GSI Environmental, Inc./USA)

PFAS and Risk Assessment: Overview of the State of the Practice. *S. Thomas and M. Frenchmeyer.*

Shalene Thomas (Wood/USA)

*** PFAS Uptake into Biota, and Detailed Human Health and Ecological Risk Assessment: An Australian Defence Base Case Study.** *B. Houghton, K. Hanson, and K. Richardson.*

Brad Houghton (Senversa/Australia)

*** PFASs Soil-to-Earthworm Uptake Factors.**

A.M. Rodolakis, N.T. Glover, and J. Berry.

Antony Rodolakis (Wood/USA)

Risk Communication in Emerging Contaminants: NGWA PFAS Guidance. *M.A. Harclerode, E. Emmett, and L. Hall.*

Melissa Harclerode (CDM Smith, Inc./USA)

*** Risk-Based Assessment, Management and Remediation of PFAS-Contaminated Soil and Groundwater.** *P. Nadebaum, T. Hammond, E. Friebe, J. Woodworth, P. Flukes, J. Jit, and B. Kennedy.*

Peter Nadebaum (GHD/Australia)

*** A Risk-Based Geospatial Framework to Evaluate Sources of Per- and Polyfluoroalkyl Substance (PFAS) Groundwater Impacts.** *J. Guelfo, T. Marlow, S. Frickel, and E. Suuberg.*

Jennifer Guelfo (Brown University/USA)

The Science Behind the PFAS Drinking Water Health Advisory and How It Affects Risk Management Decision Making. *D. Marquez and B. Hoyer.*

Diana Marquez (Burns & McDonnell Engineering Company, Inc./USA)

What Are Key Considerations for an Approach to Human Health Intake Assessment for PFAS? *A. Lee and M. Archer.*

Amanda Lee (AECOM/Australia)

A8. PFAS Fate and Transport

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Hunter Anderson (U.S. Air Force) and Andrew Mitchell (Department of Defence)

Fate and Transport Modeling of PFOS in a Fractured Chalk Aquifer towards a Large-Scale Drinking Water Abstraction. *I. Ross, J. Hurst, J. Miles, E. Houtz, J. McDonough, and J. Burdick.*

Ian Ross (Arcadis/United Kingdom)

*** Impact of Biopile Remediation of Petroleum Hydrocarbons on Poly- and Perfluoroalkyl Substances (PFASs) as Co-Contaminants.** *J. Liu, S. Mejia-Avenidaño, G. Munoz, S. Sauvé, M. Desrosiers, and P. Benoît.*

Jinxia Liu (McGill University/Canada)

*** Investigation of PFAS Contamination from Land-Applied Industrial Compost and AFFF Sources.** *I. Ross, T. Held, J. Miles, J. Hurst, E. Houtz, and J. Burdick.*

Ian Ross (Arcadis/United Kingdom)

*** Long-Range Transport (LRT) of PFAS.** *L.J. Trozzolo.*

Laura J. Trozzolo (TRC/USA)

*** PFAS, TOP Assay, and Risk Assessment: Understanding Trends in Polyfluorinated Precursor Compound Distribution.** *V. Lazenby and E. Houtz.*

Victoria Lazenby (Arcadis Australia Pacific Pty Ltd/Australia)

*** Portfolio Assessment of Key Factors Influencing PFASs Fate/Transport Including: pH, DO, ORP, TOC, CEC, and Grain Size Distribution.** *K. Tull, N. Hagelin, and D. Woodward.*

Kerry Tull (Wood/USA)

*** Roadmap for Ranking PFAS-Contaminated Sites Based on Exposure Pathway Analysis.** *A. Lee, M. Archer, and G. Williams.*

Amanda Lee (AECOM/Australia)

The Role of Surface Water and Stormwater Transport of Perfluoroalkyl Substances (PFAS) in the Creation of a Groundwater “Mega-Plume,” Washington County, Minnesota. *V. Yingling.*

Virginia Yingling (Minnesota Department of Health/USA)

Site-Specific Desorption Testing of Perfluorononanoic Acid (PFNA) to Assess Potential Soil Leaching to Groundwater. *S.O. Helgen, M. Marietta, C. Hutchings, and E. Palko.*

Steven Helgen (Integral Consulting, Inc./USA)

*** Standardized Approaches for Risk Ranking Portfolio of Sites Impacted with PFASs.** *I. Ross, J. Hurst, J. Miles, E. Houtz, J. McDonough, and J. Burdick.*

Ian Ross (Arcadis/United Kingdom)

*** Toward Understanding the Fate and Transport of AFFF-Related Contaminants within Deep Vadose Zones.**

J.A.K. Silva, M.F. Warminsky, and W.A. Martin.

Jeffrey A.K. Silva (GSI Pacific, Inc/USA)

Transformation of PFAS Precursors at an Australian Air Force Base: An Ongoing or Artifact Process? *R. Casson, D. Chiang, and V. Pearce.*

Rachael Casson (AECOM/Australia)

*** Understanding Fate and Transport of PFASs to Develop Effective Conceptual Site Models.** *I. Ross, D. Atkinson, J. Lemon, J. Miles, J. Hurst, E. Houtz, and J. Burdick.*

Ian Ross (Arcadis/United Kingdom)

A9. PFAS: Remediation

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Nathan Hagelin (Wood) and Hans Stroo (Stroo Consulting, LLC)

*** Adsorption of Perfluorooctanoic Acid (PFOA) Using Graphene-Based Materials.** *S. Lath, M.J. McLaughlin, D. Navarro, D. Losic, A. Kumar, and R. Stewart.*
Supriya Lath (University of Adelaide/Australia)

Applications of Electrochemical Oxidation for PFAS Destruction in Water, Liquid, and Solid Wastes.
D. Chiang, S. Liang, R. Casson, R. Mora, and Q. Huang.
Dora Chiang (AECOM/USA)

*** Chemical Oxidation of PFAS: Insight into Applying Demonstrated Technology for Recalcitrant and Persistent Compound Class.** *P.M. Dombrowski, P. Kakarla, W. Caldicott, Y. Chin, D. Bogdan, V. Sadeghi, F. Barajas, and D. Chiang.*
Paul Dombrowski (In-Situ Oxidative Technologies [ISOTEC]/USA)

*** Comparison of Different Approaches for Removal of PFAS in Water.** *J. Buhl.*
Jurgen Buhl (Cornelsen Umwelttechnologie GmbH/Germany)

Field Demonstration to Enhance PFAS Degradation and Mass Removal Using Thermally-Enhanced Persulfate Followed by Pump-and-Treat. *J. Kornuc, R.A. Deeb, and D.L. Sedlak.*
John Kornuc (U.S. Navy, EXWC/USA)

*** First In Situ Treatment of PFAS Ever? Lessons Learned and Questions Raised.** *J. Birnstingl, R. McGregor, and G. Carey.*
Jeremy Birnstingl (Regenesis/United Kingdom)

Full-Scale Treatment of PFAS-Impacted Wastewater Using Ozofractionation. *P.J. Storch, J. Lagowski, M. Dickson, D. Solomon, and I. Ross.*
Peter Storch (ARCADIS/Australia)

*** Immobilization of PFAS-Impacted Soil: Comparison of Amendments and Performance Metrics for Australian Soils.** *A. Nolan, D. Toase, and C. Grimison.*
Annette Nolan (Ventia Pty Ltd/Australia)

*** In Situ Treatment of PFAS in Groundwater and Other Tall Tales.** *C.H. Nelson and W. Caldicott.*
Christopher Nelson (eMinus LLC/USA)

*** Integrated Soil and Water Treatment System for Source Areas of PFAS-Impacted Sites.** *C. Morrell, C. Grimison, and S. Barthelme.*
Charles Grimison (Ventia/Australia)

*** Investigation and Remediation of Multiple PFAS Source Zones at an Airport to Safeguard an At-Risk Water Supply.** *I. Ross, D. Atkinson, J. Lemon, J. Miles, J. Hurst, E. Houtz, and J. Burdick.*
Ian Ross (Arcadis/United Kingdom)

matCARE™: A Novel Technology for Efficient Remediation of PFAS-Contaminated Wastewater and Soil. *R. Naidu and S. Chadalavada.*
Ravi Naidu (University of South Australia/Australia)

*** Optimizing the PFAS Puzzle: Piecing Together a Holistic PFAS Restoration Strategy.** *J. McDonough, I. Ross, J. Miles, K. Nowack, E. Houtz, and J. Burdick.*
Jeff McDonough (ARCADIS/USA)

*** Per- and Polyfluoroalkyl Substance (PFAS) Impacts of Stormwater Retention Ponds from Emergency Fire Response at Recycling Center.** *J.R. Dickson and C.F. Winkeljohn.*
James Dickson (CTI and Associates, Inc./USA)

*** Per- and Polyfluoroalkyl Substances (PFAS): Treatment Options for Soil and Groundwater.** *G.M. Birk, D.F. Alden, and A. Archibald.*
Gary Birk (Tersus Environmental, LLC/USA)

PFAS Thermal Treatment of Soil Demonstrated in Multiple Pilot Tests. *W.H. DiGuseppi, R. Richter, R. Grace, T. Fitzpatrick, R. Darlington, G. Colgan, L. Cook, and K. Rabe.*
William DiGuseppi (CH2M HILL/USA)

Regeneration of Granular Activated Carbon (GAC) Used for Per- and Polyfluorinated Substance (PFAS) Remediation. *R. Darlington, K. Dasu, F. Pala, and E. Kaltenberg.*
Ramona Darlington (Battelle/USA)

Removal and Destruction of Perfluoro- and Polyfluoroalkyl Substances (PFAS) from Contaminated Groundwater through Application of Advanced Reductive Processes (ARPs). *R. Tenorio, T.J. Strathmann, J.B. Brown, A. Maizel, C. Bellona, C.P. Higgins, J. Liu, D. Jiang, B. Gómez-Ruiz, H. Wright, and C.E. Schaefer.*
Timothy Strathmann (Colorado School of Mines/USA)

*** The Sorption of Per- and Polyfluoroalkyl Substances (PFASs) in Australian Soils.** *E.R. Knight, M.J. McLaughlin, D. Navarro, L. Janik, and R. Kookana.*
Emma Rae Knight (University of Adelaide/Australia)

*** A Sustainable Alternative to Excavation of PFAS Source Areas.** *J. McDonough, P. Storch, I. Ross, E. Houtz, and A. Gupta.*
Jeff McDonough (ARCADIS/USA)

*** Treatment of AFFF-Impacted Groundwater Using an Electrochemical and Biological Treatment Train Approach.** *C.E. Schaefer, C. Andaya, A. Burant, L. Ferguson, S. Choyke, C. Condee, T. Strathmann, and C. Higgins.*
Charles Schaefer (CDM Smith/USA)

A10. Pump and Treat for PFAS Remediation

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Christopher Higgins (Colorado School of Mines)
and Robert Mueller (State of New Jersey)

Accelerated Deployment and Startup of Ion Exchange Groundwater Treatment System Addresses PFAS Contamination at Australian Air Base. *S. Woodard.*
Steven Woodard (ECT/USA)

* **Applicability of Carbon Adsorption to More Challenging Matrices Such as Landfill Leachate.** *S.A. Grieco.*
Scott Grieco (OBG/USA)

* **Case Study: Lessons Learned on Perfluorinated Compounds and Groundwater Issues during Construction.** *S.R. Nelson, C. Stefanelli, K. Carpenter, and M. Montemayor-Rapier.*
Steve Nelson (City of Austin/USA)

* **Challenges, Optimization, and Lessons Learned Treating PFASs in Groundwater Using Granular Activated Carbon and Synthetic Media.** *D. Woodward, K. Falk, N. Hagelin, C. Theriault, and B. Malyk.*
Dave Woodward (Wood/USA)

* **Design and Implementation of a Groundwater Remediation System for PFAS Compounds through Modification of Existing Remedial Infrastructure.** *E.M. Germon and W.K. Crow.*
Matt Germon (CH2M HILL/USA)

An Enhanced Contact Electrical Discharge Plasma Reactor: An Effective Technology to Degrade Per- and Poly-Fluoroalkyl Substances (PFAS). *S. Mededovic Thagard, T. Holsen, S. Richardson, P. Kulkarni, C. Newell, M. Nixon, A. Bodour, and C. Varley.*
Stephen Richardson (GSI Environmental, Inc./USA)

* **Fate and Transport of PFAS in a Multi-Stage Groundwater Treatment Plant.** *J.R. Stening and S. Huo.*
James Stening (Orica Australia Pty Ltd/Australia)

* **PFAS and 1,4-Dioxane Treatment for Drinking Water System Optimization.** *S. Abrams, L. Zeng, N. Najib, A. Ciblak, C. Barnes, and R. Andersen.*
Stewart Abrams (Langan Engineering & Environmental Services Inc./USA)

A Pilot-Scale GAC Filtration Study to Assess Breakthroughs of PFAAs and Precursors. *D. Chiang, A.E. Robel, J. Field, Q. Huang, A. Bodour, and C. Varley.*
Dora Chiang (AECOM/USA)

* **Practical Aspects of Implementing a 5-MGD Treatment System for Removal of PFOA and PFOS from a Public Drinking Water Supply.** *S. Grieco, G. Rest, and N. Venkatesan.*
Scott Grieco (OBG/USA)

Removal of Per- and Polyfluoroalkyl Substances with Nanofiltration Membranes in Laboratory and Site Studies. *C. Liu, J. Brown, C. Higgins, C. Bellona, and T. Strathmann.*
Charlie Jeffrey Liu (Colorado School of Mines/USA)

* **Repurpose and Optimization of an Existing Groundwater Pump and Treat System for Removal of Perfluoroalkyl Substances.** *B.L. Porter, M.G. Quinlan, D. Crispo, M.E. Fuller, P.K. Van Groos, and P. Forbes.*
Benjamin Porter (CB&I Federal Services/USA)

* **Treatment of PFAS-Impacted Water: Results from Laboratory and Field Trials.** *D. Toase and C. Grimison.*
Danielle Toase (Ventia/Australia)

* **Water Treatment System Modification for PFCs at Mather AFB.** *D.A. Cacciatore, M. Thomas, D. Hogshead, D. Self, and M. Enloe.*
David Cacciatore (APTIM/USA)

B1. Thermal Remediation Design & Best Practices

Platforms Monday | Posters (*) Monday Evening
Chairs: Jim Cummings (U.S. Environmental Protection Agency) and Jeff DeLaet (T&M Associates, Inc.)

* **Addressing Specific Thermal Aspects and Risks in Tendering In Situ Thermal Remediations.** *B. Scheffer, E. Marnette, T. Ruffenach, J. Guerin, and D. Hiez.*
Bert Scheffer (Tauf bv/Netherlands)

Bench- and Pilot-Scale Studies: Worthwhile Tools in Optimizing Thermal Remediation Approaches. *A. Fortune, G. Heron, S.G. Nielsen, D. Phelan, R. Wenzel, R.J. Stuetzle, and J. Bunton.*
Alyson Fortune (TerraTherm/USA)

* **Challenges of Interpreting Micro-Scale Variations in Groundwater Conditions during and following Thermal Treatment at a Mixed LNAPL Site.** *C. Rockwell and P. Nangeroni.*
Cathy Rockwell (Woodard & Curran/USA)

Complex Sites and Recalcitrant Compounds: Combining ISTR Technology. *R.M. D'Anjou, M.E. Dodson, S. Griepke, and G. Heron.*
Robert D'Anjou (Cascade Environmental/USA)

* **A Contaminant Mass Recovery Model for Electrical Resistance Heating Sites: Comparison with Actual Site Data.** *D.A. Rountree.*
David Rountree (McMillan-McGee Corporation/Canada)

* **Current Models of Vapor Production and Mass Recovery at Thermal Remediation Sites and Their Implications for Appropriate Heating Strategies.** *J. LaChance, P. Hegele, and J. Munholland.*
John LaChance (Mc2 USA Inc./USA)

Data for the Design and Costing of an Electrothermal In Situ and Surface Thermal Treatment System.

B.C.W. McGee, D.B. Winder, and E. Tung.

Bruce McGee (McMillan-McGee Corporation/Canada)

*** Defining the Target Treatment Area for Thermal Remediation.** *E.L. Davis.*

Eva Davis (U.S. Environmental Protection Agency/USA)

*** Effects of Thermal Conduction and Convection on In Situ Temperature Monitoring: A Simulation Study.**

C.F. Campbell.

Clayton Campbell (McMillan-McGee Corporation/Canada)

*** Electrical Resistance Heating Remediation in Interstate Median.** *G.W. Adams and R. Poulin.*

Gray Waxhaw Adams (Michael Pisani & Associates, Inc./USA)

ERH Remediation of University Campus Shale Bedrock Site. *S. Gupta, D. Conley, J. Fager, C. Blundy, and E. Crownover.*

Sunila Gupta (Haley & Aldrich, Inc./USA)

*** Fiber Optic Sensors for Distributed Monitoring of Soil and Groundwater during In Situ Thermal Remediation.**

H. Alemohammad, A. Azhari, and R. Liang.

Hamid Alemohammad (AOMS Technologies Inc./Canada)

*** Finite Element Modeling of Heterogeneous Soils with Non-Linear Properties for the Design of an Electrothermal In Situ Thermal Remediation Project.**

B.C.W. McGee, P.R. Hegele, and M.E.J. McGee.

Bruce McGee (McMillan-McGee Corporation/Canada)

*** Fundamentals of Steam-Enhanced Remediation and Field Applications.** *L. Stewart.*

Lloyd Stewart (Praxis Environmental Technologies, Inc./USA)

If You Have all the Thermal Tools, How Do You Pick the Best One for a Site? *G. Heron, S. Nielsen, M. Dodson, and R. D'Anjou.*

Gorm Heron (TerraTherm, Inc./USA)

*** In Situ Conductive Heating of a Chlorinated Hydrocarbon-Impacted Dutch Site: Lessons Learned.**

E.C.L. Marnette, A.M. Scheffer, S.A.B. Weelink, and N. Ploug.

Emile Marnette (Tauf bv/Netherlands)

In Situ Hydrolysis and Thermal Treatment of 1,1,1-TCA during Electrical Resistance Heating. *A. Taddeo, S. Wright, L. Mitchell, and P. Dombrowski.*

Art Taddeo (AECOM/USA)

In Situ Thermal Remediation in Europe: Advances and Lessons Learned at Multiple Sites (2005 to Present).

J. Baldock, J. Dablow, and K. Johnson.

James Baldock (ERM/United Kingdom)

In Situ Thermal Remediation of a DNAPL Source Zone Program: Challenges and Post-Treatment Findings.

J.H. Levesque, C.L. McIlvaine, N. DiMarcello, and W.A. Norris.

Jeffrey Levesque (OBG/USA)

*** Inductive Thermal: Dynamic Stripping Process.**

E.W. Reid, S. Delos Reyes, D. Nyarko, and B.C.W. McGee.

Edwin Walter Reid (McMillan-McGee Corp./Canada)

*** Installing and Operating a Thermal Remediation System at an Active Industrial Site in Brazil.**

T. Keijzer, S. Rameh, S. Moreno, T. Roza, P. Jacobs, and J. Seeman.

Teresa Roza (Grupo EPA/Brazil)

*** Modelling the Recovery of Volatile Organic Compounds during In Situ Thermal Remediation.**

Q. Xie, K.G. Mumford, and B.H. Kueper.

Qianli Xie (Queen's University/Canada)

*** On-Site Evaporative Desorption Technology Soil Treatment: A "Very" Low Temperature Ex Situ Thermal Remediation Alternative.**

B. Desmarais and J. Muzzio.

Joe Muzzio (Reterro/USA)

*** Post In Situ Thermal Remediation Response at a Canadian Rail Yard.**

J. Coughlin, P. Kornelsen, and L. Thomas.

Jeremy Coughlin (Canadian Pacific/USA)

*** Site Characterization and Visualization: Reducing Costs by Designing More Efficient ISTR Systems.**

R.M. D'Anjou, K. Stonestreet, and M.E. Dodson.

Robert D'Anjou (Cascade Environmental/USA)

*** Successful Treatment of Dioxin Using Thermal Conduction Heating: Results and Lessons Learned from a First of Its Kind Project.**

J. Galligan, G. Heron, R. Michalewich, A. Fortune, T. Burdett, S. Walker, and G. Anderson.

Jim Galligan (TerraTherm, Inc./USA)

*** Sustainable Combination Heating: An Innovative Approach for In Situ Thermal Remediation in Challenging Lithology.**

J. Dablow, J. Baldock, and K. Schnell.

Jay Dablow (ERM/USA)

*** Sustainable Low Temperature Thermal Remediation of Pesticides.**

J. Baldock, J. Dinham, K. Johnson, and J. Dablow.

James Baldock (ERM/United Kingdom)

*** Targeted Small Source Zone In Situ Thermal Treatment: Lessons Learned at Two Chlorinated VOC Applications.**

D. Croteau, G. Geckeler, and C. Voci.

Grant Geckeler (GEO/USA)

*** Thermal Contouring Methods for In Situ Thermal Remediation Projects.**

P.R. Hegele, R.L. Dueck, B.C.W. McGee, and J.C. LaChance.

Paul Hegele (McMillan-McGee Corporation/Canada)

* **Thermal Projects' Need for Proper Site Characterization.** *N. Dumaresq.*
Nicholas Dumaresq (McMillan-McGee Corp./Canada)

* **Thermal Treatment: How Much Energy Does It Take?**
S.G. Nielsen, G. Heron, R.M. D'Anjou, M. Dodson, J. LaChance, B. McGee, and N. Ploug.
Steffen Griepke Nielsen (TerraTherm, Inc./USA)

* **Thin Treatment Depths: A Thorn in Thermal's Side.**
G. Sandberg, R.M. D'Anjou, and M.E. Dodson.
Greg Sandberg (Global Remediation Solutions, LLC/USA)

Unique Challenges on an ERH Project: AMCO Superfund Site, California. *A. Bowerman, M. Lawson, K. Manheimer, and P. Hegele.*
Alex Bowerman (Oneida Total Integrated Enterprises/USA)

* **Using High-Resolution Site Characterization to Reduce Cost and Improve Outcomes on Thermal Remediation Projects.** *J. Galligan, G. Heron, A. Bonarrigo, S. Pitkin, and M. Jordan.*
Jim Galligan (TerraTherm, Inc./USA)

* **Using Steam to Solve Groundwater Cooling Problems at TCH Sites.** *S.G. Nielsen, G. Heron, and N. Ploug.*
Steffen Griepke Nielsen (TerraTherm, Inc./USA)

B2. Biological Remedies

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Sandra Dworatzek (SiREM) and Heather Knotek-Smith (U.S. Army Corps of Engineers)

* **Aerobic Biodegradation of Chlorobenzene, Dichlorobenzene, and Benzene in Shallow Saturated Soils.** *A. Oka, A. Ciblak, H. Nichols, S. Abrams, and E. Seelman.*
Amita Oka (Langan Engineering & Environmental Services, Inc./USA)

Bench and Pilot Test to Evaluate the Efficiency of ERD Technology for Chlorinated Solvents Remediation in Tropical Soils. *F.C. Oliveira, F.C. Vieira, K.F.B. Silva, F. Gutierrez, R.B. Santini, and P.L. Lima.*
Fernanda Campos de Oliveira (University of Sao Paulo/Brazil)

Bioaugmentation for Remediation of Aerobic Vinyl Chloride Plumes. *J. Roberts, J. Webb, P. Dennis, S. Dworatzek, P. Dollar, T. Mattes, and N. Durant.*
Jeff Roberts (SiREM/Canada)

* **Biodegradation and Bioremediation of Chlorpyrifos by Using Indigenous Bacterial Cultures.** *F. Jabeen, M. Bashir, S. Nadeem, and M. Maria.*
Farkhanda Jabeen (Punjab University/Pakistan)

* **Biodegradation of a Chlorinated Solvent Plume Enhanced by Reducing Chemical Conditions beneath a Former Landfill.** *G. Kenoyer, A. Christensen, C. Chang, and N. Pratheepmanowong.*
Galen Kenoyer (Burns & McDonnell/USA)

* **Biodegradation Potential of Groundwater Contaminants by Acidophilic Methanotrophs.** *Y. Shao, C. Chen, and K. Chu.*
Yiru Shao (Texas A&M University/USA)

* **Complete Degradation of Chlorinated Ethanes in Sequential Bioreactors Operated under Varying Redox Conditions.** *L.M. Pipkin, V.K. Elango, and J.H. Pardue.*
Leslie Pipkin (Louisiana State University/USA)

Converting a Stormwater Pond into a Multi-Stage Treatment Reactor for Arsenic, Ammonia, and Benzene at the Industri-Plex Superfund Site. *B. Thompson, T. Majer, M. Kelley, C. Elder, C. Elmendorf, and J. Gabriel.*
Bruce Thompson (de maximis, inc./USA)

* **Dechlorination of Lightly Chlorinated Dibenzo-p-Dioxins in Enriched Sediments from the Passaic River Bay in Newark, New Jersey.** *R.K. Dean, H. Almnehlawi, L. Rodenburg, and D.E. Fennell.*
Cassidy Schneider (Rutgers University/USA)

* **Demonstrating Successful Performance of ERD Treatment at Multiple Sites.** *G. Colgan, S. Smith, J. Wilde, K. Bradley, A. Castor, J. Cox, T. Isakson, M. Reynolds, and A. Dziechciarz.*
Gary Colgan (CH2M HILL/USA)

* **Effects of Common Methods Used to Generate Anaerobic Water on Bioaugmentation Cultures Containing *Dehalococcoides sp.*** *N. Hey, S. Vainberg, and D. Leigh.*
Neil Hey (Cascade/USA)

* **Effects of Ethanol and BTEX on Local Microbial Populations following a Major Release.** *A. Madsen, R. Wilson, and J. Grosskleg.*
Aaron Madsen (Wood/Canada)

* **Enhanced In Situ Bioremediation Pilot Study for Treatment of 1,1,1-TCA.** *M. Howard, L. Mitchell, A. Taddeo, and P. Dombrowski.*
Mark Howard (AECOM/USA)

Flying below the Radar: What Are Those Other Microbes Doing? *S. Dworatzek, J. Roberts, P. Dennis, and P. Dollar.*
Sandra Dworatzek (SiREM/Canada)

* **How Effective are Biostimulation and Bioaugmentation for Chlorinated Ethenes in the Source Zone?** *L. LaPat-Polasko, B. Kutz, and T. McMahan.*
Laurie LaPat-Polasko (Matrix New World Engineering/USA)

* **Identification of the Iodate Terminal Reductase in Metal-Reducing Bacteria.** *H.D. Shin, A. Mok, Y. Toporek, B. Lee, M.H. Lee, and T. DiChristina.*
Hyun-Dong Shin (Georgia Institute of Technology/USA)

*** In Situ Enhanced Bioremediation of TCE-Impacted Groundwater in Aerobic Aquifer.** *D.N. Bekele, S. Chadalavada, M. Mallavarapu, and R. Naidu.*
Dawit Nega Bekele (University of Newcastle/Australia)

*** Kinetic Analysis Implicates Nitrous Oxide as a Potent Inhibitor of the Bacterial Reductive Dehalogenation Process.** *Y. Yin, J. Yan, G. Chen, and F.E. Loeffler.*
Yongchao Yin (University of Tennessee at Knoxville/USA)

Linking Acetylenotrophs to Microbial Remediation of Chlorinated Solvents. *D.M. Akob, Y. Shrestha, S.S. Baesman, and R.S. Oremland.*
Denise Akob (US Geological Survey/USA)

*** The Oleophilic Biobarrier: Field Demonstration Results and Lessons Learned about a Novel, Sustainable Sheen Remedy.** *M. Chalfant, W. Thomas, S. Dunn, R. Ahlers, and T. Sale.*
Marc Chalfant (Arcadis/USA)

*** Organochloride Soil Remediation by Bioestimulation via Intercalation of Aerobic and Anaerobic Environments.** *J.C. Moretti, B.J. Moretti, M. Moretti, and R. Panzetti.*
Rafael Panzetti (Moriah Ambiental Ltda/Brazil)

Performance and Refresh of a Full-Scale Biowall System Designed to Treat Chlorinated Solvents in Groundwater. *D.R. Griffiths, B. Badik, T. Belanger, and R. Battaglia.*
Daniel Griffiths (Parsons/USA)

*** Phased Lab-to-Field Bioremediation Amendment Screening for Cleanup of Explosives-Contaminated Groundwater.** *M.M. Michalsen, F.H. Crocker, A.S. King, J.D. Istok, and M. Gander.*
Mandy Michalsen (U.S. Army Corps of Engineers/USA)

*** Remediation of Ammoniacal Nitrogen Using Bioaugmentation.** *B.M. Soares, E. Martins, L.B. de Sousa, and E. Leite.*
Barbara Muniz Soares (SuperBAC Biotechnology Solutions/Brazil)

*** Remediation of Deep Trichloroethene Plume Using Enhanced In Situ Bioremediation Technology.** *S. Ridenour, M. Cassidy, D. Nunez, and C. Sandefur.*
Steven Ridenour (Alta Environmental/USA)

*** Successful In Situ Pilot-Scale Test Design and Implementation to Treat Groundwater Impacted with PCE and TCE through Organic Carbon and Soluble Iron Injections.** *J. Claffey, R. Ruhmke, J. Nguyen, K. White, and K. Ramanand.*
Jim Claffey (Brown and Caldwell/USA)

Surprises and Mysteries from the Installation and Performance of 2000-feet of Biobarriers in Brackish Water. *V. Hosangadi, R. Robitaille, P.L. Chang, and M. Pound.*
Vitthal Hosangadi (NOREAS, Inc./USA)

Testing Reductive Dechlorination Bioaugmentation Cultures in a Low pH Groundwater Setting. *J. Peeples, L. Page, R. Welch, T. Carnes, L. Lehmicke, D.L. Freedman, and H. Wang.*
James A. Peeples (T&M Associates, Inc./USA)

*** Use of Direct-Push Injections and a Biobarrier for Remediating Chlorinated Solvents during Residential Redevelopment.** *C. Elder, M. deFlaun, and J. Hochreiter.*
Carl R. Elder (Geosyntec Consultants, Inc./USA)

B3. Monitored Natural Attenuation

Platforms Tuesday | Posters (*) Monday Evening
Chairs: James Tarr (U.S. Navy) and John Wilson
(Scissortail Environmental Solutions, LLC)

*** Chemistry Rules: Developing MNA and Remedial Strategies for Norborene Flame Retardants and Insecticides.** *L. MacKinnon, A. Przepiora, E. Cox, J. Wragg, S. Needham, A. Pham, and N. Zrinyi.*
Leah MacKinnon (Geosyntec Consultants, Inc./Canada)

*** Evaluating Monitored Natural Attenuation Using Plume Stability Modeling.** *G.M. Wilming and S.G. Lehrke.*
Gina Marie Wilming (Foth Infrastructure & Environment, LLC/USA)

Groundwater Recovery to Natural Biodegradation: Demonstrating a Better Remedial Approach to Closure. *D.R. Gray.*
Doug Gray (AECOM/USA)

*** Implementing Monitored Natural Attenuation with Multiple Contaminants, Modulating Groundwater Flow, and Multiple Attenuation Mechanisms.** *P.W. McLoughlin, J. Glover, J. Wilson, and J. Rosso.*
Patrick McLoughlin (Pace Analytical Energy Services/USA)

Incorporating Background Attenuation Rates into an Active Remedy Design. *F. Payne, R. Orens, and B. Preusser.*
Fred Payne (Arcadis/USA)

*** MNA as an Alternative to the Existing Remedial Approach at a Complex Historic Industrial Site with Multiple COCs.** *M.A. Panciera, Z. Smith, and D. Bytautas.*
Matthew Panciera (AECOM/USA)

*** Modeling Microbial Oxidation of Vinyl Chloride under Simulated Field Conditions.** *P.M. Richards and T.E. Mattes.*
Patrick M. Richards (University of Iowa/USA)

Transitioning to Monitored Natural Attenuation at Active Remediation Sites: A Moving Target. *Z.S. Wahl, C.H. Bell, and G. Gay.*
Zachary Wahl (Arcadis U.S. Inc./USA)

Using Mass Discharge Techniques to Demonstrate Natural Attenuation. *G. Smith, Y. Kho, D. Hoffman, N. Ryan, T. Macbeth, J. Dougherty, R. Wymore, and C. Howell.*
Graham Smith (WSP/Australia)

B4. Abiotic and In Situ Biogeochemical Processes

Platforms Wednesday | Posters (*) Monday Evening
Chairs: Kyle Kirchner (U.S. Navy) and
Kristen Thoreson (RegenesiS)

*** Abiotic and Biotic Degradation of TCE by Aquifer Materials from the California Middlefield-Ellis-Whisman ("MEW") Site.** *M.M. Scherer, D.E. Latta, T. Robinson, T. Mattes, P. Richards, E. Suchomel, R. Deeb, and L. Kane.*
Michelle Scherer (University of Iowa/USA)

*** Abiotic Dechlorination of Chlorinated Ethene by Naturally-Occurring Ferrous Minerals under Aerobic and Anaerobic Conditions.** *C.E. Schaefer, P. Ho, E. Berns, C. Gurr, and C. Werth.*
Charles Schaefer (CDM Smith/USA)

*** Abiotic Degradation of TCE in Groundwater: A Case Study.** *R. Stanforth, K. Quinn, and K. Piontek.*
Robert Stanforth (TRC Companies, Inc./USA)

Addition of Dual-Valent Iron to Electron Donor Mixtures for Remediation of Chlorinated Ethenes: A Study of over 100 Wells. *D. Davis and O. Miller.*
Doug Davis (RegenesiS/USA)

Assessment of Biogeochemical Processes to Manage Back Diffusion at a Fractured Sandstone Site. *M. Burns, A. Bakenne, M. Brown, T. Huff, J. Baker, and D. Cummings.*
Matthew Burns (WSP/USA)

*** Biogeochemical Remediation at a Highly Fractured Bedrock Aquifer.** *L. Zeng, A. Oka, K. Kelly, B. Bond, S. Abrams, and S. Ueland.*
Lingke Zeng (Langan Engineering & Environmental Services/USA)

*** Biologically-Mediated Abiotic Degradation (BMAD) of Bisphenol A by the Manganese(II) Oxidizer *Roseobacter* sp. Strain AzwK-3b.** *J. Im, S.-W. Lee, and F.E. Loeffler.*
Jeongade Im (Kansas State University/USA)

*** Dechlorination by Sulfidated Iron and Iron Oxides.** *Y. Lan, P.G. Tratnyek, R.L. Johnson, D. Fan, A. Nunez Garcia, D.M. O'Carroll, J. Filip, and A. Agrawal.*
Ying Lan (Oregon Health & Science University/USA)

*** Diagnosing Reduction Capacity at ISCR Sites and Pre-Screening of Reductant Demand.** *C.M. Kocur, P.G. Tratnyek, and R. Johnson.*
Chris M. Kocur (Oregon Health & Science University/USA)

