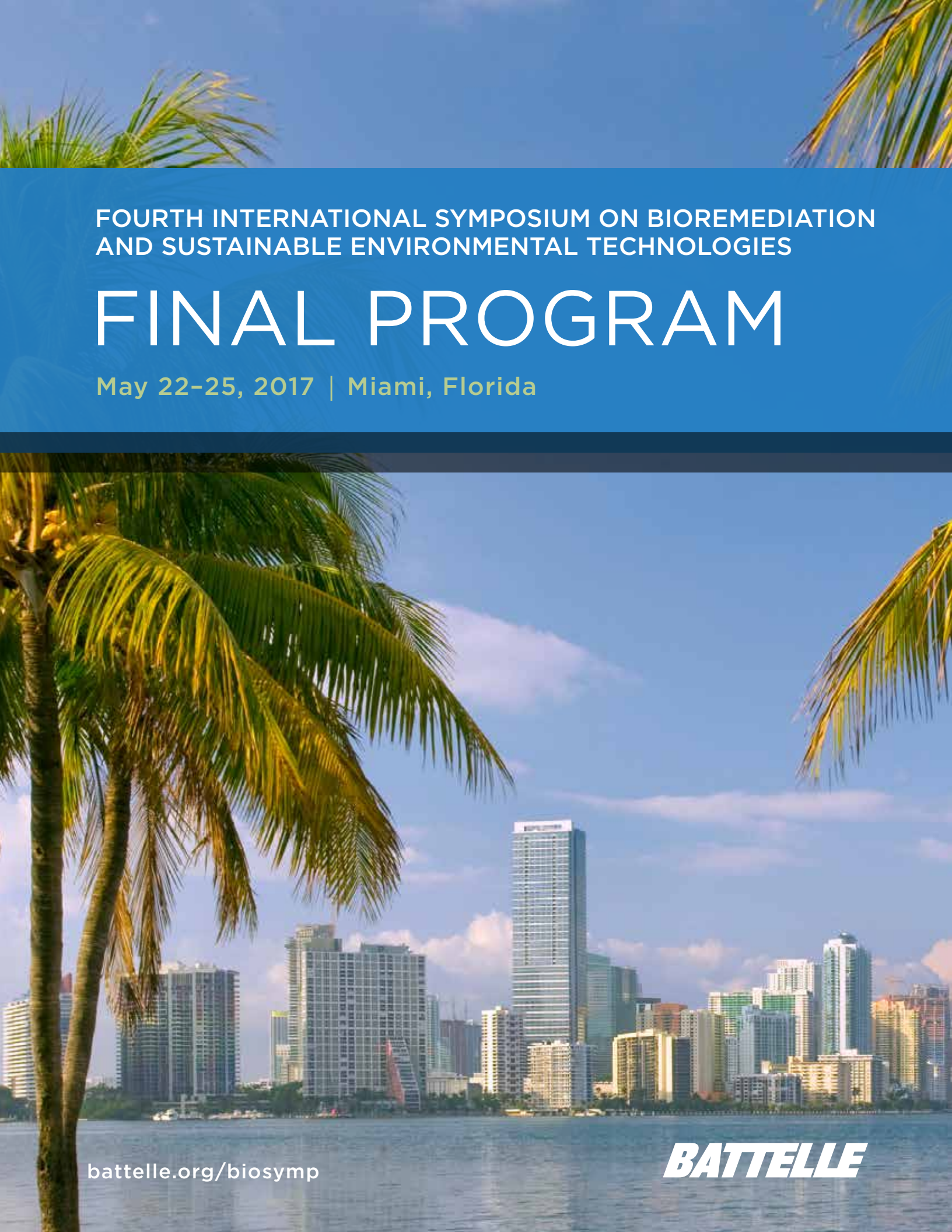

FOURTH INTERNATIONAL SYMPOSIUM ON BIOREMEDIATION AND SUSTAINABLE ENVIRONMENTAL TECHNOLOGIES

FINAL PROGRAM

May 22–25, 2017 | Miami, Florida

battelle.org/biosymp

BATTELLE

The Symposium is organized and presented by Battelle.

Battelle's environmental engineers, scientists and professionals offer focused expertise to government and industrial clients in the U.S. and abroad. Combining sound science and engineering solutions with creative management strategies, Battelle works with clients to develop innovative, sustainable and cost-effective solutions to complex problems in site characterization, assessment, monitoring, remediation, restoration, and management.

Every day, the people of Battelle apply science and technology to solving what matters most. At major technology centers and national laboratories around the world, Battelle conducts research and development, designs and manufactures products, and delivers critical services for government and commercial customers. Headquartered in Columbus, Ohio, since its founding in 1929, Battelle serves the national security, health and life sciences, and energy and environmental industries.

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It can be done

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Symposium Sponsors

Battelle gratefully acknowledges the support of the following organizations, which have made financial contributions toward the general costs of planning and conducting the Symposium. The corporate descriptions they provided appear on page 38.

AECOM
www.aecom.com

CDM Smith
www.cdmsmith.com

EOS Remediation, LLC
www.eosremediation.com

FRx
www.frx-inc.com

OBG
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REGENESIS
www.regenesis.com

FOURTH INTERNATIONAL SYMPOSIUM ON BIOREMEDIATION AND SUSTAINABLE REMEDIATION TECHNOLOGIES

Welcome back to Miami! Thank you for attending the 2017 Bioremediation Symposium. We believe you will find both the technical program content and the networking opportunities well worth your time. We're looking forward to a great week, with more than 700 environmental professionals from 25 countries participating in the extensive technical program and other events.

We appreciate the participation of the Symposium Sponsors, whose financial support has been an important part of the planning process. In addition, we recognize the efforts of the Technical Steering Committee, the session chairs and panel organizers, and the presenters who have devoted their time and technical expertise to developing a high-quality program.

The program, consisting of more than 500 platform and poster presentations, will present information on advances in bioremediation and the incorporation of green and sustainable remediation (GSR) practices in a series of technology-focused sessions. The development and use of advanced tools for assessing and monitoring bioremediation and natural attenuation, as well as the challenges of applying bioremediation at various types of complex sites and under extreme climatic conditions, will be considered. Several sessions will address characterization and bioremediation of emerging contaminants, focusing on per- and poly-fluorinated alkyl substances (PFAS) and 1,4-dioxane. A series of sessions will cover biodegradation and remediation of crude oil in various environments and the management of petroleum hydrocarbon sites. Innovative biological processes and applications for pollution prevention and waste management will be addressed, as will the evaluation and mitigation of vapor intrusion. GSR practices will be discussed as they apply to all stages of remediation, from remedy selection and optimization to long-term monitoring and management strategies. Sessions addressing the adaptation of remediation systems to climate change and international perspectives on GSR will also be included. In addition, several sessions will focus on munitions response and remediation of munitions constituents.

Three short courses will be offered on Monday, May 22. The Symposium Registration Desk will open at 2:00 p.m. Monday. The 48 exhibit booths, the Welcome Reception, and the Group 1 poster display will open at 5:00 p.m. The Plenary Session will begin at 6:30 p.m.

From Tuesday through Thursday, 55 technical sessions and three panels will be conducted. Posters will be presented in two groups, on Tuesday and Wednesday evenings. On Thursday afternoon, the Symposium will conclude at 3:30 p.m.

Come to Miami early or stay late and take advantage of all the city offers. Enjoy the international cuisine available at the many restaurants within walking distance of the hotel. Visit one of the area beaches or explore the unique architecture of the Art Deco District of South Beach. The Hyatt is located on the scenic Riverwalk in the heart of bustling downtown Miami and overlooks the Miami River and Florida's famed Biscayne Bay. It is conveniently located—near the Port of Miami, Bayside Marketplace and American Airlines Arena and 15 minutes from South Beach—and is within easy walking distance of the nightlife, shopping, sports and other attractions that bring people to "America's Riviera."

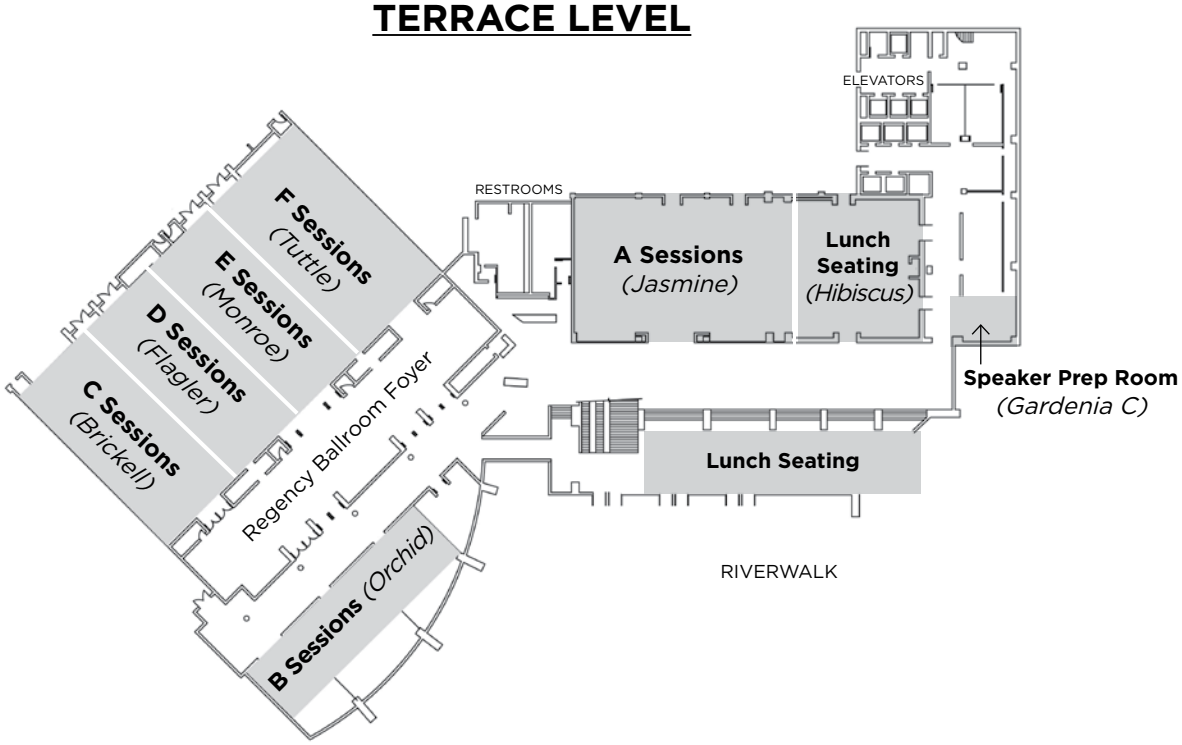
Andrew Barton
Stephen Rosansky
Symposium Chairs (Battelle)

Contents

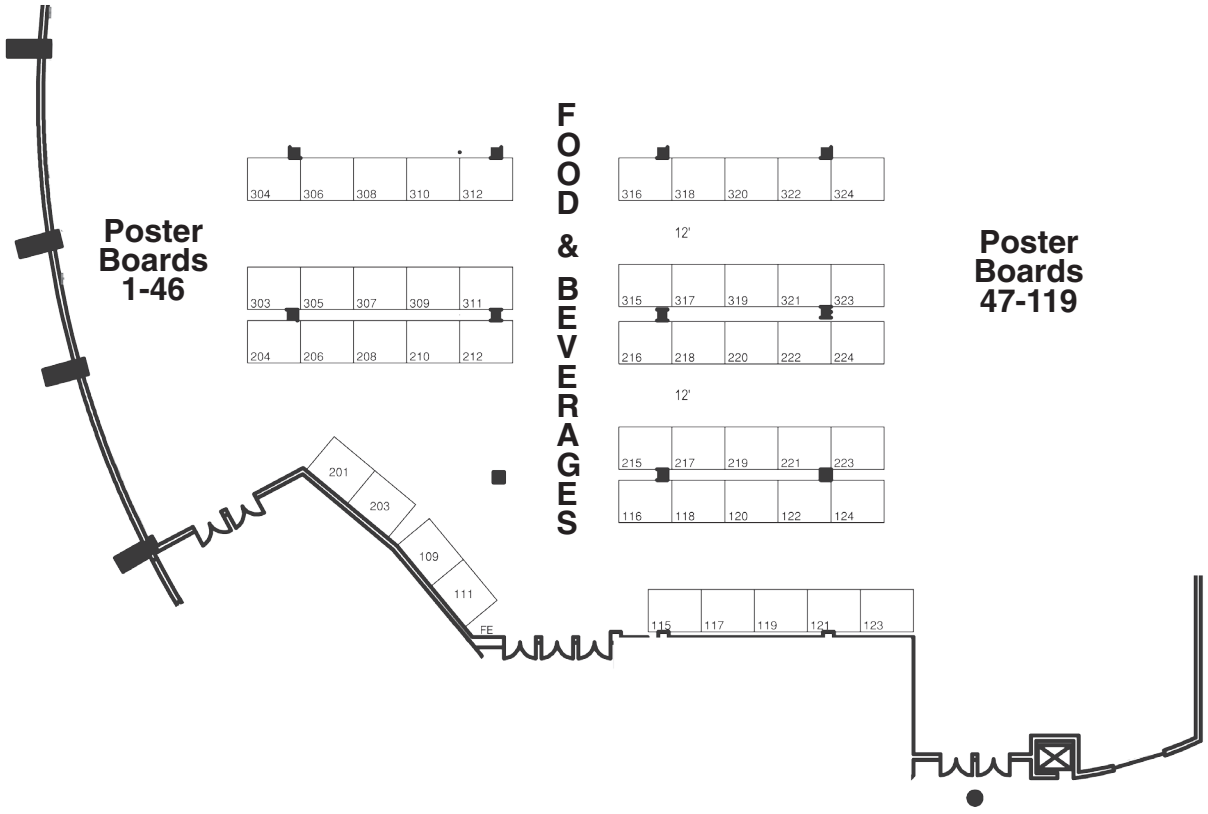
SYMPOSIUM FLOOR PLAN

LOBBY LEVEL

TERRACE LEVEL



EXHIBITORS AND EXHIBIT FLOOR PLAN



Listed by Organization—Symposium Sponsors Shown in Bold

GENERAL INFORMATION

All Symposium events will be held at the Miami Convention Center (MCC) Riverfront Hall and the Hyatt Regency Miami, Terrace Level.

Schedule Overview

Monday, May 22

- 8:00 a.m.-5:00 p.m. Short Courses (Hyatt, Terrace Level)
- 2:00-8:00 p.m. Registration Desk Open (MCC, Riverfront Hall Lobby)
- 5:00-6:30 p.m. Welcome Reception, Exhibits, Poster Group 1 Display (MCC, Riverfront Hall)
- 6:30-8:00 p.m. Plenary Session featuring Dr. Larry Brand (*University of Miami*) and Dr. David Tsao (*BP*) (Hyatt, Terrace Level)

Tuesday & Wednesday, May 23-24

- 7:00-8:00 a.m. Continental Breakfast (MCC, Riverfront Hall)
- 8:00 a.m.-5:35 p.m. Platform Presentations (Hyatt, Terrace Level)
- 11:00 a.m.-1:00 p.m. Buffet Lunch (MCC, Riverfront Hall & Hyatt, Terrace Level)
- 5:45-7:00 p.m. Poster Reception (MCC, Riverfront Hall)
  - Tuesday, Group 1 Posters
  - Wednesday, Group 2 Posters

Thursday, May 25

- 7:00-8:00 a.m. Continental Breakfast (MCC, Riverfront Hall)
- 8:00 a.m.-3:30 p.m. Platform Presentations (Hyatt, Terrace Level)
- 3:30 p.m. Conference Adjourns

See the following pages for additional information:
- Page 12: Short Courses offered on Monday.
- Pages 12-13: Overview of the platform sessions and panels to be conducted each day. Times for exhibits, breakfasts, lunches, and receptions.
- Pages 19 and 29: Presentations in each of the two poster groups.

Symposium Registration

The Symposium Registration Desk is located in the lobby of the Miami Convention Center and is accessible from the Hyatt's Main Level. Attendees can pick up their badges and Symposium materials beginning at 2:00 p.m. on Monday, May 22.

Presentations

Platform and poster presentations and panels are listed by day on pages 14-37. Late revisions in platform presentations (speaker changes, withdrawals) will be marked on overview sheets posted in the registration area and on daily lists outside each breakout room.

Photos/videos/recording of any platform, poster, or panel presentation are prohibited without securing the speaker's permission. Session Chairs or Panel Moderators must be notified in advance of the session if you have secured the speaker's permission and intend to record or take photos.