*** In Situ Biogeochemical Transformation as a Polishing Step after ISCO: A Field Test.** *J. Nemecek, P. Kozubek, L. Lacinova, M. Nechanicka, J. Zeman, and M. Cernik.*
Jan Nemecek (Technical University of Liberec/Czech Republic)

*** In Situ Delivery of ISCR Reagents: Relationships between Amendment Properties, Injection Methodology, and Distribution.** *J. Harvey and J. Freim.*
James Harvey (OnMaterials/USA)

*** Investigation of Biogeochemical Degradation Pathway of Chlorinated Aliphatic Hydrocarbons.** *C. Walecka-Hutchison, M. Zenker, R. Royer, S. Benedicto, and M. Brito.*
Claudia Walecka Hutchison (Dow Chemical Company/USA)

*** Is a Mineral Surface Critical to Rapid and Successful Anaerobic Benzene Biodegradation?** *K.M. Hyde, D. Peak, S.D. Siciliano, and K. Bradshaw.*
Kathlyne Hyde (University of Saskatchewan/Canada)

*** Is it Possible to Use Green Rusts to Reduce Chlorinated Ethylenes?** *J. Ai, W. Yin, and H.C.B. Hansen.*
Jing Ai (University of Copenhagen/Denmark)

*** Lessons Learned from the Design, Operation, and Performance of 19 Subgrade Biogeochemical Reactors.** *J. Gamlin, D. Downey, and P. Favara.*
Jeff Gamlin (CH2M HILL/USA)

*** Mass Magnetic Susceptibility Measurement for Estimating Intrinsic Abiotic Degradation Rates: Recommendations to Improve Interpretation Reliability.** *J. Studer, N. Glenn, and B. Ekstrom.*
James Studer (InfraSUR, LLC/USA)

*** Measuring the Magnetic Susceptibility of Aquifer Sediment to Evaluate the Potential for Abiotic Transformation of Trichloroethene.** *R. Edwards and J. Wilson.*
Rick Edwards (CH2M HILL Engineers, Inc./USA)

*** Multiple Methods for Discerning Abiotic and Biotic Processes Affecting Trichloroethene Plume Behavior in Fractured Sedimentary Rock.** *A.A. Pierce, B.L. Parker, S.W. Chapman, J.C. Hurley, J.A. Cherry, L. Zimmerman, and R. Aravena.*
Amanda Pierce (University of Guelph/Canada)

Practical Applications of Chemical Reactivity Probes (CRPs) to Estimate Abiotic Reduction Rates. *C.M. Kocur, P.G. Tratnyek, and R. Johnson.*
Chris M. Kocur (Oregon Health & Science University/USA)

Prospects that Abiotic Degradation of TCE by Naturally Occurring Magnetite Can Be Important for Monitored Natural Attenuation. *J.T. Wilson, B. Wilson, D. Taggart, D. Freedman, D. Cutt, and L. Thantu.*
John Wilson (Scissortail Environmental Solutions, LLC/USA)

*** Side-by-Side Evaluation of Biogeochemical, ISCR, and ERD Reagents for Treatment of CVOCs.** *J. Molin, D. Leigh, B. Smith, and A. Seech.*
Josephine Molin (PeroxyChem, LLC/USA)

*** Specially Configured Subgrade Biogeochemical Reactor to Treat Chlorinated Solvents in Low-Permeability Vadose Zone and Underlying Groundwater.** *J. Cox, S. Smith, D. Downey, and A. Dziechciarz.*
Jeremy Cox (CH2M/USA)

State of Practice of Abiotic and In Situ Biogeochemical Transformation Processes. *R. Darlington.*
Ramona Darlington (Battelle/USA)

*** Subgrade Biogeochemical Reactors for Treatment of Petroleum Hydrocarbon Contamination.** *J. Gamlin, D. Downey, P. Favara, L. Duke, and G. Anderson.*
Jeff Gamlin (CH2M HILL/USA)

Sulfidation of ZVI for Degradation of Chlorinated Ethenes: A New Approach to In Situ Biogeochemical Transformation. *S. Islam, Y.L. Han, A. Murray, K. Millerick, and W.L. Yan.*
Weile Yan (Texas Tech University/USA)

*** Sustained Remediation of Chlorinated Solvents Using In Situ Formation and Regeneration of Ferrous Sulfide.** *R. Stanforth, J. Barros, E. Schwartz, L. Hovey, D. Lennon, and R. Surrency.*
Robert Stanforth (TRC Companies, Inc./USA)

B5. Zero Valent Iron Applications

Platforms Wednesday | Posters (*) Monday Evening
Chairs: Gary Birk (Tersus Environmental, LLC) and
Dean Williamson (CH2M HILL)

*** Abiotic Reduction of Chloropicrin and Carbon Tetrachloride in Site Soil and Groundwater.** *C.G. Schreier and G. Tellegen.*
Cindy Schreier (PRIMA Environmental, Inc./USA)

*** Advancements to the EZVI Technology: Optimization of Biotic and Abiotic Processes and Improved Implementability for In Situ DNAPL Destruction.** *G. Booth, J. Mueller, C. Yestrebtsky, N. Lapeyrouse, C. Clausen, and M. Scalzi.*
J. Greg Booth (Provectus Environmental Products, Inc./USA)

Controlled Sulfidation to Optimize the Remediation Performance of Zero-Valent Iron and Related Materials. *D. Fan, Y. Lan, P.G. Tratnyek, R.L. Johnson, A. Nunez Garcia, D.M. O'Carroll, J. Filip, and A. Agrawal.*
Dimin Fan (U.S. EPA/USA)

Denmark's First Full-Scale Microscale Zero Valent Iron PRB Emplaced by Direct Push Injection. *T.H. Jorgensen, L. Nissen, A. Przepiora, N.D. Durant, and O. Mikkelsen.*
Torben Hojbjerg Jorgensen (COWI A/S/Denmark)

*** Design, Installation and Performance Monitoring of Three ZVI PRBs.** *T. Kinney, M. Coram, and S. Dore.*
Thomas Kinney (GHD/USA)

*** Effect of Dissolved Organic Carbon on Performance of ZVI-Based Remediation.** *J. Roberts, D. Schnell, and A. Przepiora.*
Jeff Roberts (SiREM/Canada)

*** eZVI: The Benefits of Abiotic and Anaerobic Remediation.** *P. Randall and S. Chen.*
Pat Randall (Hepure/USA)

*** Full-Scale Application of Colloidal ZVI and EVO via Liquid-Phase Injection for Treatment of Lesser Chlorinated Ethenes to Accelerate Site Closure.** *D. Williamson, B. Sharma, and W. Elliott.*
Dean Williamson (CH2M HILL/USA)

Groundwater Restoration and Long-Term Stewardship at a Former Smelter. *G. Leone, S. Brown, M.B. Hay, J. Horst, and R. Puga.*
Gaston Leone (ARCADIS/USA)

*** Influence of Metal Impurities in ZVI Matrix on Reactions with Chlorinated Ethenes.** *S. Islam, L. Somasundaram, W.L. Yan, and Y.L. Han.*
Weile Yan (Texas Tech University/USA)

*** nZVI Direct-Push Application as an In Situ Treatment of CHC: Results of Long-Term Monitoring Using Advanced Technology for Zonal Groundwater Sampling.** *V. Stejskal, P. Kvapil, J. Slunsky, and J. Braun.*
Vojtech Stejskal (Technical University of Liberec/Czech Republic)

*** Optimization and Performance of ZVI Amendments for In Situ Chemical and Biological Reduction: Less is More.** *G.M. Birk and D.F. Alden.*
Gary Birk (Tersus Environmental, LLC/USA)

Optimizing ZVI Formulations for the Degradation of Chlorinated Hydrocarbons: Effects of Composition and Particle Size. *J. Freim and J. Harvey.*
John Freim (OnMaterials/USA)

*** Pilot Testing of In Situ Chemical Reduction-Enhanced Bioremediation at a Former Manufacturing Plant in Germany.** *M. Zhang, P.L. Brookner, N.D. Durant, S. Stiasny, and T.R. Etter.*
Man Zhang (Geosyntec Consultants, Inc./USA)

*** Tetrachloroethylene Groundwater Remediation in a Dolomitic Limestone Aquifer Using Injectable Zero Valent Iron.** *V.L. Wilson and T.H. DeWitt.*
Timothy H. DeWitt (August Mack Environmental, Inc./USA)

B6. In Situ Chemical Reduction

Platforms Wednesday | Posters (*) Monday Evening
Chairs: Charles Schaefer (CDM Smith) and
Paul Tratnyek (Oregon Health & Science University)

Abiotic Degradation of Chlorinated Ethenes by Iron Minerals: Over Two Decades Now. *M.M. Scherer, D.E. Latta, T. Robinson, A.L. Neumann, and J. Entwistle.*
Michelle Scherer (University of Iowa/USA)

* **Comparison of Reductive Transformations of Chlorinated Hydrocarbons by Chemically-Reduced versus Bio-Reduced Hydrous Ferric Oxide.** *J. Das and A. Agrawal.*
Jaya Das (Wright State University/USA)

Evaluation of Iron and Sulfur Supplements to Promote Reactive Mineral Formation in In Situ Reactive Zones. *J. Ford, J. McDonough, M. McCaughey, R. Oesterreich, and J. Martin Tilton.*
Jeff Ford (Arcadis/USA)

* **Feasibility Assessment of Reducing Soil for Degrading Trichloroethylene.** *Y. Hou and C. Liang.*
Yuwen Hou (National Chung Hsing University/Taiwan)

* **In Situ Sensors and Injection Measurements Evaluate Electron Donor Distribution in Low-Permeability Heterogeneous Aquifer Achieving Closure through ERD.** *K. Wilhelm, R. Moore, and O. Miller.*
Karin Wilhelm (Stantec/USA)

ISCR-Based Remediation of Herbicide/Pesticide-Impacted Soils in Canada, China, Colombia, Sweden, and the United States: 22 Years of Success and Surprises. *A.G. Seech and J.T. Slater.*
Alan Seech (PeroxyChem, LLC/USA)

* **Large-Scale Remediation of TCE Using Abiotic Degradation with ZVI and Enhanced Biological Degradation.** *M. Wichman, B. Wight, R. Mowan, E. Moskal, and R. Kelley.*
Ryan Mowan (AECOM/USA)

Limitations and Lessons Learned from Applying In Situ Chemical Reduction to Treat VOCs and Metals in a Geochemically Complex Aquifer. *T.J. Patterson, R. Srirangam, and L.M. Brausch.*
Thomas J. Patterson (Roux Associates, Inc./USA)

* **Mechanochemical Destruction of DDTs with Fe-Zn Bimetal in a High-Energy Planetary Ball Mill.** *H. Sui, Y.Z. Rong, J. Song, and D.G. Zhang.*
Jing Song (Institute of Soil Science, Chinese Academy of Sciences/China)

Oxidation of Chemically-Reduced Aquifer Sediments as Characterized by Abiotic Reactivity and Induced Polarization. *J.E. Szecsody, T.C. Johnson, P. Tratnyek, E. Placencia-Gomez, M. Bradley, M.J. Truex, C.T. Resch, and B.N. Gartman.*

James Szecsody (Pacific Northwest National Laboratory/USA)

* **Performance of a Large-Scale Reductant Amended Backfill for Remediation of Hexavalent Chromium-Impacted Groundwater.** *L. Hellerich, S. Sharma, S. Ravi, S. Mikaelian, and M. Terril.*
Lucas Hellerich (AECOM/USA)

* **Post-Remedy Performance Results Comparing Soil Blending versus Direct Injection ISCR Source Area Treatment for 1,1,2 TCA.** *T. Adams.*
Timothy Adams (Roux Associates, Inc./USA)

* **Reductive Degradation of Lindane by Tea Extracts in Aqueous Phase.** *C.-W. Wang and C. Liang.*
Chi-Wei Wang (National Chung Hsing University/Taiwan)

* **Remediation for CVOCs by In Situ Chemical Reduction (ISCR) in Groundwater (Brazil Site).** *S.S. Aluani, M.C.F. Spilborghs, F.B. Tomiatti, E. Pujol, and N.C. Nascimento.*
Sidney Aluani (SGW Services/Brazil)

Using Molecular Techniques to Characterize Sites Undergoing ISCR: A Five Site Comparison Study. *D. Taggart, M. Burns, and S. Rosolina.*
Sam Rosolina (Microbial Insights, Inc./USA)

B7. Lessons Learned with In Situ Technologies

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Brad Elkins (EOS Remediation, LLC) and
Mark Harkness (OBG)

* **Advanced Design Study for the Evaluation of Dyed EVO Distribution via Recirculation in a Complex Hydrogeochemical Setting.** *A. Brown, B.J. Lazar, N.M. Rabah, R.S. Germain, and M. Lee.*
Anthony Brown (TRC Companies, Inc./USA)

* **An Assessment of Implementation Strategies for EISB: Is There a Right Way?** *D. Alden, G. Birk, and J. Roberts.*
David Alden (Tersus Environmental, LLC/USA)

* **Complex DNAPL Site 50-Year Plume Response to Successive Remedial Measures Employed with an Evolving Site Conceptual Model.** *D.T. Heidlauf and J. Stumpf.*
David Heidlauf (Ramboll Environ/USA)

*** Evaluating Methods to Rejuvenate a Clogged Zerovalent Iron (ZVI) Permeable Reactive Barrier (PRB).**

R. Welch, J. Peebles, L. Page, T. Carnes, D.L. Freedman, H. Wang, M. Soni, and L. Lehmicke.
Regan Welch (T&M Associates/USA)

Full-Scale ISCR and EISB to Treat Chlorinated Solvents in Unsaturated Soils at a Former Chlorinated Solvents Manufacturing Plant. *J. Daniels, M. Motylewski, J. Street, and B. Smith.*

John Daniels (Groundwater & Environmental Services, Inc./USA)

How Much Buffer Do You Need to Adjust Aquifer pH?

B. Yuncu and R.C. Borden.

Bilgen Yuncu (Solutions-IES, a Division of Draper Aden Associates/USA)

*** Implementation Lessons Learned from a VOC-Contaminated Coastal Site in Monterey, California.**

A. Halmstad, A. Frankel, D. Moser, T. Wotan, C. Sandefur, and S. Nigro.

Craig Sandefur (Regenesis/USA)

In Situ Chemical Oxidation: Lessons Learned at Multiple Sites. *J. Baldock, K. Morris, T. Pac, J. Parikh, P. Santos, and J. Sathaye.*

Timothy Pac (ERM/USA)

Lessons Learned from Direct-Push Injection of In Situ Reagents. *M. McCaughey, R. Oesterreich, P. Jin, M. Gentile, A. Pennington, S. Burnell, M. Chalfant, and J. McDonough.*

Matthew McCaughey (Arcadis/USA)

Lessons Learned over 20 Years of Designing and Implementing Enhanced In Situ Bioremediation Remedies. *M. Harkness.*

Mark Harkness (OBG/USA)

*** Long-Term Performance and Methanogenesis Associated with Four Remedial Amendments: Indiana Sites.** *B. Dayharsh, K. Finneran, and J. Mueller.*

Jim Mueller (Provectus Environmental Products, Inc./USA)

*** Management of Dilute Trichloroethene Plume in Low pH Aerobic Aquifer through a Combined ERD and MNA Remedy.** *N. Shetty, A. Gonzalez, M. Zenker, and S. Ross.*

Nanjun Shetty (AECOM/USA)

*** More Lessons Learned from Common Mistakes Applying In Situ Remediation Technologies in the Field.** *K. Brasaemle and N. Goers.*

Karla Brasaemle (TechLaw, Inc./USA)

*** Over Fifteen Years of Emulsified Vegetable Oil Applications: The Good, the Bad, and the Ugly!**

W.A. Newman and B.N. McShane.

Bill Newman (RNAS Remediation Products/USA)

*** Overcoming pH Effects on a "Stalled" In Situ Bioremediation System.** *C.B. Bartley and C.R. Clymer.*

Christopher Bartley (Terracon/USA)

*** Pilot Study for In Situ Bioremediation of Chlorinated Solvents in Groundwater: Successes and Challenges.**

S. Baffert, L. Conlan, and L. LaPat-Polasko.

Sherrick Baffert (Wood/USA)

*** Successes and Lessons Learned from a Soil Mixing Application with Sodium Persulfate.** *M. Perlmutter and E. Filc.*

Mike Perlmutter (CH2M HILL/USA)

*** Three Decades of Solvent Bioremediation: The Evolution from Innovation to Conventional Practice.**

M. Schnobrich, J.M. Tilton, E. Gates, and J. Horst.

Matthew Schnobrich (ARCADIS/USA)

*** Three Years of Reductive Dechlorination at a Chlorinated Solvent Site.** *J.M. Yeager, A.J. Blayney, J.B. Connolly, C.M. Ross, and D.G. Larson.*

Jessica Yeager (Geosyntec Consultants, Inc./USA)

B8. Lessons Learned in DNAPL Source Zone Remediation

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Fred Payne (Arcadis) and
Heather Campbell Veith Rectanus (Battelle)

*** 3-D Numerical Modelling of an In Situ Field-Scale Pulsed Pumping Process of a Large DNAPL Pool in a Keyed Enclosure.** *Q. Giraud, J. Gonçalvès, and B. Paris.*

Quentin Giraud (Intera/France)

*** Benefits and Limitations of Aggressive Source Removal and Treatment at a Chlorinated Solvent Site.**

C.W. MacPhee.

Craig W. MacPhee (AECOM/USA)

*** Case Study and Review of Technical Literature Regarding Cost-Effectiveness of Source Control Options.** *R.C. Bost, D. Whitley, and Z. Zho.*

Richard C. Bost (NRM Environmental Services/USA)

*** Comprehensive and Innovative Guidance for DNAPL Site Characterization and Remediation: Capturing Lessons Learned through Collaboration.** *R.A. Wymore, M.B. Smith, and N. Akladiss.*

Ryan Wymore (CDM Smith, Inc./USA)

*** Forensic Evaluation of NAPL Architecture.** *G.R. Carey.*

Grant Carey (Porewater Solutions/Canada)

*** Implementation of a Passive DNAPL Recovery Program at a U.S. EPA Region 5 CERCLA Site.**

M.L. Schmidt and T. Steib.

Martin Schmidt (AECOM/USA)

*** In Situ Treatment of a NAPL Source Zone Using Combined ISCO, Air Sparging, and SVE to Achieve Regulatory Closure.** *J.M. Jeray, C.M. Ross, J.B. Connolly, and C.S. Martin.*

Joseph Jeray (Geosyntec Consultants/USA)

Know Your Enemy: Implementation of Bioremediation within a Suspected DNAPL Source Zone following High-Resolution Site Characterization at Contractors Road Heavy Equipment Area, Kennedy Space Center, Florida.

A. Chrest, R. Daprato, M. Burcham, and J. Johnson.
Mike Burcham (Geosyntec Consultants/USA)

Lessons Learned during DNAPL Source Zone Remediation.

E. Gustafson.
Erik Gustafson (The Louis Berger Group, Inc./USA)

Polluted Soil Remediation of Heavy Chlorinated Solvents in Saturated Porous Media: Effects of Thermal and Chemical Enhancements.

S. Colombano, H. Davarzani, I. Ignatiadis, J. Deparis, D. Guyonnet, E.D. van Hullebusch, and D. Huguenot.
Stefan Colombano (BRGM/France)

*** Pushing the Edge of Practicable: Engineered Methods for Non-Ideal Aquifer Conditions for Enhanced In Situ Bioremediation Remedy.**

D.W. Tomlinson.
Derek Tomlinson (GEI Consultants, Inc./USA)

Rapid DNAPL Source Zone Characterization with Dye-Enhanced Laser-Induced Fluorescence (DyeLIF).

R. Stuetzle, R. Wenzel, N.R. Welty, M. Klemmer, and R. St. Germain.
Nicklaus Welty (Arcadis/USA)

State of the Practice: DNAPL Source Zone Treatment.

C.J. Newell.
Charles Newell (GSI Environmental, Inc./USA)

*** Successful Closure of a DNAPL Site: Lessons Learned.**

C.A. Cox.
Craig Cox (Cox-Colvin & Associates, Inc./USA)

*** Targeted Characterization Expedites Integrated Design/Construction for DNAPL Response Actions.**

M.M. Wade and K.D. Dyson.
Marilyn M. Wade (Brown and Caldwell/USA)

*** ZVI and Clay Mixing to Treat DNAPL Source Zone after Previous Implementation of Several Innovative Technologies.**

J. Cox, S. Smith, K. Bradley, R. Gates, T. Isakson, and T. Simpkin.
Jeremy Cox (CH2M/USA)

B9. In Situ Chemical Oxidation

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Prasad Kakarla (In-Situ Oxidative Technologies [ISOTEC]) and Deepti Krishnan Nair (Battelle)

*** Chemical Oxidation Treatment of Transformer Oils that Contain Antioxidant Di-tert-butyl-para-cresol (DBPC).**

C. Bucior, S. Dore, D. Pope, R. Thomas, A. Weston, and R. Fillion.
Sophia Dore (GHD/USA)

*** Combined Remedy Using In Situ Chemical Oxidation at Former Wood Treating Site, United Kingdom.**

J. Baldock, J. Dinham, D. Gallagher, K. Johnson, G. Johnstone, and T. Pac.
Timothy Pac (ERM/USA)

*** Continuous Multistage Fenton's Degradation of Organochlorides.**

J.C. Moretti, B.J. Moretti, M. Moretti, and R. Panzetti.
Michele Moretti Panzetti (Moriah Ambiental Ltda/Brazil)

Dose-Response Curves Compare the Effectiveness of Combined Cement-Persulfate Treatment with Standalone ISS and ISCO in Ten Different Soils.

D.P. Cassidy and V.J. Srivastava.
Daniel Cassidy (Western Michigan University/USA)

*** Effectiveness of In Situ Chemical Oxidation at an LNAPL Solvent Site in New Jersey.**

G.A. Angyal, J.M. Freeman, J.A. Surowiecki, K. Klink, and R. Connell.
Joelle M. Freeman (OBG/USA)

*** Enhanced In Situ Chemical Oxidation Pilot Test, Guarulhos, Brazil.**

B. Gil, W.J. Hague, K. Morris, R.D. Mutch, T. Pac, and M. Singer.
Timothy Pac (ERM/USA)

Injection of Potassium Persulfate via Hydraulic Fracturing to Address a Recalcitrant Fuel-Related and Chlorinated VOC Plume.

M. Perlmutter and A. Forsberg.
Mike Perlmutter (CH2M HILL/USA)

Innovative Carbohydrate (CH) Activation of Persulfate: Comparative Evaluation of Multiple Food-Grade CH Activators.

P. Kakarla, Y. Chin, and W. Caldicott.
Prasad Kakarla (In-Situ Oxidative Technologies [ISOTEC]/USA)

*** ISCO Eliminates NAPL and Site Disruptions to Expedite Site Closure.**

K.D. Dyson and B. Quann.
Kevin Dyson (Brown and Caldwell/USA)

*** Oxidation of Bisphenol A by Activated Persulfate Using Iron(II) Entrapped Chitosan/Alginate Substrate.**

Y.S. Chang, Y.G. Kang, and H.C. Vu.
Yoon-Seok Chang (POSTECH/South Korea)

*** Oxidation of PAHs and their Byproducts (Polar PACs) in the Saturated Zone of DNAPL-Contaminated Subsoils.**

C. Johansson, A. Joubert, P. Faure, C. Biache, P. Bataillard, S. Colombano, C. Lorgeoux, T. Pigot, and J. Frayret.
Clotilde Johansson (SERPOL/France)

Passive Sustained-Release ISCO Technology Achieves Remedial Site Closure.

P.J. Dugan and G. Walsom.
Pamela Dugan (Carus Corporation/USA)

PCB Remediation Using an Innovative ISCO Approach: Bench and Pilot Study Results.

D.R. Gray and F. Barajas.
Doug Gray (AECOM/USA)

*** Pilot Study for In Situ Chemical Oxidation Using Potassium Permanganate for Remediation of Chlorinated Hydrocarbons in Groundwater.**

A. Lizzi and P. Thimmappa.

Anthony Lizzi (Ninyo & Moore/USA)

*** Quantifying the Thermal Desorption Effect Resulting from the Exothermic Fenton's Reaction.**

G. Cronk and G. Sounhein.

Gary Cronk (JAG Consulting Group, Inc./USA)

*** Reconsidering ISCO for Treating Low Contaminant Concentrations.**

P.M. Dombrowski, P. Kakarla, and T. Eilber.

Paul Dombrowski (In-Situ Oxidative Technologies [ISOTEC]/USA)

Successful Treatment of 1,4-Dioxane with In Situ Ozone.

F.J. Krembs, G.E. Mathes, J. Pruis, M.R. Olson, and K. Power.

Friedrich Krembs (Trihydro Corporation/USA)

*** Targeted Application of Conventional and Slow-Release ISCO to Eliminate Residual TCE in Groundwater at the Aquifer-Confining Unit Boundary.**

J.E. Landmeyer, P.T. Harte, R.W. Tollett, J. Schoolfield, and M.A. Singeltary.

James Landmeyer (U.S. Geological Survey/USA)

C1. Electroenhanced Technologies

Platforms Monday | Posters (*) Monday Evening
Chairs: Gary Angyal (OBG) and
Evan E. Cox (Geosyntec Consultants)

*** Anaerobic Degradation of Sulfolane Using Passive Anode-Cathode Technology.**

A. Schryer, S.D. Siciliano, T. Carlson, T. Obal, and S.R. Burge.

Aimee Danielle Schryer (University of Saskatchewan/Canada)

*** Design and Assessment of Electrochemical Zones for Remediation of Chlorinated Solvents in Natural Groundwater Aquifer Settings.**

B.H. Hyldegaard, E.B. Weeth, R. Jakobsen, N.D. Overheu, D.B. Gent, and L.M. Ottosen.

Bente Højlund Hyldegaard (COWI/Denmark)

*** Effect of Electron Acceptors on the Stimulation of Anaerobic Benzene Degradation Using Passive Anode-Cathode Technology (PACT).**

S. Chomyshen, K. Hyde, S.D. Siciliano, S.R. Burge, and K. Bradshaw.

Samantha Corinne Chomyshen (University of Saskatchewan/Canada)

Electrokinetically-Based Remediation of Chlorinated Ethenes in Low Permeable Soils.

L.M. Ottosen, P.E. Jensen, G.M. Kirkelund, B.H. Hyldegaard,

L. Nedergaard, N. Tuxen, and T.H. Larsen.

Lisbeth M. Ottosen (Technical University of Denmark/Denmark)

*** Electrokinetically-Emplaced Amendments for Enhanced Bioremediation of Chlorinated Solvents in Clay: A Pilot Field Test.**

A. Inglis, N.A. Head, A. Nunez Garcia, A. Chowdhury, J. Gerhard, J. Hayman, J. Eimers, D. Reynolds, D. Hogberg, M. Auger, L. Austrins, A. Sidebottom, E. Edwards, L. Lomheim, and D. O'Carroll.

Ainsley Inglis (Western University/Canada)

Field Test of Electrokinetically-Delivered and Thermally-Activated Persulfate (EKTAP) for Remediation of Chlorinated Solvents in Clay.

N.A. Head, J.I. Gerhard, A.I. Chowdhury, A.M. Inglis, A.N. Garcia, J. Hayman, J. Eimers, D. Reynolds, D. Hogberg, M. Auger, L. Austrins, A. Sidebottom, and D.M. O'Carroll.

Nicholas Andrew Head (University of Western Ontario/Canada)

From Laboratory to Full-Scale Implementation: Electrokinetically-Enhanced Delivery of Amendments for In Situ Remediation.

D.B. Gent, J. Wang, E. Cox, D. Reynolds, C. Riis, I. Damgaard, and H. Kern.

David Gent (U.S. Army Corps of Engineers/USA)

*** The Influence of Electrokinetic Bioremediation on Subsurface Microbial Communities in Perchloroethylene-Contaminated Soil.**

M.L. Altizer, A.G. Delgado, R. Krajmalnik-Brown, C. Torres, J. Wang, and E. Cox.

Megan Altizer (Arizona State University/USA)

Next Generation of Nanoremediation: nZVI Application Enhanced by DC Electric Field.

V. Stejskal, P. Kvapil, J. Nosek, M. Cernik, and J. Hrabal.

Vojtech Stejskal (Technical University of Liberec/Czech Republic)

*** A Novel Graphene-Based Rotating Disc Electrode System for the Electro-Fenton Oxidation of Pharmaceutical Compounds Catalyzed by Ferrocene.**

D. Govindaraj and I.M. Nambi.

Divyapriya Govindaraj (Indian Institute of Technology Madras/India)

*** Remediation of a Vinyl Chloride Dissolved Phase Plume through the Combination of Elektrokinesis and In Situ Chemical Oxidation at the Santos Port Area, Brazil.**

C. Rodrigues, L. Silveira, G. Setti, T. Borba, Y. Lima, and A.P. Queiroz.

Ana Paula Queiroz (Waterloo Brasil/Brazil)

*** Utilizing an Electrocoagulation (EC) Treatment Train for PCB and PCE Removal, Two Case Studies: Dredge Return Water Treatment on a Superfund Site and a Construction Site Turned Remediation Project.**

L. Doty and A. Nam.

Liisa Doty (Water Tectonics, Inc./USA)

C2. Heat-Enhanced Remediation

Platforms Monday | Posters (*) Monday Evening
Chairs: Emily Crownover (TRS Group, Inc.) and
Tamzen Macbeth (CDM Smith, Inc.)

* **Biodegradation of Chlorinated Aromatic Compounds in Soils Using a Large Volume Heated Pile.** *R. Sambrotto, A. Rance, and H. Sanchez.*
Raymond Sambrotto (Columbia University/USA)

Destruction and Transformation of Pyrene by Mineral Surfaces during Thermal Desorption. *C. Oden, C.J. Werth, and L.E. Katz.*
Cameron Oden (University of Texas at Austin/USA)

Heat-Enhanced Hydrolysis and Flash Sparging.
C. Thomas and B. Morris.
Chris Thomas (TRS Group, Inc./USA)

* **Innovative Steam Auger Mixing and ISS Combined Remedy Bench-Scale Simulations.** *T.A. Jordan.*
Tommy Jordan (KEMRON Environmental Services, Inc./USA)

Monitoring the Impacts and Effectiveness of Electrical Resistance Heating Combined with Enhanced Bioremediation. *D. Taggart, K. Clark, B.R. Baldwin, R. D'Anjou, and M. Dodson.*
Dora Taggart (Microbial Insights, Inc./USA)

State of the Practice: Heat-Enhanced In Situ Remediation. *T.W. Macbeth and E. Crownover.*
Tamzen Macbeth (CDM Smith, Inc./USA)

* **Thermally-Enhanced Bioremediation and Desorption of Chlorinated Ethenes Using Groundwater Circulation.** *Y. Yamazaki, Y. Furukawa, T. Nakashima, T. Shimizu, X. Tian, and T. Kobayashi.*
Yuji Yamazaki (TAKENAKA Corporation/Japan)

* **Thermally-Enhanced Bioremediation of TCE-Contaminated Groundwater.** *P. Najmanova, J. Nemecek, V. Knytl, J. Steinova, and T. Pluhar.*
Petra Najmanova (DEKONTA, a.s./Czech Republic)

* **Thermally-Enhanced Natural Attenuation of VOCs: Two Years after In Situ Thermal Remediation.** *R. Thompson, M. Gefell, G. Heron, and B. Thompson.*
Rowan Thompson (GEI Consultants, Inc./USA)

Use of Steam to Enhance VOC-TPH NAPL Mixture Dissolution at a Major Source Area through Volatilization, Recovery, and Biodegradation, Naval Air Station North Island. *V. Hosangadi, M. Price, P.L. Chang, and M. Pound.*
Michael Pound (U.S. Navy/USA)

C3. Innovative and Optimized Delivery Methods

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Bill Newman (RNAS Remediation Products) and
Mike Perlmutter (CH2M HILL)

* **Augered Soil Removal and In Situ Biological/Chemical Degradation of PCE.** *R. Girouard, J.T. Spadaro, and M. Peterson.*
Richard Girouard (Ahtna Environmental, Inc./USA)

* **Comparison of Hydraulic and Pneumatic Injection Techniques for In Situ Chemical Reduction of TCE in Low Permeability Aquifers.** *N.E. Diem, V.S. Mankad, D.P. Leigh, and N. Hey.*
Nathan Diem (GHD Services Inc/USA)

Delivery of a Permeable Injection Network for Enhanced Reductive Dechlorination Treatment: Adapting to Site Challenges. *D.L. Schnell, P.J. Palko, and S.G. Feldmann.*
Deborah Schnell (GeoSierra Environmental, Inc./USA)

* **Effectiveness of Air Sparging Using a "Booster" Approach.** *M. Fulkerson, N. Ume, M. Perlmutter, M. Louth, D. Cleland, and C. Delaney.*
Monica Fulkerson (CH2M HILL/USA)

* **Enhancing ISCO Performance in Low Permeability Formations: What a Blast!** *B. Luhrs and J. Yerton.*
Robert Luhrs (Raytheon Co./USA)

Enhancing ISCO with In Situ Recirculation.
T.R. Andrews, S. Borchert, and V. Cocianni.
Trevre Roys Andrews (CH2M/USA)

* **In Situ Remediation of TCE-Impacted Groundwater with Limited Water-Bearing and Low-Permeability Aquifer.** *D.N. Bekele, S. Chadalavada, M. Mallavarapu, and R. Naidu.*
Sreenivasulu Chadalavada (CRC CARE Pty Ltd/Australia)

In Situ Solidification/Stabilization of a Residual Acid Tar via Deep Soil Mixing with Large Diameter Augers. *D. Collins, E. Rowney, R. Andrachek, and N. Johnson.*
David Collins (Stantec/USA)

Injectant Delivery through Combination of Infiltration Galleries and High Vacuum Extraction. *J. Byrd, P. Patey, and J. Spain.*
Jennifer Byrd (ERM/USA)

* **New Application of the Grout Bomber Technology to Remediate Low-Permeability Contaminated Media.** *S.D. Richardson, C.J. Newell, J.A. Long, M.L. Schofield, and L.M. Rocha.*
Stephen Richardson (GSI Environmental, Inc./USA)

A New Technology for In Situ Remediation of Contaminated Sites by Cryo-Enhanced Delivery of Reactants in Low Permeable Clayey Deposits. *H.U. Sørensen, R. Jakobsen, C. Kjeller, K.E. Klint, T.H. Larsen, A. Tsitonaki, and N. Tuxen.*
Helle Ugilt Sørensen (GEUS/Denmark)

* **Next Generation Injection Manifold for Controlled Delivery of Liquid Amendments for Enhanced Distribution and Contact.** *E. Cooper and D. Caputo.*
Eliot Cooper (Cascade/USA)

* **Optimizing Injections in Nonoptimal Environments: The Marriage of HRSC with Advanced Injection Approaches to Treat TCE in Glacial Till.** *K. Grosinske, C. Scala, D. DeYoung, D.K. Nair, D. Leigh, and D. Wiley.*
Deepti Krishnan Nair (Battelle/USA)

* **Permanganate Distribution and TCE Source Area Results Three Years after Full-Scale Injection of Solid Reagent by Controlled-Jet Injection.** *S. Golaski, G. Maalouf, D. Bryant, D. Knight, and B. Slack.*
Stan Golaski (Rogers & Callcott Environmental/USA)

Specifically Configured Groundwater Circulation (GCW) System for Accelerated Biodegradation of CAHs under Anaerobic Conditions. *D. Hiller, M. Piepenbrink, K. Mueller, and E. Alesi.*
Dieter Hiller (ERM GmbH/Germany)

State of the Practice for Innovative and Optimized Delivery Methods for Liquid and Solid Amendments in a Variety of Lithologies. *E. Cooper, N. Hey, S. Chen, and R. Kelley.*
Eliot Cooper (Cascade/USA)

Targeted Permeability Enhancement and ZVI Emplacement to Improve In Situ Bioremediation of a High-Concentration Source. *N.T. Smith, D.D. Nguyen, N.L. Smith, K.J. Waage, M.R. Lamar, R.A. Wymore, K.S. Sorenson, S. Garcia, I. Bowen, G. Guest, and C. Kaiser.*
Nathan Smith (CDM Smith, Inc./USA)

* **Use of Two Injection Techniques to Apply Enhanced Reductive Dechlorination at a VOC Plume Site.** *M. Perlmutter and R. Goodson.*
Mike Perlmutter (CH2M HILL/USA)

* **Utilization of Innovative Methods to Design and Install a ZVI-PRB Using Vertical Inclusion Propagation to Intercept a Chlorinated Plume.** *D.L. Schnell, P.J. Palko, and J. Santacroce.*
Deborah Schnell (GeoSierra Environmental, Inc./USA)

C4. Horizontal Wells

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Craig Divine (Arcadis) and
Monica Fulkerson (CH2M HILL)

* **Adding Accurate Control to Horizontal Well Systems under Tanks, Roads, Utilities, and Adjacent Owner Properties.** *L.I. Robinson.*
Lance Robinson (EN Rx, Inc./USA)

* **Application of Screen Design for Horizontal Injection Wells.** *B.D. Younkin, D.W. Ombalski, and J. Montoy.*
Brian Younkin (Directed Technologies Drilling, Inc./USA)

Australia's First Installation of Horizontal Wells for In Situ Chemical Oxidation (ISCO) and Biosparging: Lessons Learned. *P. Balbachevsky, W. Caldicott, M. Mercuri, and M. Sequino.*
Pedro Balbachevsky (AECOM/Australia)

* **Demonstration and Validation of the Horizontal Reactive Media Treatment (HRXTM) Well.** *B. Nzeribe, J. Furcick, M. Alexander, M. Crimi, C. Divine, and J. McDonough.*
Blossom Nzeribe (Clarkson University/USA)

Demonstration and Validation of the Horizontal Reactive Media Treatment Well (HRX Well®) for Passive In Situ Remediation. *C. Divine, J. McDonough, J. Wright, J. Wang, M. Crimi, and J.F. Devlin.*
Craig Divine (ARCADIS U.S., Inc./USA)

Distribution of Permanganate via 100-Foot Deep Horizontal Well. *M. Fulkerson, J. High, M. Perlmutter, M. Louth, D. Cleland, and C. Delaney.*
Monica Fulkerson (CH2M HILL/USA)

Effective Treatment of a CVOC Plume beneath an Active Manufacturing Facility Using Deep Horizontal Sparge Wells. *M. Strong, T. Feng, A. Elliot, and B. Dehghi.*
Mark Strong (CH2M HILL/USA)

* **Horizontal Biosparging: Case Study of Southern California Pilot Study.** *M. Lubrecht, E. Davis, and M. Strong.*
Michael Lubrecht (Directed Technologies Drilling, Inc./USA)

* **Horizontal Wells Down Under: Horizontal Wells Were Tasked to Target Source Area Under Industrial Complex.** *M. Sequino, P. Balbachevsky, and M. Mercuri.*
Mike Sequino (Directional Technologies, Inc./USA)

* **Soil Vapor Extraction Using a Horizontal Remediation Well to Remediate Biogenic Methane and VOCs at a Hydrocarbon Contamination Site.** *S.H. Bailey, M.E. Pate, and J.R. Moses.*
Sam Hendrik Bailey (Kleinfelder/USA)

* **Using Discrete Horizontal Sampling Wells to Fill Data Gaps.** *L.I. Robinson.*
Lance Robinson (EN Rx, Inc./USA)

* = poster presentations

C5. Advances in Amendments

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Carlotta Cellucci (U.S. Navy) and Raymond Lees
(Langan Engineering & Environmental Services)

*** Accelerated Aerobic Dechlorination of Pesticides, PCBs and Other Persistent Organic Chemical Pollutants in Soil.** *C.W. Young, M. Johnson, and B. Cook.*
Christopher Young (Biotech Restorations/USA)

*** Activated Carbon Applications to Address PCBs in Sediment: Examples and Results from Selected ESTCP Projects.** *J. Collins, J. Hull, and J. Jersak.*
John Collins (AquaBlok, Ltd./USA)

Development of Novel Nanomaterials for Water Remediation. *Y.S. Chang, Y.G. Kang, C.S. Lee, D.S. Oh, H.W. Yoon, and Y.Y. Chang.*
Yoon-Seok Chang (POSTECH/South Korea)

*** Evaluation of Locally-Available Substrates for Degradation of Complex Chlorinated Solvents in South America.** *C. Mowder, D. Berggren, E. Liu, M. Brito, and C. Walecka-Hutchison.*
Carol Mowder (CH2M/USA)

*** Evaluation of Potassium Persulfate as a Permeable Reactive Barrier at Three Different Sites.** *B.A. Smith, L. Kammer, J. Soukup, C. Letts, P. Lyon, T. Pac, and V. Sadeghi.*
Brant Smith (PeroxyChem, LLC/USA)

Field-Scale Evaluation of Enhanced Attenuation Processes Using Humate as an Amendment. *D.G. Jackson, B.B. Looney, J.A. Ross, J.E. Cardoso-Neto, T.F. Kmetz, G.T. Kinsman, and J. Furr.*
Dennis Jackson (Savannah River National Laboratory/USA)

Full-Scale ERD and Bioaugmentation in Deep Groundwater Using New Reducing Agent to Create Anaerobic Water. *J. Su, E. James, J.F. Daugherty, and K.A. Gruebel.*
Karen A. Gruebel (Erler & Kalinowski, Inc./USA)

*** Implementing an In Situ Reactive Zone to Mitigate Off-Site Migration: From Field Test to Full-Scale.** *M. Verbeeck, P. Valle, E. van de Ven, and B. Verhoeven.*
Mattias Verbeeck (ERM/Belgium)

New Antimethanogenic Reagents (AMRs). *J. Mueller, G. Booth, J. Haselow, B. Rehm, A. Hassel, and K. Finneran.*
Jim Mueller (Provectus Environmental Products, Inc./USA)

State of the Practice—Advances in Amendments for Remediation: Where Are We Making Progress? *D.T. Adamson.*
David Adamson (GSI Environmental, Inc./USA)

*** Using Amendments to Control Geotechnical Characteristics following Soil Mixing with ISCO.** *B.A. Smith, I. Horner, and B. Desjardins.*
Brant Smith (PeroxyChem, LLC/USA)

* = poster presentations

C6. Injectable Activated Carbon Amendments

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Jim Fenstermacher (AECOM) and Anthony Nelson (U.S. Navy)

*** Activated Carbon: A Love Affair Spanning 15 Years.** *S. Noland, B. Iden, G. Simpson, and T. York.*
Scott Noland (Remediation Products, Inc./USA)

*** Challenges of a Large-Scale In Situ Application of Activated Carbon, Nutrients, and Bacteria at the DSH Food and Gas Site in Areas with Limited Access.** *J.V. Fontana, B. Davis, and M.K. Larsen.*
John Fontana (Vista GeoScience/USA)

Combining In Situ Sorption and Bioremediation for the Management of a Chlorinated Solvent Plume at Low Concentration. *M. Petrangeli Papini, F. Arjmand, P. Ciampi, C. Esposito, J. Birnstingl, M. Carboni, P. Gorla, S. Rossetti, B. Matturro, L. Cesta Incani, and M. Bacchi.*
Marco Petrangeli Papini (University of Rome "La Sapienza"/Italy)

*** Controlling Back-Diffusive Mass Loading at Three Midwest Sites with Glaciogenic Interbedded Geology Utilizing a Colloidal Liquid Activated Carbon.** *K.M. Gaskill, D. Davis, and S. Barnes.*
Keith Gaskill (EnviroForensics/USA)

Enhanced Performance of Colloidal Zero Valent Iron through Co-Treatment with Colloidal Activated Carbon. *K.D. Pappano and K.A. Thoreson.*
Katherine Pappano (Regenesis/USA)

In Situ Groundwater Remediation by Activated Carbon (AC)-Based Amendments at Several CERCLA and RCRA Sites. *D. Fan.*
Dimin Fan (U.S. EPA/USA)

*** In Situ Remediation of Former Industrial Area (Redeveloped to New Housing Buildings) with Innovative Enhanced Reductive Dechlorination Technology.** *G.G. Ceriani.*
Gabriele Giorgio Ceriani (Ejlskov A/S/Denmark)

*** LNAPL Remediation Combining Mobile Dual-Phase Extraction with Concurrent Injection of a Carbon-Based Amendment.** *F.T. Barranco, J. Taylor, D. Hoyt, K. Bradley, and M. Roginske.*
Frank Barranco (EA Engineering, Science, and Technology, Inc., PBC/USA)

Opportunities and Limitations of DNAPL Treatment via Injectable ZVI/Carbon: Results of Bench- and Field-Scale Tests. *J. Moreskog, M. Ohr, S. Lloyd, and S. Noland.*
Johanna Moreskog (AECOM/USA)

Performance of Injected Powdered and Liquid Activated Carbon at a Petroleum Hydrocarbon Site.

R. McGregor.

Rick McGregor (InSitu Remediation Services Ltd./Canada)

*** Rapid Site Closure of a Large Gas Plant Using In Situ Bioremediation Technology in Low-Permeability Soil and Fractured Bedrock.**

T.A. Harp.

Tom Harp (LT Environmental, Inc./USA)

*** The Remediation of Recalcitrant Hydrocarbons in Soil and Groundwater Employing Bioavailable Absorbent Media (BAM) with and without Bacterial Nutrients.**

L. Kinsman and B. Tease.

Larry Kinsman (ORIN Remediation Technologies/USA)

Remediation of Volatile Organics in Groundwater Using In Situ Carbon (ISC) Injection Technologies: A Comparative Analysis.

J. Sheldon and G. Hinshalwood.

Jack Sheldon (Antea Group/USA)

*** Site Goals Achieved in Two Months at a Santa Barbara Manufacturing Facility Using a Dispersive Colloidal Activated Carbon.**

E. Haro and D. Nunez.

Dan Nunez (Regenesis/USA)

C7. Surfactant-Enhanced Remediation

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Adria Bodour (U.S. Air Force Civil Engineer Center) and
George Ivey (Ivey International, Inc.)

Combine Optimization of Surfactant Enhanced Recovery and ISCO Alkaline Activation to Treat a Brazilian Latosol Soil Contaminated with DRO Diesel.

V.W. Cibebe, D.M. Cristina, and R. Paulino.

Cibebe Vicino (Ambscience Engenharia Ltda/Brazil)

*** Combined Surfactant and Oxidant Application for Simultaneous Contaminant Liberation and Destruction.**

D. Socci, J. Holcomb, and G. Dahal.

Dan Socci (EthicalChem/USA)

Design and Implementation of Full-Scale In Situ Chemical Oxidation of PCE in Soil and Groundwater Using Surfactant-Facilitated Sodium Permanganate at an Urban Location.

K. Ramanand, D.W. Podsen, E.W. Wilson, M. Ostrowski, K.D. Dyson, and M. Temple.

Karnam Ramanand (Brown and Caldwell/USA)

*** Enhanced NAPL Recovery through Combined Surfactant and Hydrogen Peroxide Flushing.**

D. Socci, J. Holcomb, and G. Dahal.

Dan Socci (EthicalChem/USA)

Implementation of a Biosurfactant-Enhanced Treatment for Soils Impacted by PAH.

F. Cazals, M. Morlay, A. Perrault, N. Galopin, S. Rossano, S. Colombano, I. Ignatiadis, D. Huguenot, and M.O. Simonnot.

Mathieu Morlay (COLAS Environnement/France)

Lessons Learned from Surfactant-Enhanced Aquifer Remediation of Light and Dense NAPLs.

D. Alden and G. Birk.

David Alden (Tersus Environmental, LLC/USA)

Permanent Removal of Separate Phase Organics in Groundwater.

G.A. Ivey and J.S. Poynor.

George Ivey (Ivey International, Inc./Canada)

Surfactant-Enhanced Extraction to Expedite Remediation of a Carbon Tetrachloride Source Zone at an Active Grain Elevator Facility.

E. Dulle.

Eric Dulle (Burns & McDonnell/USA)

*** Surfactant Use to Enhance Performance of Chemical Oxidation Remediation.**

D. Socci, J. Holcomb, and G. Dahal.

Dan Socci (EthicalChem/USA)

C8. Phytoremediation/Mycoremediation and Plant Uptake

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Joel Burken (Missouri University of Science & Technology) and
Tesema Chekol (Battelle)

Artificial Neural Network Development to Predict Plant Uptake and Translocation of Chlorinated Contaminants: Implications on Risk and Remediation.

M. Bagheri and J.G. Burken.

Majid Bagheri (Missouri University of Science and Technology/USA)

*** Bioremediation Feasibility Study of Various PCB-Contaminated Matrices by White Rot Fungi.**

T. Cajthaml, K. Šrédlová, T. Stella, and O. Lhotský.

Tomas Cajthaml (Academy of Sciences of the Czech Republic/Czech Republic)

*** A Case Study of Phytoforensics for a PCE-Contaminated Site in Taiwan.**

M.Y. Wu, B.V. Wang, S.K. Huang, B.T. Guan, J.E. Landmeyer, H.M. Yen, W. Chen, and I.H. Chen.

Meng Yu Wu (SINOTECH Environmental Technology, Ltd./Taiwan)

Degradation of Polychlorinated Biphenyl (PCB) Mixtures (Aroclors) and Sediments Contaminated with PCBs with Encapsulated Oxidoreductase Enzymes.

K.H. Kucharzyk, E. Strozier, C.S. Peven McCarthy, and A.D. Duong.

Kate Kucharzyk (Battelle/USA)

*** Design and Implementation of an Arsenic Phytoremediation Pilot Study at a Wood Treatment/Chromated Copper Arsenate Site.**

J.A. Moore, C. Krouse, D.K. Huff, S.R. AufdenKampe, and D.S. Pittenger.

J. Alan Moore (Nutter & Associates, Inc./USA)

Dioxygenases Present in Phenanthrene and Fluoranthene Degradation by Bacterial and Fungal Co-Cultures. *M. Bello-Akinosho, R. Adeleke, and M. Thantsha.*

Rasheed Adeleke (Agriculture Research Council/South Africa)

*** Effective Management of a Recalcitrant Petroleum Hydrocarbon-Impacted Site by Phytoremediation.**

P. Campbell, J. Grosskleg, and K. Bradshaw.

Patrick Campbell (Wood/Canada)

Enhanced Degradation of TCE on a Superfund Site Using Endophyte-Assisted Poplar Tree Phytoremediation. *J.L. Freeman, S.L. Doty, C.M. Cohu, and M.J. Blaylock.*

John Freeman (Intrinsyx Technologies Corporation/USA)

*** Evaluation of Ligninolytic Enzymatic Activity in an Acrylamide-Potassium Acrylate Copolymer for Degradation of Chlorinated Compounds.**

M.C. Vargas Romero, G.M.L. Ruiz-Aguilar, N. Lovanh, A. Saldaña-Robles, and R.A. Veloz-García.

Monica Cristina Vargas Romero (Universidad de Guanajuato/Mexico)

*** Execution of a Field-Scale Planted Greenhouse PFAS Uptake Study at RAAF Base Williamtown, New South Wales, Australia.** *B. Harding, R. Casson, V. Pearce, and M. McLaughlin.*

Barry Harding (AECOM/USA)

*** Five Factors in Plant Health Care to Ensure Your Project is Reaching Optimal Performance.**

D.S. Courtright.

Scott Courtright (TEA, Inc./USA)

*** High-Resolution Site Characterization of a Chlorinated Solvent Groundwater Plume beneath a Phytoremediation Site.** *M. Meyer and C. Cellucci.*

Michael Meyer (Battelle/USA)

*** Implementation of a Hybrid Poplar Phytoremediation Program for TCE at an Arid, Fractured Bedrock Site.**

D. Rowe, C. Serlin, E. Pearson, J. Freeman, and C. Cohu.

Devon Rowe (Ramboll Environ Corporation/USA)

Mycoremediation: Evaluating Fungal Metagenomics and Biofilm Association in PAH-Contaminated Estuarine Sediments. *S.J. Volkoff, L.M. Czaplicki, and C.K. Gunsch.*

Savannah J. Volkoff (Duke University/USA)

*** Nonylphenol Translocation in Lettuce from Contaminated Soil Amended with Biochar.** *G. Beretta, A. Mastorgio, S. Saponaro, and E. Sezenna.*

Gabriele Beretta (Politecnico di Milano/Italy)

*** A Passive Sampler for Contaminant Detection in Trees.** *J.E. Landmeyer and H.S. O'Neill.*

James Landmeyer (U.S. Geological Survey/USA)

*** PHYTO-INTEGRATED™ Remediation System to Address Chlorobenzene-Contaminated Groundwater in a Complex Saprolitic Aquifer.** *E.G. Gatliff, E.B. Hollifield, M. Miller, D. Wanty, and P.R. Thomas.*

Edward Gatliff (Applied Natural Science, Inc./USA)

*** Phytoremediation and Rhizodegradation Pilot Studies at a 73-Acre Former Wastewater Pond in Northern California.** *B. Gray, B. LePage, J. Warner, D. Lind, and K. Morris.*

Kevin Morris (ERM/USA)

*** Phytoremediation of a Former Urban Sewage Lagoon.**

T. Carlson, R. Gestler, and A. Schoonmaker.

Trevor Jason Carlson (Geosyntec Consultants/Canada)

C9. Combined Remedies and Treatment Trains

Platforms Thursday | Posters (*) Wednesday Evening

Chairs: Dan Bryant (Woodard & Curran) and

Daniel Oberle (TRS Group, Inc.)

*** Achieving Regulatory Closure of a PCE Groundwater Plume Using a Hybrid Pump and Treat and ISCO Approach at a State Superfund Site in Quartzsite, Arizona.** *J.N. Clarke, M. Bunkers, and L. Robinson.*

James Nicholas Clarke (Wood/USA)

*** Adaptive Dynamic Groundwater Recirculation: A Strategy for Expedited Plume Cleanup.** *A. Horneman, M. Klemmer, and W. Parry.*

Allan Horneman (Arcadis/USA)

*** Application of MPE and ISCR in Remediation of a Chlorohydrocarbon-Contaminated Site.** *F. Zhang and L. Ma.*

Feng Zhang (Shanghai Greenment Environmental Technology Co., Ltd./China)

*** Combined In Situ Chemical Reduction and In Situ Bioremediation Groundwater Treatment for a Chlorinated VOC Plume.** *K. Diller, D.R. Griffiths, C. Ross, M.H. Mehta, and D. Clark.*

Kristi Diller (Parsons/USA)

*** Combined Remediation Approaches to Address Chlorinated Volatile Organic Impacts.** *R. Cadorette and R. Mayer.*

Raymond Cadorette (APTIM Environmental & Infrastructure, Inc./USA)

*** Combined Remedies Address Chlorinated Solvent Impacts at an Industrial Site.** *M. Mazzaresse.*

Mike Mazzaresse (AST Environmental, Inc./USA)

Downgradient Thermal Front Migration and Enhancement of Plume Area In Situ Bioremediation after Thermal Source Area Remedy. *J.R. House, R.D. Collins, D. Bryant, J. Sammon, and R. Simon.*

Jason R. House (Woodard & Curran/USA)

*** Lessons Learned: The Importance of Proper Project Planning When Integrating In Situ Mechanical and Biological Hydrocarbon Remediation Technologies.**

E.M. Jennings and S. Willis.

Eleanor Jennings (Parsons/USA)

Long-Term Anaerobic Bioremediation of Petroleum Contaminants by Iron- and Sulfate-Reducing Bacteria following Combined Cement-Persulfate Treatment.

D.P. Cassidy and V.J. Srivastava.

Daniel Cassidy (Western Michigan University/USA)

*** One Site, Seven Remedial Solutions: A Combined Approach to Increase Remediation Effectiveness.**

F. Coelho.

Flavio Coelho (ERM Brasil Ltda./Brazil)

*** Optimization of a Source Area Remedy Using SVE and ERD.**

J. Cox, J. Wilde, M. Roginske, M. Reynolds, and G. Colgan.

Jeremy Cox (CH2M/USA)

Overcoming Challenges and Closure-Strategy Development at a Long-Term, Large-Scale CVOC Bioremediation/Thermal Project.

M.A. Panciera, D. Bytautas, T. Kalinowski, L.A. Hellerich, and R. Henderson.

Matthew Panciera (AECOM/USA)

Protecting Community Water Supply through EPA Removal Actions Involving Source Soil and Bedrock Aquifer Remediation.

D.A. Zimmermann and S. Fisher.

David A. Zimmermann (Tetra Tech Inc./USA)

*** Succession of Remediation Techniques for a Complex Site Impacted by Chlorinated Solvents.**

S.S. Aluani, M.C.F. Spilborghs, F.B. Tomiatti, E. Pujol, and N.C. Nascimento.

Sidney Aluani (SGW Services/Brazil)

Thermal Soil Mixing and ZVI Injection Using Large Diameter Augers at a Former Dry Cleaner.

M.C. Crews.

Matthew Crews (Golder Associates Inc./USA)

*** When In Situ Stabilization/Solidification (ISS) Alone Is Not Enough: Evaluation of a Combined Persulfate/ISS Remedy for MGP Remediation.**

N.D. Durant, C. Robb, M. Healey, J. Roberts, T.H. Jorgensen, and A. Toff.

Neal Durant (Geosyntec Consultants/USA)

C10. Emerging Remediation Technologies

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Arul Ayyaswami (Tetra Tech, Inc.) and
Mark Kluger (TRS Group)

*** Adsorption of Antibiotics in Water onto Surface-Modified Biochar Adsorbents.**

Y. Choi, H. Jang, and E. Kan.

Eunsung Kan (Texas A&M University/USA)

*** Aromatic Dye Removal by a Combination of Anaerobic and Micro-Aerobic Degradation Processes.**

O.F. Menezes and S. Gavazza.

Savia Gavazza (Federal University of Pernambuco/Brazil)

Biological Reduction of Multi-Contaminants that Are Electron Acceptors.

M. Elkouz, S. Shrestha, J. Batista, and A. Ayyaswami.

Jacimaria Batista (University of Nevada Las Vegas/USA)

*** Combined In Situ Remedial Approach Using Activated Carbon and Bioremediation to Treat and Prevent Off-Site Migration of a Chlorinated Solvent Plume in Southern California.**

C.W. Lenker, L.M. Rebele, and A. Ayyaswami.

Carl Lenker (Tetra Tech, Inc./USA)

*** Enhanced Distribution of Modified Nano-Scale Magnesia for Injection-Based In Situ Groundwater Remediation.**

N.K. Koju, X. Song, N. Lin, and K. Xu.

Xin Song (Chinese Academy of Sciences/China)

Field Demonstration of Foam Injection to Confine a Source Zone of Chlorinated Solvents.

C. Portois, E. Essouayed, M.D. Annable, N. Guiserix, A. Joubert, and O. Atteia.

Clément Portois (ENSEGID/France)

In Situ Remediation of Pesticides, Explosives, and Chemical Weapons Using Heat-Enhanced Hydrolysis.

G. Beyke.

Greg Beyke (TRS Group, Inc./USA)

*** In Situ Stabilization of NAPL Contaminant Source Zones as a Remediation Technique to Reduce Mass Flux to Groundwater.**

D.J. Mateas, G.R. Tick, and K.C. Carroll.

Douglas J. Mateas (Geosyntec Consultants, Inc./USA)

*** Introduction of Violacein-Producing Genes into Trichloroethene-Degrading Bacteria to Avoid Protozoan Predation.**

K. Nakamura and T. Kato.

Kanji Nakamura (Tohoku Gakuin University/Japan)

Laboratory and Field Evaluation of Bioaugmented Granular Activated Carbon for Treatment of Chlorobenzenes and PCBs in Sediment.

M.M. Lorah, E.H. Majcher, S. Chow, E.J. Bouwer, A.R. Wadhawan, and N.D. Durant.

Michelle M. Lorah (U.S. Geological Survey/USA)

*** Paste Sequestration of Halides from Coal-Fired Power Plant FGD Wastewater.**

K. Ambrose.

Keith Ambrose (Duke Energy/USA)

*** Sand Cap Stabilization, Sediment Resuspension Mitigation and GAC/PAC Amendment Transport Optimization Using Innovative Protein Polysaccharide Biopolymers (PPBs).**

A. Dahmani, F. Dahan, C. Ligeikis, F. Qweider, J. Mulqueen, R. Albino, R. Beach, and S. Damon.

Amine Dahmani (SESI Consulting Engineers/USA)

*** Slow Release Multi-Oxidant Cylinders for Remediation of a 1,1-DCE Plume.** *J. Byrd, E. Hollifield, and P. Dugan.*
Jennifer Byrd (ERM/USA)

*** Sulfidation of nZVI Particles for Improved Performance in Groundwater Treatment Technologies: Laboratory versus Field Experiences.** *J. Filip, M. Brumovský, J. Oborná, R. Zboril, J. Nosek, J. Semerád, J. Slunský, and P. Lacina.*
Jan Filip (Palacký University/Czech Republic)

Taking Sulfidated nZVI to the Field: Key Considerations.
A. Nunez Garcia, J. Herrera, D. Fan, C.M. Kocur, R.L. Johnson, P.G. Tratnyek, and D.M. O'Carroll.
Denis O'Carroll (University of New South Wales/Australia)

Treatment of Chlorinated Solvents by Copper-Amended Nanoscale Zero-Valent Iron Stabilized with Carboxymethylcellulose. *A. Franze and A. Agrawal.*
Andrew Franze (Key Environmental/USA)

*** VEG Technology: A Patented Green and Sustainable Technology for On-site Thermal Remediation of Soils and Enhanced NAPL Recovery.** *M. Javaherian.*
Mehrdad Javaherian (Endpoint Consulting, Inc./USA)

D1. Estimating Cleanup Timeframes and Modeling to Support Site Closure

Platforms Monday I Posters (*) Monday Evening
Chairs: David Adamson (GSI Environmental, Inc.) and
Michael Truex (Pacific Northwest National Laboratory)

*** Analysis of Recontamination Potential: Future Surface Sediment Chemical Equilibrium Concentrations in Newtown Creek.** *R. Makhlof, L. Bateman, K. Zeigler, and K. Russell.*
Ramzy Makhlof (Anchor QEA LLC/USA)

*** Application of Linear Regression Method to Track Remediation Progress and Predict Cleanup Time for a CVOC Groundwater Plume.** *A. Hodges and T.H. Feng.*
Alan Hodges (CH2M HILL/USA)

*** Assessing MTBE Degradation in an Alluvial Aquifer.**
K. Sun, A. Brown, E. Keene, T. Andrews, and P. Salcido.
Kerang Sun (CH2M HILL/USA)

*** Attenuation of a Chlorinated Solvent Plume Expedited by Underground Construction.** *J.R. Kastrinos and O. Miles.*
John R. Kastrinos (Haley & Aldrich, Inc./USA)

Decision Support Tool for Vadose Zone Remediation of Volatile Contaminants. *M. Truex, C. Johnson, T. Appleman, R. Hinchee, and D. Becker.*
Michael Truex (Pacific Northwest National Laboratory/USA)

A Practical Modeling Tool to Estimate Cleanup Timeframes in Highly Heterogeneous Aquifers with Matrix Diffusion and Degradation Reactions.
D.K. Burnell, J. Xu, and L.S. Sims.
Daniel Burnell (Tetra Tech, Inc./USA)

Predictive Modeling of Downgradient Concentrations and Overall Closure Timeframe Resulting from Bioremediation. *F.J. Krembs, G.E. Mathes, M.R. Olson, and M.G. Sweetenham.*
Friedrich Krembs (Trihydro Corporation/USA)

*** Site Characterization and Remedial Planning for TCE-Impacted Groundwater in Saprolite and Crystalline Bedrock.** *J. Zoekler and C. Jettie.*
Christina Jettie (Hana Engineers & Consultants, LLC/USA)

*** Streamlining the Path to Site Closure Using a Two-Dimensional Spreadsheet Model and a Three-Dimensional Visualization Tool.** *M.G. Sweetenham and A. Riffel.*
Michael Sweetenham (Trihydro Corporation/USA)

*** Temporal and Spatial Statistical Monitoring Optimization Applications and Plan Modification Success.** *S.G. Lehrke and G.M. Wilming.*
Stephen Lehrke (Foth/USA)

Type Curves to Estimate Cleanup Time for Different Hydrogeologic Settings. *K.Y. Cha, R.C. Borden, and B. Yuncu.*
Ki Young Cha (Solutions-IES a division of Draper Aden Associate/USA)

*** Using Modified Stiff Diagrams and 1,1-DCA as Conservative Tracer to Support Site Closure.** *A. Verce, T.A. Eliasson, and T.J. Fojut.*
Anja Verce (Weiss Associates/USA)

D2. Big Data, Data Mining, and Portfolio Optimization

Platforms Monday I Posters (*) Monday Evening
Chairs: Travis McGuire (GSI Environmental, Inc.) and
Victor Sewaybricker (Geoklock)

Applications of R and Machine Learning to Groundwater Data. *T. Kalinowski, T. Abdul-Matin, M. Panciera, and L. Hellerich.*
Tomasz Kalinowski (AECOM/USA)

Combining ERH and TCH for More Effective Remediation: Don't Restrict Your ROD or RFP to a Single Heating Technology. *G. Heron, J. Galligan, M. Dodson, and R. Flatley.*
Gorm Heron (TerraTherm, Inc./USA)

A Dirty Secret: Duplicate Variability in Summa Canister Samples for Vapor Intrusion Investigations. *T. McHugh, C. Villarreal, S. Rauch, and L. Beckley.*

Thomas McHugh (GSI Environmental, Inc./USA)

*** Evaluation of Long-Term Performance and Sustained Treatment at Enhanced Anaerobic Bioremediation Sites: An Update.**

K.L. Walker, T.M. McGuire, D.T. Adamson, and C.J. Newell.

Kenneth Walker (GSI Environmental, Inc./USA)

*** Findings from a Machine Learning Approach to Planning Site Characterization.** *J. Dalton, A. Harrington, and R. Knox.*

Jason Dalton (Azimuth1/USA)

Optimization of a Large, Long-Term Groundwater Monitoring Program. *C. Holbert, S. Smith, M. Roginske, K. Bradley, A. Castor, G. Colgan, J. Cox, T. Isakson, M. Reynolds, and A. Dziechciarz.*

Charles Holbert (CH2M HILL/USA)

*** Over Twenty Years of 1,4-Dioxane Data at Multiple Sites: What Really Happens Long Term?** *B. Dahlgren, E. Glover, and E. Rogers.*

Bryon Dahlgren (AECOM/USA)

Tracking Cleanup of Chlorinated Solvents: Development of Benchmark Decay Rates. *K.L. Walker, T.M. McGuire, D.T. Adamson, and C.J. Newell.*

Kenneth Walker (GSI Environmental, Inc./USA)

*** Two “Flavors” of Big Data Studies in the Remediation Field: Methods and Example Applications.** *P. Kulkarni, C. Newell, T. McGuire, T. McHugh, J. McDade, and D. Adamson.*

Poonam Kulkarni (GSI Environmental, Inc./USA)

D3. Optimizing Remedial Systems

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Gunarti Coghlan (U.S. Navy) and
Jeffrey Pintenich (Brown and Caldwell)

*** Adaptive Adaptation: Flexibility of Recirculation to Accommodate Plume Change.** *N. Miller, M. Schnobrich, and D. Sonders.*

Nick Miller (Arcadis/USA)

*** Adaptive Design in Action: Fast-Tracking Site Remediation at an Active Industrial Facility.**

J. Martin Tilton, J. Ford, and M. McCaughey.

Jennifer Martin Tilton (Arcadis/USA)

*** Air Sparging as an Adaptive and Effective Plume Management Approach at Large DNAPL Sites.** *C.J. Pike, M.J. Deliz, M.J. Jonnet, C.A. Hook, and M.P. Speranza.*

Chris Pike (Tetra Tech NUS, Inc./USA)

Effective Remediation through Continuous Remedy Evaluation and Adaptation: A 20-Year Case Study.

C. Elder, R. Scott, D. Wanty, and M. Miller.

Carl R. Elder (Geosyntec Consultants, Inc./USA)

*** Environmental Fracturing in Low-K Conditions to Enhance Soil Vapor Extraction.** *S.G. Pitts, R.W. Blackmer, and K.P. Rohwer.*

Steven Pitts (Equipoise Corporation/USA)

*** Facing Remediation Challenges and Overcoming Engineering Limitations: A Plan for Change.** *B.S. Langan and S.L. Knox.*

Bonani Langan (Wood/USA)

*** In Situ Microcosms Demonstrate Value in Optimizing In Situ Remediation.** *M. Burns, M. Porter, D. Carstens, S. Haitz, and P. Groff.*

Matthew Burns (WSP/USA)

*** In Situ Thermal Treatment with Integrated Vapor Oxidation Technology: Design and Lessons Learned with GTR-O Systems.** *X. Chen, B. Krumbholz, and C. Winell.*

Xiaosong Chen (GEO/USA)

*** Laboratory Testing for Optimization of Lead Stabilization at a Former Oil Refinery.** *C. Bucior, S. Dore, D. Pope, R. Thomas, and A. Weston.*

Sophia Dore (GHD/USA)

*** Lessons Learned in Optimizing Air Sparge/Soil Vapor Extraction at a Former Dry Cleaner Site.** *S. Saalfield, A. Riggs, and J. Hayward.*

Samantha Saalfield (EA Engineering, Science, and Technology, Inc., PBC/USA)

*** Optimization of EISB and MNA Confirmation at a Complex Site Using Multiple Evaluation Tools.**

L. MacKinnon, M. McMaster, S. Mancini, L. Zimmerman, C. Elmendorf, B. Dean, and A. McCord.

Leah MacKinnon (Geosyntec Consultants, Inc./Canada)

Optimization of Hydraulic Capture of CVOCs and Management of Injection Well Fouling for a Groundwater Treatment and Injection System.