Platform talks are scheduled at 25-minute intervals, and each talk is to begin promptly at the time printed in the schedule, except as may be noted at the beginning of the day on the overview sheets and the daily lists. Session chairs are to adhere strictly to the schedule, making it possible for registrants to move between breakout rooms to hear the talks of greatest interest to them. To minimize distraction, please confine movement between rooms to the short intervals between talks.

Posters will be displayed in the Exhibit Hall. During the presentation periods, presenters will be at their posters to discuss their work, and light refreshments will be served.

Panel discussions are scheduled within the platform session tracks shown below.

Program Topics

Bioremediation Implementation Practices: Sessions A1-A8; Panel on Tuesday

Characterization and Bioremediation of Upstream Oil and Gas Releases: Sessions B1-B4

Managing Petroleum Hydrocarbon Sites: Sessions B5-B8

Biodegradation of Emerging Contaminants: Sessions B9-B11

Advanced Tools for Assessing Bioremediation: Sessions C1-C5

Innovative Biological Approaches to Pollution Prevention and Waste Management: Sessions C6-C7; Panel on Thursday

Application of Bioremediation to Complex Sites: Sessions D1-D4

Innovations in Bioremediation Technologies: Sessions D5-D9

Evaluating and Mitigating Vapor Intrusion: Sessions E1-E4

Munitions Response: Sessions E5-E6

Advances in Assessing and Monitoring Natural Attenuation: Session E7-E10

Characterization and Remediation of Per- and Poly-Fluorinated Alkyl Substances (PFAS): Sessions F1-F4; Panel on Tuesday

Sustainable Site Management Strategies: Sessions F5-F6

Green and Sustainable Remediation (GSR): Sessions F7-F10

Proceedings

All presentations given at the Symposium will be represented in the proceedings. Each platform and poster presenter was invited to submit a short paper expanding upon his or her presentation. If no paper was submitted, the one-page abstract used in the abstract collection distributed shortly before the Symposium will be included in the proceedings, along with the slide files for platform presentations. PDFs of most poster presentations will also be included. After the Symposium, the proceedings will be compiled, published in electronic format, and distributed to technical-program registrants.

Professional Development

If you would like to receive a general certificate of Symposium attendance, inquire at the Registration Desk. PDF certificates will be emailed after the Symposium. It is not necessary to log your hours if you require only a general certificate of attendance.

If your state licensing board accepts conference attendance and will require documentation of hours attended, a daily attendance log must be established for you at the Registration Desk and filled out to completion daily. A certificate with the number of hours logged will be emailed after the Symposium.

Come to the Registration Desk upon arrival to fill out your hours tracking sheet.

Exhibits

The Exhibit Hall is located in the Miami Convention Center, Riverfront Hall. The 48 exhibitors are companies, government agencies, and not-for-profit organizations that provide environmental assessment, remediation, and management activities or supply related products and services.

Exhibits will be on display from 5:00 p.m. Monday through 1:00 p.m. Thursday. See page 3 for the floor plan and the list of exhibitors.

Internet Café & Ad Hoc Meeting Space

An Internet Café will be available in the Exhibit Hall to participants who wish to check email during Symposium hours. Complimentary wireless Internet access also is available on the Session Room Level.

Private meeting rooms will be available for attendees' use for ad hoc meetings; check at the Symposium Registration Desk for available rooms.

Messages/Job Board

A message board will be available near the Symposium Registration Desk for the use of attendees wishing to contact one another. Notices about jobs available or help wanted may be posted here. This board will be used also for messages taken by the registration staff for attendees.

Meals and Receptions

For the convenience of Symposium attendees, the following light receptions, meals, and breaks will be provided during the program at no additional cost to program registrants and exhibit booth staff.

Monday, May 22

- Welcome Reception (Exhibit Hall)–5:00-6:30 p.m.

Tuesday-Wednesday, May 23-24

- Continental Breakfast (Exhibit Hall)–7:00-8:00 a.m.
- Morning Beverage Break (Exhibit Hall)–9:00-10:00 a.m.
- Buffet Lunch (Exhibit Hall/Hyatt, Terrace Level)–11:00 a.m.-1:00 p.m.
- Afternoon Beverage Break (Exhibit Hall)–2:30-3:30 p.m.
- Poster Reception (Exhibit Hall)–5:45-7:00 p.m.

Thursday, May 25

- Continental Breakfast (Exhibit Hall)–7:00-8:00 a.m.
- Morning Beverage Break (Exhibit Hall)–9:00-10:00 a.m.
- Buffet Lunch (Exhibit Hall/Hyatt, Terrace Level)–11:00 a.m.-1:00 p.m.

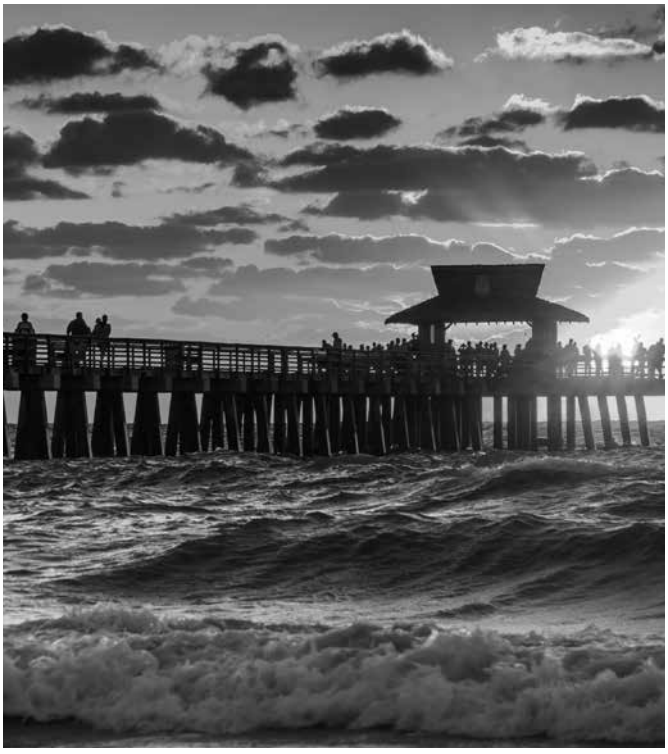
A coffee bar and restaurant are available in the Hyatt Lobby, and many other restaurants and cafes are within walking distance. Registrants can purchase guest meal tickets at the Symposium Registration Desk; guest tickets will be priced equal to the cost incurred by the Symposium for each meal.

Buffet Lunches

Tuesday-Thursday from 11:00 a.m.-1:00 p.m.

Lunch seating and buffet lines are available in the Exhibit Hall and on the Terrace Level of the Hyatt. Seating is limited on the Terrace Level. Menu selections are identical in both locations. Please have the appropriate day's ticket, located in the back of your Symposium badge, when you pass through the buffet line. It will be collected by Symposium staff at the start of each line.

Lunch buffet lines will close promptly at 1:00 p.m.; please plan your schedule accordingly.



Student Participation

In addition to the technical information gained by attending presentations and visiting exhibits, students will be able to meet and talk with environmental professionals representing a wide range of work experience and employers.

Student Paper Competition. Papers were due October 14, 2016. The winner received a complimentary Symposium registration and, through the generosity of the Student Event sponsors, a financial award to help cover travel and related costs.

Student Paper Winner

Ya He (Rice University)
Biodegradation of 1,4-Dioxane by Three Enriched Consortia
Presentation: Poster #19, Group 2 (Wednesday)

Congratulations!

Elevator Pitch Event. Up-and-coming scientists and engineers will pitch their research, technologies, and ideas during the lunch break in Orchid (B Sessions room) on Tuesday, May 23, from 11:45 a.m.-12:35 p.m. All Symposium attendees are invited to attend the Elevator Pitch event and may bring lunch into the room. The best pitch will be awarded a $100 prize at the Student & Young Professional Reception.

Student Event Sponsors. The following organizations provided financial support for the student paper awards and events.

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IN MEMORIAM

Richard (Dick) L. Raymond, Sr., passed away January 27, 2017. Dick led the team that developed the first commercial process for in situ bioremediation of hazardous waste (i.e., the Raymond process). His patent, U.S. Patent 3,846,290 (Reclamation of Hydrocarbon-Contaminated Ground Waters), provided the basis for the development of the bioremediation industry and earned him recognition by the U.S. EPA as the "grandfather of in-situ bioremediation." He went on to author or co-author an additional 22 patents throughout his career and founded the first in situ bioremediation company in the US (Biosystems, Inc.) in 1984.

However, Dick contributed more than just his ideas to groundwater bioremediation. He was always looking for a better way. He talked about science, not trade secrets. He freely shared his experience with anyone who was interested in solving a problem, from university students, to practicing engineers, to government regulators. His approach to solving problems has been widely adopted in the industry and his innovative, adventurous, and inquisitive spirit will be sorely missed.

Those wishing to remember and honor Dick are invited to join others on **Tuesday, May 23, from 6:30-7:30 p.m. in the Flamingo Room (Hyatt, 4th Floor)** for a short presentation highlighting his contributions to bioremediation.

Questions can be directed to John Wilson (Scissortail Environmental Solutions, LLC) at **john@scissortailenv.com** or 580-421-3551.

PLENARY SESSION

Plenary Session

Monday, May 22, 6:30-8:00 p.m.

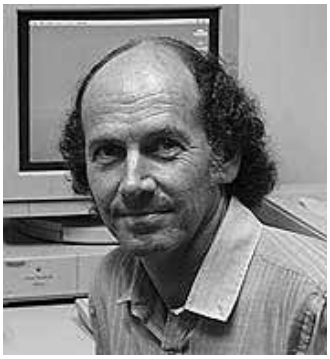
Welcome and Opening Remarks

Symposium Chairs:
Andrew Barton and Steve Rosansky
(Battelle)

Presentation of Student Paper Awards

Plenary Presentations
Harmful Algal Blooms in South Florida: Environmental Causes and Human Health Consequences
Larry E. Brand, Ph.D. *(University of Miami)*

Evaluating Bioremediation Agents as an Oil Spill Response Alternative
David Tsao, Ph.D. *(BP, Americas Remediation Engineering and Technology)*



Larry E. Brand, Ph.D.

University of Miami

Professor, Marine Biology and Ecology at the Rosenstiel School of Marine and Atmospheric Science

Harmful Algal Blooms in South Florida: Environmental Causes and Human Health Consequences

Dr. Brand is a professor of marine biology and ecology at the University of Miami in the Rosenstiel School of Marine and Atmospheric Sciences (RSMAS), where he specializes in phytoplankton ecology with a special interest in the interaction of ecological and evolutionary processes. His address will focus on the root causes and impacts of harmful algal blooms (i.e., red tides) in south Florida and across the world. Dr. Brand received his B.A in biology from the University of Texas at Austin, and his doctoral degree from the Woods Hole Oceanographic Institution/Massachusetts Institute of Technology Joint Program.

Blooms of cyanobacteria occur in Florida Bay, Biscayne Bay, Lake Okeechobee, Caloosahatchee River, St. Lucie estuary, and Indian River Lagoon. These blooms, ostensibly caused by human activities, are increasing across the U.S. and throughout the world. However, the geochemistry in south Florida is unique and the root causes of algal blooms are somewhat different compared to other regions. Dr. Brand will be discussing these localized factors and their effect on south Florida's coastal waters, and potential remedial options for addressing the impacts associated with the algal blooms.

He will also examine the role of algal toxins and their effect on human health, which is one focus of his current research. Virtually all algal toxins have been discovered because of their relatively rapid effect on human health, which can be tracked back to their source epidemiologically. For example, the cyanotoxin microcystin was discovered because it causes relatively rapid gastrointestinal disorders or death. Once examined in detail, it has been discovered to also lead to long term liver damage and liver cancer. Algal toxins that cause slow developing, long-term health effects (e.g., cancer, neurodegenerative diseases), but no immediate health effects, are extremely difficult to discover. The neurotoxin beta-Methylamino-L-alanine (BMAA) is an exception, in that it causes no immediate health effects, but increasing evidence suggests it can lead to neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, and Amyotrophic lateral sclerosis (also known as Lou Gehrig's disease).

David T. Tsao, Ph.D.

BP

Manager, Americas Remediation Engineering and Technology

Evaluating Bioremediation Agents as an Oil Spill Response Alternative

Dr. David Tsao is BP's Group Subject Matter Expert on soil and groundwater remediation and is currently responsible for a team of specialists coordinating, developing, and implementing the technical cleanup strategies for a broad range of BP sites as well as evaluating and minimizing the potential environmental impacts of new products and activities associated with unconventional and alternative energy sources.

Dr. Tsao is a chemical engineering graduate of Purdue University where his research included plant biotechnology, pharmaceutical production, and plant production for space (NASA) closed ecological life support systems. His experience includes specialization in the remediation of fuel oxygenates and the use of bio- and phyto-technologies for remediation and prevention and he actively publishes research and technical guidance, develops, and teaches these technologies.

He is active in oil spill response planning and prevention and led the Bio-Chem Strike Team for the *Deepwater Horizon* response. In his address, he will be discussing that team's evaluation of the effectiveness of bioremediation agents that were proposed as a response action for various aspects of the incident (in the water and on shorelines).

Dr. Tsao is current President of the International Phytotechnology Society and Senior Editor of the *International Journal of Phytoremediation*. He also serves on the Board of Advisors for the Interstate Technology and Regulatory Council.

PROGRAM COMMITTEE, SESSION CHAIRS AND PANEL MODERATORS

Program Committee

Symposium Chairs

Andrew Barton (Battelle)

Stephen Rosansky (Battelle)

Technical Steering Committee

Les Clarke, PMP (Battelle)

Charles Coyle, PE (USACE)

Diana Cutt (U.S. EPA)

Ramona Darlington, Ph.D. (Battelle)

Rick Hanoski (EA Environmental)

Kate Kucharzyk, Ph.D. (Battelle)

Matthew Lahvis (Shell)

Carmen Lebron (SERDP/ESTCP)

Patricia Reyes (ITRC)

Russell Sirabian, PE, PMP, LEED Green Associate (Battelle)

John Simon (SURF)

Jim Tarr, MS, PG (U.S. Navy)

Tuesday Platform Sessions

A1. Amendment Delivery Strategies
Charles Newell (GSI Environmental, Inc.)
Brant Smith (PeroxyChem, LLC)

A2. Combined Remedies for VOCs
Tom Cornuet (OBG)
Tamzen Macbeth (CDM Smith, Inc.)

B1. Bioremediation in Marshes and Deep-Sea Environments
John Pardue (Louisiana State University)

B2. Biodegradation and Remediation of Crude Oil in Cold Regions
Matthew Alexander (Texas A&M University-Kingsville)
Harley Hopkins (Exxon Mobil Corporation)

B3. Remediation of Heavy Hydrocarbon-Contaminated Soils
Roopa Kamath (Chevron Energy Technology Company)
James Wang (Geosyntec Consultants)

B4. Remediation of Hydrocarbon Spills
Sanjay Garg (Shell Global Solutions)
Ian Hers (Golder Associates Ltd.)

C1. Modeling and Monitoring Approaches to Improve Remedy Design and Implementation
Eric Nichols (Substrata LLC)
Heather Campbell Veith Rectanus (Battelle)

C2. Compound-Specific Isotope Analysis
Ramon Aravena (University of Waterloo)
Patrick McLoughlin (Pace Analytical Energy Services)

C3. Next Generation MBTs: A Pathway to Precision Bioremediation
Andrea Leeson (SERDP/ESTCP)
Frank Loeffler (University of Tennessee)

D1. Biodegradation in Fractured Bedrock Sites
Naji Akladiss (Maine Department of Environmental Protection)
Timothy Mattes (University of Iowa)

D2. Managing Large and Dilute Plumes
Anthony Danko (U.S. Navy)
Chapman Ross (Geosyntec Consultants)

D3. Amendment Distribution Challenges for Large Bioremediation Sites
Tanwir Chaudhry (U.S. Navy Consultant)
James Romer (Amec Foster Wheeler)

D4. Bioremediation of Sediments
Kirsten Kerns (U.S. Army Corps of Engineers)
Birthe Kjellerup (University of Maryland)

E1. Inhalation Exposures from Subsurface Contamination
Bart Eklund (AECOM)
Robert Ettinger (Geosyntec Consultants)

E2. Innovative Tools for Evaluating Vapor Intrusion Risk
Todd McAlary (Geosyntec Consultants, Inc.)
Thomas Szocinski (Land Science)

E3. Vapor Intrusion Mitigation Methods
Donna Caldwell (U.S. Navy)
David Folkes (Geosyntec Consultants)

E4. VOC Vapor Intrusion
Christopher Lutes (CH2MHILL)
Erick Suuberg (Brown University)

F1. Fate and Transport of PFAS
Neal Durant (Geosyntec Consultants)
James Tarr (U.S. Navy)

F2. Sorption Technologies for PFAS
Tim Appleman (U.S. Navy)
Erika Houtz (Arcadis)

F3. Toxicological Impacts of PFAS in Human Health and the Environment
Janet Anderson (Integral Consulting Inc.)
Michael Quinn (Army Public Health Center)

Wednesday Platform Sessions

A3. Case Studies
Travis Borrillo (U.S. Navy)
Venus Sadeghi (AECOM)

A4. Bioremediation of Heavy Metals
Raymond Lees (Langan Engineering & Environmental Services, Inc.)
Kevin Torrens (Brown and Caldwell)

A5. Enhancements to Biodegradation Strategies
Rick Gillespie (Regenesis)
Kevin Sowers (University of Maryland, Baltimore County)

B5. Natural Source Zone Depletion
Tom Sale (Colorado State University)
Michael Singletary (U.S. Navy)

B6. LNAPL Mobility, Transmissivity, and Recoverability
Mark Benotti (NewFields Environmental Forensics Practice, LLC)
Derek Tomlinson (GEI Consultants)

B7. Remediation and Management of Petroleum-Hydrocarbon Contaminated Sites
David Burris (Integrated Science & Technology, Inc.)
Laurie LaPat-Polasko (Ramboll Environ)

B8. Combined Approaches for the Remediation of Petroleum Hydrocarbons
Matthew Lahvis (Shell Global Solutions)
Curtis Stanley (GSI Environmental, Inc.)

C4. Petroleum Hydrocarbon-Related Molecular Diagnostics
Dora Ogles-Taggart (Microbial Insights, Inc.)
Kerry Sublette (University of Tulsa)

C5. High-Resolution Site Characterization
Stephen Dyment (U.S. EPA)
Murray Einarson (Haley & Aldrich, Inc.)

D5. Enhanced Methods for Biodegradation of Organic and Inorganic Contaminants
Brad Elkins (EOS Remediation, LLC)
David Freedman (Clemson University)

D6. Advances in Amendment Formulation
Daniel Leigh (PeroxyChem, LLC)
Scott Wilson (Regenesis)

E5. Bioremediation of Munitions Constituents
Paul Caprio and Rick Hanoski (EA Engineering, Science, and Technology, Inc.)

E6. Insensitive Munitions: Characterization, Fate, and Transport
James Field (University of Arizona)
Kevin T. Finneran (Clemson University)

E7. Advances in Tools and Techniques for Assessing MNA
Kent Sorenson (CDM Smith, Inc.)
Todd Wiedemeier (T.H. Wiedemeier & Associates, Inc.)

F4. Innovative Treatment Technologies for PFAS Compounds
Greg Deaver (AECOM)
John Kornuc (US Navy, EXWC)

F5. Optimizing Existing Systems
Gunarti Coghlan and Patricia Venable (U.S. Navy)

F6. Risk Management Strategies
Sandip Chattopadhyay (U.S. EPA)
Rula Anselmo Deeb (Geosyntec Consultants)

F7. Incorporating GSR into Remedy
Melissa Harclerode (CDM Smith, Inc.)
Russell Sirabian (Battelle)

Thursday Platform Sessions

A6. Biobarrier Installation and Management
Bruce Henry (Parsons)
Cannon Silver (CDM Smith, Inc.)

A7. Strategies for Bioremediation Performance Assessment
Mandy Michalsen (U.S. Army Corps of Engineers)
Kevin Morris (ERM)

A8. Successes and Failures of Bioaugmentation and Biostimulation
Michael Kozar (OBG)
Ryan Wymore (CDM Smith, Inc.)

B9. 1,4-Dioxane Treatment Technologies I
Paul Hare (OBG)
Rebecca Mora (AECOM)

B10. 1,4-Dioxane Treatment Technologies II
Arul Ayyaswami (Tetra Tech, Inc.)
Dora Chiang (AECOM)

B11. Other Emerging Contaminants
Linda Fiedler (U.S. EPA)
P. James (Jim) Linton (Geosyntec)

C6. Microbial-Based Alternative Energy
Patrick Evans (CDM Smith, Inc.)
Harold May (Medical University of South Carolina)

C7. Advances in Biological Wastewater Treatment Processes
Paul Hatzinger (CB&I Federal Services, LLC)

D7. Cometabolic Bioremediation
Friedrich Krembs (Trihydro Corporation)
Bilgen Yuncu (Solutions-IES, a Division of Draper Aden Associates)

D8. Engineering Biogeochemical Transformation
Robert Borden (EOS Remediation, LLC)
Nanjun Shetty (AECOM)

D9. Phytoremediation/ Mycoremediation
Tesema Chekol (Battelle)
David Tsao (BP Corporation)

E8. Natural Attenuation Processes
Ramona Darlington (Battelle)
John Wilson (Scissortail Environmental Solutions, LLC)

E9. MNA for Achieving Site Goals
Jeremy Birnstingl (Regenesis)
John Connor (GSI Environmental, Inc.)

E10. Groundwater/Surface Water Interaction
James Landmeyer (U.S. Geological Survey)
Joseph Quinnan (Arcadis)

F8. Sustainable Remediation Assessment Tools
Carol Lee Dona (U.S. Army Corps of Engineers)
Paul Favara (CH2M HILL)

F9. Best Practices in GSR
Rick Wice (Tetra Tech, Inc.)
Gerlinde Wolf (AECOM)

F10. Incorporating Sustainability Considerations into Remediation Projects
Carlos Pachon (U.S. EPA)
Jonathan Smith (Shell Global Solutions)

Panel Discussions

Tuesday—Track A
A Model for Combined Remedies at Well 12A Superfund Site, Tacoma, Washington

Moderators: Jim Cummings (U.S. EPA) and Neil Smith (CDM Smith)

Tuesday—Track F
Sampling and Analysis of PFAS Compounds: Lessons Learned and State of the Science

Moderator: Ramona Darlington (Battelle)

Thursday—Track C
Using Geology to Follow the Groundwater, Follow the Flow to Successful Remediation

Moderators: Rick Cramer (Burns & McDonnell) and John Wilson (Scissortail Environmental Solutions, LLC)

MONDAY, MAY 22, 2017

7:00-8:00 a.m. Morning Short Course Check-In
12:00-1:00 p.m. Afternoon Short Course Check-In
6:30-8:00 p.m. Plenary Session
2:00-8:00 p.m. Symposium Registration

8:00 a.m.-5:00 p.m. Short Courses

8:00 a.m.-Noon

- Groundwater Statistics to Geospatial Analysis for Remediation Compliance and Optimization: An ITRC Course

- The Utilization of Stable Isotopes as a Tool for Monitoring the Onset and Extent of Attenuation of Organic Compounds in Contaminated Sediments and Other Potential Applications Related to Bioremediation

1:00-5:00 p.m.

- Comprehensive ITRC DNAPL Guidance: Integrated DNAPL Site Strategy, Mass Flux-Discharge, and Bioremediation of DNAPL Sites

5:00-6:30 p.m. Welcome Reception, Exhibits, Poster Group 1 Display
6:30-8:00 p.m. Plenary Session

TUESDAY, MAY 23, 2017

7:00 a.m.-7:00 p.m. Registration, Exhibits, Poster Group 1 Display
7:00-8:00 a.m. Continental Breakfast
11:00 a.m.-1:00 p.m. Lunch
11:45 a.m.-12:35 p.m. Student & Young Professional Eievator Pitch

8:00 a.m.-5:35 p.m. Platform Sessions

A1. Amendment Delivery Strategies
A2. Combined Remedies for VOCs
PANEL. A Model for Combined Remedies at Well 12A Superfund Site, Tacoma, Washington

B1. Bioremediation in Marshes and Deep-Sea Environments
B2. Biodegradation and Remediation of Crude Oil in Cold Regions
B3. Remediation of Heavy Hydrocarbon-Contaminated Soils
B4. Remediation of Hydrocarbon Spills

C1. Modeling and Monitoring Approaches to Improve Remedy Design and Implementation
C2. Compound-Specific Isotope Analysis
C3. Next Generation MBTs: A Pathway to Precision Bioremediation

D1. Biodegradation in Fractured Bedrock Sites
D2. Managing Large and Dilute Plumes
D3. Amendment Distribution Challenges for Large Bioremediation Sites
D4. Bioremediation of Sediments

E1. Inhalation Exposures from Subsurface Contamination
E2. Innovative Tools for Evaluating Vapor Intrusion Risk
E3. Vapor Intrusion Mitigation Methods
E4. VOC Vapor Intrusion

F1. Fate and Transport of PFAS
F2. Sorption Technologies for PFAS
F3. Toxicological Impacts of PFAS in Human Health and the Environment
PANEL. Sampling and Analysis of PFAS Componds: Lessons Learned and State of the Science

5:45-7:00 p.m. Poster Group 1 Presentations and Reception
See page 19 for sessions in Poster Group 1.
7:30-8:45 p.m. Student & Young Professional Reception

WEDNESDAY, MAY 24, 2017

7:00 a.m.-7:00 p.m. Registration, Exhibits, Poster Group 2 Display
7:00-8:00 a.m. Continental Breakfast
11:00 a.m.-1:00 p.m. Lunch

8:00 a.m.-5:35 p.m. Platform Sessions

A3. Case Studies
A4. Bioremediation of Heavy Metals
A5. Enhancements to Biodegradation Strategies

B5. Natural Source Zone Depletion
B6. LNAPL Mobility, Transmissivity, and Recoverability
B7. Remediation and Management of Petroleum-Hydrocarbon Contaminated Sites
B8. Combined Approaches for the Remediation of Petroleum Hydrocarbons

C4. Petroleum Hydrocarbon-Related Molecular Diagnostics
C5. High-Resolution Site Characterization

D5. Enhanced Methods for Biodegradation of Organic and Inorganic Contaminants
D6. Advances in Amendment Formulation

E5. Bioremediation of Munitions Constituents
E6. Insensitive Munitions: Characterization, Fate, and Transport
E7. Advances in Tools and Techniques for Assessing MNA

F4. Innovative Treatment Technologies for PFAS Compounds
F5. Optimizing Existing Systems
F6. Risk Management Strategies
F7. Incorporating GSR into Remedy

5:45-7:00 p.m. Poster Group 2 Presentations and Reception
See page 29 for sessions in Poster Group 2.

THURSDAY, MAY 25, 2017

7:00 a.m.-1:00 p.m. Registration, Exhibits, Poster Group 2 Display
7:00-8:00 a.m. Continental Breakfast
11:00 a.m.-1:00 p.m. Lunch

8:00 a.m.-3:30 p.m. Platform Sessions

A6. Biobarrier Installation and Management
A7. Strategies for Bioremediation Performance Assessment
A8. Successes and Failures of Bioaugmentation and Biostimulation

B9. 1,4-Dioxane Treatment Technologies I
B10. 1,4-Dioxane Treatment Technologies II
B11. Other Emerging Contaminants

C6. Microbial-Based Alternative Energy
C7. Advances in Biological Wastewater Treatment Processes
PANEL. Using Geology to Follow the Groundwater, Follow the Flow to Successful Remediation

D7. Cometabolic Bioremediation
D8. Engineering Biogeochemical Transformation
D9. Phytoremediation/Mycoremediation

E8. Natural Attenuation Processes
E9. MNA for Achieving Site Goals
E10. Groundwater/Surface Water Interaction

F8. Sustainable Remediation Assessment Tools
F9. Best Practices in GSR
F10. Incorporating Sustainability Considerations into Remediation Projects

3:30 p.m. Symposium adjourns

TUESDAY MORNING

	A Sessions Jasmine	B Sessions Orchid	C Sessions Brickell
8:00	**Technologies, Methodologies, Best Practices for Distribution of Liquid and Solid Amendments for Chlorinated Solvent Remediation.** *E. Cooper and S. Chen.* Eliot Cooper (Cascade/USA)	**Transport of Crude Oil Aggregates and Associated Microbial Populations: Impact on Biodegradation Potential.** *D. Curtis, V. Elango, and J. Pardue.* Vijaikrishnah Elango (Louisiana State University/USA)	**Novel Use of Mass Flux Mapping to Optimize Large-Scale Biobarriers for Treatment of Perchlorate, TCE, Chromium and High Explosives.** *F.J. Krembs, D. Gravelding, and M.R. Olson.* Friedrich Krembs (Trihydro Corporation/USA)
8:25	**Strategies for Applying Reagents into Low Permeability and Fractured Media: Lessons Learned, Specific Challenges, and Best Practices.** *J. Molin, B. Smith, and F. Lakhwala.* Josephine Molin (PeroxyChem, LLC/USA)	**Microbially-Driven Fenton Reaction for Degradation of Oil Spill Contaminants.** *Y. Toporek, N. Xie, R. Sekar, M. Taillefert, and T. DiChristina.* Yael Toporek (Georgia Institute of Technology/ USA)	**Contaminant Mass Discharge Reduction as a Compliance Metric for a Multi-Technology Remedial Action.** *D. Giaudrone, T. Macbeth, N. Smith, R. Chichakli, R. Chappell, K. Lynch, and C. Cora.* Dominic Giaudrone (CDM Smith, Inc./USA)
8:50	**Lessons Learned from the Optimization of In Situ Bioremediation through Injection of Carbon Substrate.** *E. Tyler, J. Galemore, E. Nuttall, and L. Dalton.* Edward (Ted) Tyler (Kleinfelder, Inc./USA)	**Microbe Interactions with Environmental Variables in Hydrocarbon-Polluted Mangrove Swamp of Niger Delta Region, Nigeria.** *C.C. Nwankwo, C.J. Ogugbue, V.I. Obidiugwu, and G.C. Okpokwasili.* Chika Christiana Nwankwo (University of Port Harcourt/Nigeria)	**Biodegradation of Chlorinated Natural Organic Matter in Contaminated and Uncontaminated Sediment and Soil.** *H. Temme and P. Novak.* Hanna Temme (University of Minnesota/USA)
9:15	SESSION BREAK	**Aerobic Biostimulation of Buried MC252 Oil: Metagenomic and Biogeochemical Assessment of a New Response Approach.** *L. Fitch, Z. Romaine, V. Elango, and J. Pardue.* John Pardue (Louisiana State University/USA)	***Dehalococcoides* Social Networks in Chlorinated Solvent Environments.** *S. Cecillon, T.M. Vogel, M. Altizer, A.G. Delgado, and R. Krajmalnik-Brown.* Sebastien Cecillon (Ecole Centrale de Lyon/ France)
9:40	**Overcoming a Vexing Problem of Remediation at Sites with Complex Geology: Field Demonstrations of EK-Enhanced In Situ Remediation.** *J. Wang, E. Cox, D. Reynolds, D. Gent, M. Singletary, and A. Wilson.* James Wang (Geosyntec Consultants/USA)	SESSION BREAK	**Cryogenic Core Collection and High-Throughput Core Analysis: Post Remediation Performance Assessment.** *M. Olson, W. Clayton, T. Sale, M. Irianni-Renno, and R. Johnson.* Mitchell Olson (Trihydro Corporation/USA)
10:05	**Field Trials of Subsurface Chaotic Advection for Enhanced Reagent Delivery.** *M.S. Cho and N.R. Thomson.* Michelle Cho (University of Waterloo/Canada)	**Identifying Active Microbial Communities during In Situ Hydrocarbon Degradation in Cold Soils Using Heavy Phosphate.** *S. Mamet, A. Schebel, B. Ma, A. Ulrich, and S.D. Siciliano.* Steven Siciliano (University of Saskatchewan/ Canada)	SESSION BREAK
10:30	**A Rigorous Demonstration of Permeability Enhancement Technology for In Situ Remediation at Three Low Permeability Sites.** *K.S. Sorenson, D.D. Nguyen, N.T. Smith, M.R. Lamar, H. Anderson, G. Guest, and R. Kelley.* Kent Sorenson (CDM Smith, Inc./USA)	**Bioremediation of Petroleum Hydrocarbon-Contaminated Soils in Cold Climates: A Scaled-Up Field Experiment for the Feasibility of Extending Bioremediation beyond the Conventional Summer Treatment Season.** *J. Kim, R.N. Riess, and W. Chang.* Wonjae Chang (University of Saskatchewan/ Canada)	**Compound Specific Isotope Analysis (CSIA) as a Method to Verify Bioremediation of Chlorofluorocarbons at a Hazardous Waste Site.** *J. Manna, A. Horst, T. Gilevska, G. Lacrampe-Couloume, B. Sherwood Lollar, S. Dworatzek, and J. Webb.* Jesse Manna (University of Toronto/Canada)
10:55	**Soil Blending.** *J. Rossabi, J.S. Haselow, E. Escochea, S.J. Markesic, and J. Romano.* Joseph Rossabi (Redox Tech, LLC/USA)	**An Integrated Soil Respiration Model for Assessing Hydrocarbon Biodegradation Activity in Cold Region Site Soils.** *J. Kim and W. Chang.* Jihun Kim (University of Saskatchewan/Canada)	**Monochlorobenzene Contaminated Site Characterization by the Use of ^{37}Cl, ^{13}C and ^{2}H-Compound-Specific Isotope Analysis (CSIA), Biological Molecular Techniques (BMTs) and Numerical Modeling.** *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)
11:20	SESSION BREAK Lunch available from 11:00 a.m.-1:00 p.m.	**Field Demonstration of Citrate Amendments for Hydrocarbon Degradation in Cold Region Soils.** *S. Siciliano, T. Chen, C. Phillips, D. Peak, J. Grosskleg, K. Bradshaw, and T. Carlson.* Steven Siciliano (University of Saskatchewan/ Canada)	**Use of Diagnostic Tools to Assess the Efficiency of Sulfate Land Application to a Petroleum Hydrocarbon Plume.** *V. Ponsin, D. Hunkeler, D. Bouchard, E.L. Madsen, C.M. Derito, N.R. Thomson, K. Sra, T. Buscheck, R. Kolhatkar, and E. Daniels.* Violaine Ponsin (University of Neuchatel/ Switzerland)