J. Williams, C. Canfield, and I. Jones.

John Williams (The Boeing Company/USA)

*** Optimization of Remedial Design and Regulatory Corrective Action in a Multi-Layer Geology Using Fate and Transport Modeling.** *N.M. Talimcioglu and P. Ludvigsen.*

N. Mete Talimcioglu (First Environment, Inc./USA)

*** Optimized Treatment of 1,4-Dioxane in Extracted Groundwater and Reinjection for Aquifer Replenishment.**

T. Kruk, J. Engels, K. Spikes, and S. Woodard.

Taras Kruk (EHS Support, LLC/USA)

Optimizing a Complex Remediation Project in an Evolving Environment. *C. Coladonato, B. Goodwin, and P. Nadebaum.*

Peter Nadebaum (GHD/Australia)

Remedial Process Optimization of a Groundwater Extraction and Recharge System at a Superfund Site in New Jersey. *M. Ostrowski, J.R. Caputi, C. Meyn, and S. Havlik.*

Marek Ostrowski (Brown and Caldwell/USA)

Remedy Performance Reporting: Driving Remediation System Optimization and Site Progression. *K.M. Lienau, D. Sweeten, and C. Blanchard.*

Kevin M. Lienau (GES/USA)

*** Shut-Down Test after 22 Years of Groundwater Treatment Reveals Optimal Strategy.** *S. Knox, D. Barsotti, and D. Young.*

Sheri Knox (Wood/USA)

U.S. EPA Superfund Optimization: Progress and Outcomes. *K. Biggs, E. Gilbert, M. Jefferson, and C. Pachon.*

Carlos Pachon (U.S. Environmental Protection Agency/USA)

*** Using Soil Gas Concentration Mapping to Predict Soil Vapor Extraction Radius of Influence Variances and Optimize Remedial System Design.** *C. Martin.*

Collin Martin (EnviroForensics LLC/USA)

Utilizing a Contaminant Transport Model to Assess Remedial Alternatives, Estimate Cleanup Times, and Ultimately Optimize the Existing Remedial System.

M. Coram, T. Kinney, and T. DeFouw.

Michael Coram (GHD Services, Inc./USA)

*** When a Temporary Solution Becomes a Long-Term System.** *R. Evans.*

Richard Evans (Groundwater & Environmental Services, Inc./USA)

*** You Have to Spend Money to Save Money: The Business Case for Pre-Remedial Assessment.**

D. Nelson, J. Byrd, E. Hollifield, and D. Gomes.

Denice Nelson (ERM/USA)

D4. Advances in Monitoring Injection Effectiveness (e.g., Radius of Influence)

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Victor Medina (U.S. Army Corps of Engineers)
and Scott Noland (Remediation Products, Inc.)

Application of Helium and Sulfur Hexafluoride as Tracer Gasses to Optimize Air Sparging Performance.

A. Hodges, T.H. Feng, and B. Dehghi.

Alan Hodges (CH2M HILL/USA)

*** Applications of Electrical Resistivity Tomography to Support Remedy Selection and Implementation.**

T. Johnson, M. Truex, C. Strickland, J. Thomle, S. Springer, B. Williams, F. Elloy, P. Baynes, and M. Byrnes.

Michael Truex (Pacific Northwest National Laboratory/USA)

Case Studies: Field QA/QC Monitoring of Subsurface BOS 100® Injections. *N. Lichti, B. Tunncliffe, and M. Mazzaresse.*

Nathan Lichti (Vertex Environmental Inc./Canada)

*** Digital Documentation and Evaluation of CPS Distribution in Soil Cores Following Injection for Hexavalent Chromium Fixation.** *C.S. Alger, N. Gregory, E. Levy, and J. Marshak.*

Christopher S. Alger (Terraphase Engineering/USA)

*** Geophysics Tomography for Time-Lapse Mapping of In Situ STAR Thermal Remediation.** *L.M. Trento, J.I. Gerhard, P. Tsourlos, M. McMaster, A. Sims, D. Liefel, and J. Vidumsky.*

Jason Gerhard (University of Western Ontario/Canada)

*** Lines of Evidence for Injection Solution Distribution in a Groundwater Transition Zone.** *C. Bell, F. Stanin, D. Garcia, and D. Eley.*

Caitlin Bell (Arcadis/USA)

Temporal Surface Geophysical Mapping to Assess Permanganate Injection Distribution and Recirculation Using a 100-Foot Deep Horizontal Well. *T. Halihan, M. Fulkerson, J. High, and S. McDonald.*

Todd Halihan (Oklahoma State University/USA)

*** The Use of High-Resolution Tools for Preliminary Assessment of ROI of Injections of Remediation Products.** *V.V. Sewaybricker and R. Spina.*

Victor Vanin Sewaybricker (GEOKLOCK/Brazil)

*** Using High-Resolution Data to Evaluate Distribution and Effectiveness of In Situ Injectates.** *T.A. Harp.*

Tom Harp (LT Environmental, Inc./USA)

Using Multiple Techniques to Monitor Effectiveness of In Situ Injections. *T.A. Harp.*

Tom Harp (LT Environmental, Inc./USA)

Where's Waldo: Finding Injected Amendments and Estimating Radius of Influence at a Former Retail Station in Rural Kentucky. *W. Brab, B. Borth, and R. Boyle.*

William Brab (AST Environmental, Inc./USA)

D5. Assessing Performance and Cost of Remedies

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Rick Gillespie (Regenesis) and
Charles Newell (GSI Environmental, Inc.)

*** An Accurate and Auditable Cost Estimating Tool for Environmental Remediation Financial Liability.** *A. Kakai.*
Anne Kakai (AECOM/USA)

Balancing the Cost of Short-Term Cleanup and Long-Term Stewardship during Remediation Decision Making. *J. Carnahan.*

Jeffrey Carnahan (EnviroForensics, LLC/USA)

*** Cost-Effectiveness of In Situ Aerobic Cometabolic Biodegradation for Treating Large Deep Dilute Plumes Containing 1,4-Dioxane and CVOCs.** *M.Y. Chu, P. Bennett, and R. Borrego.*

Min-Ying Jacob Chu (Haley & Aldrich, Inc./USA)

Enhanced Reductive Dechlorination (ERD) Treatment of Large-Scale Chlorinated Solvent Site: Evaluation of Substrate Options, Unit Costs, and Performance Data.

T. McKeon and T. Colligan.

Tom McKeon (CALIBRE Systems, Inc./USA)

Estimating the Costs of and Performing the Remedy at the SRSNE Superfund Site. *B. Thompson and M. Gefell.*

Bruce Thompson (de maximis, inc./USA)

Hudson River Post-Remediation: When Can We Expect to Achieve Remedial Goals and How Do We Measure It? The 2017 Five-Year Review. *E.A. Garvey,*

S. Gbondo-Tugbawa, J. Atmadja, M. Traynor, K. Takagi, B. Fidler, J. Kern, J. Wolfe, K. von Stackelberg,

G. Klawinski, and M.S. Greenberg.

Edward Garvey (Louis Berger/USA)

Intergenerational Cost Estimates: Challenges and Solutions for Long-Term Cleanup Decision Making.

P.J. Favara, K.D. Thomsen, and D. Pitzler.

Paul Favara (CH2M HILL/USA)

*** Large Diffuse Plume Alternative Approach to Pump and Treat/MCLs: A Sustainable Plume Management Approach Using the Arizona WQARF Model.**

S.P. Zachary, E. Pigati, and P. Panzino.

Scott Zachary (Haley & Aldrich, Inc./USA)

*** Performance-Based Remediation: Cost-to-Objective Achieved Utilizing In Situ Reductive Remediation of Chlorinated Solvents.** *S. Betts.*

Steve Betts (Groundwater & Environmental Services, Inc./USA)

*** Simulation-Based Optimal Placement of Slow Release Oxidant Cylinders and Comparison of Cost with Injections.** *J.L. Clark-Stone, K.R. Kavannagh, M. Crimi, and G. Yao.*

Jesse L. Clark-Stone (Clarkson University/USA)

*** Source Remediation of Chlorinated Ethenes Using Enhanced Reductive Dechlorination and a Change in Strategy toward Performance-Based Delivery.**

J.E. Day, M. Perlmutter, G. Van den Daele, R. Francioso, and T. Keijzer.

Jim Day (CH2M HILL/Germany)

Targeted In Situ Remediation of Multiple Contaminants to Achieve Site Closure in a Performance-Based Remediation Contract. *S. Suryanarayanan, P. Srivastav,*

S. Watson, A. Willmore, and R. Mayer.

Sowmya Suryanarayanan (APTIM/USA)

D6. Applications of Mass Flux and Mass Discharge for Remedial Design/Optimization

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Michael Annable (University of Florida) and
Nicklaus Welty (Arcadis)

*** Comparison of Three Mass Flux Estimation Methods Applied to a NAPL-Impacted Sedimentary Aquifer in Brazil.** *G. Van den Daele, P. Rego, L. Ribeiro, W. LeFevre,*

E. Spande, C. Mowder, M. Sherrier, and J. Henderson.

Gerd Van den Daele (CH2M/Brazil)

Development of Advanced Single-Well Applied Tracer Techniques for Improving Reliability of Groundwater and Contaminant Mass Flux Monitoring. *S. Brouyère,*

P. Jamin, P. Orban, A. Dassargues, and F. Cosme.

Serge Brouyère (University of Liège/Belgium)

Evaluation of Mass Discharge to Surface Water in Tidally-Influenced Aquifer by Passive Flux Meters.

R.K. Sillan.

Randall Sillan (AECOM/USA)

*** Field and Laboratory Comparison of an Innovative Velocity Tool with Other Methods for Velocity Measurement in Aquifers.** *E. Essouayed and O. Atteia.*

Elyess Essouayed (INNOVASOL/France)

*** Groundwater Flux Modeling of Chlorinated Compounds through Metamorphic Fractured Bedrock in Rhode Island.** *J. Bartos, J. Hershberger, N. Goulding,*

and J. Breza.

John Bartos (EHS Support LLC/USA)

*** High-Resolution Mass Discharge Evaluation at a Chlorinated Solvent Release Site in Sao Paulo, Brazil.**

O. Miles, M. Einarson, and M. Singer.

Owen Miles (Haley and Aldrich/USA)

*** Mass Discharge Approved as Primary Regulatory Criteria at Two Major Industrial Sites.** *A.A. Rees and K. Green.*

Assaf Rees (AECOM/USA)

Panel Discussion—Wednesday, Track D

Building a Remedy with the End in Mind: Advances in Adaptive Management for Efficient Cleanup of Complex Sites

Moderators

Kira Lynch (U.S. EPA)
Tamzen Macbeth (CDM Smith)

Panelists

David Becker (USACE)
Tom Blackman (Lockheed Martin)
Alec Naugle (CA RWQCB)
Hope Lee (DOE HQ) (pending confirmation)
Insurance Industry representative (pending confirmation)

As cleanup programs for complex contaminated sites mature, those remaining often have significant underlying technical challenges and financial constraints. One of the most significant technical challenges is the presence of nonaqueous phase liquids (NAPL) in groundwater. The focus of this panel will be on developing adaptive site management strategies as the primary approach for addressing dense nonaqueous phase liquid (DNAPL)/ light nonaqueous phase liquid (LNAPL) site remedial actions. More often than not, significant remediation efforts at these “complex” sites have not, or cannot, practically achieve stringent, promulgated cleanup goals. Decisions then have to be made about whether and how to commit additional resources towards achieving meaningful remedial progress and protection of receptors. Often, there is significant uncertainty in the site conceptual model as programmatic decisions are made for implementing remedial actions, which can create barriers to efficient cleanup when conditions are different. Often, adaptive management approaches are better suited to facilitate meaningful cleanup by using an adaptive framework to reduce risk to human health and the environment as progress is made and more is learned about the site during implementation.

The panel will be made up of leading researchers and practitioners working to understand the nature of the problem and have experience implementing adaptive remedial strategies that meet the needs of various regulatory programs. An important component of this panel will be an effort to reach out to a wide group of industry experts, regulators, and program managers to identify programmatic, scientific and engineering insights to advance more efficient cleanups. Among the topics to be discussed:

- How are decisions made about moving forward with remediation? (What is the risk profile? What is the return on investment? Are goals achievable?)
- What are the options for developing NAPL source zone remedial action objectives?
- How are technical risks quantified to financial risks and incorporated into program management and planning?
- Developing holistic, sustainable plume management strategies with consideration of site complexity and significant uncertainty in the decision process.
- Appropriate roles for risk based strategies (i.e. low-threat closure), monitored natural attenuation (MNA) and technical impracticability (TI) waivers.
- How to develop multi—technology strategies with interim performance goals to achieve progress and protect receptors.

Mass Flux as a Tool for Evaluating and Demonstrating Remedial Objectives and Optimizing a Combined Remedy Hydraulic Containment and Bioremediation System. *J. Langenbach, J. Bartlett, and S. Thotapalli.*
Jim Langenbach (Geosyntec Consultants/USA)

* **Passive Flux Sampling in Groundwater: Guidelines and Demonstration Cases with iFLUX Samplers.**
G. Verreydt, P. Meire, T. Op't Eyndt, F. Meesters, I. Van Keer, and J. Bronders.
Goedele Verreydt (University of Antwerp/Belgium)

* **A Passive Method for Measuring Microbial Biomass Flux in Porous Media.** *A. Haluska, A. Ogram, J. Cho, and M. Annable.*
Alexander Haluska (University of Florida/USA)

A Practical Framework for Flux-Based Monitoring Programs. *A. Horneman, C. Divine, T. Sandtangelo-Dreiling, S. Lloyd, H. Anderson, M.B. Smith, and J.E. McCray.*
Allan Horneman (Arcadis/USA)

* **Return on Investigation (ROI) Using SMART Characterization Approach for the Remedial Design of a TCE Plume in a Granitic Weathered Bedrock Aquifer in Brazil.** *L.J. Athayde, F. Gutierrez, K.F. Barbosa, R.B. Santini, V.F. Bernardo, and P.L. Lima.*
Lucas Athayde (Arcadis/Brazil)

* **Site-Specific Geochemical and Mass Flux Assessments for Metals Lead to Optimized Groundwater Remedial Approach Adjacent to a River.** *C. Reuter, S. Havlik, R. Fraser, E. Roaza, A. Lillie, N. Goulding, and J. Vondracek.*
Ernie Roaza (EHS Support LLC/USA)

Spatially-Averaged, Flow-Weighted Concentrations: A More Relevant Regulatory Metric for Groundwater Cleanup. *M. Einarson.*

Murray Einarson (Haley & Aldrich, Inc./USA)

*** Transient Mass Discharge Reduction versus Source Mass Reduction Following an In Situ LNAPL Source Remediation.**

S.R. Lenschow, A.G. Christensen, A.M.B. Lindof, P. de Blanc, and K. Kostarelos.

Soren Lenschow (NIRAS A/S/Denmark)

Use of Flux Measurement for Remedial Design Optimization of a Combined Remedy for Source Treatment and Large Dilute Plume Management.

K. Lynch, T. Macbeth, D. Giaudrone, N.L. Smith, R. Chichakli, C. Cora, and R. Fuentes.

Kira Lynch (U.S. Environmental Protection Agency/USA)

*** Use of Mass Discharge Performance Metrics to Transition an Active LNAPL Source Area Remedy to MNA.**

A.L. Gray, A. Krasnopoler, and R.M. Glazier.

Adam Gray (Geosyntec Consultants, Inc./USA)

D7. Reusing and Revitalizing Contaminated Sites

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Stewart Abrams (Langan Engineering & Environmental Services Inc.) and
Frederick Blickle (GHD)

*** Bioremediation and Enhanced Chemical Reduction via EZVI at an Active Brownfield Redevelopment Site.**

L. Zeng and B. Gochenur.

Brian Gochenaur (Langan Engineering and Environmental Services, Inc./USA)

*** The Challenges of Relying on Land Use Planning for Remedy Decisions at Hunters Point Shipyard.**

D. Shipman, C. Rain, A. Brownell, and T. Drew.

Christina L. Rain (Langan/USA)

*** Combined Treatment Train to Address Mixed Plume at an Urban Brownfield Site.**

J.F. Good, J. Hayes, B. Gochenaur, M. Burke, A. Schmiedicke, L. Zeng, S. Abrams, and M. Dooley.

Joseph Good (Langan Engineering & Environmental Services/USA)

*** Combining Multiple Remedial Technologies to Accelerate Property Development and Manage Off-Site Risk.**

C.M. Taddeo, D. Taylor, P. Dombrowski, and M. Mazzaresse.

Carol-Anne M. Taddeo (AECOM/USA)

*** Commercial Redevelopment in East Bay San Francisco: Managing Residual PCB-Contaminated Soil.**

F.W. Blickle and N. Colley.

Frederick Blickle (GHD/USA)

*** The Development of Environmental Site Restrictions for Construction and Revitalized Use of a Contaminated Site.** *B. Landale.*

Beth Landale (GHD/USA)

*** Emerging Contaminant Considerations while Performing Due Diligence for Property Transactions.**

C. Leas, J. Hayes, M. Burke, and J. Good.

Jason Hayes (Langan Engineering & Environmental Services/USA)

*** Importance of Working with Regulatory Agencies for Cost-Effective, Ex Situ Stabilization of Heavy Metals.**

M.J. Quimby and J.A. Lively.

James Lively (TDJ Group/USA)

Integrating Remediation Systems with Site Redevelopment: A New York State Brownfield Cleanup Program Site Case Study.

O. Uppal, S. Ciambuschini, C. McMahon, M. Ambrusch, N. Najib, S. Abrams, and I. Khan.

Omer Uppal (Langan Engineering & Environmental Services, Inc./USA)

Redevelopment of Treasure Island: Overcoming Long-Lasting Remedial Challenges.

E. Kimbrel, C. Glenn, D. Shipman, and R. Beck.

Elizabeth Kimbrel (Langan Engineering and Environmental Services, Inc./USA)

Restoration of a Coal Ash and Power Station Site: Science, Perception and Regulations.

F.A. Abo and C. Rigby.

Fouad Abo (GHD/Australia)

*** Returning Former NFD Point Molate to Beneficial Reuse: The Challenging Cleanup of a Fuel- and Metal-Impacted Sump Pond.**

W.L. Carson, T. Schetrit, J.R. Raines, and P. Zawislanski.

William L. Carson (Terraphase Engineering Inc./USA)

Reusing and Revitalizing a Contaminated Former Production and Testing Facility in a Rust Belt City.

T. Kinney, M. Coram, and G. Trigger.

Thomas Kinney (GHD/USA)

Seven Remediation and Mitigation Techniques in Use at One Active Brownfield Redevelopment Site.

J.M. Yeager, J.B. Connolly, A.J. Blayney, D.G. Larson, and C.M. Ross.

Jessica Yeager (Geosyntec Consultants, Inc./USA)

*** Simultaneous Remediation of a Former Gasoline Filling Station and Construction of a 10-Story Mixed Use Development.**

B. Gochenaur, H. Nichols, S. Abrams, M. Burke, and J. Hayes.

Brian Gochenaur (Langan Engineering and Environmental Services, Inc./USA)

*** Transforming Alameda Point: Reuse and Revitalization of a Superfund Site.**

D. Shipman, C. Rain, J. Ernst, B. Graves, and J. Feeley.

Christina L. Rain (Langan/USA)

Use of In Situ Remediation Technology at Redevelopment Sites: An Overview and Lessons Learned. *S. Abrams, L. Zeng, O. Uppal, H. Nichols, J. Good, M. Burke, and J. Ludlow.*
Stewart Abrams (Langan Engineering & Environmental Services Inc./USA)

D8. GSR Best Practices and Case Studies

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Carlos Pachon (U.S. Environmental Protection Agency) and Russell Sirabian (Battelle)

* **Accelerating Cleanup, Reducing Costs, and Increasing Sustainability at Travis Air Force Base.** *J. Gamlin, P. Favara, D. Berwick, L. Duke, and G. Anderson.*
Jeff Gamlin (CH2M HILL/USA)

ASTM E2893-16 Greener Cleanup Self-Declaration at Marine Corps Base Camp Lejeune. *M. Fulkerson, B. Reid, P. Favara, M. Louth, D. Cleland, and C. Delaney.*
Monica Fulkerson (CH2M HILL/USA)

Green and Sustainable Remediation of Contaminated Land in China: Perception, Progress, and Path Forward. *D. Hou and Y. Song.*
Deyi Hou (Tsinghua University/China)

* **Green/Sustainable Petroleum Management: Building a Dataset around an Intuitive Connection.** *A. Pennington, J. Gatterby, R. Ahlers, C. Flanders, D. Randhawa, M. Chalfant, and S. Dunn.*
Andy Pennington (ARCADIS U.S., Inc./USA)

* **Harnessing the Power of the Sun: Designing Optimized Remediation Systems Using Solar Power at Travis Air Force Base.** *D. Berwick, J. Gamlin, G. Anderson, and L. Duke.*
Douglas Berwick (CH2M HILL/USA)

* **Lowering the Carbon Footprint of Thermal Remediation Systems.** *J. Dinham, J. Baldock, J. Brett, S. Tillotson, and J. Dablow.*
Joanne Dinham (ERM/United Kingdom)

* **Management of Wood from Site Clearing and Storm Debris.** *D. Cutt, D. Carpenter, K. Giacalone, T. Hwilka, J. McKernan, K. Litzenberger, C. Pachon, S. Rock, D. Salkie, S. Vaughn, and K. Weitz.*
Diana Cutt (U.S. Environmental Protection Agency/USA)

Performance, Cost, and Emissions Optimization Using Solar-Powered ISB System. *M.G. Sweetenham, F.J. Krembs, S. Lombardo, G. Risse, and G. Mathes.*
Michael Sweetenham (Trihydro Corporation/USA)

* **Reduced Carbon Inputs for an Innovative Large-Scale Sub-Slab Depressurization System Using a Repurposed HVAC Distribution System.** *K. Eisen, A. Zack, N. Czoschke, and B. Schwie.*
Kevin Eisen (Barr Engineering Company/USA)

* **Setting Your Project Up for Successful GSR Outcomes.** *P.J. Favara.*
Paul Favara (CH2M HILL/USA)

Thermal In Situ Sustainable Remediation (TISR): Linking Renewable Energy to Sustainable Site Restoration. *C. Flanders, P.W. Visser, and D. Rosso.*
Davinder Randhawa (ARCADIS/USA)

* **Wind-Driven Air Sparge System for Passive Remediation of Hydrocarbons in Groundwater.** *M. Olson, J. Pruis, T. Moloney, B. McAlexander, M. Lyverse, and J. Wong.*
Mitchell Olson (Trihydro Corporation/USA)

Working on the Railroad: Implementation of Sustainable Remediation at a Programmatic Level. *G. Wolf and S. Pittenger.*
Gerlinde Wolf (AECOM/USA)

D9. GSR Metrics and Resiliency Evaluations

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: John Simon (Gnarus Advisors) and Rick Wice (Battelle)

* **Adopting Sustainable Remediation Concepts to Improve Performance of a Waste Removal Project in Brazil.** *B.E. Sciulli and F. Coelho.*
Berguedof E. Sciulli (ERM/Brazil)

Battelle Methodology for Evaluating Climate Change Resilience of Environmental Remediation Sites. *S. Moore, R. Sirabian, and W. Condit.*
Sam Moore (Battelle/USA)

* **Can Thermal Remediation Be Sustainable? Use of Modelling to Optimize Design.** *J. Dinham, J. Baldock, and J. Dablow.*
Joanne Dinham (ERM/United Kingdom)

* **Can We Quantitatively Select The “Greenest” Cleanup Standard?** *D. Hou.*
Deyi Hou (Tsinghua University/China)

* **Climate Change Adaption: Waste Sites and Wildfires.** *E. Beckwith, J. Claypool, and K.J. Tipton.*
Eleanor Beckwith (Brown and Caldwell/USA)

* **Developing Optimized Remedies for Complex Sites: Technology Assignment Framework, Sustainability, and Resiliency.** *D. Janda, E. Blischke, M. Harclerode, T. Macbeth, and M. Fattahipour.*
Melissa Harclerode (CDM Smith, Inc./USA)

* **Feasibility of Greenhouse Gas Emissions Offsets at Petroleum Release Sites.** *B. McAlexander.*
Ben McAlexander (Trihydro Corporation/USA)

*** From Non-Linear Geostatistics to Scraper Grading: How to Minimize Excavation Costs for Site Redevelopment while Minimizing Greenhouse Impact of Remedial Operations.** *F. Achour.*
Farid Achour (Ramboll Environ/USA)

Incorporating Climate Change into Long-Term Remedies and Operation and Maintenance Plans.
L.J. Pype and M.A. Harclerode.
Lucinda Pype (CDM Smith/USA)

*** State of the Practice of Sea Level Rise and Climate Change as Related to Site Remediation.** *R. Wice.*
Rick Wice (Battelle/USA)

Sustainable Remediation of Polluted Agricultural Land in China. *D. O'Connor and D. Hou.*
David O'Connor (Tsinghua University/China)

*** Sustainable Remediation of Solid Waste: How to Nip it in the BUD.** *S. Ng and K. McCarty.*
Stacey Ng (Integral Consulting Inc./USA)

Transforming Environmental Liabilities into Assets: A Brazil-Based Case Study. *P. Barreto, J. Henderson, P. Carvalho, R. Silva, C. Martins, O. Maurer, and P. Favara.*
Paola Barreto Quintero (CH2M HILL/USA)

E1. Fractured Rock Site Characterization

Platforms Monday | Posters (*) Monday Evening
Chairs: Jason R. House (Woodard & Curran) and
Michael Smith (VT Dept Environmental Conservation)

*** Airborne Geophysical Program to Evaluate the Tertiary Ogallala and White River Groups Hydrostratigraphy, Laramie County, Wyoming.** *P.G. Ivancie and J. Abraham.*
Paul Ivancie (Wood/USA)

Characterization of Rock Matrix Properties Controlling Contaminant Storage in Fractured Rock Using Novel Geophysical Technologies. *L.D. Slater, J. Robinson, K. Keating, B. Parker, S. Falzone, C. Rose, S. Chapman, C. Johnson, and F.D. Day-Lewis.*
Lee D. Slater (Rutgers University Newark/USA)

*** Characterization of Vertical Migration of PCE in a Granitic Aquifer Using Specialty Surface Geophysics.**
T. Halihan and S. McDonald.
Todd Halihan (Oklahoma State University/USA)

Conceptual Site Model Development for Migration of MGP Tar and Related Groundwater Impacts in a Highly Deformed Fractured Rock Unit. *R. O'Neill, J. Marolda, and S. Stucker.*
Robert O'Neill (Brown and Caldwell/USA)

A Field Method to Quantify Chlorinated Solvent Diffusion, Retardation and Degradation Coefficients in Fractured Sedimentary Rock. *R.M. Allen-King, R. Kiekhaefer, and J. Brotsch.*
Richelle M. Allen-King (University at Buffalo, SUNY/USA)

Hydraulic Tomography: 3-D Hydraulic Conductivity and Fracture Connectivity in a Contaminated Mudstone Aquifer, Newark Basin, New Jersey. *W. Barrash, C.R. Tiedeman, C. Thrash, J. Patterson, and C.D. Johnson.*
Warren Barrash (Boise State University/USA)

Insights from Multi-Method High-Resolution Characterization of Contaminant Distributions in Sedimentary versus Igneous Rock Settings.
S.W. Chapman, B.L. Parker, S. Pitkin, T.E. Imbrigiotta, D.J. Goode, and L. Davidsson.
Steven Chapman (University of Guelph/Canada)

Lessons Learned from High-Resolution Site Characterization of Many Dual-Porosity Fractured Rock Sites. *S. Pitkin.*
Seth Pitkin (Cascade/USA)

*** A New Method for Efficient High-Resolution Mapping of DNAPL and Dissolved Phase Contamination in Fractured Bedrock.** *C. Keller, M. Higgins, B. Parker, S. Chapman, and S. Pitkin.*
Carl Keller (Flexible Liner Underground Technologies/USA)

Selection, Design and Construction of a Multilevel Groundwater Monitoring System. *J.N. Dougherty.*
John N. Dougherty (CDM Smith/USA)

State of the Practice in Geophysical Site Characterization and Monitoring. *F.D. Day-Lewis, L.D. Slater, and T.C. Johnson.*
Frederick D. Day-Lewis (U.S. Geological Survey/USA)

TCE Source Area Investigation in Fractured Bedrock Using Phytoscreening and Membrane Interface Probe Sampling at a Former Landfill. *K. Fox, F. Barranco, J. Drummond, B. Rundell, and R. Bower.*
Kathy Fox (EA Engineering, Science, and Technology, Inc., PBC/USA)

E2. Managing/Remediating Chlorinated Solvent Impacts at Fractured Bedrock Sites

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Naji Akladiss (Maine Department of
Environmental Protection) and
Larry Deschaine (HydroGeoLogic, Inc.)

*** Anaerobic Biodegradation Rates and Controlling Factors for Trichloroethene and Its Fluorinated Surrogate in Fractured Rock.** *M.M. Lorah, C. Morel, D.A. Akob, R. Allen-King, and T.E. Imbrigiotta.*
Michelle M. Lorah (U.S. Geological Survey/USA)

* **Application of In Situ Chemical Reduction (ISCR) to Treat Chlorinated Ethenes in Fractured Bedrock at a Redevelopment Site.** *F.S. Lakhwala, R. Srirangam, R. Harwood, E. Mertz, M. Meriney, and L. Dodge.*
Fayaz Lakhwala (PeroxyChem, LLC/USA)

* **Assessment of PlumeStop® to Manage Back Diffusion at a Fractured Sandstone Site.** *M. Burns, M. Brown, S. Schoenmann, T. Huff, and S. Kretschman.*
Matthew Burns (WSP/USA)

* **Case Study of TCE Source Zone Treatment Using Potassium Permanganate In Situ Chemical Oxidation in a Crystalline Bedrock Aquifer.** *A. Franze, J. Kasper, and J. Zubrow.*
Andrew Franze (Key Environmental/USA)

Contraction of a 15-Acre TCE Plume in Overburden and Bedrock Three Years after Full-Scale Barrier Construction by Controlled-Jet ZVI Injection. *G. Maalouf, S. Golaski, D. Bryant, D. Knight, and B. Slack.*
Dan Bryant (Woodard & Curran/USA)

* **Enhanced Bioremediation in Weathered Bedrock: Modifying ROD Selected Remedy, Design, and Implementation.** *D. Bytautas, P. Dombrowski, M. Snyder, and C. Weeden.*
Dustin Bytautas (AECOM/USA)

* **Evaluation of ISCO Oxidant-Infused Wax Cylinders within a Tetrachloroethene-Impacted Fractured Bedrock Aquifer.** *J. MacQueen, B. Diertert, A. Lindley, J. Shirley, and G. Lyssy.*
Jessica MacQueen (Parsons Corporation/USA)

* **First European Thermal Remediation of Crystalline Bedrock.** *N. Ploug, J. Holm, and S.G. Nielsen.*
Niels Ploug (Kruger A/S/Denmark)

* **Flux Mapping to Optimize Hydraulic Containment Systems in Bedrock Aquifers.** *M.K. Cobb, M.D. LeFrancois, and M.R. Schnobrich.*
Michael Cobb (Arcadis U.S., Inc./USA)

* **Fractured Bedrock Remediation: Multiple Pilot Test Program Produces Cost-Effective Site-Wide Remediation.** *B.S. Langan and J. Bennett.*
Bonani Langan (Wood/USA)

* **Geochemical and Microbiological Progress Metrics for Bioremediation of Mixed Chlorinated Ethenes and Methanes.** *B. Bond, M. Morris, L. Zeng, and S. Abrams.*
Bob Bond (Langan Engineering & Environmental Services, Inc./USA)

How Does Understanding Matrix Diffusion help to Remediate Fractured Bedrock Sites? *K. Johnson, J. Baldock, and K. Leahy.*
Kathryn Johnson (ERM/United Kingdom)

Implementing Complementary Remedies for Source and Distal Plume Areas of a Mixed Chlorinated Plume in a Fractured Shale Aquifer. *K. Kelly, B. Bond, S. Abrams, and L. Zeng.*
Kevin Kelly (Langan Engineering & Environmental Services, Inc./USA)

* **In Situ Remediation of a Fractured Sedimentary Bedrock Groundwater and Overburden Impacted with TCE through Organic Carbon and Soluble Iron Injections: Pilot-Scale and Full-Scale Results.** *K. Ramanand, T. Chaturgan, K.D. Dyson, and P. Randazzo.*
Karnam Ramanand (Brown and Caldwell/USA)

ITRC's Guidance for Characterization and Remediation of Fractured Bedrock: Part I Characterization. *M.B. Smith, R. Wymore, and N.A. Akladiss.*
Michael Smith (VT Dept Environmental Conservation/USA)

ITRC's Guidance for Characterization and Remediation of Fractured Bedrock: Part 2 Remediation. *R.A. Wymore, M.B. Smith, and N. Akladiss.*
Ryan Wymore (CDM Smith, Inc./USA)

* **Long-Term Strategies for Persulfate Injection into Fractured Rock.** *G.R. Carey and R. McGregor.*
Grant Carey (Porewater Solutions/Canada)

PCE and Daughter Remediation in Limestone Bedrock: Brownfields Redevelopment of a Former Tubing Manufacturing Facility. *R.W. Johnston and W.B. Brab.*
R. William Johnston (Linebach Funkhouser, Inc./USA)

* **Seeking Site Closure in Bedrock: In Situ Chemical Oxidation Strategy for Treatment of a TCE Plume in Fractured Bedrock.** *H. Nichols, E. Sterzinar, B. Blum, and S. Abrams.*
Howard Nichols (Langan Engineering & Environmental Services/USA)

Stimulating and Quantifying TCE Biodegradation in Multiple Fractured Bedrock Strata. *P.W. Hare, M.R. Harkness, R.E. Morse, P.A. Freyer, and J.M. Uruskyj.*
Paul Hare (OBG/USA)

Treatment of TCE to 30 Meters in Fractured Granite: How to Close a Site When You Cannot Drill and Sample the Rock. *G. Heron, S. Nielsen, A. Bonarrigo, A. Caravella, E. Pearson, and C. Serlin.*
Gorm Heron (TerraTherm, Inc./USA)

E3. Karst Aquifer Case Studies

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Stephen Rosansky (Battelle) and Keith White (ARCADIS U.S., Inc.)