A1. Amendment Delivery Strategies

B1. Bioremediation in Marshes and Deep-Sea Environments

B2. Biodegradation and Remediation of Crude Oil in Cold Regions

C1. Modeling and Monitoring Approaches to Improve Remedy Design and Implementation

C2. Compound-Specific Isotope Analysis

D Sessions Flagler	E Sessions Monroe	F Sessions Tuttle	
D1. Biodegradation in Fractured Bedrock Sites	**E1. Inhalation Exposures from Subsurface Contamination**	**F1. Fate and Transport of PFAS**	
Hydraulic Tomography: Estimating 3-D Hydraulic Conductivity in a DNAPL-Contaminated Fractured Rock Aquifer, Newark Basin, New Jersey, USA. *W. Barrash, C. Tiedeman, C. Thrash, J. Patterson, and C. Johnson.* Warren Barrash (Boise State University/USA)	**Mass Flux Characterization as an Alternative Approach to Evaluating Upper Bound Impacts of Vapor Intrusion on Building Occupants.** *H.E. Dawson, W. Wertz, T. McAlary, and D. Carr.* Helen Dawson (Geosyntec Consultants/USA)	**Per- and Poly-Fluorinated Alkyl Substance (PFAS) Distribution Trends in Soil and Groundwater at Former Air Force Installations.** *P.J. Bond and C. McMillen.* Catherine McMillen (Aerostar SES LLC/USA)	**8:00**
Enhanced Bioremediation of Chlorinated Solvents in Fractured Bedrock Aquifers. *D. Taggart, K. Clark, B.R. Baldwin, and M. Burns.* Dora Ogles-Taggart (Microbial Insights, Inc./USA)	**Data Collection and Interpretation to Support Screening Approaches for Vapor Intrusion Risk from Lead Scavengers.** *I. Hers, P. Jourabchi, J. Wilson, H. Luo, R. Kolhatkar, and M. Lahvis.* Ian Hers (Golder Associates Ltd./Canada)	**Environmental Sequence Stratigraphy-Based Conceptual Site Model: The First Consideration for Characterizing PFAS.** *C. Plank, R. Cramer, J. Gillespie, and M. Shultz.* Colin Plank (Burns & McDonnell/USA)	**8:25**
Identification of PCE Degradation Processes in Fractured Rock Aquifer. *M. Stayrook, J. Waddell, and M. Dever.* Jonathan Waddell (EHS Support LLC/USA)	**Estimating VI Exposure Risks: A VI Modeling Approach that Combines the Influence of Wind and Stack Effects on Indoor and Subsurface Environments.** *E. Shirazi, M. Roghani, and K.G. Pennell.* Kelly Pennell (University of Kentucky/USA)	**PFC Distribution at Three Unique Release Sites and the Implications on Characterization Design.** *S. LaRosa, F. Riccardi, and B. Martin.* Steve LaRosa (Weston & Sampson/USA)	**8:50**
The Effect of Bioremediation on Microbial Community Dynamics, Transport and Degradation of Chlorinated Solvents in a Fractured-Rock Aquifer. *J.C. Underwood, R.W. Harvey, D.M. Akob, M.M. Lorah, and T.E. Imbrigiotta.* Jennifer Underwood (U.S. Geological Survey/USA)	**Empirical Study to Estimate the Air Exchange Rate within a Trench for Modeling Inhalation Risks.** *S. Thompson, P. Michalski, and J. Pruis.* Shannon Thompson (212 Environmental Consulting, LLC/USA)	**Investigation and Treatment of Perfluoroalkyl Substances at a Rurally-Located Naval Airfield.** *L. Cook, J. Dean, A. Jones, and J. Hatton.* Laura Cook (CH2MHILL/USA)	**9:15**
ITRC's Bioremediation of Chlorinated Ethenes: DNAPL Source Zones—Fractured Rock Applications. *R.A. Wymore, T. Macbeth, N. Akladiss, and M.B. Smith.* Ryan Wymore (CDM Smith, Inc./USA)	SESSION BREAK	**Variable PFC Attenuation Rates across a Discrete Aquifer Horizon below a Former Manufacturing Facility.** *M.F. Eberle and M. Edelman.* Michael Eberle (TRC Companies, Inc./USA)	**9:40**
The Influence of Complex Fractured Bedrock on In Situ Enhanced Reductive Dechlorination of TCE. *F. Barranco, K. Fox, J. Drummond, B. Rundell, and R. Bower.* Frank Barranco (EA Engineering, Science, and Technology, Inc./USA)	**Long-Term Passive VOC Sampling Validation under Time-Varying Conditions at a Vapor Intrusion Study House.** *Y. Guo, H. O'Neil, P. Dahlen, and P.C. Johnson.* Yuanming Guo (Arizona State University/USA)	**Fate and Transport Modeling of PFOS in a Fractured Chalk Aquifer towards a Large-Scale Drinking Water Abstraction.** *I. Ross, J. Burdick, J.A.L. Miles, E. Houtz, and J. McDonough.* Ian Ross (ARCADIS/United Kingdom)	**10:05**
SESSION BREAK	**Real-Time FTIR Monitoring of Parts per Trillion Level Vapor Intrusions.** *C.T. Laush and T.A. McAlary.* Curtis Laush (Geosyntec Consultants/USA)	SESSION BREAK	**10:30**
D2. Managing Large and Dilute Plumes	**E2. Innovative Tools for Evaluating Vapor Intrusion Risk**	**F2. Sorption Technologies for PFAS**	
Combined Active and Passive Treatment of Large, Dilute PCE Plume. *F.J. Krembs, G.E. Mathes, M.R. Olson, and M.G. Sweetenham.* Friedrich Krembs (Trihydro Corporation/USA)	**Interpreting Vapor-Intrusion Data with Radar Plots.** *M. Schmidt.* Martin Schmidt (Cox-Colvin & Associates/USA)	**Sorption Behavior of Per- and Poly-Fluoroalkyl Substances (PFASs) on Filter Material for Remediation.** *M. Sorengard and L. Ahrens.* Mattias Sörengård (Swedish University of Agricultural Sciences/Sweden)	**10:55**
In Situ Bioreactors (ISBRs) for Effective Bioremediation of Chlorinated Hydrocarbons in Deep, Fractured Bedrock Aquifers. *D. Taggart, K. Clark, B.R. Baldwin, R. Beebe, E. Raes, and K. Sublette.* Ryan Beebe (Earth Data Northeast, Inc./USA)	**Evaluation of Indoor Air Concentrations and Exposures and Implications for Indoor Air Sampling Approaches.** *N. Weinberg, C. Lutes, R. Truesdale, B. Schumacher, and J. Zimmerman.* Christopher Lutes (CH2MHILL/USA)	**Technical Solution for the Removal of PFAS in Water.** *J. Buhl and M. Cornelsen.* Jurgen Buhl (Cornelsen Umwelttechnologie GmbH/Germany)	**11:20**

TUESDAY AFTERNOON

A Sessions
Jasmine

B Sessions
Orchid

C Sessions
Brickell

11:45

SESSION BREAK
Lunch available from 11:00 a.m.-1:00 p.m.

SESSION BREAK
Lunch available from 11:00 a.m.-1:00 p.m.

Student & Young Professional Elevator Pitch Event from 11:45 a.m.-12:35 p.m.

C2. Compound

Assessing the Potential and Limitations of the Current "State of the Art" of CSIA-Based Forensics. *P.W. McLoughlin.*
Patrick McLoughlin (Pace Analytical Energy Services/USA)

12:10

Panel

A Model for Combined Remedies at Well 12A Superfund Site, Tacoma, Washington

Moderators
Jim Cummings (U.S. EPA)
Neil Smith (CDM Smith)

Panelists
Emily Crownover, Ph.D. (TRS Group, Inc.)
Dominic Giaudrone (CDM Smith)
Tamzen Macbeth, Ph.D. (CDM Smith)

12:35

B3. Remediation of Heavy Hydrocarbon-Contaminated Soils

Hottpad: Results from a Field Demonstration Project for Treatment of Heavy Oil Sludge and Oil-Impacted Soil. *D. Thomas, G. Sabadell, P. Bireta, D. Major, G. Scholes, and C. Murray.*
Gabriel Sabadell (Chevron Energy Technology Company/USA)

SESSION BREAK
Lunch available from 11:00 a.m.-1:00 p.m.

1:00

Interpreting Interactions between Ozone and Residual Petroleum Hydrocarbons in Soil. *T. Chen, A.G. Delgado, B.M. Yavuz, J. Maldonado, Y. Zuo, R. Kamath, P. Westerhoff, R. Krajmalnik-Brown, and B.E. Rittmann.*
Tengfei Chen (Arizona State University/USA)

C3. Next Generation MBTs: A Pathway to Precision Bioremediation

Next Generation MBTs: A Pathway to Precision Bioremediation. *F.E. Loeffler.*
Frank Loeffler (University of Tennessee/USA)

1:25

Integrated Soil Bioremediation Using Selected *Pseudomonas spp.* Bacteria for the Cleanup of a Former Bulk Facility in an Urban Setting. *K. Reynolds, N. Irish, G. McIver, and R. von Wedel.*
Greg McIver (Bulldog Green Remediation, Inc./USA)

System Level Metagenomics and Metatranscriptomics in Quantitative Site Assessment and Bioremediation. *G.S. Sayler.*
Gary S. Sayler (The University of Tennessee/USA)

1:50

SESSION BREAK

Pilot Test of In Situ Smoldering Combustion for Remediation of Navy Special Fuel Oil LNAPL at Defense Fuel Supply Point in Yorktown, Virginia. *J. Wang, N. Durant, G. Grant, S. O'Hara, S. Rosansky, S. Moore, R. Sirabian, C. Landin, and T. Kowalski.*
James Wang (Geosyntec Consultants/USA)

RNA versus DNA Applications for Bioremediation Management. *T.M. Vogel, J.-S. Beaulne, S. Demanèche, S. Cecillon, C. Malandain, O. Sibourg, J. Chastanet, and J.-M. Côme.*
Timothy Vogel (University of Lyon/USA)

2:15

A2. Combined Remedies for VOCs

Recent Trends in the Selection of Remedies for Groundwater, Soil, and Sediment at Superfund Sites. *L. Fiedler, C. Pachon, P. Sinski, and D. Wohler.*
Linda Fiedler (U.S. EPA/USA)

In Situ Stabilization/Solidification as a Sustainable Alternative for the Remediation of Heavy Hydrocarbon Sites. *J. Carr and C.A. Robb.*
Jule Carr (Geosyntec Consultants/USA)

Proteomic Tools to Monitor Chlorinated Solvent Bioremediation and Estimate In Situ Degradation Rates. *K.H. Kucharzyk, C. Bartling, L. Mullins, M.M. Michalsen, P.B. Hatzinger, and F.E. Loeffler.*
Kate Kucharzyk (Battelle/USA)

2:40

Decision Framework for Selecting Multi-Technology Remedy for Complex DNAPL Remediation. *R. Cardoso, D. Janda, T. Macbeth, and M. Fattahipour.*
Rebecca Cardoso (U.S. Navy/USA)

SESSION BREAK

Metabolomics, Lipidomics, and Kinetic Flux Profiling; Developing Tools for Monitoring the Physiology of Ecologically Relevant Microbial Communities. *S.R. Campagna, H. Castro, S. Dearth, A. Buchan, and S.W. Wilhelm.*
Shawn R. Campagna (University of Tennessee/USA)

3:05

Combined Remedy Bioremediation Enhancement to Address a Trichloroethene Source at a Legacy Hydraulic Containment Site. *J. Langenbach, J. Bartlett, and S. Thotapalli.*
Jim Langenbach (Geosyntec Consultants, Inc./USA)

B4. Remediation

Enhancement in the Removal of High Viscosity Oil through Steam Injection. *R. Spina and R. Coelho.*
Rubens Spina (GEOKLOCK/Brazil)