* **After the Injections: Karst Remediation of PCE.** *K.E. Thompson.*
Karen E. Thompson (Smith Management Group/USA)

*** Characterization of Fate and Transport Processes and Contaminant Distribution in Karst Groundwater Systems.** *N.I. Torres, J. Toro, E. Rodriguez-Medina, and I.Y. Padilla.*

Norma I. Torres (University of Puerto Rico at Mayagüez/ USA)

The Detection of Deep Karst Features Using New Geophysical Technique “MERIT.” *D. Harro and H. Kiflu.*

David Harro (G3 Group/USA)

*** Karstic Terrain Hydrogeologic Characteristics Challenges to Protective Remedy Selection and Implementation.** *D.T. Heidlauf, B. Kennington, S. Popelar, and A. DeDolph.*

David Heidlauf (Ramboll Environ/USA)

*** Lesson Learned from Deep Soil Gas Profiles in a Fractured Aquifer at an Ammunition Factory in Israel.**

G. Reshef and N.Z. Dvory.

Guy Reshef (Israel Water Authority/Israel)

Long Distance Transport of TCE Vapors in a Cavernous Karst Area. *T. Aley, N. Keith, and S. Beeman.*

Shiloh Beeman (Ozark Underground Laboratory/USA)

*** Multiple Lines-of-Evidence Approach for Optimizing Operation of a TCE Remedial System in a Karstic Aquifer.** *P. Mugunthan, B.S. Kennington, A.E. DeDolph, and S. Tarmann.*

Pradeep Mugunthan (Ramboll Environ/USA)

*** Observations following 10 Years of Bioreactor Operations in a South-Central Texas Fractured Bedrock Aquifer.** *B. Dietert, J. MacQueen, K. Rice, J. Shirley, and G. Lyssy.*

Bradly Dietert (Parsons Corporation/USA)

*** Remediation of a Large Gasoline Spill in Bermuda’s Karst Terrane.** *K.A. White, R. Bastida, and J. Perella.*

Keith White (ARCADIS U.S., Inc./USA)

Successful Bioaugmentation for DNAPL Carbon Tetrachloride in a Karst Aquifer. *M.F. deFlaun, C.R. Elder, and R. Gross.*

Mary deFlaun (Geosyntec Consultants, Inc./USA)

Thermal Remediation of Karst Limestone at Redstone Arsenal, Alabama. *C. Crownover, L. Soos, C. Thomas, and S. Wilson.*

Lauren Soos (TRS Group, Inc./USA)

E4. Adaptive Site Management and Risk Management Strategies

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Rula Anselmo Deeb (Geosyntec Consultants) and Kathleen Stetser (GEI Consultants, Inc.)

*** An Adaptive Approach to Integrating RCRA Corrective Action with Facility Demolition.** *D. Marquez,*

M. Hildebrandt, C. Grant, and D. Barker.

Diana Marquez (Burns & McDonnell Engineering Company, Inc./USA)

Can Aquifer Quality at Complex Remediation Sites be Restored? *N. Grosso and G.P. Wealthall.*

Nancy Grosso (DuPont/USA)

*** Enhanced In Situ Biosparge Treatment of Toluene through Adaptive Design/Management.** *M.W. Killingstad and T.P. Hays.*

M.W. Killingstad and T.P. Hays.

Marc Killingstad (Arcadis/USA)

Integration of a Technical Impracticability Waiver and Groundwater Hydraulic Containment to Mitigate Risk at a Fractured Rock DNAPL Site. *P.E. Nangeroni,*

J.R. House, A. Martin, and D. Dinsmore.

Peter Nangeroni (Woodard & Curran/USA)

*** LEAN Approaches to the Remediation Process.**

J. Dalton.

Jason Dalton (Azimuth1/USA)

*** A New Approach to Managing LNAPL.**

T.R. Andrews and C. David.

Trevre Roys Andrews (CH2M/USA)

*** Optimizing an Adaptive Remedy in a Highly Heterogeneous Aquifer Using Modeling.** *P.P. Brussock,*

D.K. Burnell, and J. Xu.

Peter Brussock (The ELM Group, Inc./USA)

*** Regulatory Negotiations: Case Study for the Remedy Development and Selections to Treat Large Complex Groundwater Plumes.** *M.H. Schulman, L. McGlochlin,*

D.R. Griffiths, J. Schuetz, and K. Garon.

Michael Schulman (Parsons Engineering/USA)

Remediation Management of Complex Sites. *J.B. Price and C. Spreng.*

J.B. Price and C. Spreng.

John Price (State of Washington Department of Ecology/ USA)

The Use of Adaptive Management Approaches in Support of Remedial Design/Remedial Action at Two Superfund Sites. *R.A. Wymore, M. Lamar, N. Smith,*

N. Smith, T. Macbeth, K. Sorenson, M.B. Smith, and S. Garcia.

R.A. Wymore, M. Lamar, N. Smith, T. Macbeth, K. Sorenson, M.B. Smith, and S. Garcia.

Ryan Wymore (CDM Smith, Inc./USA)

E5. Large, Dilute and Commingled Plume Case Studies

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Kira Lynch (U.S. Environmental Protection Agency)
and Cathy Rockwell (Woodard & Curran)

* Case Study of the Biotreatment of a Dilute Chlorinated Solvent Plume in an Acidic Aerobic Aquifer.

M.L. Alexander and C.A. Motley.
Matthew Alexander (Texas A&M University-Kingsville/USA)

* Case Study: Biodegradation Potential Assessment at a Site Contaminated by a Chlorobenzene, BTEX, and Pharmaceuticals.

O. Lhotsky and T. Cajthaml.
Ondrej Lhotsky (DEKONTA a.s./Czech Republic)

* Distinguishing between Multiple Dry Cleaner Sources in a Commingled Chlorinated Solvent Groundwater Plume.

K.R. Robrock and P.M. Mesard.
Kristin Robrock (Exponent, Inc./USA)

* Enhanced Anaerobic Biodegradation of Trichloroethene and Hexahydro-1,3,5-trinitro-1,3,5-triazine in a Commingled Source Area Using Permeable Reactive Barriers and Groundwater Recirculation.

S. Eichelberger and C. Crane.
Shawn Eichelberger (HydroGeoLogic, Inc/USA)

Evaluation and Remediation of a Large Commingled Dilute VOC Plume in Western Ohio: A Case Study.

C.A. Cox.
Craig Cox (Cox-Colvin & Associates, Inc./USA)

* Evaluation of a Sustainable and Passive Approach to Treat Large, Dilute Chlorinated VOC Groundwater Plumes.

D.R. Lippincott, G.M. Lavorgna, R. Rezes, P.G. van Groos, J.F. Begley, and D.W. Ombalski.
David R. Lippincott (APTIM/USA)

* In Situ Chemical Reduction of Chlorinated Ethenes and its Effect on a Commingled Molybdenum Plume.

G. Van den Daele, R. Francioso, M. Perlmutter, B. Schroth, J. Day, and T. Keijzer.
Gerd Van den Daele (CH2M/Brazil)

* Integrated In-Well Air Stripping and In Situ Chemical Oxidation to Remediate a Large Dilute VOC Plume in a Deep Aquifer.

D. Fisher, D. Smallbeck, N. Chrisman, and S. Pearson.
Douglas Fisher (Wood/USA)

* Multiple Remediation Technologies and an Updated Conceptual Site Model to Treat a Large cVOC Plume.

R.E. Mayer, J. Koelsch, K. Chambers, and C. Lutz.
Robert Mayer (APTIM/USA)

* Optimizing Enhanced In Situ Bioremediation of Commingled Chlorinated Ethanes and Ethenes at Two Groundwater Remediation Sites.

L. Hellerich, T. Kalinowski, P. Gratton, F. Barajas, K. Ryan, C. Shuman, and S. Sharma.
Lucas Hellerich (AECOM/USA)

* = poster presentations

* Procedural Strategy for Management and Oversight of Commingled Plumes: A Regulatory Perspective.

A. Kuoch.
Alan Kuoch (State Water Resources Control Board/USA)

* Pump-and-Treat System at a Large Dilute Plume: Opportunities and Challenges for Drinking Water End Use.

J. Chambon, K. Craig, B. Petty, and J. Nyman.
Julie Chambon (Geosyntec Consultants/USA)

Remediation of a 3-Mile Hexavalent Chromium Plume in Hinkley, California.

I. Baker, B. Brunswick, and M. Gentile.
Iain Baker (Pacific Gas and Electric/USA)

San Fernando Valley Superfund Site: Case Study of a Regional Plume in Los Angeles County, California.

N. Clite and K. Manheimer.
Nova Clite (OTIE/USA)

* Simultaneous Degradation of Commingled Contaminants by a Microbially-Driven Fenton Reaction Operated in Fed-Batch and Flow-Through Reactor Configurations.

Y. Toporek, N. Xie, R. Sekar, M. Taillefert, and T.J. DiChristina.
Yael Toporek (Georgia Institute of Technology/USA)

* Site Characterization in Fractured Bedrock for Source Identification and Commingled Plume Evaluation.

E. Palko and J. Hochreiter.
Erin Palko (Integral Consulting Inc./USA)

* Stringfellow Superfund Site: Trichloroethene Revisited.

J.M. Finegan and L.V. Simmons.
James Finegan (Kleinfelder/USA)

Supplemental Investigation of Dilute and Diffuse Chlorinated Solvents in Groundwater: An Innovative Screening Approach.

N.E.F. Rohrbach, N. Payton, and J. Sohl.
Nick E.F. Rohrbach (GeoEngineers, Inc./USA)

* Technology Coupling for a Large TCE Plume Using a Subgrade Biogeochemical Reactor, Enhanced Phytoremediation, Biobarriers, and Enhanced Attenuation.

D. Berwick, J. Gamlin, G. Anderson, and L. Duke.
Douglas Berwick (CH2M HILL/USA)

Unmixing Dual Aquifer Commingled Plumes with a Bifurcated Tail and Two Distal Discharge Points.

B. Bond, E. Magee, and M. Morris.
Bob Bond (Langan Engineering & Environmental Services, Inc./USA)

* Untangling a Commingled Plume: A Case Study of Overcoming Challenging Site Conditions.

J. Brisman, C. Thomas, T. Geiger, and C. Elder.
Jared Brisman (Geosyntec Consultants, Inc./USA)

E6. Low-Permeability Zone Case Studies

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Bonani Langan (Wood) and
William Slack (FRx, Inc.)

* **Achieving Favorable Substrate Distribution in Layered, Low-Permeability Aquifers.** *G. Colgan, S. Smith, J. Wilde, K. Bradley, A. Castor, J. Cox, T. Isakson, M. Reynolds, and A. Dziechciarz.*
Gary Colgan (CH2M HILL/USA)

* **Biostimulation of a Vinyl Chloride Dissolved Plume at 35 m Deep in a Low-K Zone.** *R.C.M. Nobre, M.M.M. Nobre, and P.A. Pereira.*
Rosane Nobre (Federal University of Alagoas/Brazil)

* **Chlorinated Solvents in Tight Clay/Weathered Rock Reduced 98% in 17 Months at a Superfund Site.** *K. Casper, A. Moore, R. Moore, and O. Miller.*
Ryan Moore (Regenesis/USA)

A Comparative Analysis at Low and High pH Activation of Sodium Persulfate in Fractured Granitic Gneiss Aquifer. *J. Catanzarita, R. Srirangam, P. Tames, and W. Caldicott.*
Jeff Catanzarita (U.S. Environmental Protection Agency/USA)

* **Documentation of Remediation in the Source Zone in Low Permeable Soils Applying Amendment Technologies.** *B. Grosen, J.D. Jepsen, and T.H. Jorgensen.*
Bernt Grosen (COWI/Denmark)

DPT Jet Injection for Remediation of Low-Permeability Zones: Full-Scale Case Study Results from 3 Years of Treatment. *C.M. Ross, D. Eberle, N.D. Durant, W.W. Slack, D. Baird, T.H. Jørgensen, E.B. Weeth, and P. Johansen.*
Chapman Ross (Geosyntec Consultants/USA)

Electrical Resistance Heating Thermal Remediation in a Difficult Aquifer Matrix. *J. Byrd.*
Jennifer Byrd (ERM/USA)

* **Full-Scale Enhanced Anaerobic Bioremediation of Two Low Permeability Source Areas.** *H. Fariello, M. Sausville, M. Harkness, T. Antonoff, and D. Foti.*
Heather Fariello (Aptim Environmental & Infrastructure, Inc./USA)

* **In Situ Chemical Reduction of TCE Using Multiple Electron Donors in Low Permeability Subsurface Soils.** *V.S. Mankad, N.E. Smith, and D.P. Leigh.*
Vibhav Mankad (GHD/USA)

* **Long-Term Backdiffusion from Low Permeability Zone with Horizontal ISCO Permeable Barriers.** *H. Huang, J.M. Fenstermacher, D. Kistner, and J. Moreskog.*
He Huang (AECOM/USA)

Long-Term Soil Vapor Extraction (SVE) Monitoring and Effectiveness in Two Adjoining Low-Permeability Soil Horizons. *R. Plybon, M. Moes, D. Harbaugh, A. Ng, D. Sabba, and J. Argyres.*
Robert Plybon (EKI Environment & Water, Inc./USA)

* **A New Process for the In Situ Remediation of Aged Low-K DNAPL Source Zone by Enhanced Mobilization and Bioremediation.** *M. Petrangeli Papini, M. Majone, L. Pierro, F. Arjmand, M. Sagliaschi, S. Sucato, E. Alesi, E. Bartsch, S. Rossetti, and B. Maturro.*
Marco Petrangeli Papini (University of Rome "La Sapienza"/Italy)

Performance of Combined Biorecirculation and ZVI Emplacement Remedy for Chlorinated Solvent Source Treatment. *N.L. Smith, N.T. Smith, D. Nguyen, K.J. Waage, K. Saller, R.A. Wymore, K.S. Sorenson, S. Garcia, I. Bowen, G. Guest, and C. Kaiser.*
Neil Smith (CDM Smith, Inc./USA)

* **PHYTO-INTEGRATED™ Remediation System to Address CCl₄ Contaminated Groundwater in a Low-Permeability Aquifer.** *E.G. Gatliff, P.J. Linton, R.S. Rought, D.J. Riddle, and P.R. Thomas.*
Edward Gatliff (Applied Natural Science, Inc./USA)

* **Remediating 1,2-Dichloropropane Contaminated Groundwater in Low Permeability Media Using Micro-Scale ZVI and Organic Carbon Amendment.** *A. Leombruni, M. Mueller, and M. Sunseri.*
Mike Mueller (PeroxyChem, LLC/Austria)

Success Stories at Low-Permeability Sites: Field Demonstrations of Electrokinetic-Enhanced Amendment Delivery for In Situ Remediation. *J. Wang, E. Cox, D. Reynolds, D. Gent, and M. Singletary.*
James Wang (Geosyntec Consultants/USA)

Using Multiple Amendments and Delivery Methods to Treat Extensive PCE Impacts in Low-Permeability Soil and Bedrock Matrices. *T.A. Harp.*
Tom Harp (LT Environmental, Inc./USA)

E7. Cold Region Case Studies

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Darrell Moore (U.S. Army Corps of Engineers) and
Bruce Noble (AECOM)

* **A 24-Day Study to Test Methods and Assess Variability of Indoor Air Trichloroethene Concentrations Arising from Vapor Intrusion.** *W.D. Calicchio, D.M. Groher, and K.A. Malinowski.*
Wolfgang Calicchio (Wood/USA)

* **Deriving Cleanup Goals for Soil Gas for the Protection of Groundwater.** *G.P. Gordon and L.G. Cain.*
Glen Gordon (Wood/USA)

* **A Dynamic Three-Dimensional Conceptual Site Model for CRREL: Historical Overview and Environmental Issues at CRREL.** *R.R. Rustad, S.F. Calkin, and D. Moore.*
Rod Rustad (Wood/USA)

* **HAPSITE® GC/MS as an Investigation Tool for Characterizing Trichloroethene in Groundwater.**
J. Besse, W.D. Calicchio, and K.A. Malinowski.
Jack Besse (Wood/USA)

Monitoring of a Large Trichloroethene Soil Gas Plume: Prior to, during, and Post Soil Vapor Extraction Pilot Testing. *R.R. Rustad, W. Calicchio, G. Gordon, S.F. Calkin, and D.M. Groher.*
Rod Rustad (Wood/USA)

* **Optimizing Groundwater Contaminant Capture in a Variable, Semi-Confined Geologic Environment.**
R.R. Rustad, S.F. Calkin, and D.M. Groher.
Rod Rustad (Wood/USA)

River Sub-Bottom Characterization of a Legacy Trichloroethene Release and Relationship to Bedrock Groundwater Contamination. *S.F. Calkin, P.T. Thompson, R.R. Rustad, and K.J. Heim.*
Scott Calkin (Wood/USA)

A Room-by-Room Study of Trichloroethene Exposure Point Concentration Variation: TO-15 Summa versus HAPSITE® Data. *A.R. Quintin, M.J. Murphy, and L.G. Cain.*
Amy Quintin (Wood/USA)

* **Soil Vapor Extraction Pilot Test Effects on Sub-Slab Depressurization Influent TCE Concentrations.**
R.T. Belcher, W. Calicchio, G. Gordon, and D.M. Groher.
Ryan Belcher (Wood/USA)

Trichloroethene-Contaminated Soil Gas as a Source of Groundwater Contamination in a Deep Vadose Zone Environment. *G.P. Gordon, S.F. Calkin, D.A. Moore, and D.M. Groher.*
Glen Gordon (Wood/USA)

E8. Surface Water/Groundwater Interactions

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Felicia Barnett (U.S. EPA) and
Jennifer Segura (U.S. Navy)

Contaminant Mass Discharge in an Aquifer Influenced by an Estuary. *P.C. Negrao, R.W. Cleary, and S. Pereira.*
Paulo Negrao (State University of Campinas - Unicamp/ Brazil)

* **Fluorescent Dyes Used for Characterization of the Interaction and Mixing between Groundwater Plumes and Surface Water.** *N. Larsson, G. Lilbaek, B.A. Hunner, A. Storgaard, F. Nilsson, A.G. Christensen, U. Winnberg, K. Forsberg, and T. Aley.*
Anders Christensen (NIRAS A/S/Denmark)

* = poster presentations

* **How Influential Site Drainage Can Affect Groundwater Flow and Plume Migration.** *J. Oakeshott and S. MacKay.*
Jane Oakeshott (ERM/United Kingdom)

* **Hydraulic Barrier and Physical Barrier Construction for River Protection.** *R.O. Coelho and V.V. Sewaybricker.*
Rodrigo Coelho (GEOKLOCK/Brazil)

* **Impact of Land Development on the Stability of a TCE Plume.** *D. Taege and P. Roelen.*
Piper Roelen (Landau Associates, Inc./USA)

Improving Dissolved Organic Chemical Concentration Measurements at Groundwater/Surface-Water Interfaces Containing NAPL. *M.J. Gefell, D. Vlassopoulos, M. Kanematsu, and D. Lipson.*
Michael Gefell (Anchor QEA, LLC/USA)

* **Keeping the Balance: Understanding and Protecting Baseflow in a Brook Adjacent to a Pump-and-Treat Remedy.** *M.A. Apfelbaum, C.M. Rockwell, B.L. Gregory, and P.E. Nangeroni.*
Michael Apfelbaum (Woodard & Curran/USA)

Multiscale Geophysical, Geochemical, and Thermal Investigation of Groundwater/Surface Water Interaction in a Highly Regulated River System. *T.C. Johnson, J.N. Thomle, J. Stegen, C. Strickland, and V. Vermeul.*
Tim Johnson (Pacific Northwest National Laboratory/USA)

New Approaches for Direct Measurement of Contaminated Groundwater Discharge to Receiving Surface Water. *F. Cosme, A. Holloway, K. Ye, K. De Greene, S. Lamontagne, J. Stening, J. Tyler, B. Dietman, and S. Brouyere.*
Frederic Cosme (Golder Associates Pty Ltd/Australia)

* **Numerical Modeling Simulation of the Impact of Source Controls on Site Recovery in Dead-End Tidal Waterbodies.** *S. Gbondo-Tugbawa, S. McDonald, C.C. Pranh, K. Takagi, T. Hasegawa, N. Kim, S. Ertman, and R. Weissbard.*
Solomon Gbondo-Tugbawa (Louis Berger/USA)

* **Using Two Mass Flux Methods to Evaluate Areas of TCE Discharge to a Creek.** *D. Taege, P. Roelen, and J. Ninteman.*
Piper Roelen (Landau Associates, Inc./USA)

E9. Landfill Redevelopment and Management

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Christopher Glenn (Langan Engineering) and
Rubens Spina (GEOKLOCK)

Application of HPT/EC Tools for Assessment of the Distribution of Permeability in Excavation and Drawdown Target Area. *V.V. Sewaybricker and R. Spina.*
Victor Vanin Sewaybricker (GEOKLOCK/Brazil)

Case Study of the On-Site Remediation of a Former Industrial Landfill from the Chlorine Industry.

M. Broquaire, P-Y. Klein, and J-D. Vilomet.

Mathias Broquaire (Solvay/France)

*** Dewatering a CCP Landfill with a Horizontal Well.**

M. Lubrecht and R. Baeten.

Michael Lubrecht (Directed Technologies Drilling, Inc./USA)

*** Hybrid Landfill Gas Mitigation System Implementation.**

O. Uppal, N. Najib, S. Abrams, H. Nichols, I. Khan, V. Yarina, and R. Simon.

Omer Uppal (Langan Engineering & Environmental Services, Inc./USA)

*** In Situ Chemical Oxidation for Remediation of Chlorinated Ethanes in a Former Municipal Landfill.**

M.T. Becker, S. Sharma, and A. Patel.

Mark Becker (AECOM Technical Services/USA)

Innovative Design Approach for Mitigating Landfill Gas: A Landfill Post-Closure Mixed-Use Development Case Study.

O. Uppal, M. Ambrusch, N. Najib, A. Falabella, J. Ludlow, C. Glenn, S. Abrams, I. Khan, G. Corcoran, and M. Fredlund.

Omer Uppal (Langan Engineering & Environmental Services, Inc./USA)

Modifying an Existing Sub-Slab Methane Mitigation System at a Redeveloped Landfill Site after Years of Settlement.

J. Schaettle, C. Glenn, and J.F. Ludlow.

Jessica Schaettle (Langan Engineering & Environmental Services Inc./USA)

*** Remediation Using In Situ Solidification/Stabilization in Brazil of a Contaminated Source at an Industrial Landfill with Various Reagents.**

I. Peter, T. Moran, and M. Crimi.

Isabel Peter (Brasfond/Brazil)

*** When Elegant Solutions Fail: Deep Geomembrane Barrier for Long-Term Containment at a Landfill.**

A. Wilson and E. Schwartz.

Amy Wilson (TRC/USA)

E10. Radiological Issues

Platforms Thursday I Posters (*) Wednesday Evening
Chairs: Melanie Kito (U.S. Navy) and
Bruce Marvin (Geosyntec Consultants, Inc.)

*** Addressing Radiological Concerns and Awareness of Differences to Traditional Programs.**

K. Sykes, K. Smallwood, and N.M. Berliner.

Nicholas M. Berliner (CH2M HILL/USA)

*** Chitinous Biomass-Mediated Precipitation of Uranium: The Dual Role of Hydroxylammonium Acetate.**

C.S. Griggs and S.L. Larson.

Chris S. Griggs (U.S. Army Engineer Research and Development Center/USA)

Field Test of Vapor-Phase Ammonia Injection for Vadose Zone Remediation of Uranium.

M. Truex, C. Strickland, J. Szecsody, G. Chronister, and P. Baynes.

Michael Truex (Pacific Northwest National Laboratory/USA)

*** Implementing Field-Scale Remediation Technologies for Uranium and Tetrachloroethylene in Soil and Groundwater.**

C.S. Morie.

Scott Morie (Nuclear Fuel Services, Inc./USA)

*** Influence of Calcium Carbonate Chemistry on Inorganic Contaminant Natural Attenuation and Secondary Sources.**

N. Qafoku, A. Lawter, J. Szecsody, M. Snyder, and M. Truex.

Michael Truex (Pacific Northwest National Laboratory/USA)

Site Characterization and Remedial Design for Surface Impoundments Containing Technologically-Enhanced, Naturally-Occurring Radioactive Material (TENORM).

J. Wallace, P. Zawislanski, C. Jones, and T. Ikenberry.

Jeff Wallace (Terraphase Engineering Inc./USA)

Understanding Uranium Plume Persistence Processes at a Former Uranium Mill Tailings Area through the Use of Laboratory and Field Methods.

R.H. Johnson, P.W. Reimus, R. Bush, and W. Frazier.

Raymond H. Johnson (Navarro Research and Engineering, Inc./USA)

*** Uranium Plume Persistence at U.S. Department of Energy UMTRCA Sites.**

A. Ranalli, R.H. Johnson, and R. Bush.

Anthony Ranalli (Navarro Research and Engineering, Inc./USA)

F1. Natural Source Zone Depletion

Platforms Monday I Posters (*) Monday Evening
Chairs: Parisa Jourabchi (Golder Associates, Ltd.) and
Derek Tomlinson (GEI Consultants, Inc.)

*** Assessing NSZD for Creosote DNAPLs.**

J. Smith, B. Koons, R. Holm, R. Sillan, S. Gaito, and G. Jeffries.

Jonathon Smith (AECOM/USA)

Comparing Natural Source Zone Depletion in the Vadose and Saturated Zones at a Fuel Release Site.

D. Mackay, C. Paradis, R. Schmidt, H. Zhang, T. Buscheck, and N. Sihota.

Douglas Mackay (University of California, Davis/USA)

*** A Comprehensive Mass Balance Approach to Quantify Subsurface Natural Losses and Optimize Remediation System Operation.**

J. Fitzgibbons and T. Palaia.

Jeff Fitzgibbons (CH2M HILL/USA)

*** Computational Methods for Transforming LNAPL Site Temperature Data to NSZD Rates.**

K. Karimi Askarani, J. Ham, and T. Sale.

Kayvan Karimi Askarani (Colorado State University/USA)

*** Development of a Protocol for Carbon Dioxide Efflux Measurements Using Dynamic Closed Chamber for NSZD Estimates.** *P. Jourabchi, A. Wozney, I. Hers, and H. Hopkins.*
Parisa Jourabchi (Golder Associates, Ltd./Canada)

*** Estimates of Hydrocarbon NAPL Depletion from Compositional Change over Time.** *G.E. DeVuall and I. Rhodes.*
George DeVuall (Shell Global Solutions/USA)

Hydrologic Controls on Losses of Individual Components of Crude Oil. *B.A. Bekins, W.N. Herkelrath, M.J. Baedecker, R.P. Eganhouse, I.M. Cozzarelli, and G.-H.C. Ng.*
Barbara Bekins (U.S. Geological Survey/USA)

Integrating Theory and Practice to Better Understand and Apply NSZD at Field Sites. *S. Garg, C.J. Newell, P.R. Kulkarni, and D.C. King.*
Sanjay Garg (Shell Global Solutions (US) Inc./USA)

Multi-Year Natural Source Zone Depletion Measurements at a Large Industrial Site. *N. Sihota, B. McAlexander, M. Lyverse, and K.U. Mayer.*
Natasha Sihota (Chevron Energy Technology Company/USA)

Natural Source Zone Depletion (NSZD) Investigation at a Paved Former Service Station Site in Spain. *R.E. Sweeney, G.T. Ririe, A. Sayas, M. Marti, B. Beuthe, and L. Barreales.*
Robert Sweeney (E&P Geochemistry/USA)

Natural Source Zone Depletion of Waste Oil Residuals and Other Constituents at a Superfund Mega Site. *P.P. Brussock, H. Martin, T. Loper, J. Loper, and D. Tomlinson.*
Peter Brussock (The ELM Group, Inc./USA)

*** Natural Source Zone Depletion Rates Based on Analysis of Empirical Soil-Gas Data.** *M.A. Lahvis.*
Matthew Lahvis (Shell Global Solutions/USA)

New Developments in Thermal Monitoring Methods for Continuous NSZD Measurement: Application at an LNAPL Site. *P.R. Kulkarni, K.L. Walker, D.C. King, G.P. Marquardt, C.J. Newell, T. Sale, K.K. Askarani, H. Hopkins, M.W. Malander, L. Smalley, and J.H. Higinbotham.*
Poonam Kulkarni (GSI Environmental, Inc./USA)

NSZD State of the Practice. *T. Sale.*
Tom Sale (Colorado State University/USA)

*** The Potential for Natural Source Zone Depletion of Petroleum Hydrocarbons in Tropical Environments.** *T. Simpkin, T. Palaia, M. Gatan, A. Lee, and J. Zimbron.*
Tom Simpkin (CH2M HILL/USA)

*** Relationship between NSZD and Ambient Temperature, Precipitation, and Groundwater Elevation at a Former Petroleum Refinery.** *B. McAlexander and N. Sihota.*
Ben McAlexander (Trihydro Corporation/USA)

Temperature Effects on Petroleum NSZD Processes: Lessons from Coupled Heat Transfer and Heat Generation Modeling. *J. Zimbron, J. DiMarzio, and G. Silco.*
Julio Zimbron (E-Flux/USA)

*** Temporal and Spatial Variability in NSZD Rate Measurements.** *K. Piontek, T. Sale, K.K. Askarani, and E.D. Emerson.*
Keith Piontek (TRC Environmental Corporation/USA)

*** Using Dynamic Flux Chambers to Estimate the Natural Attenuation Rates in the Subsurface at Contaminated Sites.** *R. Baciocchi, I. Verginelli, and R. Pecoraro.*
Renato Baciocchi (University of Rome Tor Vergata/Italy)

**Panel Discussion—Tuesday, Track F
Natural Source Zone Depletion (NSZD):
Treatment Train Engine or Caboose?**

Moderator

Derek Tomlinson (GEI Consultants, Inc.)

Panelists

Barbara Bekins (USGS)

Justin Meredith (Tennessee DEC)

Sanjay Garg (Shell Oil Company)

Natasha Sihota (Chevron Corporation)

Thomas Sale (Colorado State University)

Julio Zimbron (E-Flux)

Natural source zone depletion (NSZD) is a term used to describe the collective, naturally occurring processes of dissolution, volatilization, and biodegradation that result in mass losses of light non-aqueous phase liquid (LNAPL) petroleum hydrocarbon constituents from the subsurface. NSZD is coming to the forefront of decision making at LNAPL remediation sites because much higher source attenuation rates are now being measured due to increased understanding of the degradation pathways including direct LNAPL degradation via methanogenesis, and quantification of biodegradation rates of dissolved- and vapor-phases accounting for mass losses measured in the range of 300 to 7,700 gallons/acre/year.

NSZD of LNAPL sources is occurring from point of release to the end (hence the 'Engine') within both porous and fractured media. NSZD is only called a remedy when we begin to monitor or quantify, which is very similar to the Natural Attenuation (NA) and Monitored Natural Attenuation (MNA) arc for groundwater. For petroleum releases, NSZD like NA is occurring once petroleum hydrocarbons are introduced into the subsurface, and it becomes a remedy when NSZD is monitored/quantified to address the remediation of the remaining residual and nuisance mobile LNAPL with time (hence the 'Caboose').

Each panelist will provide a talk giving their thoughts on NSZD. A series of questions from the moderator for the panelists to answer will be part of the panel followed by an open microphone session for Q&A.

F2. In Situ Remediation of Petroleum Hydrocarbons

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Robert Elliott (Remediation Products, Inc.) and Sanjay Garg (Shell Global Solutions, Inc.)

* **Application of Poly Remediation Technologies for Petroleum-Contaminated Sites.** *C.-K. Yen, C.-C. Kao, and C.-H. Cheng.*

Chen-Kai Yen (Sinotech Environmental Technology, Ltd./Taiwan)

* **Benzene Degradation under Anaerobic Conditions: Using Treatability Studies and Molecular Tools to Provide Insights.** *S. Dworatzek, J. Webb, K. Bradshaw, F. Luo, N. Bawa, S. Guo, and E. Edwards.*

Sandra Dworatzek (SiREM/Canada)

* **Biosparging in a Confined Aquifer Using Chimneys as Subsurface Bioreactors at a BTEX Site in Wyoming.**

J.D. Hartley, I. Sutton, and G. Ng.

Jim Hartley (CH2M HILL/USA)

A Bioventing System Destroys Multimillions of Pounds of Petroleum Hydrocarbons: An Inquiry into the Mass Removal Mechanisms. *V. Gamez Grijalva, T. Palaia, R. Frank, and R. Hinchee.*

R. Frank, and R. Hinchee.

Victor Gamez Grijalva (CH2M HILL/USA)

* **Case Study: Low-Cost In Situ Remediation on Oil-Contaminated Soil.** *S. Svanstrom, J. Bergman, and S. Haller.*

S. Haller.

Say Svanstrom (RGS Nordic AB/Sweden)

Enhanced In Situ Bioremediation at a Former Refinery Site due to Recycling of Aerosol Sulfate in the Groundwater Fluctuation Zone. *R.E. Sweeney and G.T. Ririe.*

G.T. Ririe.

Robert Sweeney (E&P Geochemistry/USA)

Field Applications of Bioelectrochemical Technology for Treating Petroleum Hydrocarbon Contaminants.

S. Jin, P.H. Fallgren, and Z.J. Ren.

Song Jin (University of Wyoming/USA)

Heuristic Numerical Modeling Study of LNAPL

Depletion under Natural Conditions. *P. Jourabchi, I. Hers, A. Kirkman, K.U. Mayer, and J. Wilson.*

A. Kirkman, K.U. Mayer, and J. Wilson.

Parisa Jourabchi (Golder Associates, Ltd./Canada)

An Innovative Air Sparging Approach for Treatment of BTEX and VOCs. *M. Ambrusch, S. Ciambuschini, O. Uppal, N. Najib, A. Quinn, and S. Abrams.*

O. Uppal, N. Najib, A. Quinn, and S. Abrams.

Matthew Ambrusch (Langan Engineering & Environmental Services/USA)

* **Microbial Recovery after Eutrophic Conditions during Biostimulation at Hydrocarbon-Impacted Sites.**

L.M. Moehlman, S.D. Siciliano, K. Bradshaw, and T.J. Carlson.

T.J. Carlson.

Lisa Moehlman (University of Saskatchewan/Canada)

* **Monitoring of Air Injection Remediation Systems Using Carbon Dioxide Efflux Measurements.** *T. Palaia, J. Fitzgibbons, D. Downey, R. Hinchee, and J. Zimbron.*

J. Fitzgibbons, D. Downey, R. Hinchee, and J. Zimbron.

Tom Palaia (CH2M HILL/USA)

* **Passive Hydrocarbon Remediation in a Foreshore Marine Environment.** *C. Boys, M. Lyverse, M. Sutherland, R. Magaw, M. Gill, R. Horwath, R. Kannappan, C. Ott, and J. Malick.*

R. Magaw, M. Gill, R. Horwath, R. Kannappan, C. Ott, and J. Malick.

Ram Kannappan (AECOM/USA)

* **Permeable Reactive Pavement for Controlling the Transport of Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) Contaminants.** *S. Huang and C. Liang.*

S. Huang and C. Liang.

Shengyi Huang (National Chung Hsing University/Taiwan)

* **Reclamation of a TPH-Impacted Site via LNAPL Recovery and ISCO Treatment: Case Field, Italy.**

C. Sandrone, A. Campi, F. Accorsi, and J. Mueller.

Jim Mueller (Provectus Environmental Products, Inc./USA)

Remediation of Hydrocarbon-Contaminated Sites Using High Frequency Investigation/Sampling as Design Tool: Scandinavian Approach. *G.G. Ceriani.*

G.G. Ceriani.