SESSION BREAK

D Sessions Flagler	E Sessions Monroe	F Sessions Tuttle	
D2. Managing Large and Dilute Plumes **Characterization and Remediation Approaches for a Deep Subsurface Site: Hanford.** *M.H. Lee, B.D. Lee, T.C. Johnson, and M.J. Truex.* Brady Lee (Pacific Northwest National Laboratory/USA)	**E2. Innovative Tools for Evaluating Vapor** **Predictive Soil Vapor Assessment.** *G. Smith, C. Howell, O. Henderson, and N. Ryan.* Graham Smith (Parsons Brinckerhoff/Australia)	**F2. Sorption Technologies for PFAS** **Immobilization and Safe Disposal of Aqueous Film-Forming Foam (AFFF)-Impacted Soil in Australia.** *R. Stewart.* Richard Stewart (Ziltek Pty., Ltd./Australia)	**11:45**
D2. Managing Large and Dilute Plumes **Bioremediation of Deep Contamination: Deeper Is Not Always More Difficult.** *R.A. Wymore.* Ryan Wymore (CDM Smith, Inc./USA)	**E2. Innovative Tools for Evaluating Vapor** **New Tools for Evaluating Sub-Slab Depressurization Systems and Identification of Alternative Vapor Intrusion Pathway.** *D. Mali, T. McAlary, P. Nicholson, and W. Wertz.* Darius Mali (Geosyntec Consultants/Canada)	**F2. Sorption Technologies for PFAS** **PFAS In Situ Stabilization Treatability Test Work.** *P. Storch, J. Ritchie, J. McDonough, and I. Ross.* Peter Storch (ARCADIS/Australia)	**12:10**
			12:35
SESSION BREAK Lunch available from 11:00 a.m.-1:00 p.m.	SESSION BREAK Lunch available from 11:00 a.m.-1:00 p.m.	SESSION BREAK Lunch available from 11:00 a.m.-1:00 p.m.	**1:00**
D3. Amendment Distribution Challenges for Large Bioremediation Sites **Application of Biostimulation and Bioaugmentation to Promote In Situ Biodegradation of Chlorinated Ethenes in Complex Hydrogeology.** *L. LaPat-Polasko and C. Aziz.* Laurie LaPat-Polasko (Ramboll Environ/USA)	**E3. Vapor Intrusion Mitigation Methods** **Effectiveness of a Sub-Slab Depressurization System at an Alternative Vapor Intrusion Pathway Site.** *Y. Guo, P. Dahlen, and P.C. Johnson.* Yuanming Guo (Arizona State University/USA)	**F3. Toxicological Impacts of PFAS in Human Health and the Environment** **Per- and Polyfluoroalkyl Substances in Human Serum and Urine Samples from a Residentially Exposed Community.** *R. Rogers Worley, S. McAfee Moore, B.C. Tierney, X. Ye, A.M. Calafat, S. Campbell, M.B. Woudneh, and J. Fisher.* Rachel Rogers Worley (Center for Disease Control and Prevention/USA)	**1:25**
D3. Amendment Distribution Challenges for Large Bioremediation Sites **Enhancing Bioremediation through In Situ Sorption of Extremely Low Chlorinated Solvent Concentrations at a High-Speed, Italian Railway Station.** *G. Leonard, J. Birnstingl, M. Carboni, P. Goria, M. Petrangeli Papini, F. Arjmand, L. Cesta Incani, and M. Bacchi.* Jeremy Birnstingl (Regenesis/United Kingdom)	**E3. Vapor Intrusion Mitigation Methods** **Assessment of an Aerated Floor System for Mitigating Vapor Intrusion.** *D.A. Egarr, L. Horton, D.J. Folkes, and T.E. Kuehster.* Darrell Anthony Egarr (MMI Engineering Ltd/ United Kingdom)	**F3. Toxicological Impacts of PFAS in Human Health and the Environment** **Aqueous Film Forming Foam (AFFF) Effects on Microbial Function Explained in Terms of Perfluoroalkyl Substance (PFAS) Constituents.** *N. Mohapp, M. Simcik, and P. Novak.* Nicole Mohapp (University of Minnesota/USA)	**1:50**
D3. Amendment Distribution Challenges for Large Bioremediation Sites **Modification of a Sparge/Vent Groundwater Remediation System in Fractured Rock for Reductive Dechlorination.** *D. Graves, L. Griffin, B. Amos, J. Ivanowski, and R. Satkin.* Ben Amos (Geosyntec Consultants/USA)	**E3. Vapor Intrusion Mitigation Methods** **HVAC Systems for VI Mitigation in Large Buildings: Reliability and Long-Term Performance Monitoring Considerations.** *D. Shea and B. Green.* David Shea (Sanborn, Head & Associates, Inc./ USA)	**F3. Toxicological Impacts of PFAS in Human Health and the Environment** **Health Risk Assessment of PFASs in Crops, Produce, and Soils from the Land Application of Biosolids.** *L. Hall, T. Hoang, and R. Scofield.* Robert Scofield (GSI Environmental, Inc./USA)	**2:15**
D3. Amendment Distribution Challenges for Large Bioremediation Sites **Optimization Strategies for In Situ Bioremediation of a TCE Plume at a Complex Site under a Regulatory Paradigm Shift.** *N.M. Rabah, B.J. Lazar, Y. Kunukcu, and A. Brown.* Brendan Lazar (TRC Companies, Inc./USA)	**E3. Vapor Intrusion Mitigation Methods** **Detailed Field Evaluation of Soil Vapor Extraction to Prevent Vapor Intrusion.** *C. Lutes, J. Lowe, R. Truesdale, B. Schumacher, J.H. Zimmerman, R. Connell, B. Stewart, and J. De Loera.* Christopher Lutes (CH2MHILL/USA)	**F3. Toxicological Impacts of PFAS in Human Health and the Environment** **Accumulation of Poly- and Perfluoroalkyl Substances (PFASs) in a Freshwater Food Web from the Great Lakes Region.** *D. Bogdan, U. Vedagiri, and J.M. Cuthbertson.* Dorin Bogdan (AECOM/USA)	**2:40**
SESSION BREAK	**E3. Vapor Intrusion Mitigation Methods** **Engineering Optimization for SVE of Methane in a Large Shopping Mall in Sao Paulo City, Brazil.** *G.D.C. Mello and R. Lattouf.* Gustavo de Mello (Ramboll Environ/Brazil)	**F3. Toxicological Impacts of PFAS in Human Health and the Environment** **Bridging Data Gaps for Ecological Assessment of Perfluoroalkyl and Polyfluoroalkyl (PFAS) Substances.** *N.A. Richardson, P.J. Rodgers, D.J. Chappie, and S.A. Hines.* Stephanie Hines (Battelle/USA)	**3:05**

TUESDAY LATE AFTERNOON

	A Sessions Jasmine	B Sessions Orchid	C Sessions Brickell
3:30	**Concurrent Application of Biological and Chemical Reduction Technologies to Treat DNAPL® in Groundwater: An Update.** *A. Northup, T. Feng, and A. Hodges.* Abe Northup (CH2M HILL/USA)	**Remediation and Management of Deep Petroleum Hydrocarbon Impacts Using PersulfOx® at a Former Agricultural Site.** *D. Klimenko and J. Rao.* Ashley Cedzo (Regenesis/USA)	**Activity-Based Protein Profiling as a Novel Molecular Diagnostic Tool.** *M. Hyman.* Michael Hyman (North Carolina State University/USA)
3:55	SESSION BREAK	**Sustainable Remediation of Dissolved-Phase Hydrocarbons at an Active Fuel Service Station Using an Integrated In Situ Remedial System.** *B. Rakewich, K. Jackson, K. Bradshaw, and J. Grosskleg.* Barry Rakewich (Nichols Environmental Ltd./Canada)	**Phylogenetic and Functional Fluorescent Probes for Identifying and Sorting Indigenous 1,4-Dioxane Degraders.** *M. Li, Y. Yang, J. Mathieu, and P.J.J. Alvarez.* Mengyan Li (New Jersey Institute of Technology/USA)
4:20	**Bioremediation of a High-Concentration Chlorinated Solvents Mixture: Bioremediation with ISCO Polishing.** *B.V. Brown, A. Ryan, S.S. Turner, D.L. Anderson, and K.S. Sorenson.* Brendan Brown (CDM Smith, Inc./USA)	**Sustainable Bioremediation of a Legacy Hydrocarbon Plume Using Biostimulation: Microbiology and Biogeochemistry.** *S.D. Colville, J.M. McBeth, V.F. Bondici, K. Bradshaw, J. Grosskleg, W. Xiong, C. Mathies, M. Pachal, and T. Carlson.* Scott Colville (University of Saskatchewan/Canada)	**Metaomics-Enabled Approaches for Identifying Biomarkers Directly from Mixed Microbial Communities.** *K. Rossmassler and S.K. De Long.* Karen Rossmassler (Colorado State University/USA)
4:45	**Combining Persulfate, In Situ Ferrate Generation and Enhanced Bioremediation for Safer, More Effective Remedial Actions.** *J.G. Mueller, K. Finneran, R. Darlington, and M. Scalzi.* Jim Mueller (Provectus Environmental Products, Inc./USA)	**Australian Success in Bioremediation Cluster Approach.** *L. Cartwright, O. King, and M. Treloar.* Louise Cartwright (Enviropacific Services/Australia)	**Assessing the Contribution of Vinyl Chloride-Oxidizing Bacteria to In Situ Bioremediation Performance.** *T.E. Mattes, Y. Liang, X. Liu, and P. Richards.* Timothy Mattes (University of Iowa/USA)
5:10	**Integrated Characterization of NA of PCE Plume after Thermal Source Zone Remediation: Microbial Techniques and Dual Isotope Analysis.** *M.M. Broholm, A. Badin, J. Palau, D. Hunkeler, C.S. Jacobsen, P. Dennis, and N. Just.* Mette Broholm (Technical University of Denmark/Denmark)	**Enhanced Remediation of Crude Oil-Contaminated Soil by Bioelectrochemical Systems.** *L. Lu, H. Yazdi, Z.J. Ren, P. Fallgren, S. Jin, and Y. Zuo.* Song Jin (University of Wyoming/USA)	**Development and Application of a Rapid, User-Friendly and Inexpensive Method to Detect *Dehalococcoides spp.* Reductive Dehalogenase Genes from Groundwater.** *Y.H. Kanitkar, R.D. Stedtfeld, S.A. Hashsham, P.B. Hatzinger, and A.M. Cupples.* Yogendra Kanitkar (Michigan State University/USA)

A2. Combined Remedies for VOCs

B4. Remediation of Hydrocarbon Spills

C3. Next Generation MBTs: A Pathway to Precision Bioremediation

POSTER GROUP 1: SCHEDULE

Display: Monday 5:00 p.m.–Tuesday 7:00 p.m.
Presentations/Reception: Tuesday 5:45–7:00 p.m.

The following posters will be on display from Monday evening through Tuesday evening in the Exhibit Hall. During the Presentations/Reception period Tuesday evening, presenters will be at their displays to discuss their work.

D Sessions Flagler	E Sessions Monroe	F Sessions Tuttle	
In Situ Bioremediation Alternatives for Sediments Contaminated with Hexabromocyclododecane. *H. Demirtepe and I. Imamoglu.* Hale Demirtepe (Middle East Technical University/Turkey)	SESSION BREAK	SESSION BREAK	**3:30**
Influence of Capping Material Type upon Biodegradation of Polycyclic Aromatic Hydrocarbons in Sediments. *G. Pagnozzi, K. Millerick, and D. Reible.* Giovanna Pagnozzi (Texas Tech University/USA)	**A Breath of "Fresh Air": Evaluating the Role of Sewer Pathways in Vapor Intrusion.** *T.E. McHugh and L.M. Beckley.* Thomas McHugh (GSI Environmental, Inc./ USA)	**Sampling and Analysis of PFAS Compounds: Lessons Learned and State of the Science** **Moderator** Ramona Darlington (Battelle) **Panelists** Adria Bodour (U.S. Air Force) Kim Parker Brown (U.S. Navy) Cynthia Caporale (U.S. EPA) Erika Houtz (Arcadis) Dave Woodward (Amec Foster Wheeler)	**3:55**
Bioremediation of PAHs-Contaminated Marine Sediments Using SMFCs under Different Redox Conditions. *H.Z. Hamdan, D.A. Salam, A.R. Hari, P. Saikaly, and L. Semerjian.* Hamdan Hamdan (American University of Beirut/Lebanon)	**Modeling and Measurement of VOC Mass Transfer within Sewer Lines that Act as Preferential Pathways.** *M. Roghani, E.J. Willet, E. Shirazi, and K.G. Pennell.* Kelly Pennell (University of Kentucky/USA)		**4:20**
Pilot-Scale In Situ Treatment of PCB-Impacted Sediments by Bioaugmentation. *K.R. Sowers, U. Ghosh, R. Payne, and H.D. May.* Kevin Sowers (University of Maryland, Baltimore County/USA)	**Vertical Screening Distance Criteria to Evaluate Vapor Intrusion Risk from Lead Scavengers.** *R. Kolhatkar, H. Luo, T. Peargin, M.A. Lahvis, I. Hers, P. Jourabchi, and J. Wilson.* Ravi Kolhatkar (Chevron Energy Technology Company/USA)		**4:45**
Isolation and Characterization of Dibenzofuran-Degrading Bacteria from Contaminated Sediments and their Ability to Transform Lightly Chlorinated Dioxins. *H.S. Al Mnehlawi, S. Capozzi, L.A. Rodenburg, and D.E. Fennell.* Haider Salman Awaid Al Mnehlawi (Rutgers University/USA)	**Large/Old Industrial Buildings: Will the Real Attenuation Factor Please Stand Up.** *M. Pound and V. Hosangadi.* Michael Pound (U.S. Navy/USA)		**5:10**

D4. Bioremediation of Sediments

E4. VOC Vapor Intrusion

Panel

POSTER GROUP 1: SESSION TITLES

A1. Amendment Delivery Strategies
A2. Combined Remedies for VOCs
A3. Case Studies
A4. Bioremediation of Heavy Metals
A5. Enhancements to Biodegradation Strategies
B2. Biodegradation and Remediation of Crude Oil in Cold Regions
B3. Remediation of Heavy Hydrocarbon-Contaminated Soils
B4. Remediation of Hydrocarbon Spills
B5. Natural Source Zone Depletion
B6. LNAPL Mobility, Transmissivity, and Recoverability
C1. Modeling and Monitoring Approaches to Improve Remedy Design and Implementation
C2. Compound-Specific Isotope Analysis
C3. Next Generation MBTs: A Pathway to Precision Bioremediation
D1. Biodegradation in Fractured Bedrock Sites
D2. Managing Large and Dilute Plumes
D3. Amendment Distribution Challenges for Large Bioremediation Sites
D4. Bioremediation of Sediments
E1. Inhalation Exposures from Subsurface Contamination
E2. Innovative Tools for Evaluating Vapor Intrusion Risk
E3. Vapor Intrusion Mitigation Methods
E4. VOC Vapor Intrusion
F1. Fate and Transport of PFAS
F2. Sorption Technologies for PFAS
F3. Toxicological Impacts of PFAS in Human Health and the Environment

POSTER GROUP 1: PRESENTATIONS

The poster board number assigned to each presentation appears below.

A1. Amendment Delivery Strategies

1. Highly Successful ERD Pilot via Simple Additive Delivery System Lead to Full-Scale Biostimulation Strategy for Destruction of Residual cVOCs. *K.C. Armstrong and G. Bell.*
Kent Armstrong (TerraStryke Products, LLC/USA)

2. Comparing Shear-Thinning Fluid with Traditional Injection Techniques for Treatment into Low-Permeability Source PCE and TCE. *M.R. Lamar, T.W. Macbeth, D. Nguyen, and J. Beattie.*
Michael Lamar (CDM Smith, Inc./USA)

3. Field Implementation Techniques for Permeability Enhancement Technology (Environmental Fracturing) at Low-Permeability Sites. *D.D. Nguyen, N.T. Smith, K.S. Sorenson, R.A. Wymore, and M.R. Lamar.*
Dung Nguyen (CDM Smith/USA)

4. Mobility-Control Methods to Improve the Delivery and Distribution of Bioremediation Amendments in Heterogeneous Aquifers. *J.A.K. Silva.*
Jeffrey A.K. Silva (GSI Pacific, Inc/USA)

5. Biological Reduction of Hexavalent Chromium Using a Novel Substrate Injection Approach in Northern Italy. *T.J. Simpkin, G. Ng, I. Bona, S. Frisario, F. Mazza, A. Tognoni, P. Goria, and M. Carboni.*
Tom Simpkin (CH2M HILL/USA)

A2. Combined Remedies for VOCs

6. Combined ISCO/Bioremediation at an Operating Gas Station. *M. King and J. Mueller.*
Everett C. Bonniwell (Wilcox Environmental Engineering, Inc./USA)

7. Treatment of Multiple TCE Plumes in Shallow Aquifer by Sequencing SVE, Chemical Oxidation, and Enhanced Reductive Dechlorination. *R.C. Bunker, J.T. Spadaro, and F.J. Krembs.*
Russ Bunker (Amec Foster Wheeler/USA)

8. A State-Led Combined Remedy Approach for Elimination of Chlorinated Solvent Exposure under a Residential Neighborhood. *B. Poling, D. Harn, D. Davis, and C. Roebuck.*
Doug Davis (Regenesis/USA)

9. Combined Remedies Used to Remediate Transportation-Related Spills. *M. Dooley.*
Maureen Dooley (Regenesis/USA)

10. Development of a Bioassay to Assess Clogging of a Zero-Valent Iron Permeable Reactive Barrier. *H. Wang, D.L. Freedman, R.Yu, E. Simonds, L. Lehmicke, and J. Peeples.*
David Freedman (Clemson University/USA)

11. Rapid Reduction of Chlorinated Solvents Using Combined Bioaugmented Enhanced Reductive Dechlorination and In Situ Chemical Reduction Approaches. *K.M. Gaskill and D. Davis.*
Keith Gaskill (EnviroForensics/USA)

12. Combined ISCO/Bioremediation for In-Place Soil Treatment. *J. Ogden and J. Mueller.*
Jim Mueller (Provectus Environmental Products, Inc./USA)

13. Looking Back at Sites Treated with Electrical Resistance Heating. *J. Sankey.*
John Sankey (True Blue Technologies, Inc./USA)

14. Sequencing ISCO and Bioamendments for Successful Cleanup. *J. Sheldon, T. Vanek, and A. Cedzo.*
Jack Sheldon (Antea Group/USA)

15. Bioaugmentation-Enhanced Chemical Reduction at a Brownfield Redevelopment Site. *L. Zeng, S. Abrams, B. Gochenaur, M. Wenrick, K. Novalis, M. Boquszewski, and M. Burke.*
Lingke Zeng (Langan Engineering & Environmental Services, Inc./USA)

A3. Case Studies

16. Highly Successful ERD Pilot Evaluation Utilizing Simple Additive Delivery Approach to Compare Additive Efficacy under Actual Site Biogeochemical Conditions. *K.C. Armstrong.*
Kent Armstrong (TerraStryke Products, LLC/USA)

17. Comparing Parallel ERD and Oxidation Pilot Tests in a Low Permeability Area. *B. Dahlgren and J. Zhou.*
Bryon Dahlgren (AECOM/USA)

18. Enhanced Denitrification for Treatment of Nitrate Plumes Associated with Fertilizers. *C. Bucior, S. Dore, D. Pope, R. Thomas, and A. Weston.*
Sophia Dore (GHD/USA)

19. Enhanced In Situ Bioremediation to Treat Groundwater Impacted with Chlorinated Solvents. *A. Haryani and R. Doshi.*
Amit Haryani (AECOM Technical Services, Inc./USA)

20. Enhanced Reductive Dechlorination at General Services Administration Reclamation Yard, Kennedy Space Center, Florida. *A. Chrest, D. Johansen, H. Faircloth, C. Adkison, and D.J. Strickland.*
Christopher Adkison (Jacobs Engineering/USA)

21. Enhanced Bioremediation of a DNAPL Source Area Using Lactate and Ethanol. *D.J. Miller.*
Don Miller (Golder Associates, Inc./USA)

22. The Use of Biostimulation to Safely Treat a Chlorinated VOC Plume in a Residential Community. *R. McGrath, R.D. Collins, L.J. Campe, P. Nangeroni, and A. Roche.*
Peter Nangeroni (Woodard & Curran/USA)

23. Application of Multiple Remedial Techniques and Approaches (In Situ/Ex Situ) at the Ewan Property Superfund Site. *D.J. Russell, C.P. Wong, and P. Jannett.*
David Russell (AECOM/USA)

A4. Bioremediation of Heavy Metals

24. Full-Scale Treatment of a Large, Dissolved Lead Plume: Injection Approach, Field Operations, and Distribution Assessment. *D.E. Knight, A.M. Baird, and W.W. Slack.*
Drew Baird (FRx, Inc./USA)

25. Effects of Earthworms on Remediation of Sewage Sludge Containing Heavy Metals. *N. Kitir, A. Gunes, and M. Turan.*
Nurgül Kitir (Yeditepe University/Turkey)

26. Rehabilitation of Former Industrial Area through the Technique of Advanced Chemical Treatment. *M. Sillos, F. Santos, S. Nascimento, S. Alvarez, M. Saint-Pierre, and L. Gonçalves.*
Marcos Sillos (Edutech & Rentaltech Ambiental/Brazil)

27. Treatability Test Based on Complex Systems of Coprecipitated Coordination: Degraded Area in Rio de Janeiro, Brazil. *M. Sillos, F. Santos, S. Nascimento, S. Alvarez, M. Saint-Pierre, and L. Gonçalves.*
Marcos Sillos (Edutech & Rentaltech Ambiental/Brazil)

28. Treatment Train Approach as an Expedited Site Closure Strategy at a Long-Term Superfund Site Impacted with CVOCs and Heavy Metals. *R. Srirangam, F. Lakhwala, T. Patterson, and P. Villa.*
Ravikumar Srirangam (PeroxyChem, LLC/USA)

A5. Enhancements to Biodegradation Strategies

29. Combined In Situ Chemical Reduction and Enhanced Bioremediation to Treat Chlorinated Solvents in Unsaturated Soils at a Former Chlorinated Solvents Manufacturing Plant. *R. Evans, M. Motylewski, J. Street, B. Smith, A.D. Peacock, and J. Freim.*
Richard Evans (Groundwater & Environmental Services, Inc./USA)

30. Field-Scale Evaluation of Enhanced Reductive Dechlorination for Treatment of a Dilute Trichloroethene Plume in Low pH Aerobic Aquifer. *A. Gonzalez, N. Shetty, and S. Ross.*
Amanda Gonzalez (AECOM/USA)

31. Use of Fungal-Derived Enzymatic Cocktail Encapsulated in Biodegradable Shell for Degradation of Environmental Contaminants. *K.H. Kucharzyk, R. Darlington, R.S. Lalgudi, and A. Duong.*
Kate Kucharzyk (Battelle/USA)

32. The Effect of Emulsified Zero Valent Iron on Trichloroethene in the Presence of Chlorofluorocarbon 113. *L. Porterfield, B.F. Droy, C. Yestrebsky, and J. Roberts.*
Les Porterfield (TEA, Inc./USA)

B2. Biodegradation and Remediation of Crude Oil in Cold Regions

34. Assessing the Potential of Natural Source Zone Depletion (NSZD) of Hydrocarbon as a Cold-Climate Soil Remediation Strategy. *Z.D. Bauman and S.M. Mercer.*
Sean Mercer (Imperial/Canada)

35. Biostimulatory Solutions for Petroleum Hydrocarbon-Impacted Sites in Cold Regions: Effects of C: N-P Ratios on Degrader Prevalence and Potential Activity in Clayey Soils. *L.M. Moehlman, S.D. Siciliano, and T. Carlson.*
Lisa Moehlman (University of Saskatchewan/ Canada)

36. Voltage and Microbial Respiration: In Situ Hydrocarbon Remediation Sensors. *A. Schebel, S.D. Siciliano, and S.R. Burge.*
Alixandra Schebel (University of Saskatchewan/ Canada)

37. A New Microcosm Design for Treatability Assessment in Cold Region Petroleum Hydrocarbon-Impacted Clayey Sites. *A.D. Schryer, L.M. Moehlman, S.D. Siciliano, and T. Carlson.*
Aimee Danielle Schryer (University of Saskatchewan/Canada)

B3. Remediation of Heavy Hydrocarbon-Contaminated Soils

38. Microbial Bioremediation of Polycyclic Aromatic Hydrocarbons (PAHs) in Hydrocarbon Production Waste Sediment Using OBD-PLUS® Technology in Obagi, Niger Delta, Nigeria. *A.A. Otaiku.*
Ayodele Otaiku (ARATIBIOTECH Limited/Nigeria)

39. Remediation of Heavy Hydrocarbon-Impacted Soils by Soil Washing: Assessment of TPH Removal in Coarse versus Fine Fractions. *K.R. Saladi, W.G. Rixey, B.A. Lyon, N.M. Wilton, K.D. Pennell, A. Robbat, R. Kamath, K. McVey, and T. Hoelen.*
Krishna Saladi (University of Houston/USA)

40. Laboratory Testing of Remedial Approaches for Heavy Hydrocarbons-Impacted Soil and Sediment. *T.J. Simpkin.*
Tom Simpkin (CH2M HILL/USA)

B4. Remediation of Hydrocarbon Spills

41. Production of CO_2 during Bioremediation of Used Lubricating Oil-Contaminated Clay Brazilian Soils. *A.J. Adeyemo, J.W.V. Mello, and S.O. Agele.*
Adebayo Jonathan Adeyemo (Federal University of Technology/Nigeria)

42. Kuwait Environmental Remediation Program (KERP): Oil Lakes Remediation in Southeast Kuwait. *D.H. Al-Gharabally, A.S. Al-Barood, and H.A. Al-Kandari.*
Dhari Al-Gharabally (Kuwait Oil Company/Kuwait)

43. Predictive Kinetics Model for Bioremediation of Crude Oil-Contaminated Soil in Arid Environment. *D.E. Lekmine, M. Al Bader, A.S. Al Kandari, A. Al Maqseed, and M. Al Mumin.*
Abdullah Salem Sabti Al-Kandari (KOC/Kuwait)

44. Remediation of Groundwater Contamination of Ogoniland, Nigeria. *N.A. Rufus and A.B. Cundy.*
Rufus Abadi Ndukari (University of Brighton/ United Kingdom)

45. Reducing Mine Site Costs Using a Handheld Infrared Technology for Measuring Total Petroleum Hydrocarbons (TPH) in Soil. *R. Stewart, G. Webster, and M. Tazewell.*
Richard Stewart (Ziltek Pty., Ltd./Australia)

46. Effective Application Dosage of Nutrient Amendments Used for Remediation of Hydrocarbon-Impacted Soil. *C.K. Wachukwu, O.A. Ollor, C.A. Azike, and A.E. Ben-Chioma.*
Confidence Wachukwu (Rivers State University of Science and Technology/Nigeria)

B5. Natural Source Zone Depletion

47. Field Comparison of Two CO_2 Sorbent Trap Methods and Dynamic Closed Chamber Method for Soil Gas Flux Measurements. *R. Ahlers, A. Pennington, J. Zimbron, and C. Jones.*
Rick Ahlers (Arcadis/USA)

48. Microbial and Source Zone Reduction Sensors for Managing Contaminated Sites. *S.R. Burge, R.G. Burge, D.A. Hoffman, and S. Koenigsberg.*
Scott Burge (Burge Environmental, Inc./USA)

49. Spatial and Temporal Variation in NSZD Rates at a Large Former Oil Refinery. *J. Eichert, B. McAlexander, M. Lyverse, P. Michalski, and N. Sihota.*
Justin Eichert (Trihydro Corporation/USA)

50. Quantifying Petroleum Biodegradation Rates Using Temperature. *S. Gaito, J. Smith, B. Koons, B. Harding, C. Brownfield, and N. Swiger.*
Steven Gaito (AECOM/USA)

51. Quantitative Assessment of Natural Source Zone Depletion Rates at a Former Refinery Site. *P. Jourabchi, I. Hers, A. Wozney, U. Mayer, and H. Hopkins.*
Parisa Jourabchi (Golder Associates, Ltd/Canada)

52. Historical Trend Testing of a Mass-Balance Method for LNAPL Body Stability at Bemidji, Minnesota. *D.A. Lundy, J.F. Dowd, and T.C. Rasmussen.*
Don Lundy (Groundwater & Environmental Services, Inc./USA)

53. Natural Source Zone Depletion Interacts with Active Remediation at an LNAPL Recovery Site. *B. McAlexander, K. Tomita, S. Hunt, and B. Tallant.*
Ben McAlexander (Trihydro Corporation/USA)

54. LNAPL Management: Strategy Development through Investigation, LCSM and NSZD. *C. Mulry.*
Christopher Mulry (GES, Inc./USA)

55. Heat Flux Based-Estimates of Petroleum NSZD Rates: Uncertainty Analysis Using a Modeling Approach. *J. Zimbron, E. Kasyon, S. Gadaleta, and B. Thakur.*
Julio Zimbron (E-Flux/USA)

B6. LNAPL Mobility, Transmissivity, and Recoverability

56. Quantifying LNAPL Mobility in Fractured Rock: An Equivalent Porous Media Approach. *A. Danielson, J. Berns, and P. McHugh.*
Alec Danielson (Barr Engineering Co./USA)

57. Surfactant-Enhanced Extraction to Expedite Remediation of a Carbon Tetrachloride Source Zone at an Active Grain Elevator Facility. *Eric S. Dulle and George Ivey.*
Eric Dulle (Burns & McDonnell/USA)

58. Single-Day LNAPL Transmissivity Measurement through Improved Efficiency Baildown Testing. *J.M. Hawthorne and A.J. Kirkman.*
J. Michael Hawthorne (GEI Consultants, Inc./ USA)

59. LNAPL Program Management through Transmissivity: Investigation through IRM Completion. *M. Nagaiah, S. Uelend, and D. Law.*
Manivannan Nagaiah (Langan/USA)

60. LNAPL Transmissivity: Too Simple of a Metric in Complex Conditions? *D.T. de Courcy-Bower.*
Denice Nelson (ERM/USA)

61. Focusing a Mineral Spirit LNAPL Investigation towards Remedial Design Using UVOST Combined with Traditional Sampling to Assess 3-D Distribution. *R. Simon and M. Pietrucha.*
Ralph Simon (Woodard & Curran/USA)

62. Evaluation of Direct-Push Methods for Quickly Assessing LNAPL Presence, Mobility, and Recoverability. *J. Wright, T. Nelson, T. Duffy, and A. Pennington.*
Nicklaus Welty (Arcadis/USA)

C1. Modeling and Monitoring Approaches to Improve Remedy Design and Implementation

63. Verification of Analytical and Amendment Approaches for an In Situ Microcosm Device for Testing Enhanced Bioremediation Processes. *P. Dennis, M. Healy, P. Dollar, D. Graves, H. Groenevelt, and S.Mancini.*
Philip Dennis (SiREM/Canada)

64. Feasibility Study of Low Temperature In Situ Thermal in DNAPL Source Zone Remediation through Numerical Simulation. *A.Y. Fu, Y. Zhang, L. Zheng, and M.D. Annable.*
Amy Fu (Ellis & Associates, Inc./USA)

POSTER GROUP 1: PRESENTATIONS

65. Community Structure of Microorganisms in Crude Oil-Polluted Mangrove Swamp in Niger Delta, Nigeria. *C.C. Nwankwo, G.C. Okpokwasili, and V. Obidiugwu.*
Victor Obidiugwu (Institute of Soil Science/ Nigeria)

66. 3-D Printed Conceptual Site Models: Visualizing Geology and NAPL Distribution at a Superfund Site. *C. Ross, R. Lempert, C. Martin, R.D. Walker, B. Jackson, and A. Barton.*
Chapman Ross (Geosyntec Consultants/USA)

C2. Compound-Specific Isotope Analysis

67. Multi-Element Isotopic Fingerprinting on Aqueous-Phase Chloroethenes Derived from Chlorinated Pitches. *A. Gargini, M. Filippini, H.H. Richnow, and I. Nijenhuis.*
Alessandro Gargini (University of Bologna/Italy)

68. Investigation of In Situ Bioremediation of Chlorofluorocarbons at a Contaminated Field Site via Compound Specific Isotope Analysis (CSIA). *T. Gilevska, A. Horst , B. Sherwood Lollar, E. Seger, E. Lutz, S. Norcoss, S.A. Morgan, K.A. West, and E.E. Mack.*
Tetyana Gilevska (University of Toronto/Canada)

69. Identification of Abiotic Degradation Pathways of Chlorinated Ethenes: Novel Lines of Evidence from Compound-Specific Stable Isotope Analysis. *T. Kuder, A. Sullivan Ojeda, R.P. Philp, and B.D. Lee.*
Tomasz Kuder (University of Oklahoma/USA)

70. CSIA of Challenging VOCs Sample Matrices Using 2-D Gas Chromatography: Principles and Applications of the Method. *T. Kuder and R.P. Philp.*
Tomasz Kuder (University of Oklahoma/USA)

71. Use of Compound-Specific Isotope Analysis (CSIA) to Assess the Efficiency of Soil Vapor Extraction Applied to a Petroleum Hydrocarbon Source Zone. *D. Bouchard, D. Hunkeler, V. Ponsin, R. Aravena, E.L. Madsen, T.E. Buscheck, R. Kolhatkar, E. Daniels, L. Klinchuch, and P. Stumpf.*
Violaine Ponsin (University of Neuchatel/ Switzerland)

72. Utilizing Dual Carbon and Hydrogen Isotope Analyses to Differentiate between Various Biodegradation Pathways of 1,2-Dichloroethane. *O. Shouakar-Stash, J. Palau, D. Hunkeler, M. Elsner, S.H. Mortan, E. Marco-Urrea, M. Rosell, A. Soler, R. Yu, and D.L. Freedman.*
Orfan Shouakar-Stash (Isotope Tracer Technologies, Inc./Canada)

C3. Next Generation MBTs: A Pathway to Precision Bioremediation

73. Using Stable Isotope Probing to Confirm Biodegradation of 1,4-Dioxane during In Situ Remediation. *C. Bell and K. Gerber.*
Caitlin Bell (Arcadis/USA)

74. Correlation between Planktonic and Attached-Growth Bacteria Densities in Bioaugmented Flow-through Column Test. *W.D. Harms, D. Taggart, and K. Clark.*
Willard Harms (EHS Support LLC/USA)

75. Activity-Based Protein Profiling of Alkane Hydroxylase in *Pseudomonas putida* Strain GPo1. *K. Bennett, M. Hyman, and W. Chrisler.*
Michael Hyman (North Carolina State University/ USA)

76. Molecular Tools to Understand Intrinsic Aerobic Biodegradation of Chlorinated Contaminants in Groundwater Samples from the Wichita Northern Industrial Corridor. *B.D. Lee, J. Morad, S. Brooks, J. Powell, M.H. Lee, M. Williams, K. Sorenson, R. Olsen, S. Maloney, and D. Brown.*
Brady Lee (Pacific Northwest National Laboratory/ USA)

77. Potential for Polychlorinated Biphenyl Biodegradation in Sediments from a Wastewater Lagoon at Altavista, Virginia. *Y. Liang, J.M. Ewald, A. Martinez, A.M. Awad, J.L. Schnoor, and T.E. Mattes.*
Yi Liang (The University of Iowa/USA)