Gabriele Giorgio Ceriani (Ejlskov A/S/Denmark)

Shoreline Remediation of Petroleum Hydrocarbons Using an Oleophilic Biobarrier for Sheen Control on the Portland Harbor Superfund Site. *S. Martin, K. Sheets, and J. Gentry.*

S. Martin, K. Sheets, and J. Gentry.

J. Gentry.

Jeff Gentry (CH2M HILL/USA)

* **Soil Excavation and Bioremediation Using ORC® and Organic Fertilizer at a Tidally-Influenced Site.**

H. Benfield, C. Ferrell, R. Brenner, and S. Sadrpour.

Heather Benfield (Tetra Tech, Inc./USA)

Thermal Modeling of Natural Source Zone Depletion and Temperature-Enhanced Biodegradation. *I. Hers, P. Jourabchi, and H. Hopkins.*

I. Hers, P. Jourabchi, and H. Hopkins.

Ian Hers (Golder Associates Ltd./Canada)

* **Vacuum Driven In-Well Stripping and Recirculation, Comparative Evaluation of Two Pilot Studies.**

M. Pehlivan.

Mehmet Pehlivan (Bays Environmental Remediation

Management/USA)

F3. LNAPL Recovery/Remediation Technology Transitions

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: David De Courcy Bower (ERM) and Harley Hopkins (Exxon Mobil Corporation)

* **Application of a Horizontal Well for Optimized Light Nonaqueous Phase Liquid Recovery.** *A. Kerr and M. Poltorak.*

A. Kerr and M. Poltorak.

Nicole Longinotti (Stantec/USA)

Comparison of Laser-Induced Fluorescence Profiles following a Decade of LNAPL Recovery. *C. Shen, P. Stumpf, R. Kannappan, J. Lentini, and S. Ganna.*
Peter Stumpf (Aecom/USA)

*** Comparison of UVOST-CPT Profiling, LNAPL Transmissivity Testing, and Skimming Recovery and Implications for Plume Management.** *J. Studer, P. Parmentier, and N. Irish.*
James Studer (InfraSUR, LLC/USA)

Evaluating LNAPL Mobility and Transmissivity: A Route to Case Closure. *S. Drummond and M.J. Zenker.*
Sharon Drummond (AECOM/USA)

LNAPL Recovery and Remedy Transitions: A Case Study at a Railyard Fueling Facility. *J. Coughlin, A. Pennington, and D. Gabardi.*
Jeremy Coughlin (Canadian Pacific/USA)

LNAPL Transmissivity, NSZD and Incidental Bioventing Characterization for Evaluation of an LNAPL Recovery Program. *B.L. McAlexander, K. Tomita, and S. Hunt.*
Ben McAlexander (Trihydro Corporation/USA)

*** Optimization of Large-Scale LNAPL Recovery Operations Using a Graphical Analysis Tool.** *C. Shen, P. Stumpf, R. Kannappan, J. Lentini, and S. Ganna.*
Cynthia Shen (AECOM/USA)

Remedial Optimization: Transitioning from Physical LNAPL Removal to Enhanced Biological Degradation to Natural Depletion. *T. Miller, B. Carreon, and Y. Chuang.*
Todd Miller (Kennedy/Jenks Consultants/USA)

Soil Vapor Extraction Using Horizontal Remediation Wells and Condensation Treatment to Recover Chlorinated and Petroleum NAPLs. *V. Hosangadi, C. Winell, and P. Chang.*
Grant Geckeler (GEO/USA)

F4. Remediation of Heavy Hydrocarbons

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Matthew Alexander (Texas A&M University-Kingsville) and
Schaun Smith (Chevron)

An Adaptation of Standard Mobility Tests for DNAPL. *T. Andrews and L. Tseng.*
Trevre Roys Andrews (CH2M/USA)

Enhancement of Oily Sludge Biodegradation in Historic Refinery Wastewater Lagoons. *M.L. Alexander, O. Ruvalcaba, and J. Walker.*
Matthew Alexander (Texas A&M University-Kingsville/USA)

*** In Situ Smoldering Combustion (STAR): Challenges, Limitations, and Methods Developed to Maximize Remedial Performance.** *G.P. Grant, G. Scholes, D. Major, J.I. Gerhard, and J. Brown.*
Gavin Grant (Savron/Canada)

*** Remediation of Fuel Oil No. 6 LNAPL at a Challenging Site in New Jersey.** *T. Geiger, W. Caldicott, P. Kakarla, M. Temple, K. O'Neal, S. Sacco, and D. Riddle.*
Tom Geiger (Geosyntec/USA)

STARx™ (Ex Situ Smoldering) for the Treatment of Contaminated Soils and Liquid Organic Wastes: Results from a Full-Scale Application. *G. Scholes, G.P. Grant, D.W. Major, C. Murray, G.P. Sabadell, D. Thomas, and J. Dominguez.*
Grant Scholes (Savron/Canada)

*** STARx™ (Ex Situ Smoldering): Field Pilot Test in Kaohsiung, Taiwan to Treat Base Oil-Impacted Soils.** *L. Kinsman, G. Scholes, G. Grant, D. Major, L. Lin, J. Fang, J. Chen, and D. Chiang.*
Laura Kinsman (Savron/Canada)

*** STARx™ (Ex Situ Smoldering) for the Treatment of Contaminated Soils and Liquid Organic Wastes: Prototype Testing and Optimization.** *J.I. Gerhard, G. Scholes, R. Solinger, G.P. Grant, D. Major, C. Murray, G.P. Sabadell, D. Thomas, and J. Gabayet.*
Jason Gerhard (University of Western Ontario/Canada)

Surprising Efficacy of “Sipping” Heavy DNAPL without Disturbing Formations, Using Low-Flow, Above-Grade Piston Pumps. *M. Bertane.*
Mark Bertane (Blackhawk Technology/USA)

F5. MGPs

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Michael Gefell (Anchor QEA, LLC) and
Bernard Kueper (Queen's University)

*** Chemical Fixation of Contaminated Soil from a Gasworks Site.** *D. Alden, G. Birk, and R. Stewart.*
David Alden (Tersus Environmental, LLC/USA)

*** Coal Tar Recovery from Former Manufactured Gas Plant Sites Using Single-Phase Microemulsion.** *P. Sharma, S.S. Palayangoda, and K. Kostarelos.*
Pushpesh Sharma (University of Houston/USA)

*** Enhancing the EPRI Generic Work Plan to Assess Dense Nonaqueous Phase Liquid Mobility in the Subsurface at Manufactured Gas Plant Sites.** *D.W. Tomlinson, J.M. Hawthorne, L.A. Reyenga, G.R. Brubaker, J.A. Clock, and D.V. Nakles.*
Derek Tomlinson (GEI Consultants, Inc./USA)

Field-Scale Evaluation of Aerobic Bio-Oxidation to Deplete Groundwater Contaminants from Coal Tar and Creosote. *R.K. Sillan.*

Randall Sillan (AECOM/USA)

Full-Scale Treatment of Coal Tar Lagoons with In Situ Smoldering: Successful Field Stories and Lessons Learned.

J.E. Vidumsky, M. McMaster, L. Jo, L. deVlaming, D. Liefel, and A. Sims.

John Vidumsky (DuPont/USA)

*** High-Resolution Mobile NAPL Interval Identification and Transmissivity Calculations for DNAPL.** *L. Reyenga,*

J.M. Hawthorne, and D. Tomlinson.

Lisa Reyenga (GEI Consultants, Inc./USA)

In Situ Gasworks Remediation: Challenges and Innovations. *W. Caldicott, P. Kakarla, M. Temple, T. Eilber, B. Kay, and T. O'Callaghan.*

Will Caldicott (In-Situ Oxidative Technologies [ISOTEC]/USA)

*** In Situ Solidification in Glacial Till Stratigraphy.**

E. Beckwith and M. Ostrowski.

Eleanor Beckwith (Brown and Caldwell/USA)

*** ISS Treatability Study on MGP Pond Sludge.**

T.A. Jordan.

Tommy Jordan (KEMRON Environmental Services, Inc./USA)

*** Multiple In Situ Technology Pilot Tests for Gas Work DNAPL and LNAPL Groundwater Contamination.**

J. Bergman, H. Nord, and M. Sundesten.

Jonny Bergman (RGS 90 Sverige AB/Sweden)

NAPL Migration and Plume Geometry at Former Manufactured Gas Plant Sites Controlled by the Depositional Environment of Site Stratigraphy.

C.P. Plank, G. McLinn, and R. Cramer.

Colin Plank (Burns & McDonnell/USA)

Selection of In Situ Stabilization Target Areas for NAPL-Impacted Sediment Remediation. *J. Gentry,*

A.J. Salter-Blanc, J. Hess, and C.D. Tsiamis.

Jeff Gentry (CH2M HILL/USA)

Thermal Remediation of Creosote-Impacted Sand: Treatability Testing during Heating and Post-Heating Dissolution. *B.N. Hicknell, K.G. Mumford, and*

B.H. Kueper.

Kevin G. Mumford (Queen's University/Canada)

*** Treatment of Polycyclic Aromatic Hydrocarbons in Groundwater from a Former MGP Site to the Parts per Trillion Level for Discharge into Lake Superior.**

M.R. Schowengerdt, R. Onderko, B. Symons, B. Hanks, and B. Bell.

Matthew Schowengerdt (Foth Infrastructure and Environment/USA)

F6. TPH Risk Assessment and Metabolites

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Robert Scofield (GSI Environmental, Inc.) and Dawn A. Zemo (Zemo & Associates)

*** An Alternative Hypothesis of the Nature of Dissolved Organic Carbon in Groundwater at Petroleum Release Sites.** *K. O'Reilly, S. Ahn, A. Tiwary, D. Zemo, R. Mohler, R. Magaw, and C. Espino Devine.*

Kirk O'Reilly (Exponent, Inc./USA)

*** Approaches to Evaluate Ecological Risk from Polar Petroleum Degradation Metabolites in Groundwater at Mature Petroleum Sites.** *P. Zawislanski, A. Chakrabarti, and W.L. Carson.*

Peter Zawislanski (Terraphase Engineering Inc./USA)

*** Composition of Extractable Organics in Groundwater at Biodegrading Crude Oil Release Sites.** *R. Mohler, C. Espino Devine, R. Magaw, N. Sihota, K. O'Reilly, S. Ahn, A. Tiwary, and D. Zemo.*

Rachel E. Mohler (Chevron Energy Technology Company/USA)

*** Current State of Cleanup Levels and Approaches for Petroleum-Contaminated Sites.** *M. Pattanayek, R. Thun, and R. Scofield.*

Mala Pattanayek (Integral Consulting Inc./USA)

An Empirical Ecological Risk Assessment at a Mature Bay Margin Petroleum Site Focused on Polar Degradation Metabolites. *A. Chakrabarti, P. Zawislanski, W.L. Carson, and J. Cotsifas.*

Arnab Chakrabarti (Terraphase Engineering/USA)

Insight into the Composition and Structure of Petroleum Metabolites Not Identified by Standard Methods of Analysis. *D.C. Podgorski, P. Zito, D.F. Smith, X. Cao, K. Schmidt-Rohr, S. Wagner, A. Stubbins, J.T. McGuire, D. Martinovic-Weigelt, G.R. Aiken, I.M. Cozzarelli, R.G.M. Spencer, and B.A. Bekins.*

David C. Podgorski (University of New Orleans/USA)

Lifecycle of Extractable Organics in Groundwater at Biodegrading Fuel Release Sites. *D. Zemo, K. O'Reilly, S. Ahn, A. Tiwary, R. Mohler, R. Magaw, and C. Espino Devine.*

Dawn A. Zemo (Zemo & Associates/USA)

*** Petroleum Metabolites: Friends or Foes?**

U. Hellmann-Blumberg and R. Steenson.

Uta Hellmann-Blumberg (CalEPA Department of Toxic Substances Control/USA)

Potential Human and Aquatic Toxicity of Petroleum Biodegradation Metabolites in Groundwater at Fuel Release Sites. *R. Magaw, R. Mohler, C. Espino Devine, A. Tiwary, K. O'Reilly, S. Ahn, and D. Zemo.*

Rena Magaw (Chevron/USA)

Regulatory Challenges Posed by Petroleum Metabolites in Groundwater. *R. Steenson, D. Elias, and U. Hellmann-Blumberg.*

Ross Steenson (CalEPA Regional Water Quality Control Board/USA)

State of the Practice: Risk Assessment and Management of Metabolites and Degradation Products from Total Petroleum Hydrocarbons. *R. Scofield and T. Hoang.*

Robert Scofield (GSI Environmental, Inc./USA)

*** Toxicity Assessment of Groundwater Contaminated by Petroleum Hydrocarbons at a Well-Characterized, Aged, Crude-Oil Release Site.** *D. Martinovic-Weigelt, J.T. McGuire, H.N. Link, I.M. Cozzarelli, and B.A. Bekins.*
Isabelle Cozzarelli (US Geologic Survey/USA)

*** Update on ITRC's Guidance on TPH Risk Evaluation at Petroleum-Contaminated Sites.** *T. Booze, R. Thun, and M. Kwiecinski.*
Roy Thun (GHD/USA)

F7. Environmental Considerations for Hydraulic Fracturing/Shale Gas Production

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Isabelle Cozzarelli (US Geologic Survey) and Doug Spicuzza (Woodard & Curran)

Alarming Differences in Commercial Data: Two Studies Illustrating the Challenges in Using Methane Data for Regulatory Reporting. *D. Gratson, R. Vitale, S. Brower, and L. Work.*

David Gratson (Environmental Standards, Inc./USA)

*** Assessing Engineering Risk from Unconventional Oil and Gas Wells.** *D.J. Soeder.*

Daniel J. Soeder (South Dakota School of Mines & Technology/USA)

*** Challenges in the Measurement of Dissolved Gases in Water Samples from Shale Plays.** *K. Bagawandoss.*

Kesavalu Bagawandoss (TestAmerica Laboratories, Inc./USA)

*** Diagnosis of Wellbore Integrity Defects with Sustained Casing Pressure Testing: Environmental Implications for Shale Gas Well Life Cycle.** *J.R. Sminchak and M. Place.*

Joel R. Sminchak (Battelle/USA)

Geochemical and Microbiological Indicators of Oil and Gas Wastewater Releases. *I.M. Cozzarelli, D.M. Akob, K.J. Skalak, A.C. Mumford, W.H. Orem, K.B. Haase, M.A. Engle, and D.B. Kent.*

Isabelle Cozzarelli (US Geologic Survey/USA)

*** Improving Dissolved Hydrocarbon Gas Analysis in Water.** *M.L. Bruce.*

Mark Bruce (TestAmerica/USA)

New API Industry Standards for Shale Development.

G. Bengé, D. Miller, S. Meadows, and R. Goodman.
Glen Bengé (Benge Consulting/USA)

A Summary of the U.S. Environmental Protection Agency Multi-Year Study of the Contamination Risks to Drinking Water from Hydraulic Fracturing.

S. Dunn-Norman, W. Hufford, and S. Almond.
Walter Hufford (REPSOL/USA)

F8. Managing/Remediating Petroleum Impacts at Fractured Bedrock Sites

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Duane Guilfoil (AST Environmental, Inc.) and Ryan Wymore (CDM Smith, Inc.)

Can Soil Vapor Extraction be Effective in LNAPL-Impacted Fractured Bedrock Environments? Lessons from Selected Case Studies. *S.D. Mohr and E. Soumillion.*

Samuel Mohr (Environmental Resources Management/South Africa)

Characterization and In Situ Remediation in a Complex Fracture-Flow Regime. *D.N. Cantrell, W.B. Brab, R.J. Hutchinson, and J.G. Wingfield.*

Doug Cantrell (State of Tennessee/USA)

*** Compartmentalized Approach to Bedrock and Overburden Remediation at a Legacy Petroleum Site.**

B. Morrow and N. Thacker.
Brandt Morrow (AECOM/USA)

High-Resolution Characterization of an Aged Toluene Source Zone and Plume in a Dolostone Aquifer.

B.L. Parker, J. Fernandes, S.W. Chapman, C. Maldaner, P. Wanner, K. Dunfield, R. Aravena, E. Haack, and D. Tsao.
Beth L. Parker (University of Guelph/Canada)

*** In Situ Injections for Remediation of a Former Gas Station.** *T. Sorrells and M. Critchley.*

Tree Sorrells (Alpine Remediation, Inc./USA)

Pilot Testing of Multi-Phase Extraction Technology for Full-Scale Remediation of a High-Concentration MTBE Source Area. *M. Poltorak and D. Collins.*

Matthew R. Poltorak (Stantec Consulting Services Inc./USA)

Pilot-Scale ISCO Remediation Using Base-Activated Persulfate in a Fractured Dolostone Aquifer Contaminated by Mid-Distillate LNAPL. *J. Halstead and J. Leu.*

John Halstead (Parsons Canada Ltd./Canada)

*** Quantification of LNAPL Transmissivity in Fractured Porous Media.** *L. Reyenga, J.M. Hawthorne, A. Elder,*

D.M. Walker, H. Hopkins, and M. Malander.
Lisa Reyenga (GEI Consultants, Inc./USA)

G1. Vapor Intrusion Risk Assessment and Site Management

Platforms Monday I Posters (*) Monday Evening
Chairs: Loren Lund (CH2M) and
David Tsao (BP Corporation North America, Inc.)

* **Applications of the Navy Quantitative Decision Framework at Military Buildings.** *C. Holton, L. Lund, C. Lutes, and R. MacLure.*
Chase Holton (CH2M HILL/USA)

* **Carbon Dioxide Vapor Intrusion of Landfill Gas to Parcel Houses.** *K.M. Kristensen, A.G. Christensen, and M. Sonne.*
Katrine Moes Kristensen (NIRAS A/S/Denmark)

Developing a Quantitative Decision Framework for Residential Vapor Intrusion Evaluations. *C. Lutes, L. Lund, K. Hallberg, C. Holton, D. Caldwell, and E. Corl.*
Loren Lund (CH2M/USA)

* **Evaluating Vapor Intrusion Risk and Deciding When Risk Management is Recommended: A Standardized Approach for California Cleanup Sites.** *N. Fry, R. Steenson, C. Prowell, C. Sorrentino, D. Gallagher, B. Renzi, K. Kramer, and S. McMasters.*
Nicole Fry (San Francisco Regional Water Quality Control Board/USA)

* **Hydrocarbon Background Levels in Denmark: Indoor and Outdoor Air.** *P. Loll, P. Novrup, and B. Hvidberg.*
Per Loll (DMR A/S/Denmark)

* **Modeling of Source to Building Exclusion Distances at Petroleum-Contaminated Sites.** *I. Verginelli and R. Baciocchi.*
Iason Verginelli (University of Rome Tor Vergata/Italy)

* **The New Subsurface Intrusion Pathway in the CERCLA Hazard Ranking System (HRS): Impacts on Site Management Strategies.** *C. Holton, L. Lund, and C. Lutes.*
Chase Holton (CH2M HILL/USA)

Quantifiable Lines of Evidence for Chemical Vapor Intrusion. *C. Holton, H. Schuver, C. Lutes, J. Kurtz, and R. Truesdale.*
Henry Schuver (U.S. EPA/USA)

* **A Review of Current TCE Short-Term Indoor Air Standards.** *L.J. Trozzolo.*
Laura J. Trozzolo (TRC/USA)

* **Summary of State Approaches to Vapor Intrusion: 2018 Update.** *B. Eklund, L. Beckley, and R. Rago.*
Bart Eklund (AECOM/USA)

Supporting Stakeholders through Vapor Intrusion Response Actions in a Large Active Military Manufacturing Building. *K.J. Campbell, T.N. Creamer, and D. Caldwell.*

Karen J. Campbell (Naval Facilities Engineering Command Southeast/USA)

* **Trichloroethylene (TCE) Emerging Issues and Vapor Intrusion Rapid Action.** *J. Lowe, L. Lund, and C. Lutes.*
Loren Lund (CH2M/USA)

Vapor Intrusion at Former Manufactured Gas Plants: Do the Petroleum Hydrocarbon Site Exclusion Criteria Apply? *A.J. Christensen and D.Y. Marquez.*
Aaron Christensen (Burns & McDonnell Engineering Company, Inc./USA)

G2. Vapor Intrusion Mitigation and Effectiveness

Platforms Monday I Posters (*) Monday Evening
Chairs: Pamela Chang (Battelle) and
Thomas Szocinski (Land Science)

Automated Continuous Vapor Intrusion Monitoring and Response for Evaluating Mitigation and Remediation Effectiveness. *M. Kram, B. Hartman, and C. Frescura.*
Mark Kram (Groundswell Technologies, Inc./USA)

* **Building Survey, Indoor Source Identification, and Vapor Mitigation Lessons Learned at a Superfund Site.** *M. Patil, J.D. Graber, and D.C. Shipman.*
Mukta Patil (Langan Engineering and Environmental Services, Inc./USA)

* **Challenges in Design and Operation of a Sub-Slab Depressurization System at an Occupied, 150-Year Old Former Mill Building.** *L.J. Campe, P. Nangeroni, R. McGrath, A. Roche, and B. Aigler.*
Peter Nangeroni (Woodard & Curran/USA)

Cyclical SVE for VI Mitigation of High-Strength Soil Gas VOCs at an Active Military Building, Naval Air Station North Island. *V. Hosangadi, R. Mennis, P.L. Chang, and M. Pound.*
Michael Pound (U.S. Navy/USA)

* **From Vapor Intrusion to Mitigation: A Status Review of the Current Practice.** *M. Ambrusch, S. Ciambuschini, B. Blum, O. Uppal, N. Najib, A. Falabella, and S. Abrams.*
Matthew Ambrusch (Langan Engineering & Environmental Services/USA)

* **In Flux: A Case Study of Transition from Active to Passive Sub-Slab Depressurization Systems for Vapor Intrusion Sites.** *L. Campe and P. Nangeroni.*
Peter Nangeroni (Woodard & Curran/USA)

Mitigation of PCE-Impacted Soil beneath Former Dry Cleaner: Full-Scale Design and Mitigation Based on Sub-Slab Vapor Mitigation Pilot Test Data. *R.J. Roth and A.J. Sufulko.*
Robert Roth (Terracon/USA)

* **Mitigation of Petroleum Vapor Intrusion Using Low-Flow Air Injection.** *P. Michalski and S. Thompson.*
Paul Michalski (212 Environmental Consulting, LLC/USA)

Optimizing VI Mitigation Design and Performance: A Case Study. *M. Radford, L. Lund, K. Hallberg, D. Cleland, and B. Beck.*
Maggie Radford (CH2M/USA)

* **Performance of SVE Systems in Preventing VI: Multisite Comparison.** *K. Hallberg, C. Lutes, J. Minchak, R. Truesdale, B. Schumacher, J. Zimmerman, R. Connell, B. Stewart, J. De Loera, and J. Narusawa.*
Keri E. Hallberg (CH2M HILL/USA)

* **Strategy Used to Avoid Design and Construction of Active Methane Mitigation Systems.** *M. Patil, S. Reinis, and J. Ludlow.*
Mukta Patil (Langan Engineering and Environmental Services, Inc./USA)

* **Strategy Used to Distinguish between Potential Vapor Intrusion, Indoor Sources, or Building Systems Malfunction.** *S. Reinis, H. Farr, J. Schaettle, and J.F. Ludlow.*
Sigrida Reinis (Langan Engineering & Environmental Services/USA)

Successful Rapid Response Mitigation of a High-Strength Vapor Plume Underneath a Large, Active Navy Building. *M. Pound, L. Goode, N. Durant, P. Chang, and V. Hosangadi.*
Lisa Goode (Geosyntec Consultants Inc./USA)

* **Trichloroethylene Removal from an Active Cooling System at the Main Laboratory Building Located at Cold Regions Research Engineering Laboratory, Hanover, New Hampshire.** *N. Schofield, M. Oliva, and M. Cicales.*
Neil Schofield (Sovereign Consulting Inc/USA)

* **Vapor Intrusion and Air Cleaners: A Review of Field Performance Data: Application Selection Methods and Research Needs.** *K. Hallberg, C. Lutes, R. Truesdale, K. Owen, and B. Schumacher.*
Keri E. Hallberg (CH2M HILL/USA)

* **A Vapor Intrusion Mitigation Site's Follies and Lessons Learned.** *J.R. Dickson and C.F. Winkeljohn.*
James Dickson (CTI and Associates, Inc./USA)

* **Vapor Intrusion Mitigation Using HVAC System Engineering Controls: Performance and Reliability Demonstration.** *D. Shea and B. Green.*
David Shea (Sanborn, Head & Associates, Inc./USA)

* **Variable Slot Spacing in Vapor Collection Piping for Sub-Slab Vapor Mitigation Systems to Affect Equal Distribution of Sub-Slab Vacuum and Zone of Influence Vapor Removal.** *R.J. Roth and A.J. Sufulko.*
Robert Roth (Terracon/USA)

* **Vertical Shaft Excavation to Remove Contaminated Soil with Passive Vent Tube Backfill Completion.** *F.W. Blickle and T. Kinney.*
Frederick Blickle (GHD/USA)

G3. Vapor Intrusion Preferential Pathways

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Thomas McHugh (GSI Environmental, Inc.) and Michael Meyer (Battelle)

Analysis of TCE Vapor Distribution in Utility Corridors above a Dissolved Plume and Spatial Correlation with Residential Vapor Intrusion Impacts. *Y. Guo, P. Dahlen, and P.C. Johnson.*
Yuanming Guo (Arizona State University/USA)

The Autobahn of Vapor Intrusion Migration: Pathway Evaluation from a Sole Source-Impacted Subsurface Sewer. *A.P. Friedrich and A. Wallace.*
Aaron Friedrich (ERM/USA)

Flow Dynamics in Sewer Systems and Potentials on VI Preferential Pathways. *T.V. Bote, B.N. Hoffmark, L. Nissen, K.B. Mortensen, K.R. Thygesen, H. Nielsen, K.D. Raun, and S.R. Pedersen.*
Tage Bote (COWI A/S/Denmark)

* **Geospatial Screening Method to Identify Sewer Gas Inhalation Exposure Risks near Hazardous Waste Sites.** *E.J. Willett and K.G. Pennell.*
Evan Willett (University of Kentucky/USA)

* **Indoor Air Problems Caused by Chlorinated Solvents Spreading through Public Sewer Systems.** *K.B. Nielsen and K. Rüegg.*
Karin Birn Nielsen (Central Denmark Region/Denmark)

* **New Insights Into Exposure through Preferential Pathway Vapor Migration.** *M. Hamilton, C. McFall, and G. Randall.*
Megan Hamilton (EnviroForensics, LLC/USA)

Prevalence and Extent of cVOC Contamination in Sanitary Sewers due to Groundwater Contamination in the San Francisco Bay Area. *B. Richman, K. Pennell, M. Armen, G. Skulason, A. Vitouchkine, C.R. Viteri, and A.E. Miller.*
Anthony Miller (Entanglement Technologies, Inc./USA)

* **Sewer Preferential Pathway Vapor Intrusion: Fake News or the New Normal?** *L. Beckley and T. McHugh.*
Lila Beckley (GSI Environmental, Inc./USA)

Sewer Ventilation as a VI Mitigation Alternative: Case Studies. *K. Hallberg, L. Lund, J. High, Q. Bingham, D. Cleland, and M. Roginske.*
Keri E. Hallberg (CH2M HILL/USA)

Sewers as a Preferential VI Pathway: Dynamic Measurements and Quantitative Risk Assessments. *P. Loll, P. Larsen, C. Larsen, H. Nielsen, K.D. Raun, K.R. Thygesen, and K.B. Mortensen.*
Per Loll (DMR A/S/Denmark)

*** Using Real-Time Data to Evaluate the Sewer Gas to Indoor Air Pathway.** *A.P. Friedrich and A. Wallace.*
Aaron Friedrich (ERM/USA)

*** Vapor Transport through Sewer Systems: Mechanisms and Variables.** *M. Roghani and K.G. Pennell.*
Mohammadyousef Roghani (University of Kentucky/USA)

G4. Advances in Vapor Intrusion Investigations

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Donna Caldwell (U.S. Navy) and Nadine Weinberg (ERM)

*** Approaches to Consider the Influence of Building Infiltration and Ventilation on Vapor Intrusion Exposure Risks.** *E. Shirazi and K.G. Pennell.*
Elham Shirazi (University of Kentucky/USA)

*** Automated Continuous Real-Time Vapor Intrusion Monitoring and Response: Preventing Acute Exposures.** *M. Kram, B. Hartman, and C. Frescura.*
Mark Kram (Groundswell Technologies, Inc./USA)

Compound-Specific Isotope Analysis Used to Identify the Origin of VOCs in the Indoor Environment: Internal Sources versus Subsurface Contamination. *M. Wahid, I. Damgaard, I.H. Kerrn-Jespersen, N. Tuxen, T.H. Larsen, and T.S. Jepsen.*
Trine Skov Jepsen (Orbicon/Denmark)

Continuous Indoor Air Sampling to Understand Variable Concentrations of Trichloroethene in a Complex Industrial Facility. *P. Fahey, C.F. Silver, and B. Hartman.*
Pamela O'Reilly Fahey (CDM Smith/USA)

Effects of Remediation and Background Indoor Air Sources on Indoor Air in a Commercial Facility. *N.M. Weinberg, E. Hoffman, and J. Campbell.*
Nadine Weinberg (ERM/USA)

*** Evaluation of Soil Vapor Extraction Data to Characterize Mass Flux to the Vapor Intrusion Boundary.** *L. Stewart, R.S. Truesdale, C. Lutes, B. Schumacher, and J. Zimmerman.*
Lloyd Stewart (Praxis Environmental Technologies, Inc./USA)

A Field Study to Validate a Newly Developed Flow Controller Used to Monitor Vapor Intrusion. *B.D. Stone, A. Rossner, M. Crimi, M. Carroll, and J. Miceli.*
Benjamin David Stone (Clarkson University/USA)

*** Measuring Trace Level VOCs in High Concentration Soil Gas Matrices: A New Tool to Meet Risk-Based Screening Levels.** *H.C. Hayes and D. Benton.*
Heidi Hayes (Eurofins Air Toxics/USA)

*** Multiple Lines of Evidence, Including CSIA, to Differentiate an Indoor Source from Vapor Intrusion.** *S. Dergham, C. Serlin, D. Rowe, and B. Hartman.*
Safaa Dergham (Ramboll Environ Corporation/USA)

Optimizing Vapor Intrusion Response Actions in a Large Active Military Manufacturing Building. *T.N. Creamer, K.J. Campbell, and D. Caldwell.*
Todd Creamer (Geosyntec Consultants/USA)

Tree Sampling as a Screening Tool for Vapor Intrusion Potential to Protect Human Health. *J.L. Wilson, M.A. Limmer, V.A. Samaranayake, J.G. Schumacher, and J.G. Burken.*
Jordan Wilson (U.S. Geological Survey and Missouri University of Science and Technology/USA)

*** Using Field Observations to Determine Equilibration Times and Purge Volume Removal for Soil Vapor Sampling.** *A.K. Haar and S.E. Jones.*
Angela K. Haar (Jones Environmental, Inc./USA)

*** Using Real-Time Analytical Methods and Passive Air Samplers to Evaluate Indoor Air Sources.** *C.E. Regan, A.P. Friedrich, and J.T. Hancock.*
Catherine Regan (ERM/USA)

*** Vapor Intrusion Snapshot of Updates.** *T.R. Walker and D. Caldwell.*
Teresie Walker (NAFVA Atlantic/USA)

G5. Advances in Technology Transfer

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Carmen Lebron (Consulting Engineer) and Andrea Leeson (SERDP/ESTCP)

ENVIRO.wiki: Your Environmental Information Gateway. *A. Stenger and R.C. Borden.*
Allison Stenger (Draper Aden Associates/USA)

Evaluating Tech Transfer Challenges and Successes: The XRF Case Study. *J. Costanza, D. Crumbling, L. Fiedler, E. Gilbert, and C. Pachon.*
Carlos Pachon (U.S. Environmental Protection Agency/USA)

Improving the Effectiveness of Technology Transfer Programs: Lessons Learned from SERDP/ESTCP Webinar Program. *R.A. Deeb, J. Nyman, and A. Leeson.*
Rula Anselmo Deeb (Geosyntec Consultants/USA)

Innovative Technology Transfer Approach for a Background Soil Study in Puerto Rico. *J. Aviles, D. Cuevas, D. Cutt, M. Maddaloni, K. Mishkin, C. Nace, R. Seda, and R. Wilkin.*
Diana Cutt (U.S. Environmental Protection Agency/USA)

Key Factors in the Successful Commercialization of Three High-Resolution Site Characterization (HRSC) Technologies. *M. Einarson.*
Murray Einarson (Haley & Aldrich, Inc./USA)

* **The National Network of Danish Test Sites for Development of Environmental Technology.** *H. Milter, N.D. Overheu, and S.R. Petersen.*
Hasse Milter (Region Zealand/Denmark)

NAVFAC's Technology Transfer and Outreach Programs for Environmental Restoration: Sharing Technology Trends and Leveraging Feedback.
T. Meyers, W. Condit, K. Neil, and D.K. Nair.
Tara Meyers (U.S. Navy/USA)

* **SERDP and ESTCP's Effective Diversified Informational Tools Used to Reach Out to DoD Remedial Program Managers.** *C.A. Lebron, A. Leeson, H. Stroo, and M. Xavier.*
Carmen Lebron (Consulting Engineer/USA)

Technology Transfer for Molecular Biological Tools (MBTs) and their Role in Stakeholder Communications.
D. Taggart, A. Biernacki, and B.R. Baldwin.
Dora Taggart (Microbial Insights, Inc./US)

Lunch & Learn—Wednesday, Track G

ITRC Lunch & Learn

Patricia Reyes (ITRC Director)
Aiyana Bodi (ITRC Project Associate)
Claudio Sorrentino (California EPA)
Erik Gessert
(Colorado DLE Division of Oil and Public Safety)
Ginny Yingling (Minnesota Department of Health)
Bob Mueller
(New Jersey Department of Environmental Protection)
Carl Spreng
(Colorado Department of Public Health and Environment)
John Price III (Washington Department of Ecology)
Michael B. Smith
(Vermont Department of Environmental Protection)
Naji Akladiss
(Maine Department of Environmental Protection)
Harold Templin
(Indiana Department of Environmental Management)

The ITRC Lunch & Learn will include presentations from ITRC staff and technical teams. The Interstate Technology & Regulatory Council (ITRC) is a state-led coalition working with the federal government, private sector, and public stakeholders to reduce barriers to the use of innovative air, water, waste, and remedial environmental technologies and practices. ITRC produces guidance documents and trainings that broaden and deepen technical knowledge, all while protecting human health and the environment. With over 900 members from all 50 states, the District of Columbia, and Puerto Rico, ITRC is imperative for implementing national consensus regarding environmental technologies and approaches.

Panel Discussion—Wednesday, Track G

Accelerating the Use of Innovative Technologies: What is the Role of Pilot Testing, Demonstration, Verification, and Certification?

Moderator

Amy Dindal (Battelle)

Panelists

Richard Stewart (Ziltek)
Jim Cummings (U.S. EPA)
John Neate (VerifiGlobal)

There are a variety of opportunities for developers to evaluate the performance of their technologies. The purpose of this panel is to discuss various options for evaluating the performance of new and emerging technologies, along with the need to develop clear metrics and/or lines of evidence for remedy success. The panel will share applicable best practices from the environmental restoration field, as well as from other industries in testing, verifying, and certifying new technologies. Approaches include self-funded or client-funded pilot tests, end user-driven/funded demonstrations (e.g., ESTCP), reviews by credible third-parties (e.g., US EPA Environmental Technology Verification (ETV) Program), evaluation following international standards (e.g., ISO 14034:2016 which specifies principles, procedures and requirements for ETV), or certification for compliance or approval for use. Why and how a technology developer utilizes one or more of the described approaches depends upon the technology maturation level, the availability/applicability of standards, fields of use, available funding, benefits/return on investment to the prospective users, and most critically, stakeholder information needs. The panel will define and discuss the different types of evaluations and key lines of evidence for evaluating technology performance. The role that these approaches may play in accelerating the use of innovative technologies will be discussed.

G6. Stakeholder Success Stories and Risk Communication

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Amy Dindal (Battelle) and Patricia Reyes
(Interstate Technology and
Regulatory Council/ECOS)

Communicating Risk to Achieve Successful Environmental Restoration: Reshaping LNAPL Management Policies by Better Defining Risk.

R. Chapman and E. Gessert.

Erik Gessert (Colorado Department of Labor and Employment/USA)

Doing a Good Job Is Not Enough: You Need to Let People Know.

C. Sorrentino and V.M. Hanley.

Claudio Sorrentino (California Department of Toxic Substances Control/USA)

Implementing Groundwater Strategy: Visualizing and Communicating the Priorities through GIS.

H. Sckerl and B. Bisgaard.

Halfdan Sckerl (Central Denmark Region/Denmark)

A National PFAS Investigation Program in Australia: Sense-Making and Risk Communication Challenges.

M. Bruce, L. McLeod, and A. Mitchell.

Andrew Mitchell (Department of Defence/Australia)

*** Proactive Stakeholder Engagement to Support Decision Making and Path forward in the Field of Site Remediation: A Case Study.**

F. Beaudoin, S. Hains, F. Gauthier, and C. David.

Francois Beaudoin (Golder Associates/Canada)

*** Risk Communication in the Execution of an Environmental Recovery Project in a Residential Area with Historical Conflicts of Interest.**

V.V. Sewaybricker and R.O. Coelho.

Victor Vanin Sewaybricker (GEOKLOCK/Brazil)

State-Level Risk Communication of Waterborne Contaminants: Per- and Polyfluoroalkyl Substances and Harmful Algal Blooms.

A.L. Bodi and S.G. Longworth.

Aiyana Bodi (Environmental Council of the States/USA)

*** Turning Contaminated Properties into Profit: A Regulatory Perspective.**

A.N. Amini.

A. Nick Amini (California Regional Water Quality Control Board/USA)

G7. Decision Analysis Tools for Environmental Restoration Applications

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Paul Favara (CH2M HILL) and
David Reynolds (Geosyntec Consultants)

Cognitive Tool to Support Remediation Technology Selection.

M. Paquet.

Marc Paquet (WikiNet/Canada)

*** Design Optimization of Environmental Contamination Projects Using Massively Parallel Simulation and Optimization Solution Methods.**

L.M. Deschaine.

Larry Deschaine (HydroGeoLogic, Inc./USA)

*** An Interactive Training System for Reduction in Cost and Complexity of Remediation and Long-Term Management of Contaminated Sites.**

D. Reynolds, S. Mancini, J. Rosen, M. Kavanaugh, B. Kueper,

K. Mumford, J. Kaupp, and S. Bryck.

David Reynolds (Geosyntec Consultants/Canada)

*** Remediation of DNAPL-Impacted Sites Using Enhanced In Situ Bioremediation: Experience-Based Remediation Using Virtual Data Set.**

B.H. Kueper,

K.G. Mumford, S. Bryck, D.A. Reynolds, S. Mancini,

D. Major, and M.C. Kavanaugh.

Bernard Kueper (Queen's University/Canada)

A Stochastic Modeling Approach to Evaluate the Value of Additional Information for Site Characterization and Remediation.

J.B.H. Rayner, C. Crea, D.A. Reynolds, and M.C. Kavanaugh.

James Rayner (Geosyntec Consultants/Canada)

A Survey of Decision Support Tools for Comparing Cleanup Options and Increasing Decision-Making Confidence.

P.J. Favara.

Paul Favara (CH2M HILL/USA)

Virtual Site Investigation: Using Perfect Information to Evaluate Strategies for Conceptual Site Model Development at DNAPL Sites.

K.G. Mumford,

B.H. Kueper, S. Bryck, D.A. Reynolds, D.W. Major,

S. Mancini, M.C. Kavanaugh, and P.K. Kitanidis.

Kevin G. Mumford (Queen's University/Canada)

G8. Precipitation and Stabilization of Metals

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Roger L. Olsen (CDM Smith) and
Matt Yovich (Woodard & Curran)

* **Capping of Marine Sediments with Valuable Industrial Byproducts: Evaluation of Inorganic Pollutants Immobilization.**

M. Taneez, C. Hurel, and P. Francour.
Mehwish Taneez (International Islamic University/Pakistan)

First Ever Heavy Metal Stabilization Project in Korea.

H. Shan, J. Lee, J. Lee, S. Kim, H. Kim, J. Seo, W. Joo, and W. Kang.
Huifeng Shan (PeroxyChem, LLC/China)

Geochemical Stabilization of Nickel in Groundwater: Full-Scale Implementation and Adaptive Design.

E. Williams-Carter, M. McCaughey, P. Jin, L. Luo, and J. McLaughlin.
Erika L. Williams Carter (ARCADIS U.S., Inc./USA)

* **In Situ Remediation of a Barium-Contaminated Site with Drainage Trenches and Effluent Recirculation.**

M.M.M. Nobre, R.C.M. Nobre, and P.A. Pereira.
Manoel Nobre (Maia Nobre Engenharia/Brazil)

* **Managing Leachable Arsenic for Sustainable On-Site Retention.**

J. Fox and R. Stewart.
Richard Stewart (Ziltek Pty., Ltd./Australia)

Precipitating Success: A Solution to Heavy Metals in Groundwater.

J. McDonough, R. Royer, G. Sitomer, and R. Murphy.
Jeff McDonough (ARCADIS/USA)

Removal of Selenium from Refinery Wastewater Using Sulfur-Modified Iron (SMI).

C.G. Schreier and P.F. Santina.
Cindy Schreier (PRIMA Environmental, Inc./USA)

* **Selenium Attenuation via Naturally-Induced Reductive Precipitation in the Southeast Idaho Phosphate Patch.**

M.B. Hay, G. Leone, D. Silverman, and B. Wilking.
Michael Hay (Arcadis U.S., Inc./USA)

Sustainable In Situ Remediation Approach for Arsenic-Impacted Groundwater at a Superfund Site in New Jersey.

T. North, L. Sehayek, R. Wilkin, H. Young, and D. Cutt.
Tricia North (U.S. Army Corps of Engineers/USA)

* **The Transport and Fate of Arsenic-Loaded Nano Zero-Valent Iron in Subsurface Systems under Various Geochemical Conditions.**

I.M.C. Lo, W. Zhang, Z. Yu, D. Lin, and L. Hu.
Irene M.C. Lo (The Hong Kong University of Science & Technology/China)

* **Understanding Geochemical Effects on Mercury Speciation, Stability, and Potential Remedial Strategies.**

M. Sapanara, K. Kinsella, M. Mobile, and A. Ricciardelli.
Maryann Sapanara (GZA GeoEnvironmental, Inc./USA)

G9. Managing Chromium-Contaminated Sites

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Daniel Leigh (PeroxyChem, LLC) and
Kim Prestbo (U.S. Environmental Protection Agency)

* **Chemical Reduction and Stabilization via Shallow Soil Mixing to Treat CrVI and Lead in Soil in Barranquilla, Colombia.**

K. Morris, C. Hernandez, R. Silva, D. Sanchez, J. Henderson, and P. Barreto.
Kevin Morris (ERM/USA)

Evaluation of Stored Reducing Capacity to Optimize Operations and Maintenance for In Situ Biological Treatment of Cr(VI) in Groundwater.

M. Gentile, I. Wood, L. Weigt, and F. Lenzo.
Margaret Gentile (Arcadis/USA)

* **Geochemical Fixation of Hexavalent Chromium Site Resulting in Expedited Remediation and Significant Reduction in Liability and Cost Savings.**

P.J. Palko, D.L. Schnell, and J. Gorin.
Peter Palko (Panther Technologies, Inc./USA)

* **Hexavalent Chromium Reduction in a Biocathodic Microbial Electrolysis Cell.**

G. Beretta, A. Mastorgio, S. Saponaro, and E. Sezenna.
Gabriele Beretta (Politecnico di Milano/Italy)

Implementing a Rapid Response Action during a Remedial Design Phase to Protect an at-Risk Municipal Wellfield.

J. Catanzarita, J. Gorin, L. Pype, F. Tsang, and J. Bolduc.
Jeff Catanzarita (U.S. Environmental Protection Agency/USA)

In Situ Chemical Reduction of Hexavalent Chromium in Groundwater at an Industrial Site near Athens, Greece.

R.L. Olsen, O. Henseler, D.D. Nguyen, and M.R. Lamar.
Roger L. Olsen (CDM Smith/USA)

Injection of pH-Adjusted Calcium Polysulfide to Treat Groundwater Plume Commingled with Cr(VI) and TCE.

J. Leu, M. Bettahar, J. Goepel, S. Craig, and T.E. Yargeau.
Jim Leu (Parsons/USA)

* **Innovative ISCR Remediation of Hexavalent Chromium-Impacted Groundwater in a Challenging Subsurface.**

M.A. Apfelbaum, C.M. Rockwell, and D.R. MacDonald.
Michael Apfelbaum (Woodard & Curran/USA)

* **Keys to Successful In Situ Chemical Reduction (ISCR) of Hexavalent Chromium and Concomitant Geochemical Fixation of Associated Heavy Metals and Metalloids.**

J.V. Rouse, R. Christensen, and A. Parra De Jesudian.
Jim V. Rouse (Acuity Environmental Solutions/USA)

*** Multi-Phase, Large-Scale Implementation of Recirculation Systems to Remediate Hexavalent Chromium-Contaminated Groundwater Using Calcium Polysulfide (CaSx).** *Y. Kunukcu, N. Rabah, and J. Oliva.*
Yasemin Kunukcu (TRC Companies, Inc./USA)

Remediation of Hexavalent Chromium in a Permanganate-Treated Plume: Comparative Evaluation of Five Reducing Agents. *P. Kakarla, Y. Chin, A. Hackman, and M. Wilson.*
Prasad Kakarla (In-Situ Oxidative Technologies [ISOTEC]/USA)

A Review of Chemical Treatment Methods for Soil and Groundwater Containing Arsenic and Chromium.
A. Seech, D. Leigh, and J. Molin.
Alan Seech (PeroxyChem, LLC/USA)

*** Use of a Deep Horizontal Injection Well for In Situ Hexavalent Chromium Groundwater Plume Treatment: Applications and Lessons Learned.** *A.N. Mason, P. Rosewicz, V. Murt, J. Gorin, L. Pype, and F. Tsang.*
Angela Mason (US Army Corps of Engineers/USA)

*** Well Rehabilitation and Sitewide Adaptive Management for In Situ Treatment of Hexavalent Chromium in Groundwater in Hinkley, California.**
J. Erickson and B. Prowd.
Jay Erickson (Arcadis/USA)

H1. Groundwater Modeling Advancements

Platforms Monday | Posters (*) Monday Evening
Chairs: Ronald Falta (Clemson University) and Sorab Panday (GSI Environmental)

An Analytical Modeling Framework for Matrix Diffusion in Multi-Layered Systems. *J. Thompson and E. Tollefsrud.*
Jay Thompson (Geosyntec Consultants, Inc./USA)

*** Application of Hydrogeochemical Modeling Tools (PHREEQC/PHT3D) for Study of an Environmental Remediation Site.** *V.V. Sewaybricker and R.O. Coelho.*
Victor Vanin Sewaybricker (GEOKLOCK/Brazil)

*** Application of Numerical Modeling for Optimization of Groundwater Remediation Methods of the Site Contaminated with Organic Compounds on the Example of Old Gasworks in Bydgoszcz (Poland).**
E. Kret and M. Czop.
Ewa Kret (AGH University of Science and Technology/Poland)

Characterization of the Microbially-Driven Fenton Degradation of Chlorinated Compounds Using a Modeling Approach. *M. Taillefert, N. Xie, Y. Toporek, R. Sekar, and T.J. DiChrs.*
Martial Taillefert (Georgia Institute of Technology/USA)

The Combination of Matrix Diffusion and Abiotic Decay Makes Two Slow Natural Attenuation Processes a Dynamic Duo. *K.J. Quinn, S. Sellwood, and D. Hay.*
Kenneth J. Quinn (TRC Companies, Inc./USA)

Comparing Simulation with Field Data to Enhance Modeling Accuracy. *M.E.J. McGee and B.C.W. McGee.*
Meghan E.J. McGee (McMillan-McGee Corp/Canada)

*** An Improved Simulation Method Using the Dual-Domain Formulation: Mass Transfer versus Mass Transfer Rate.** *S.T. Potter, M.P. Kladias, M.W. Killingstad, J. Wang, and K. Ashfaque.*
Michael Kladias (Arcadis/USA)

*** Matrix Diffusion Modeling: Handling Heterogeneity.**
S.K. Farhat, C.J. Newell, R.W. Falta, and K. Lynch.
Shahla K. Farhat (GSI Environmental, Inc./USA)

MODALL: A Tool for Effective Design and Operation of DGR™ Systems to Advance Plume Restoration.
M.W. Killingstad, S.T. Potter, and M.P. Kladias.
Marc Killingstad (Arcadis/USA)

*** Modeling Approaches to Assess Upward DNAPL Migration Potential in Shallow Sediments to Support Remedy Design.** *J.B.H. Rayner, G.P. Wealthall, D.A. Reynolds, K.D. Pennell, D.W. Himmelheber, H.L. Cumberland, and J.F. Beech.*
James Rayner (Geosyntec Consultants/Canada)

Modeling LNAPL Source Zone Depletion at a Former Xylene Processing Facility (Germany). *G.R. Carey.*
Grant Carey (Porewater Solutions/Canada)

*** MTBE: An Innovative Remedial Strategy for an Old Contaminant of Concern.** *O. Uppal, M. Ambrusch, A. Kerr, J. McMains, and S. Abrams.*
Omer Uppal (Langan Engineering & Environmental Services, Inc./USA)

*** Novel 3-D Modeling Approach for Sites with Complex, Well-Characterized Geology.** *M. Sellwood, J. Barros, A. Wilson, E. Schwartz, J.P. Kimball, and L. Hovey.*
Mike Sellwood (TRC Companies, Inc./USA)

*** Numerical Groundwater Modeling to Support Biowall Injection Design and Cost Strategy.** *J.W. Schuetz and D.R. Griffiths.*
James Schuetz (Parsons/USA)

Numerical Modeling for Recalcitrant Contaminants Research and Effective Remediation Solution in the Former Chemical Plant “Organika-Azot” in Jaworzno (Southern Poland). *E. Kret and M. Czop.*
Mariusz Czop (AGH University of Science and Technology/Poland)

*** Numerical Modeling of a Pumping Test to Determine Foam Spatial Distribution and Heterogeneity after a Field Site Injection.** *O. Atteia, E. Verardo, and C. Portois.*
Olivier Atteia (Bordeaux University/France)

REMChlor-MD: A Screening Level Remediation Simulation Model that Considers Matrix Diffusion.

R.W. Falta, N. Muskus, C. Newell, and S. Farhat.
Ronald Falta (Clemson University/USA)

*** Simulation of Nearshore Groundwater-Seawater Interactions Using SEAWAT 2000 and MODFLOW USG: A Comparative Case Study.** *M.Y. Chu.*

Min-Ying Jacob Chu (Haley & Aldrich, Inc./USA)

*** Simulation of Variable Contaminant Decay in the Presence of a Decaying Carbon Substrate.** *J. Roller and M. Kladias.*

Jonathan Roller (ARCADIS/USA)

Three-Dimensional Computational Pneumatic Modeling: Why It Is a Must When Designing Remedial Systems.

M. Ambrusch, O. Uppal, S. Abrams, and M. Fredlund.
Matthew Ambrusch (Langan Engineering & Environmental Services/USA)

Panel Discussion—Tuesday, Track H

How Can We Improve Groundwater Transport Modeling?

Moderator

Dr. Charles Newell (GSI Environmental, Inc.)

Panelists

Dr. Fred Molz (Clemson University)
Dr. Fred Payne (Arcadis)
Dr. Prabhakar Clement (Auburn University)
Dr. Ronald Falta (Clemson University)
Dr. Sorab Panday (GSI Environmental, Inc.)
Dr. Timothy Scheibe (PNNL)

The panelist will be asked to address one or more of these key issues regarding groundwater contaminant transport modeling:

1. Is the key to better solute transport modeling to “lower our expectations?”
2. Should we change our thinking about dispersion, or is the current framework useful?
3. Do current transport models have problems with simulating matrix diffusion?
4. How do transport models fit into the world of “big data” and new visualization technologies?
5. Other topics that the panelists find important.

H2. Conceptual Site Models

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Bruce Alleman (Noblis) and
Angela Paolucci (Battelle)

*** 3-D Printing for Visualizing Sites: Printing Models Instead of Maps.** *C.M. Ross, C.S. Martin, R.D. Walker, B. Jackson, and A. Barton.*
Chapman Ross (Geosyntec Consultants/USA)

*** Benefits of an “Evergreen” Conceptual Site Model for Remedy Optimization at a Rural Northeast Superfund Site.** *P. Nangeroni, R. McGrath, and A. Bittner.*
Peter Nangeroni (Woodard & Curran/USA)

Characterizing Contaminant Transport in a Dual Aquifer System with Significant Intervening Vadose Zone Flow for Remedy Selection. *E.B. Dieck, R.E. Lees, B. Bond, K. Kelly, and J. Breiner.*
Eric B. Dieck (LANGAN/USA)

*** Coal Combustion Residual (CCR) Remediation Road Map: How to Get There from Here.** *D.R. Gray and B. Dahlgren.*
Doug Gray (AECOM/USA)

*** Complex Challenges at Light Nonaqueous Phase Liquid Sites: An Overview of the NAVFAC Fact Sheet.** *D.W. Tomlinson, T. Meyers, W. Condit, S. Rosansky, D. Nair, and N. Durant.*
Derek Tomlinson (GEI Consultants, Inc./USA)

*** Developing a Site Conceptual Model: The Influence of Deep Building Foundations on Contaminant Transport.** *M.B. Dail and M.T. Jordan.*
Michael Dail (Terracon/USA)

Development of Conceptual Site Models and Evaluation of Groundwater Corrective Measures for Coal Ash Sites. *J.R. Hesemann, W. Weber, and E. Dulle.*
John Hesemann (Burns & McDonnell/USA)

*** Effect of Grain Shape, Consolidation and Compaction on Interfacial Areas and Dissolution in Unsaturated Porous Media.** *P. Mohammadmoradi and A. Kantzas.*
Peyman Mohammadmoradi (University of Calgary/Canada)

Is There a Conceptual Model in a 3-D Heterogeneous Multilayer Aquifer, and How Can It Be Approached? *O. Atteia, C. Portois, M. Annable, and N. Guiserix.*
Olivier Atteia (Bordeaux University/France)

*** Quantifying Aquifer Recharge from an Unlined Drainage Ditch Receiving Treated Water.** *K. Sun, A. Brown, A. Barnhart, E. Keene, T. Andrews, and P. Salcido.*
Kerang Sun (CH2M HILL/USA)

Statistically-Based 3-D Conceptual Site Models and Time-Lapse Animation. *J.D. Depa.*
James D. Depa (St. John-Mittelhauser and Associates/USA)

*** Three-Dimensional Data Visualization (3DVA): A Tool for Analyzing and Presenting Complex Environmental Data Sets.** *J.C. Ruf.*

Jason Ruf (S2C2, Inc./USA)

*** Traditional Site Investigation and High-Resolution Investigation: Using the Right Tools for Deciphering a Hydrogeological Model.** *S.S. Aluani, M.C.F. Spilborghs, F.B. Tomiatti, E. Pujol, R.C. Moura, and N.C. Nascimento.*

Sidney Aluani (SGW Services/Brazil)

*** Use of Contaminant Phase Distribution Calculations to Support Compartment-Based Conceptual Site Models.**

K.D. Pennell and N.N. Akladiss.

Kurt Pennell (Brown University/USA)

Panel Discussion—Tuesday, Track H

Enough is Enough: When Do You Have Enough Data?

Moderator

David Reynolds (Geosyntec)

Panelists

Trevor Carlson (Geosyntec)

David Thomas (Chevron) (pending confirmation)

Michael Smith (Vermont DEP)

Site investigation, remediation performance, and long-term site management all require collecting data, most often with the aim of reducing uncertainty. In many cases (particularly in the monitoring phases) the actual value of the data is unknown, and the cost to collect it is not justified. During site investigation, data is often collected based on plans that are static or only moderately dynamic, and as a result the ROI for much of the collected data can be essentially zero.

The panel is intended to explore specific key questions concerning the process of collecting data, ways to evaluate the worth of collected data, and the need to find a path to the end of data collection that meets site needs, regulatory requirements, and the capacity of the site owner.

The panel will include an audience-focused interactive session and a closing poll to determine what progress has been made on the key questions during the panel discussion.

H3. High-Resolution Site Characterization (HRSC)

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Andrew Barton (Battelle) and Seth Pitkin (Cascade)

Application of High-Resolution Site Characterization Tools for Source Delineation and In Situ Thermal Treatment Design Optimization.

M. Jordan, D. Phelan, G. Heron, J. Bierschenk, and D. Palmer.

Michael Jordan (Cascade/USA)

*** Application of OIP Tool for Quick Assessment of Environmental Liability.**

V.V. Sewaybricker and R. Spina.
Victor Vanin Sewaybricker (GEOKLOCK/Brazil)

Confirming Laser-Induced Fluorescence NAPL Delineation in Newtown Creek Superfund Site.

S.D. McDonald, C. Prabhu, S. Gbondo-Tugbawa, R. Weissbard, and R. St. Germain.

Shane McDonald (Louis Berger/USA)

From Characterization to Closure of a 1-Mile Long TCE Plume.

N.R. Welty, I. Drost, K. Trestrail, and D.T. Rogers.

Nicklaus Welty (Arcadis/USA)

High-Resolution Delineation of Chlorinated Solvent Concentrations, Biogeochemical Processes, and Microbial Communities in Saturated Subsurface Environments.

H. Schneider, W.A. Jackson, P.B. Hatzinger, and P. Koster van Groos.

Haley Schneider (Texas Tech University/USA)

*** High-Resolution Site Characterization in Low-Permeability Zones: When to Stop and Conclude?**

K. Rugge, B.T. Bay, P. Johansen, and H. Overgaard.

Kirsten Rugge (COWI/Denmark)

*** High-Resolution Subsurface Characterization of Nonaqueous Phase Liquid and Groundwater Impacts at a Former Manufactured Gas Plant Site.**

M.S. Raimonde, R.J. Meller, S.L. Goetz, R.M. Kick, B.D. Symons, and N.A. Azzolina.

Michael S. Raimonde (Foth Infrastructure & Environment, LLC/USA)

Lessons Learned from 25 Years of High-Resolution Site Characterization.

S. Pitkin.

Seth Pitkin (Cascade/USA)

*** Mapping and Modeling Fluorescence of Thin Stratified LNAPL, and Other Applications, Using the New High Resolution Optical Image Profiler (OIP) Tool.**

J.V. Fontana.

John Fontana (Vista GeoScience/USA)

Newly Developed Aquifer Characterization Procedure by Means of Hydraulic Profiling Tool and Mini Pump Tests. *E. Martac, B. Berbee, and G.R. van Goor.*
Eugen Martac (Fugro Consult GmbH/Germany)

*** Real-Time Identification and Characterization Approaches to Perched Water Zones.** *A. Gupta, C. Shepherd, W. McCall, N. Welty, and J. Quinnan.*
Ankit Gupta (Arcadis/USA)

Specialty Electrical Resistivity Imaging at NAPL-Impacted Site in Brazil: Key Contributions to the Conceptual Site Model. *C.S. Mowder, L. Ribeiro, P. Rego, G. Van den Daele, P. Barreto, O. Maurer, M. Sherrier, and J. Henderson.*
Carol Mowder (CH2M/USA)

Stratigraphic Flux: Applying Sequence Stratigraphy and High-Resolution Site Characterization to Find Contaminant Flux. *J.A. Quinnan, P. Curry, E. Killenbeck, L. Peters, K.C. Glover, and C. Varley.*
Joseph Quinnan (Arcadis/USA)

*** Using HPT-GWS Direct Push Tooling to Delineate Uranium Impacts in Groundwater at a Former Fuel Processing Facility.** *J.L. Binder and B.R. Hoyer.*
Brian Hoyer (Burns & McDonnell Engineering Company, Inc./USA)

*** Why the Historical VOC Production Trends Necessitate the Use of High-Resolution Site Characterization Techniques.** *C.A. Cox.*
Craig Cox (Cox-Colvin & Associates, Inc./USA)

H4. Remediation Geology: Geology-Focused Approach to Remediation Site Management

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Rick Cramer (Burns & McDonnell) and Herbert Levine (U.S. Environmental Protection Agency)

Focus on Geology to Improve In Situ Remediation Outcomes: Perspectives for the Remediation Engineer. *P.M. Dombrowski.*
Paul Dombrowski (In-Situ Oxidative Technologies [ISOTEC]/USA)

A Geology-Focused Approach at Three Industrial Sites to Enhance Conceptual Site Models and Remedial Design. *K. Carr and A. Rees.*
Katharine Carr (AECOM/USA)

Graphical Core Logging: Maximizing Your Opportunity to Observe Actual Subsurface Conditions. *C.P. Plank and M.R. Shultz.*
Colin Plank (Burns & McDonnell/USA)

The Heterogeneous Homogeneous Aquifer: Remediation Geology from Lessons Learned at CFB Borden. *D.W. Tomlinson and N.R. Thomson.*
Derek Tomlinson (GEI Consultants, Inc./USA)

Introduction to EPA Technical Issue Paper: Best Suggested Practice for Characterization and Remediation of Sediments and Aquifers: Environmental Sequence Stratigraphy. *M.R. Shultz, C.P. Plank, R.S. Cramer, and H. Levine.*
Mike Shultz (Burns & McDonnell/USA)

*** Leveraging Environmental Sequence Stratigraphy to Refine Mass Discharge Estimates: Magothy Aquifer, New Jersey Coastal Plain.** *R.C. Samuels, J. Sadeque, M. Ohr, and S.D. Lloyd.*
Ryan C. Samuels (AECOM/USA)

Site Hydrostratigraphy Refinement: Integrated Field Methods for Characterizing a NAPL-Impacted Sedimentary Aquifer in Brazil. *L.A.F.S. Ribeiro, P.S. Rego, G. Van de Daele, M.P. Sherrier, J.K. Henderson, C.S. Mowder, and O. Maurer.*
Lucas Andreata F. S. Ribeiro (CH2M/Brazil)

*** Understanding Subsurface Stratigraphy for PFAS Environmental Characterization Using Modern Analogs.** *J. Sadeque and J.M. Cuthbertson.*
Junaid Sadeque (AECOM/USA)

Use of Electrical Conductivity Logging for Risk Evaluation at a Gasoline Spill Site. *J.T. Wilson, K. Jewell, J. Weaver, and H. White.*
John Wilson (Scissortail Environmental Solutions, LLC/USA)

Using Applied Environmental Sequence Stratigraphy to Predict TCE Contaminant Migration Pathways: Air Force Plant 42, Palmdale, California. *R.C. Samuels and J.L. Gillespie.*
Ryan C. Samuels (AECOM/USA)

H5. Improvements in Site Data Collection, Data Management, and Data Visualization

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Joseph Quinnan (Arcadis) and Junaid Sadeque (AECOM)

*** Ants in the Strat? Current Research on the Geoenvironmental Use of Ant Colony Optimization Paradigm.** *B. Harding and A. Downard.*
Barry Harding (AECOM/USA)

*** Assessing Impact of Mechanical Remediation Systems on Natural Attenuation Using Tetrahedral Analysis.** *K. Sra, K. McVey, and E. Daniels.*
Kammy Sra (Chevron Energy Technology Company/USA)

Augmented Reality: The Future of Conceptual Site Models. *N.R. Welty, A. Yanites, and J.A. Quinnan.*
Nicklaus Welty (Arcadis/USA)

*** An Automated Approach for Selecting Statistical Routines to Identify Releases as Part of the 2016 CCR Rules.** *M.J. Ungs.*
Michael Ungs (Tetra Tech/USA)

*** The Benefits of Acquiring Continuous Cores for Aquifer Characterization: Lessons from Petroleum Industry Best Practices.** *J. Sadeque.*
Junaid Sadeque (AECOM/USA)

*** Best Prediction and Uncertainty Analysis of VOC-Impacted Soils Using Regression Kriging and Monte-Carlo Simulation.** *C. Holbert, R. Gates, D. Waite, G. Colgan, and M. Roginske.*
Charles Holbert (CH2M HILL/USA)

CSM Development and In Situ Bioremediation Optimization in Fractured Bedrock Using 3-D Visualization and Analysis. *E.B. Dieck, R.E. Lees, B. Bond, K. Kelly, and J. Breiner.*
Eric B. Dieck (LANGAN/USA)

*** CVOC Source-Area Characterization Using the Membrane Interface Probe: Ten Years of Success, Failure, and Everything in Between.** *R.M. Ruf, J.C. Ruf, and T. Koester.*
Richard Matthew Ruf (S2C2 Inc./USA)

Data, Data, Data: Development of an Integrated Information Management System to Support Complex Environmental Programs and Projects. *C. Gepner and B.R. Hoyer.*
Christina Gepner (Burns & McDonnell/USA)

*** Detailed Geological Modelling of a Contaminated Urban Area Based on Geophysical Mapping: A Case Study from Horsens, Denmark.** *T.R. Andersen and S.E. Poulsen.*
Theis Raaschou Andersen (VIA University College/ Denmark)

Geologic Modeling and Digital Visualization of Complex Data Sets: A Contaminant Fate and Transport Fractured Bedrock Case Study. *J. Drummond, F. Barranco, K. Fox, B. Rundell, and R. Bower.*
Jesse Drummond (EA Engineering, Science, and Technology, Inc., PBC/USA)

*** Graphical Method for Delineating Redox Zones in Groundwater.** *G.R. Carey.*
Grant Carey (Porewater Solutions/Canada)

An Evaluation of Electronic Field Data Collection Solutions: Lessons Learned. *D. Cleland and T. Wright.*
David Cleland (Groundwater & Environmental Services, Inc./USA)

*** High-Resolution Site Characterization (HRSC) and Three-Dimensional Data Visualization for a Fractured Rock Site: A Path to Streamlined Closure.** *J. Orris and J. Ruf.*
Joshua Orris (Antea Group/USA)

*** Innovative Visualization Method for Demonstrating Natural and Enhanced Attenuation.** *G.R. Carey.*
Grant Carey (Porewater Solutions/Canada)

Interactive Visualizations of 5 Million Sensor Measurements of the Capillary Fringe Lead to an Optimized Soil Remedy. *T. Kalinowski, C. Dixon, C. Brownfield, S. Mikaelian, and M. Terril.*
Tomasz Kalinowski (AECOM/USA)

*** Make Your Microsoft® Excel Work Harder: Everyday Data Visualization Approaches for Remediation Projects.** *M. Ohr and S.D. Lloyd.*
Matthias Ohr (AECOM/USA)

*** Non-Intrusive and Cost-Effective Investigation of Chlorinated Solvents at a Former Dry Cleaner.** *L. Torin.*
Lena Torin (Golder Associates AB/Sweden)

*** Reimagining Bedrock Conceptual Models with Simplifying Assumptions, Spreadsheets, and Visualization Tools: An Approachable Method for Qualitative Evaluation of Fate and Transport.** *B.P. Shedd, J. Alix, and R.R. Thompson.*
Brian P. Shedd (United States Army Corps of Engineers/ USA)

Saturated Soil Sampling to Determine Effective Source Remedy Strategies. *P.J. Curry, J.A. Quinnan, and J. Wright.*
Patrick Curry (Arcadis-US/USA)

Use of Multiple Direct-Sensing Technologies and 3-D Visualization to Complete a High-Resolution Site Characterization of a DNAPL Pool. *T. Koester, S.B. Gelb, R.M. Ruf, K. English, and M.K. Morelli.*
Tom Koester (S2C2, Inc/USA)

Using Augmented Reality to Improve Communications and Decision Making of Stakeholders at a Former Chemical Manufacturing Facility. *T.A. Fewless and I. Richardson.*
Thomas Allen Fewless (GHD/USA)

Using Data Management and 3-Dimensional Data Visualization to Generate More Complete Conceptual Site Models and Streamline Site Closure. *J. Orris and J. Ruf.*

Joshua Orris (Antea Group/USA)

*** When the Data are Conflicting or Confusing: Which Data Should You Believe?** *E.L. Davis.*

Eva Davis (U.S. Environmental Protection Agency/USA)

H6. Risk Assessment and Bioavailability Considerations

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Stephanie Hines (Battelle) and
Claudio Sorrentino (California Department of Toxic
Substances Control)

*** Application of the Method for Environmental Risk Assessment of the EPA in an Area Contaminated by Pesticides, Organic Compounds, and Metals: Case Study.** *V.V. Sewaybricker and R. Spina.*

Rubens Spina (GEOKLOCK/Brazil)

California Arsenic Bioaccessibility Method: Bench-Top Prediction of Relative Bioavailability in Contaminated Soils. *V.M. Hanley, C. Sorrentino, S. Whitacre, and N.T. Basta.*

Valerie Mitchell Hanley (California Department of Toxic
Substances Control/USA)

Effects-Driven Assessment and Management of Complex Operating Sites: Results of Initial Field Investigation. *P. Campbell, S. Siciliano, and K. Bradshaw.*
Patrick Campbell (Wood/Canada)

Evaluation of Bioavailability of Contaminants in Soil: State-of-the-Art Guidance from ITRC. *C. Sorrentino, K. Durant, and L. Hay Wilson.*

Claudio Sorrentino (California Department of Toxic
Substances Control/USA)

*** Focused Testing to Resolve Sediment Toxicity for Ecological Risk Assessment at a Complex Urban Waterway.** *D. Haury, L. Logan, and D. Hennessy.*
David Haury (Anchor QEA, LLC/USA)

Guidance on Establishing Remediation Objectives for Sites in Australia. *J.N. Jit, B.P. Kennedy, and R. Naidu.*
Joytishna Jit (CRC CARE / UniSA/Australia)

Oral Bioavailability of Nonpolar Organic Chemicals in Soil for Use in Human Health Risk Assessment. *S. Yu, R. Schoof, and D. Harrekilde.*

Shuo Yu (Ramboll Environ/USA)

*** Risk Assessment: Challenges and Opportunities, Emerging Contaminants, and More.** *J. Phillips.*
Jenny Phillips (TRC/USA)

Using a Risk-Based Approach to Guide Remedial Goals: Oral Relative Bioavailability of PAHs at Formerly Used Defense Sites. *N.D. Forsberg, B.H. Magee, A.K. Meyer, G.C. Hoeger, and C.M. Duarte.*
Norman Forsberg (Arcadis U.S., Inc./USA)



Panel Discussion—Monday, Track I

International Perspectives on Management Approaches for PFAS

Moderator

Rula A. Deeb (Geosyntec)

This panel will provide an overview of international approaches to managing per- and polyfluoroalkyl substances (PFAS), highlighting key differences as well as topic areas where collective agreement and shared challenges are emerging. Invited panelists will provide perspectives from Australia, Canada, Europe (Norway, Sweden, Germany, The Netherlands, United Kingdom) and the United States.