78. Evolution of a Chlorinated Solvent-Degrading Microbial Community in a Geochemically Diverse Aquifer Undergoing Heating. *T.W. Macbeth, D. Giaudrone, N. Smith, R. Chichakli, K. Kunas, C. Cora, and K. Lynch.*
Tamzen Macbeth (CDM Smith, Inc./USA)

79. Did My Remedial Amendment Produce All That Methane? *R. Coffin, J.G.D. Peale, T. Boyd, and J. Mueller.*
Jim Mueller (Provectus Environmental Products, Inc./USA)

80. Assessment of Post Remediation Performance of a Biobarrier Oxygen Injection System at an MTBE-Contaminated Site. *K. Neil, T. Chaudhry, C. Bartling, P. Chang, H. Rectanus, and K. Kucharzyk.*
Kenda Neil (NAVFAC EXWC/USA)

81. Late Stage Degradation Rates for TCE Daughter Products Correlated with Microbial Community Composition Determined by NGS Analysis. *J.G.D. Peale, C. Savoie, E. Edwards, K. Krivushin, P. Dollar, and P. Dennis.*
James Peale (Maul Foster & Alongi, Inc./USA)

D1. Biodegradation in Fractured Bedrock Sites

82. Bioaugmentation of DNAPL in Fractured Bedrock and Low Permeability Soil. *S. Abrams, L. Zeng, M. Pepperman, T. Clark, and N. Rivers.*
Stewart Abrams (Langan Engineering & Environmental Services, Inc./USA)

83. Bioremediation in a Fractured Bedrock Aquifer Using High Concentration Sodium Lactate. *G. Chen, J.T. Lyons, K. Kaster, D. Patel, and J. Romig.*
Ge (Grace) Chen (CDM Smith, Inc./USA)

84. Full-Scale Implementation of In Situ Chemical Reduction and Enhanced Bioremediation of VOC-Impacted Fractured Bedrock and Groundwater. *D.M. Conley and E. Bishop.*
Denis Conley (Haley & Aldrich, Inc./USA)

85. More Than a Decade of Challenges and Success: Enhanced In Situ Reductive Dechlorination of Trichloroethene/1,1,1-Trichloroethane Source Area in Fractured Bedrock. *C.A. Fogas, M.S. Kozar, and M.A. Hepner.*
Christine Fogas (OBG/USA)

86. Enhanced Biotic and Abiotic Attenuation of TCE in Fractured Sandstone. *R. Yu, D.L. Freedman, and R.G. Andrachek.*
David Freedman (Clemson University/USA)

87. Source Area Bioaugmentation of Multiple Chlorinated VOCs in Overburden and Bedrock Aquifers. *K.F. Kelly, L. Zeng, R.M. Bond, and S. Abrams.*
Kevin Kelly (Langan Engineering & Environmental Services, Inc./USA)

88. Lessons Learned from Application of In Situ Chemical Reduction Technology to Treat Chlorinated Ethenes in Fractured Bedrock at a Redevelopment Site. *F. Lakhwala, R. Srirangam, R. Harwood, E. Mertz, M. Meriney, and L. Dodge.*
Fayaz Lakhwala (PeroxyChem, LLC/USA)

D2. Managing Large and Dilute Plumes

89. Strategy for Site Closure of a Large and Dilute MTBE Groundwater Plume. *P.L. Chang and B. Patel.*
Pamela Chang (Battelle/USA)

90. Biosparging Large Plume with Horizontal Wells at an Active Terminal. *G.N. Iosue, M.J. Sequino, and K. Ford.*
Glenn Nicholas Iosue (Penn E&R/USA)

91. Treatment of Multi-Layer Aquifer with In Situ Bioreactors (ISBRs) and Liquid Activated Carbon Leads to Nondetect Results within Months. *C. Uthgenannt, E.J. Raes, K. Sublette, and G. Araujo.*
Eric Raes (Bio-Enhance/USA)

D3. Amendment Distribution Challenges for Large Bioremediation Sites

92. Inhibitory and Synergistic Effects during Biodegradation of Mixed Contaminants at an Industrial Site in South America. *P.A. Barreto, D.L. Freedman, M. Lemes, J.K. Henderson, E.E. Mack, and C.S. Mowder.*
Paola Barreto Quintero (CH2M HILL/USA)

93. Utilizing Multiple Methods to Remediate Groundwater in Heterogeneous Soils: Three Florida Case Studies. *L. Bienkowski.*
Lee Bienkowski (Ellis & Associates, Inc./USA)

94. Comparison of Biological, Biogeochemical and In Situ Chemical Reduction for Treatment of Mixed Chlorinated Ethenes and Methanes. *G. Su, M. Tischuk, A. Sidebottom, S. Owen, B. Desjardins, and D. Leigh.*
Grace Su (TEA, Inc./USA)

D4. Bioremediation of Sediments

95. In Situ Bioremediation Alternatives for Sediments Contaminated with Hexabromocyclododecane. *H. Demirtepe and I. Imamoglu.*
Hale Demirtepe (Middle East Technical University/ Turkey)

96. Measuring Reductive Dechlorination Rates at Environmental Relevant PCB Concentrations. *N.J. Lombard, K. Sowers, B.V. Kjellerup, and U. Ghosh.*
Nathalie Lombard (University of Maryland, Baltimore County/USA)

97. In Situ Control of Typical Taste and Odor Matters in River Sediments and Identification of Functional Bacteria Species. *X.-H. Zhang, Q.W. Song, and Y. Tao.*
Xi-Hui Zhang (Tsinghua University/China)

E1. Inhalation Exposures from Subsurface Contamination

98. The Use and Effectiveness of Subslab and Subsurface Vapor Extraction for Simultaneous Contaminant Mass Removal and Exposure Control. *C.M. Ferguson and K. Hoylman.*
Christopher Ferguson (Protect Environmental/ USA)

99. How Sewers Were Designed, Maintained and Located: Insights for Vapor Intrusion (VI) Projects. *C.C. Lutes, K. Moffat, and J. Kastanek.*
Christopher Lutes (CH2MHILL/USA)

100. Impact of Sewer and Drain Lines in Vapor Intrusion. *J.G.V. Ström, R. Shen, and E.M. Suuberg.*
Jonathan Gustaf Viking Ström (Brown University/ USA)

E2. Innovative Tools for Evaluating Vapor Intrusion Risk

101. Experimental and Modeling Study on Light Gas Transport in a Soil Column. *C.-S. Fen, Y.-R. Lin, and C.-Y. Chen.*
Chiu-Shia Fen (Feng Chia University/Taiwan)

102. Implications of Continuous Dynamic Monitoring on Vapor Intrusion Mitigation, Naval Air Station North Island. *V. Hosangadi, M. Pound, B. Hartman, and M. Kram.*
Vitthal Hosangadi (NOREAS, Inc./USA)

103. Optical Sensor for Real-Time Measurement of Chlorinated Solvents in Air. *S.T. Soerensen, H. Hansen, N. Hamburger, N. Tuxen, M. Christophersen, L. Bennedsen, Y. Tseng, P. Tidemand-Lichtenberg, and C. Pedersen.*
Sine Thorling Soerensen (The Capital Region of Denmark/Denmark)

104. Modeling Contaminant Vapor Communication between the Subsurface and Indoor in Vapor Intrusion Controlled Pressure Conditions. *R. Shen, F. Yu, and E.M. Suuberg.*
Erick Suuberg (Brown University/USA)

105. Reducing Potential Impacts of a Large-Scale Sub-Slab Depressurization System through the Use of Remote, Long-Term Monitoring. *E. Blodgett, N. Czoschke, K. Eisen, and B. Schwie.*
Nadine Czoschke (Barr Engineering Co./USA)

E3. Vapor Intrusion Mitigation Methods

106. Soil Vapor Mitigation: Urban Complexities for Depressurization System Design. *J.F. Good and J.J. Hayes.*
Joseph Good (Langan Engineering & Environmental Services/USA)

E4. VOC Vapor Intrusion

107. Evaluation of Vapor Intrusion Risk from a Shallow Chlorinated Solvent Plume, Former Naval Air Warfare Center Warminster. *A.C. Barton, J.M. Dale, P. Rodgers, I. MacGregor, and J. Good.*
Andrew Barton (Battelle/USA)

F1. Fate and Transport of PFAS

108. Development of a Conceptual Site Model (CSM) Using a Novel Analytical Method. *D. Bogdan, G.F. Peaslee, and D. Lunderberg.*
Dorin Bogdan (AECOM/USA)

109. PFAS Investigations: A Site Investigation Framework Based on Lessons Learned. *S. Marconetto, J. Paul, A. Holloway, C. Quinn, and I. Hers.*
Ian Hers (Golder Associates Ltd./Canada)

110. PFAS Use in Fire Fighting Foams: Evolution of Fire Fighting Agents and Critical Decision Criteria. *S.H. Korzeniowski.*
Stephen Korzeniowski (BeachEdge Consulting, LLC/USA)

111. Understanding Fate and Transport of PFAS to Develop Good Conceptual Site Models of AFFF-Impacted Facilities. *J. Hurst, J.A.L. Miles, J. Burdick, M. Reinhard, J. McDonough, E. Houtz, and I. Ross.*
Ian Ross (ARCADIS/United Kingdom)

112. Assessment of PFAS in Soil and Groundwater: New Analytical Technologies for Comprehensive Analysis of PFAS Including Precursors. *I. Ross, J. Burdick, E. Houtz, and A. Horneman.*
Ian Ross (ARCADIS/United Kingdom)

113. Sorption Behavior of PFOS on Soils with Different Physicochemical Properties. *C.L. Wei and X. Song.*
Changlong Wei (University of Chinese Academy of Sciences/China)

F2. Sorption Technologies for PFAS

114. Efficient Removal of Perfluorooctane Sulfonate in Water Using Layered Double Hydroxides. *Z. Hu and X. Song.*
Xin Song (Chinese Academy of Sciences/China)

115. Immobilization of Per- and Poly-Fluorinated Alkyl Substances (PFASs) in Fourteen Soils from Airport Sites across Australia. *R. Stewart and R. McFarland.*
Richard Stewart (Ziltek Pty., Ltd./Australia)

116. Reducing the Bioavailability of Per- and Poly-Fluorinated Alkyl Substances (PFAS) in Soils Using a Commercial Adsorbent. *J. Braunig, C. Baduel, R. Stewart, and J. Mueller.*
Richard Stewart (Ziltek Pty., Ltd./Australia)

117. In Situ Containment of PFOA/PFOS Using Colloidal Activated Carbon. *K. Thoreson and M. Pham.*
Kristen Thoreson (Regenesis/USA)

F3. Toxicological Impacts of PFAS in Human Health and the Environment

118. Recent Developments in Toxicology and Regulation of Per- and Poly-Fluoroalkyl Substances. *W. DiGuiseppi, B. Selcoe, A. Salter-Blanc, and R. Cameron.*
William DiGuiseppi (CH2M HILL/USA)

119. Toxicological Effects of Per- and Poly-Fluoroalkyl Substances (PFASs) and their Regulatory Impact. *R.J. Kotun.*
Ronald Kotun (Tetra Tech, Inc./USA)

WEDNESDAY MORNING

A Sessions
Jasmine

B Sessions
Orchid

C Sessions
Brickell

8:00

Remedial Approaches for In Situ Anaerobic Bioremediation. *G. Chen, F. Tsang, M. Zeolla, P.R. Rosewicz, and J.T. Lyons.*
Ge (Grace) Chen (CDM Smith, Inc./USA)

API Guide on Petroleum Natural Source Zone Depletion Evaluation. *T. Palaia, E. Nichols, B. Bauman, and J. Zimbron.*
Tom Palaia (CH2M HILL/USA)

The Use of Omic-Based Tools to Aid in the Assessment of Monitored Natural Attenuation of MTBE Contaminated Sites with Biobarrier Oxygen Injection Systems. *K.H. Kucharzyk, C. Bartling, and K. Neil.*
Kate Kucharzyk (Battelle/USA)

8:25

Biotic, Abiotic, and Adsorption Source Area Treatment Pilot Tests of Dissolved Chlorinated Ethenes. *A. Cuellar and L. Sweet.*
Angel Cuellar (Tetra Tech, Inc./USA)

Implications of Seasonality for NSZD Rate Measurements. *N.J. Sihota, J. Trost, B. Bekins, E. Warren, and K.U. Mayer.*
Natasha Sihota (Chevron Energy Technology Company/USA)

Functional Metagenomics of Microbial Communities in Groundwater for a Bedrock Plume and Source Area. *R. Lamendella, J.R. Wright, T.W. Macbeth, D.A. Marabello, and J. McDermott.*
Tamzen Macbeth (CDM Smith, Inc./USA)

8:50

Bioremediation Integrated Approach for Chlorinated Compounds in a Complex Brazil Facility. *G.D.C. Mello, M. Mejac, and A. Gatti*
Gustavo de Mello (Ramboll Environ/Brazil)

Use of MIN3P-Dusty Numerical Model to Simulate Rates of LNAPL Depletion for Natural and Bioventing Conditions. *I. Hers, P. Jourabchi, A. Kirkman, U. Mayer, and J. Wilson.*
Ian Hers (Golder Associates Ltd./Canada)

Monitoring and Enhancing Anaerobic Benzene Biodegradation in Groundwater Systems. *F. Luo, S. Guo, N. Bawa, J. Webb, S. Dworatzek, T. Carlson, and E.A. Edwards.*
Fei Luo (University of Toronto/Canada)

9:15

The Use of Biostimulation to Safely Treat a Chlorinated VOC Plume in a Residential Community. *P. Nangeroni, R. McGrath, L.J. Campe, and A. Roche*
Peter Nangeroni (Woodard & Curran, Inc./USA)

Insights from Continuous Monitoring of LNAPL Natural Source Zone Depletion Rates. *K. Piontek, T. Sale, K. Karimi Askarani, and E.D. Emerson.*
Keith Piontek (TRC Environmental Corporation/USA)

Next Generation Sequencing and qPCR as Complementary Approaches for Evaluating MNA at a Petroleum Hydrocarbon-Impacted Site. *D. Taggart, K. Clark, B.R. Baldwin, C. Curtis, and S. Marchetti.*
Dora Ogles-Taggart (Microbial Insights, Inc./USA)

9:40

Fortuitous Volatilization and Steam-Enhanced Biodegradation of VOC-TPH NAPL Mixture, Naval Air Station North Island. *V. Hosangadi, M. Pound, and N. Durant.*
Vitthal Hosangadi (NOREAS, Inc./USA)

Current Developments in Thermal NSZD Monitoring: Application at an LNAPL Research 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)

Microbial Diversity of Produced Water Sources for Oil and Gas Development. *S.D. Richardson, J.S. Kromann, A.P. Smith, A.R. Sager, D.B. Burnett, A. Biernacki, and D. Ogles-Taggart.*
Stephen Richardson (GSI Environmental, Inc./USA)

10:05

Bioremediation of Phenol Plume in Groundwater. *R. Spina, R. Coelho, and V. Vanin Sewaybricker.*
Victor Vanin Sewaybricker (GEOKLOCK/Brazil)

Evolving Conceptual Models for Natural Source Zone Depletion: Methanogenesis, Gas Transport, and Sequenced Biodegradation. *S. Garg, C. Newell, P. Kulkarni, D.C. King, M. Irianni-Renno, and T. Sale.*
Sanjay Garg (Shell Global Solutions/USA)

SESSION BREAK

10:30

SESSION BREAK

Bioventing Revisited: Enhanced NSZD Outperforms Hydraulic LNAPL Recovery. *B. Koons, J. Smith, S. Gaito, and A. Kirkman.*
Brad Koons (AECOM/USA)

Naphthalene Stable Isotope Probing Illustrates That Sulfate Amendment Enhances Biodegradation at a Former Manufactured Gas Plant. *M.B. Heintz, J. McDonough, J. Brussel, C. Geraci, M. Hysell, and J.F. Morgan.*
Monica Heintz (Arcadis/USA)

10:55

Bioremediation-Based Water Treatment for Mine Closure: A Pilot-Scale Study. *L. Santisteban, I. Lee, E. Weiland, and D. Ramey.*
Ilsu Lee (Freeport-McMoRan/USA)

SESSION BREAK

Generating Definitive Data for Biodegradation: Case Studies on Practical Use of Stable Isotope Probing. *M. Burns, C.E. Warford, J.L. Andrews, and D. Liwicki.*
Matthew Burns (WSP | Parsons Brinckerhoff/USA)