The panel discussion will span 100 minutes. The moderator will provide an overview of the panel's goals and introduce the panelists with international experience addressing various aspects of PFAS contamination, including source control, fate and transport, ecotoxicology and risk assessment, treatment, liability, and applied research and development of innovative environmental solutions. Next, each panelist will present a short overview of PFAS regulations and priorities for a country/region, aspects of their own PFAS experience, and relevant examples, success stories and failures, and lessons learned. These overview presentations will be followed by open discussion involving the audience.

Several themes will be raised for panelists to discuss. Examples include the following:

- What are the key differences among these countries in addressing PFAS contamination? What aspects of the countries' regulatory frameworks facilitate or hinder addressing contamination?
- Compare regulatory frameworks for PFAS in other countries to the framework in the U.S. or in specific U.S. states.
- What can the U.S. learn from research and practical experience in other countries on PFAS?
- What do we (collectively) still need to learn about PFAS?
- What is the range of acceptability for the reuse or disposal of PFAS-contaminated wastes?
- What are differences in sources of PFAS in different countries, if any? What types of source control measures have been identified?
- Regardless of location, what are the latest developments for treatment of PFAS?
- Is consensus evolving among different countries as to what constitutes safe levels of PFAS in the environment?

Additional questions may build on key topics of discussion from the First International PFAS Conference at CleanUp 2017 in Melbourne, Australia, as well as a recent expert workshop on PFAS research needs conducted by SERDP/ESTCP in May 2017, key findings and discussion topics from Interstate Technology Regulatory Council (ITRC) PFAS team meetings and fact sheets, and other recent publications and conference presentations.

11. Advancing Environmental Science and Remediation in Vietnam

Platforms Monday I Posters (*) Monday Evening
Chairs: Daniel Moats (Hatfield Consultants) and
Kent Sorenson (CDM Smith, Inc.)

Advancing Hazardous Waste Characterization and Remediation Capacity in a Developing Country: Agent Orange Case Study in Vietnam. *K.S. Sorenson, R.E. Chichakli, P.M. Chenevey, and D. Moats.*
Kent Sorenson (CDM Smith, Inc./USA)

Bioaccumulation of PCDD/Fs in Foodstuffs Collected Near Bien Hoa and Da Nang Airbases: Assessment for Sources, Environmental Distribution, and Their Intake by Humans. *N.H. Minh, N.V. Thuong, N.T.M. Hue, T.M. Tri, T.B. Minh, and T.T.T Hanh.*
Hung Minh Nguyen (Vietnam Environment Administration/ Vietnam)

* **Bioaccumulation of Trace Metals in *Meretrix lyrata* near the Saigon-Dong Nai River Estuary, Vietnam.**

V.T. Tran, D.P. Nguyen, and E. Strady.

Viet Tuan Tran (Institute for Tropicalization and Environment/ Vietnam)

Bringing State-of-the-Art Technology to a Developing Country: A Capacity Building and Knowledge Transfer Success Story.

J. Galligan, G. Heron, J. Bierschenk, R. Michalewich, S. Walker, G. Anderson, T. Burdett, D. Tran, C. Pruitt, K. Sorensen, and P. Chenevey.
Jim Galligan (TerraTherm, Inc./USA)

* **Comparative Study of 2,4-Dichlorophenoxyacetic Acid Adsorption onto Alkali-Activated Carbon Nanotubes and Activated Carbon.**

H.K. Hue, L.V. Anh, and L.M. Cam.
Hoang Kim Hue (Chemical Command/Vietnam)

Concentration and Temporal Trends of PCDDs/PCDFs in Ambient Air at the Agent Orange Remediation Site between 2013 and 2017 Using Passive Samplers.

T.K. Sau, X.T. Nghiem, D.T. Nguyen, and D.L. Han.
Trinh Khac Sau (Vietnam-Russia Tropical Centre/Vietnam)

*** Degradation of 2,4,6-Trinitrotoluene (TNT) in Wastewater by Advanced Oxidation System $\text{Fe}^0/\text{H}_2\text{O}_2/\text{Na}_2\text{S}_2\text{O}_8/\text{EDTA}$.** *N.T. Huong, T.V. Chung, T.D. Hoanh, and K.H. Binh.*

Nguyen Thu Huong (Academy of Military Science and Technology/Vietnam)

Dioxin Remediation at the Da Nang Airport Using the Incremental Sampling Methodology for Soil and Sediment Confirmation Sampling. *A.A. Lopez, K.S. Sorenson, R.E. Chichakli, J.T. Bamer, and D. Moats.*

Alexis Lopez (CDM Smith/USA)

*** Diversity of Bacteria Produces Lignocellulolytic Enzymes in the Rumen of Goats Harvested in Vietnam.** *K.H.V. Nguyen, T.H. Do, and N.H. Truong.*

Nguyen Khanh Hoang Viet (Institute of New Technology/Vietnam)

*** Stakeholder Engagement and Capacity Building for Dioxin Remediation in Vietnam.** *J. Mason, R. Chichakli, D. Moats, P. Chenevey, and M.P. Nguyen.*

Jasmine Mason (Hatfield Consultants/Canada)

*** Synthesis of Carbon Aerogel from Waste Paper for Removal of Heavy Metal Ion in Aqueous Solutions.**

T.T. Nguyen, V.T. Nguyen, T.T. Do, M.T. Nguyen, and T.H. Nguyen.

Hung Tran Nguyen (Hanoi Institute of Chemistry and Materials Science/Vietnam)

Application of Enhanced Reductive Dechlorination: The Value of Assessing Site Conditions Prior to Decision Making. *J. Bastrup and H. Ashur.*

Hamdi Abdi Ashur (Geo/Denmark)

*** Application of Multiple Technologies to Achieve Risk-Based Remediation of Petroleum Hydrocarbons in a Challenging International Environment.** *T. Simpkin and C. Romero.*

Tom Simpkin (CH2M HILL/USA)

*** Application of World Advanced Remediation Technologies in China.** *Z. Mei, G. Lu, Z. Liu, and H. Shan.*

Huifeng Shan (PeroxyChem, LLC/China)

*** Challenges in the Implementation of the Remediation Actions in a Residential Area with a History of Conflict of Interest.** *V.V. Sewaybricker and R. Spina.*

Victor Vanin Sewaybricker (GEOKLOCK/Brazil)

*** Combination of Chemical Oxidation and Electrokinetic for LNAPL Remediation in a Tropical Soil Capillary Fringe.** *L.P.M. Silveira, B.O. Agostinho, I.P. Leme, L.M.U. Morioka, S.R. Honda, S.A.C. Furquim, and J.G. Freitas.*

Lilian Puerta Machado Silveira (UNIFESP, Integrated Environmental Analysis/Brazil)

*** Complexities Surrounding China's Soil Action Plan: A Scientific Perspective.** *D. Hou.*

Deyi Hou (Tsinghua University/China)

*** Consolidating Regulations and Risk-Based Management Will Promote the Effective and Sustainable Development of Contaminated Site Remediation in China.** *G. Guo, C. Zhang, W. Wang, and Z. Fu.*

Guanlin Guo (Chinese Research Academy of Environmental Sciences/China)

In Situ Source Zone Remediation Using Electrical Resistance Heating on a Project Site Located near Troyes, France. *M. van den Brand, J. van Rossum, M. Stumbaugh, and T. Warner.*

Marco van den Brand (TRS Europe/Netherlands)

*** Largest ERH Site in Latin America.** *A.L. Donzelli and J. Seeman.*

Ana Lygia Donzelli (Cyrela/Brazil)

Lessons Learned from an In Situ Thermal Desorption Pilot in Shanghai China. *S. Zhang, H. Tu, C. Wang, and L. Ma.*

Sailor Zhang (Shanghai Greenment Environmental Technology Co., Ltd./China)

*** Numerical Simulation of Solute Migration Facilitated Groundwater Remedial Design under a Hexavalent Chromium-Contaminated Site.** *Z. Ding and N. Sun.*

Zhenyu Ding (Chinese Academy for Environmental Planning/China)

12. International Case Studies

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Thiago Gomes (TRSDoxor) and Jun Ma (Baohang Environmental Co., Ltd.)

*** Abiotic and Biotic TCE Reduction Bench Study Using Local Organic Carbon and Iron Sources Conducted in Sao Paulo, Brazil.** *K. Morris, M. Singer, and B. Gil.*

Kevin Morris (ERM/USA)

Advance in Health Risk Assessment Methodology of Brownfield Sites in China. *L. Jiang and M.S. Zhong.*

Lin Jiang (Beijing Municipal Research Institute of Environmental Protection/China)

*** An Approach to the Beneficial Use of Fine Sediments by Solidification: I. Leaching Properties and Intensity.** *K. Kim, E.-J. Won, Y. Gang, and K. Ra.*

Kyoungrean Kim (Korea Institute of Ocean Science and Technology/South Korea)

*** Remediation of Chlorinated Groundwater Plumes in Denmark: A Technology Development Project.** *N. Tuxen, D. Harrekilde, L. Bennedsen, and M.M. Broholm.*
Dorte Harrekilde (Ramboll/Denmark)

*** Remediation of Mercury Contamination at a Former ChlorAlkali Plant in NSW Using Integrated Cap and Containment Technologies.** *G. Butterfield, G. Schmertmann, C. Vernon, F. Cosme, J. Stening, and A.D. Laase.*
Gavan Butterfield (Golder Associates Pty Ltd/Australia)

*** The Results from Three Years of Wide-Scale Chlorinated Hydrocarbon Assessment and Mitigation.** *A.W. Pruszinski, D.C. McGill, S. Thompson, and M.R. Talbot.*
Andrew Pruszinski (Environment Protection Authority/Australia)

*** Searching for the Crucial Piece of the Plume Puzzle: A Case Study from Central Denmark Region, Denmark.** *H.J. Blæsbjerg and S.G. Lauridsen.*
Helle Jusjong Blæsbjerg (Central Denmark Region/Denmark)

*** A Set of Complete Technological System-Based Soil Washing for the Remediation of a Heavy Metals-Contaminated Site.** *Y. Li and X.-Y. Liao.*
You Li (Chinese Academy of Science/China)

Thermal Source Remediation of VOCs at a Residential Condominium in Sao Paulo, Brazil. *G. Setti, C. Rodrigues, A.P. Queiroz, T. Borba, P. Lima, and D. Damasi.*
Ana Paula Queiroz (Waterloo Brasil/Brazil)

*** Those Stubborn Sterilants: Environmental Management of Sites Impacted with Bromacil, Dicamaba, and Tebuthiuron.** *B. Rakewich and H. Bakker.*
Barry Rakewich (Nichols Environmental Ltd./Canada)

Treatability Studies and Pilot Test Program for Remedial Selection in a NAPL-Impacted Site in Brazil. *P. Barreto, C. Mowder, E.E. Mack, and J. Henderson.*
Paola Barreto Quintero (CH2M HILL/USA)

13. Botany “Mega” Site Cleanup Project

Platforms Tuesday | Posters (*) Monday Evening
Chairs: Julie Konzuk (Geosyntec Consultants, Inc.) and James Stening (Orica Australia Pty Ltd)

Adaptive Remediation Management of a Groundwater Cleanup Project. *J.C. Fairweather and J.R. Stening.*
James Fairweather (Orica Ltd./Australia)

*** Aerobic Biodegradation of 1,2-Dichloroethane at the Botany Industrial Park.** *J.E. Munro, E.F. Liew, M.-A. Ly, and N.V. Coleman.*
Nicholas V. Coleman (University of Sydney/Australia)

An Iterative Approach to Improve Model Predictions and Site Conceptual Models. *A. Laase, J. Rumbaugh, and J. Stening.*
Al Laase (Navarro Research and Engineering/USA)

*** Botany Groundwater Cleanup Project: Arguably the Largest and Most Complex in Australia.** *J.R. Stening.*
James Stening (Orica Australia Pty Ltd/Australia)

*** A Case Study of the Anatomy of a Dynamic High Concentration Chlorinated Solvent Plume and Consequences on Remedial Strategy.** *J. Duran.*
Joe Duran (Golder Associates/Australia)

*** Evolution of a Conceptual Site Model for the Botany Chlorinated Hydrocarbon “Mega-Site” Cleanup Project.** *A. Woinarski, G. Dasey, and J. Stening.*
Andrei Woinarski (Senversa Pty Ltd/Australia)

Insights on Risk-Reduction Mechanisms from 12 Years of Operation of a Pump-and-Treat System at the Botany Chlorinated Hydrocarbon “Mega-Site.” *G. Dasey, A. Woinarski, and S. Corish.*
Greg Dasey (JBS&G Australia Pty Ltd/Australia)

Microbial Metabolism of the Priority Pollutant Trichloromethane in Subsurface Environments. *M.J. Manefield, M.J. Lee, and J. Stening.*
Matthew Lee (University of New South Wales/Australia)

Natural Source Zone Depletion Studies at the Botany Groundwater Cleanup Program. *C.J. Newell, P. Kulkarni, J. Stening, J. Fairweather, L. Alexander, and J. Zimbron.*
Charles Newell (GSI Environmental, Inc./USA)

*** Technology Screening and Remedy Selection at Large-Scale, Complex DNAPL Sites: Orica Botany Case Study.** *E. Suchomel and M. Kavanaugh.*
Eric J. Suchomel (Geosyntec Consultants/USA)

Why Is the Plume Disappearing Faster than it Should? Mass Loss Investigations at the Orica Botany Site. *J.S. Konzuk, C. Crea, S. Mancini, and L. Jorstad.*
Julie Konzuk (Geosyntec Consultants, Inc./Canada)

14. Compound-Specific Isotope Analysis

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Ramon Aravena (University of Waterloo) and
Tomasz Kuder (University of Oklahoma)

* $\delta^{13}\text{C}$ and $\delta^{37}\text{Cl}$ Isotope Fractionation for Distinguishing between Aerobic and Anaerobic Degradation of TCE.

A. Gafni, C. Lihl, F. Gelman, M. Elsner, and A. Bernstein.
Almog Gafni (Ben Gurion University of the Negev, Israel/
Israel)

Advancing Application of CSIA to Estimate Degradation Rates: Linking Differences in PCE Isotopic Fractionation to Metabolic Potential.

S. Mancini,
J. Konzuk, C. Cheyne, L. Douglas, B. Sherwood Lollar,
E. Edwards, L. Hug, and J. Stening.
Silvia Mancini (Geosyntec Consultants, Inc./Canada)

Application of CSIA in 1,4-Dioxane Studies: Latest

Developments. P. Bennett, M.Y. Chu, R. Aravena,
H.T. El Mugammar, C. Smith, M. Hyman, and M. Nickelsen.
Peter Bennett (Haley & Aldrich, Inc./USA)

Characterization by the Use of ^{37}Cl , ^{13}C and ^2H : Compound-Specific Isotope Analysis (CSIA), Biological Molecular Techniques (BMTs) and Numerical Modeling of a Site Contaminated by Monochlorobenzene.

M. Marchesi, I. Pietrini, M. Antelmi, L. Alberti, T. Stella,
A. Franzetti, D. Antonelli, F. de Ferra, R. Aravena, and
O. Shouakar-Stash.
Massimo Marchesi (Politecnico di Milano/Italy)

Characterization of the Intrinsic Biodegradation Potential of an Aquifer Contaminated with Chlorinated Ethenes and Implementation of a Field-Scale

Biostimulation Test. E. Marco-Urrea, T. Vicent,
N. Blázquez-Palli, J. Varias, M. Bosch, M. Rossell, and
A. Soler.
Ernest Marco-Urrea (Universitat Autònoma de Barcelona/
Spain)

* Chlorine and Hydrogen Isotope Fractionations during Physical Processes.

F. Vakili and O. Shouakar-Stash.
Fatemeh Vakili (Isotope Tracer Technologies Inc./Canada)

* Compound-Specific Carbon Stable Isotope Analysis of Chlorinated Ethenes following Pre-Concentration by In-Tube Extraction (ITEX).

C.T. Yarnes.
Christopher Yarnes (University of California, Davis/USA)

Compound-Specific Isotope Analysis and Microbial Molecular Data for Effective Monitoring of a Bioremediation Pilot Trial at a Heavily-Contaminated 1,2-DCA Area: Laboratory and Field Results.

F. De Ferra,
G. Carpani, L. Zaninetta, I. Pietrini, L. Alberti, and
M. Marchesi.
Francesca DeFerra (ENI/Italy)

* Differing Carbon Isotope Fractionation during Anaerobic Biodegradation of Ethylene Dibromide by *Dehalococcoides*- and *Dehalogenimonas*-Containing Cultures.

J. Palau, M. Rosell, A. Soler, R. Yu,
D.L. Freedman, S.H. Mortan, E. Marco-Urrea, G. Caminal,
and O. Shouakar-Stash.
Orfan Shouakar-Stash (Isotope Tracer Technologies, Inc./
Canada)

* Direct Application of CSIA for Degradation Pathway Distinction.

D. Taggart, M. Burns, and S. Rosolina.
Sam Rosolina (Microbial Insights, Inc./USA)

* Field Application of CSIA for Vapor Intrusion/Indoor Air Quality Assessment: Determination of TCE Source in Residence.

D. Rowe, C. Serlin, S. Dergham, and
E. Pearson.
Devon Rowe (Ramboll Environ Corporation/USA)

Hydrogen Isotope Effects in Reactions of Chlorinated Ethenes: Potential Tool for Discrimination of

Chlorinated Ethenes Degradation Pathways. T. Kuder,
A. Sullivan Ojeda, and R.P. Philp.
Tomasz Kuder (University of Oklahoma/USA)

Integrated Assessment of Anaerobic Reductive Dechlorination of Chlorinated Ethenes by Stable Isotope Analysis and Microbial Techniques.

C.B. Ottosen, M.M. Broholm, K. Tsitonaki, J. Zimmermann,
D. Hunkeler, and N. Tuxen.
Cecilie Bang Ottosen (Technical University of Denmark
[DTU]/Denmark)

* Multi-Elemental Isotope Analysis as a Tool for Characterizing Degradation Pathways of

Bromophenols. F. Gelman, Y. Zakon, L. Halicz, R. Golan,
A. Bernstein, Z. Ronen, and T. Kuder.
Faina Gelman (Geological Survey of Israel/Israel)

* Post-Bioremediation Bulk Vinyl Chloride Attenuation Rate Estimation in an Overburden Groundwater Aquifer in Kansas.

C.J. Voci and A.K. Gulli.
Christopher Voci (Terraphase Engineering Inc./USA)

15. Environmental Forensics

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Jaana Pietari (Exponent, Inc.) and
Amy Wilson (TRC)

* Advances in Oil Spill Forensic Analysis Using Biomarkers and Isotope Ratio Techniques.

H. Behzadi.
Harry Behzadi (SGS North America/USA)

* Characterization of Contaminants of Potential Concern in NAPLs from Multiple Sources in a

Superfund Site. C. Prabhu, S. McDonald,
S. Gbondo-Tugbawa, Y. Wang, and R. Weissbard.
Chitra Prabhu (The Louis Berger Group, Inc./USA)

*** Characterizing Sheens in Combined Sewer Overflow and Municipal Separate Storm Sewer System Discharges to Newtown Creek.** *J. Quadrini.*
James Quadrini (Anchor QEA, LLC/USA)

Chemical Fingerprinting of PFASs in Sediment, Biota and Surface Water Associated with AFFF Release Areas: Implications of Differences. *S.F. Gormley, A. Bernhardt, M.L. Bevier, S.Thomas, R. Singer, and M. Helton.*
Sean Gormley (Wood/USA)

Development and Application of the Forensic Approach to Determine Contaminant Sources in the Environment. *R.P. Philp.*
R. Paul Philp (University of Oklahoma/USA)

*** Environmental Forensics Applied to Per- and Polyfluoroalkyl Substances (PFAS).** *J. Hatton, W. DiGuiseppi, C. Holton, E. Piña, and N. Badon.*
James W. Hatton (CH2M HILL/USA)

*** Extended Congener and Speciation Analysis of PCBs, Dioxins and Hydrocarbons for Environmental Forensics: Applications.** *B. Chandramouli, R. Grace, M. Woudneh, and M.C. Hamilton.*
Bharat Chandramouli (SGS AXYS/Canada)

Nuclear Magnetic Resonance: An Improved Source Fingerprinting Analytical Tool. *J. Longstaffe, J.S. Konzuk, C. Cheyne, S. Mancini, M. McMaster, and E.E. Mack.*
Julie Konzuk (Geosyntec Consultants, Inc./Canada)

*** Stable and Radio Isotope Analysis to Identify Sources of Methane during a Remedial Action.** *R. Coffin, E. Benson, and J. Mueller.*
Jim Mueller (Provectus Environmental Products, Inc./USA)

Tracking Chlorinated Solvents in the Environment. *I.G. Petrisor.*
Ioana Gloria Petrisor (ToxStrategies, Inc./USA)

The Value of Matrix Diffusion Modeling When Applied to Solvent Release History Forensics. *J. Thompson and E. Tollefsrud.*
Jay Thompson (Geosyntec Consultants, Inc./USA)

16. Unmanned Systems for Remote Monitoring

Platforms Wednesday | Posters (*) Wednesday Evening
Chairs: Irene Montero (BP Remediation Management) and Daniel C. Mummert (Trihydro Corporation)

*** Environmental Applications for Unmanned Aerial Vehicles.** *W. Stiteler and A. McManus.*
William Stiteler (Arcadis U.S., Inc./USA)

A Multipurpose Unmanned Aerial Vehicle (UAV) for Water Sampling and Mapping in a Flooded Mine Pit. *I.S. Fairweather, L. Burmeister, and J. Jonas.*
Ian S. Fairweather (Fairweather IT LLC/USA)

Unmanned Aerial Systems (UAS): Redefining Vegetation Analysis. *D.C. Mummert.*
Daniel C. Mummert (Trihydro Corporation/USA)

Unmanned Aircraft Systems: History of the Technology and Uses in Site Investigations, Surveying and Other Environmental Applications. *J. Popiel, P. Eaton, and A. Lindemann.*
Paul Eaton (Geotech Environmental/USA)

Unmanned Partially Autonomous Boat for Profiling and Sampling the Berkeley Pit. *T.A. Duaine, G.A. Icopini, B.E. Hill, P. Cote, W. Leishman, A. Alangari, M. Erickson, T. Holliday, C. Ellertson, and T. Fricks.*
Bryce Ensign Hill (Montana Tech of the University of Montana/USA)

17. Innovative Sampling and Investigation Tools

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Rodrigo Coelho (GEOKLOCK) and Richard Stewart (Ziltek Pty., Ltd.)

Coupled Radiocarbon and Short-Term Incubations Measure In Situ Hydrocarbon Degradation Rates. *T.J. Boyd, R.H. Cuenca, Y. Hagimoto, and M.T. Montgomery.*
Thomas Boyd (U.S. Naval Research Laboratory/USA)

*** Cryogenic Coring of LNAPL for Independent Verification of NSZD Rates.** *M. Lyverse, T. Sale, and M. Irianni-Renno.*
Mark Lyverse (Chevron Corporation/USA)

Direct Determination of Dechlorination Rates Using Radiolabeled cis-DCE Enabling Optimized Risk and Plume Management. *R. Jakobsen, C.N. Albers, K. Tsitonaki, M.M. Broholm, L. Clausen, and N. Tuxen.*
Rasmus Jakobsen (Geological Survey of Denmark and Greenland [GEUS]/Denmark)

*** Estimating NAPL Effective Hydraulic Conductivity and Potential Velocity in the Field Based on Laboratory Pore-Fluid Mobility Test Results.** *M.J. Gefell, K. Russell, and M. Mahoney.*
Michael Gefell (Anchor QEA, LLC/USA)

*** An Evaluation of Metals and Hydrocarbon Field Screening Methodology for Enhanced Soil Contamination Delineation.** *B. Reed and J. Zepeda.*
Brandon A. Reed (TRC Companies/USA)

*** Field Tests with the OIP-Green DP Photo-Logging System for Detection of Coal Tars.** *W. McCall, T.M. Christy, D.A. Pipp, B. Jaster, R. Bean, and I. Smith.*
Wesley McCall (Geoprobe Systems/USA)

*** MiProbe: Recent Test Results for a (Bio)Electrochemical Sensor System for Continuous Redox Surrogate Monitoring.** *J. Studer, K. Polansky, and S. Burge.*
James Studer (InfraSUR, LLC/USA)

*** Novel Technology for Sampling Volatiles in the Unsaturated Zone.** *P. Larsen, P. Loll, C. Larsen, and H.C.K. Østergaard.*
Poul Larsen (Dansk Miljøradgivning A/S/Denmark)

Polyethylene Devices (PEDs): Customizable Tools for Unique Applications in a Variety of Environmental Scenarios. *E.M. Kaltenberg and L.F. Lefkowitz.*
Eliza Kaltenberg (Battelle/USA)

Rapid Mapping of Soils in China Using a Handheld Device. *R. Stewart.*
Richard Stewart (Ziltek Pty., Ltd./Australia)

*** Rare Earth Elements: Potential Natural Tracers for In Situ Remediation of Groundwater.** *R.T. Wilkin, R.D. Ludwig, and T.R. Lee.*
Richard T. Wilkin (U.S. EPA/USA)

*** Real-Time and In Situ Monitoring of Aquatic Environments Using Indigenous Microbial Community-Based Biosensors.** *T.M. Vogel, M. Altizer, J.M. Monier, and O. Sibourg.*
Timothy Vogel (University of Lyon/USA)

*** Reduced Variability In Groundwater Monitoring Results Using the TIGER™ Time-Integrated Groundwater Sampler.** *T. McHugh, H. O'Neill, K. Moran, B. Oyston, and A. Schumacher.*
Thomas McHugh (GSI Environmental, Inc./USA)

*** Simple, Rapid, Cost-Effective Vertical Hydraulic Conductivity Measurement in the Field Using Fresh Sediment Cores.** *M.J. Gefell, K. Russell, and M. LaRue.*
Michael Gefell (Anchor QEA, LLC/USA)

Use of an Innovative Multi-Increment Sampling Approach to Estimate Mass Balance and Optimize Remediation of PCE in Soil. *W.Y. Ng, S. Cocchia, and F.D. Hopkins.*
Sergio Cocchia (CH2M Hill/USA)

*** What is between These Two Wells? Cross Borehole Georadar for Identifying Migration Pathways at Contaminated Sites.** *K. Tsitonaki, M.C.L. Zibar, L. Nielsen, N. Tuxen, and A. Edsen.*
Katerina Tsitonaki (Orbicon A/S/Denmark)

18. Real-Time Analysis to Inform Decision-Making

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Murray Einarson (Haley & Aldrich, Inc.) and Friedrich Krembs (Trihydro Corporation)

Adaptive Response to Vapor Intrusion during Thermal Remediation Based on Continuous Vapor Monitoring and Web-Based Real-Time Data Reporting. *N. Clite, M. Lawson, K. Manheimer, M. Kram, and B. Hartman.*
Nova Clite (OTIE/USA)

*** Application of Navigation System for Real-Time, Large-Scale VOCs and Gas Detection at a Remote Potential Spill Site.** *P. Berutti and J.P. Davit.*
Paolo Berutti (Golder Associates s.r.l./Italy)

*** Autonomous LNAPL and Groundwater Level Monitoring: Repeatable, Reliable, and Robust.** *D. Holmes.*
David Holmes (Ecologia Environmental Solutions Limited/United Kingdom)

*** Benefits of Using Down-Well, Real-Time, Telemetric Water Quality Meters to Monitor the Effects of an In Situ Chemical Oxidation Remediation.** *S.V.F. Kozicki, B.D. Symons, and R.M. Kick.*
Sharon Kozicki (Foth Infrastructure and Environment/USA)

High-Resolution Monitoring for Thermal Remediation Optimization. *C.A. Hook, A.M. Chrest, R.F. Davis, C.J. Pike, and M.P. Speranza.*
Christopher Hook (Tetra Tech, Inc./USA)

*** Rapid Measurement of Petroleum Hydrocarbons during Site Remediation.** *R. Stewart, G. Chien, and L. Lin.*
Richard Stewart (Ziltek Pty., Ltd./Australia)

Real-Time Data Monitoring during Source Zone Remediation Using Large Diameter Auger with Steam and Zero-Valent Iron. *C. Soistman, J. Langenbach, and Z. Munger.*
Catherine Soistman (Geosyntec Consultants/USA)

Real-Time Measurements of Hydrocarbon Concentrations in Soils. *N. Sihota and T. Miao.*
Natasha Sihota (Chevron Energy Technology Company/USA)

*** Source Zone and Plume Characterization Using Smart Characterization and Real-Time Techniques in Brazil.** *J. Vilar, M.R. Sousa, J. Smith, J. Overgord, N. Welty, K. Haymond, A. Joly, G. Martinelli, C. Umilta, and C. Petroni.*
Marcelo Rodrigues de Sousa (Arcadis/Brazil)

Successful TCE DNAPL Source Area Remediation through Real-Time Analysis of Oxidant Concentration during ISCO. *R. Bunker, J.T. Spadaro, M.G. Sweetenham, F.J. Krembs, and K. McDonald.*
Michael Sweetenham (Trihydro Corporation/USA)

19. Use of Advanced Molecular Tools for Site Assessment or Remedy Performance

Platforms Thursday | Posters (*) Wednesday Evening
Chairs: Dora Taggart (Microbial Insights, Inc.) and
Jennifer Weidhaas (University of Utah)

Association between qPCR Analyses for Oxygenase Enzymes and Rate Constants for Cooxidation of TCE in Groundwater. *J.T. Wilson, B. Wilson, D. Taggart, and D. Freedman.*

John Wilson (Scissortail Environmental Solutions, LLC/USA)

Comparing Reductase Enzyme Peptides to *Dehalococcoides* DNA as Predictors of Rates of Dechlorination of cis-DCE and VC. *P. Hatzinger, M.M. Michalsen, K.H. Kucharzyk, C. Bartling, L. Mullins, F. Loeffler, J. Wilson, and J. Istok.*

Mandy Michalsen (U.S. Army Corps of Engineers/USA)

*** Comparison of Bench-Scale Environmental Molecular Diagnostics to Pilot-Scale Data during Bioremediation of 1,4-Dioxane.** *C. Bell, M. Heintz, Y.R. Miao, S. Mahendra, P. Gedalanga, and D. Favero.*

Caitlin Bell (Arcadis/USA)

*** Detection of Potential Pathogenic Bacteria in Bioremediation Microbial Consortia Using Metagenomics Techniques.** *J. Yang and J. Park.*

Jihoon Yang (Yonsei University/South Korea)

*** Development of Multiple Reaction Monitoring (MRM) Proteomic Assay for the Detection of Methyl Tertiary-Butyl Ether (MTBE) Degradation Peptides.**

K.H. Kucharzyk, C. Bartling, L.A. Mullins, J. Meisel, and K. Neil.

Kate Kucharzyk (Battelle/USA)

*** Evaluation of Metabolomics as a Monitoring Tool at Chlorinated Solvent Sites.** *S.R. Campagna, F.E. Loeffler, Y. Xie, and M.M. Michalsen.*

Shawn Campagna (University of Tennessee/USA)

*** High-Throughput Quantification of the Functional Genes Associated with RDX Degradation Using the WaferGen SmartChip Platform.** *J.M. Collier, B. Chai, J.R. Cole, and A.M. Cupples.*

Jennifer Collier (Michigan State University/USA)

*** A Metagenomic Approach to Understanding Microbial Community Shifts during Reductive Dechlorination.**

R. Reiss, P. Guerra, and O. Makhnin.

Rebecca Reiss (New Mexico Tech [Retired]/USA)

*** Microbial Community Characterization at Five Chlorinated Solvent Sites Following Bioaugmentation with *Dehalococcoides*-Enriched Culture, SDC-9.**

H. Dang, Y. Kanitkar, R. Stedtfeld, S. Hashsham, A. Cupples, and P. Hatzinger.

Hongyu Dang (Michigan State University/USA)

Molecular Biological Tools: Where Will the Journey Take Us? *F.E. Loeffler.*

Frank Loeffler (University of Tennessee/USA)

Molecular Characterization to Monitor Remedy Performance. *S. Fiorenza, J. Nyvall, and S. Lummus.*

Stephanie Fiorenza (BP/USA)

*** New Genes for Monitoring of In Situ Remediation of Aromatic Hydrocarbons: Outdoor Mesocosm Study.**

M.V. Brennerova and M. Stavelova.

Maria Brennerova (Czech Academy of Sciences/Czech Republic)

*** New Quadrupole Mass Spectrometer Method for the Quantification of ¹⁸O-Stable Isotope Probing Inorganic and Organic Phosphate Species.** *A. Schryer, S.D. Siciliano, and K. Bradshaw.*

Siciliano, and K. Bradshaw.

Aimee Danielle Schryer (University of Saskatchewan/Canada)

*** Practical Examples of High-Throughput DNA Sequencing Support Engineering and Policy Decisions.**

A. Rocha, J. Smith, and D. Graves.

Duane Graves (Geosyntec Consultants, Inc./USA)

Quantification of Reductive Dehalogenase Peptides Using Multiple Reaction Monitoring Proteomics.

K.H. Kucharzyk, C. Bartling, L. Mullins, J. Meisel, P. Hatzinger, F. Loeffler, J. Wilson, J. Istok, and M. Michalsen.

Kate Kucharzyk (Battelle/USA)

*** Use of Molecular Biological Tools and CSIA to Assess Natural Attenuation of MTBE and TBA.** *D. Collins, N. Longinotti, and D. Chheda.*

N. Longinotti, and D. Chheda.

David Collins (Stantec/USA)

Using Environmental Molecular Diagnostics to Support a Rhizodegradation Closure Strategy at a Service Station Site.

J. Sheldon and J. Friedman.

Jack Sheldon (Antea Group/USA)

*** Validation of Advanced Molecular Biological Tools for Monitoring Chlorinated Solvent Bioremediation and Estimating Degradation Rates.** *M.M. Michalsen, K.H. Kucharzyk, C. Bartling, L. Mullins, P. Hatzinger, F. Loeffler, J. Wilson, and J. Istok.*

M.M. Michalsen, K.H. Kucharzyk, C. Bartling, L. Mullins, P. Hatzinger, F. Loeffler, J. Wilson, and J. Istok.

Mandy Michalsen (U.S. Army Corps of Engineers/USA)