11:20

Enhanced In Situ Bioremediation of Cadmium- and Lead-Impacted Groundwater. *A. Madison, C. Hemingway, M. Lewis, and S. Mitchell.*
Andrew Madison (Golder Associates, Inc./USA)

Era of the BioGeoPhysioChemoHydrogeologist Is Now: Integration of Disparate Lines of Evidence to Craft Robust LNAPL Conceptual Site Models in Support of LNAPL Remedies. *A.J. Kirkman and J.M. Hawthorne.*
Andrew Kirkman (BP Corporation/USA)

Characterization of MTBE Biodegradation Using Multiple Lines of Evidence: Equilibrium Partitioning, CSIA, and Microbial Analysis. *D. Collins and N. Longinotti.*
David Collins (Stantec/USA)

A3. Case Studies

A4. Bioremediation of Heavy Metals

B5. Natural Source Zone Depletion

B6. LNAPL

C4. Petroleum Hydrocarbon-Related Molecular Diagnostics

D Sessions Flagler	E Sessions Monroe	F Sessions Tuttle	
D5. Enhanced Methods for Biodegradation of Organic and Inorganic Contaminants	**E5. Bioremediation of Munitions Constituents**	**F4. Innovative Treatment Technologies for PFAS Compounds**	
Effect of Sodium Polyacrylate on the Fermentative Production of Biohydrogen. *P.X. Sotelo-Navarro, H.M. Poggi-Varaldo, and S.J. Turpin-Marion.* Perla Xochitl Sotelo-Navarro (CINESTAV and U.A. Metropolitana-Apotzalco/Mexico)	**Treatability Study to Evaluate In Situ Soil Mixing of EVO and ZVI to Reduce Munitions Constituents in Saturated and Vadose Zones.** *S.T. Downey, R. Mayer, and R.L. Meadows.* Steven Downey (CB&I Federal Services, LLC/ USA)	**Remediation of Poly- and Per-Fluoroalkyl Substances: Developing Remediation Technologies for Emerging Challenges.** *I. Ross, J. Hurst, J. Miles, E. Houtz, J. McDonough, and J. Burdick.* Ian Ross (ARCADIS/United Kingdom)	**8:00**
Bioelectrochemically-Enhanced In Situ Biodegradation of Benzene and Other Petroleum Contaminants in Groundwater. *S. Jin, P. Fallgren, M. Larsen, and J. Strauss.* Song Jin (University of Wyoming/USA)	**Bioremediation Treatability Study for Nitrobenzene, Aniline, and Diphenylamine at a Former Explosives Manufacturing Facility, Southern New Jersey, USA.** *R. Lees, K. Mckeever, and S. Yalvigi.* Raymond Lees (Langan Engineering & Environmental Services, Inc./USA)	**Ex Situ Treatments of Aqueous Film-Forming Foam Impacted Water.** *G.M. Birk and D.F. Alden.* Gary Birk (Tersus Environmental, LLC/USA)	**8:25**
A Sustainable Bioremediation Approach for BTEX-Contaminated Groundwater under Methanogenic and Sulfate-Reducing Conditions. *L.M. Pipkin, V.K. Elango, and J.H. Pardue.* Leslie Pipkin (Louisiana State University/USA)	**Wide-Area Infiltrative Delivery of Bioamendments to Treat Energetics Contamination within Tropical Vadose Zone Soils on DoD Live-Fire Ranges.** *J.A.K. Silva, R. Babcock, Z. Payne, and C. Nelson.* Jeffrey A.K. Silva (GSI Pacific, Inc/USA)	**Novel Approach to Optimize GAC Performance for PFAS Treatment.** *S.-Y. Chiang, Q. Huang, J. Field, L. Pugh, D. Pohlmann, and A. Bodour.* Dora Chiang (AECOM/USA)	**8:50**
Experimental Analysis and Modeling of the Gas-Liquid Mass Transfer in a Slurry Bioreactor Treating PAH-Contaminated Soil. *D.O. Pino-Herrera, Y. Pechaud, D. Huguenot, N. Oturan, E.D. van Hullebusch, M.A. Oturan, Y. Fayolle, S. Pageot, and G. Esposito.* Douglas Oswaldo Pino-Herrera (Université Paris-Est/France)	**Pump and Treat Groundwater Remedy Optimization Using In Situ Bioremediation at Naval Base Kitsap, Bangor Site F.** *M.M. Michalsen, A.S. King, J.D. Istok, and M.J. Gander.* Aaron King (USACE/USA)	**Coupling Technology Approach to Treat High Levels of PFAS in Regenerant Wastes.** *D. Chiang, S. Liang, and Q. Huang.* Dora Chiang (AECOM/USA)	**9:15**
Management and Treatment of Contaminants in Low Permeability Zones with Colloidal Activated Carbon. *K. Saller and K. Thoreson.* Kevin Saller (CDM Smith, Inc./USA)	**Ex Situ Treatment of Perchlorate in Groundwater.** *B.A. Robinson, T. Slater, E.C. Ipsen, and K. Deeny.* Kevin Morris (ERM/USA)	SESSION BREAK	**9:40**
SESSION BREAK	SESSION BREAK	**F5. Optimizing Existing Systems** **An Industry Perspective on Remediation Portfolio Optimization Efforts.** *E.J. Daniels and G.M. Harris.* Eric Daniels (Chevron Energy Technology Company/USA)	**10:05**
Bioaugmentation Using Engineered Polyvalent Bacteriophages. *J. Mathieu, P. Yu, C. Schwarz, and P.J.J. Alvarez.* Jacques Mathieu (Rice University/USA)	**E6. Insensitive Munitions: Characterization, Fate, and Transport** **Biocatalyst for 2,4-Dinitroanisole Biodegradation and Detection.** *S. Karthikeyan, Z. Kurt, G. Pandey, J. Bolotin, T. Hofstetter, and J. Spain.* Jim Spain (University of West Florida/USA)	**The Discipline of Honest Future Thinking and Benefits to Optimization of Existing Systems.** *P. Favara and J. Butner.* Paul Favara (CH2M HILL/USA)	**10:30**
Stimulation of Trichloroethene Degradation with Natural Organochloride Amendment. *M.J. Krzmarzick, X. Wang, and M. Brooks.* Mark James Krzmarzick (Oklahoma State University/USA)	**Chemical and Biological Degradation of Insensitive Munitions (IM) Mediated by Fe(III)-Reducing Microorganisms.** *K.T. Finneran, K. McGee, K.A. Millerick, and J.B. Niedzwiecka.* Kevin T. Finneran (Clemson University/USA)	**Passive Groundwater Sampling: Effective Tools and Lessons Learned to Make the Transition.** *K. Gerber, E. Cohen, and K. Houston.* Kathleen Gerber (U.S. Air Force/USA)	**10:55**
Stimulation of Dechlorination of Lightly Chlorinated Dibenzo-p-Dioxins in Aquatic Sediments. *C. Schneider, V. Krumins, H. Almnehlawi, L. Rodenburg, and D.E. Fennell.* Cassidy Schneider (Rutgers University/USA)	**Transformation Products of the Insensitive Munitions Explosive 2,4-Dinitroanisole in Biotic Systems.** *C.L. Just and H.W. Schroer.* Craig Just (University of Iowa/USA)	**Remedy Performance Reporting: Driving Remediation System Optimization and Site Progression.** *R. Evans, D. Sweeten, and C. Blanchard.* Richard Evans (Groundwater & Environmental Services, Inc./USA)	**11:20**

WEDNESDAY AFTERNOON

A Sessions
Jasmine

B Sessions
Orchid

C Sessions
Brickell

11:45

A4. Bioremediation of Heavy Metals

An Innovative Approach to Treatment of Heavy Metals in Soil and Groundwater Using Elemental Iron, Iron Sulfides, and Related Reactive Minerals. *F.S. Lakhwala, A.G. Seech, and P. Hicks.*
Fayaz Lakhwala (PeroxyChem, LLC/USA)

B6. LNAPL Mobility, Transmissivity, and Recoverability

You Get What You Measure: Emerging Concepts and Philosophies for the Quantification, Interpretation, and Application of LNAPL Transmissivity. *J.M. Hawthorne.*
J. Michael Hawthorne (GEI Consultants, Inc./USA)

C4. Petroleum

Comparing Microbial Profiles from Five Service Station Sites. *J. Sheldon and J. Friedman.*
Jack Sheldon (Antea Group/USA)

12:10

A4. Bioremediation of Heavy Metals

Injection of Emulsified Vegetable Oil for Full-Scale In Situ Treatment of Hexavalent Chromium: Two Years Later. *H. Holbrook, R. Mora, and K. Hinckley.*
Holly Holbrook (AECOM/USA)

B6. LNAPL Mobility, Transmissivity, and Recoverability

Field Trials of Periodic-Sinusoidal Slug Tests for Aquifer Properties and LNAPL Transmissivity. *D.A. Lundy, D. Demko, and G. Rosenzweig.*
Don Lundy (Groundwater & Environmental Services, Inc./USA)

C4. Petroleum

Sulfate Delivery Using Permeable Filled Borings to Enhance Petroleum Hydrocarbon Biodegradation. *D. Mackay, N. de Sieyes, J. Peng, R. Schmidt, T. Buscheck, D. Patten, and T. Flora.*
Timothy Buscheck (Chevron Energy Technology Company/USA)

12:35

B6. LNAPL Mobility, Transmissivity, and Recoverability

Application of LNAPL Mass Flux and Natural Source Zone Depletion to Demonstrate LNAPL Body Stability. *R. Ahlers.*
Rick Ahlers (Arcadis/USA)

1:00

SESSION BREAK
Lunch available from 11:00 a.m.-1:00 p.m.

SESSION BREAK
Lunch available from 11:00 a.m.-1:00 p.m.

SESSION BREAK
Lunch available from 11:00 a.m.-1:00 p.m.

1:25

A5. Enhancements to Biodegradation Strategies

A Case Study: Evaluation of Enhanced In Situ Bioremediation Performance in Low pH Aquifer. *S. Damasceno and J. Linton.*
Stephanie Damasceno (Geosyntec Consultants/USA)

C5. High-Resolution Site Characterization

Conceptualization of Residual Contamination Using Depth Discrete Monitoring of Dynamic PCE Concentration Changes during and after Remedial Pumping and Pumping Test. *M.M. Broholm, A.S. Fjordbøge, K. Mosthaf, P.J. Binning, B. Brauns, T. Tsitseli, P.L. Bjerg, and H. Kerrn-Jespersen.*
Mette Broholm (Technical University of Denmark/Denmark)

1:50

A5. Enhancements to Biodegradation Strategies

Enhanced Bioremediation of Polychlorinated Biphenyls (PCBs) in Sediment: Application of Biofilm-Activated Carbon Aggregates as a Delivery Vehicle. *A. Prieto, C. Bodeneider, S. Ghandehari, and B.V. Kjellerup.*
Birthe Kjellerup (University of Maryland/USA)

B7. Remediation and Management of Petroleum-Hydrocarbon Contaminated Sites

Evaluate a Remedial Alternative to Long-Term LNAPL Management at a Former Refinery Site. *D.B Gent, A.M. Friona, J. Wang, G. Grant, S. O'Hara, M.T. Kuhn, P.M. Horner, B. Bouwhuis, S. Pearson, and J. Pawloski.*
David Gent (U.S. Army Corps of Engineers/USA)

C5. High-Resolution Site Characterization

Fuel Fluorescence Logging Using the Optical Imaging Profiler (OIP): A New High-Resolution Direct Push Tool for Delineating LNAPL. *D. Pipp, T.M. Christy, J. Wiley, S. Doxtader, and J. Fontana.*
Dan Pipp (Geoprobe Systems/USA)

2:15

A5. Enhancements to Biodegradation Strategies

Optimization of a Large-Scale Biostimulation and Bioaugmentation Remedy. *M. Perlmutter, J. Minchak, S. Appaji, and S. Jetter.*
Mike Perlmutter (CH2M HILL/USA)

B7. Remediation and Management of Petroleum-Hydrocarbon Contaminated Sites

No Further Action: A Case Study on High-Resolution Site Characterization and Bioremediation in a Fractured Bedrock Setting. *D. Guilfoil, N. Thacker, and R. Boyle.*
Duane Guilfoil (AST Environmental, Inc./USA)

C5. High-Resolution Site Characterization

Impact of High-Resolution Characterization during Baseline Sampling at Contractors Road Heavy Equipment Area, Kennedy Space Center, Florida. *A. Chrest, R. Daprato, M. Burcham, and J. Johnson.*
Mike Burcham (Geosyntec Consultants/USA)

2:40

A5. Enhancements to Biodegradation Strategies

Evaluation of Multiple Innovative Approaches for Accelerating Low VOC Concentration Plume Attenuation. *M. Perlmutter, B. Reid, M. Fulkerson, D. Cleland, and C. Delaney.*
Dean Williamson (CH2M HILL/USA)

B7. Remediation and Management of Petroleum-Hydrocarbon Contaminated Sites

Field-Scale Evaluation of Biosparging to Mitigate Long-Term Dissolution and Mass Discharge of Contaminants from Coal Tar and Creosote. *R.K. Sillan and R.M. Keyser.*
Randall Sillan (AECOM/USA)

C5. High-Resolution Site Characterization

Stratigraphic Flux: Applying Sequence Stratigraphy and High-Resolution Site Characterization to Find Contaminant Flux. *J.A. Quinnan, P. Curry, E. Killenbeck, L. Peters, C. Varley, K. Glover, and M. Rodriguez.*
Joseph Quinnan (ARCADIS U.S., Inc./USA)

3:05

A5. Enhancements to Biodegradation Strategies

High-Pressure Application of Ferrous Iron-Enhanced Organic Substrate at Concord Naval Weapons Station. *J. Schen, D. Darrow, and D. Leigh.*
Jason Schen (NOREAS, Inc./USA)

B7. Remediation and Management of Petroleum-Hydrocarbon Contaminated Sites

Evaluation of Analytical Methodologies to Differentiate Biogenic Organic Carbon (BOCs) from Heavy Petroleum Hydrocarbons (PHCs) in Tropical Rainforest Organic Soils. *F. Kelly-Hooper, J. Bishop, J. Coffey, and V. Ucar.*
Francine Kelly-Hooper (CH2M HILL/Canada)

C5. High-Resolution Site Characterization

High-Resolution Site Characterization for Assessment of Accelerated Anaerobic Bioremediation at Site WP21, Dover AFB. *T. Deane, A. Bloom, H.A. Brown, and R. Lyon.*
TJ Deane (AECOM/USA)

	D Sessions Flagler	E Sessions Monroe	F Sessions Tuttle	
D5. Enhanced Methods	**Effects of Chlorinated Methanes (CMs) on the Reductive Dehalogenation of Trichloroethene.** *E. Ehret, M. Azizian, and L. Semprini.* Emma Ehret (Oregon State University/USA)	E6. **Biodegradation of the Emerging Insensitive Munitions Compound 3-Nitro-1,2,4-Triazol-5-One (NTO) by Soil Microorganisms.** *C.L. Madeira, J. Chorover, R. Sierra-Alvarez, and J.A. Field.* Camila Madeira (University of Arizona/USA)	F5. Optimizing **Applying Lean to Optimize Site Reviews for Project Strategy Alignment and Sustainable Remedial Approaches.** *B.Z. Brooks, S.L. Boyle, and J. Baker.* Sunila Gupta (Haley & Aldrich, Inc./USA)	**11:45**
D5. Enhanced Methods	**Molecular Mechanism of Microbial Iodate Reduction.** *H.D. Shin, Y. Toporek, A. Mok, B. Lee, M.H. Lee, and T.J. DiChristina.* Hyun-Dong Shin (Georgia Institute of Technology/USA)			**12:10**
	SESSION BREAK Lunch available from 11:00 a.m.-1:00 p.m.	SESSION BREAK Lunch available from 11:00 a.m.-1:00 p.m.	SESSION BREAK Lunch available from 11:00 a.m.-1:00 p.m.	**12:35**
E7. Advances in Tools and Techniques for Assessing MNA		**Use of a ^{14}C Assay to Determine Rates of TCE Co-oxidation in Groundwater.** *J.C. Mills, D.L. Freedman, J.T. Wilson, and T.H. Wiedemeier.* James Mills (Clemson University/USA)	F6. Risk Management Strategies **Managing a Complex Contaminated Site Based on Toxicity Rather Than Individual Compounds.** *S. Siciliano, P. Campbell, M. Hanson, N. Hogan, M. Hecker, and T. Carlson.* Patrick Campbell (Amec Foster Wheeler/ Canada)	**1:00**
D6. Advances in Amendment Formulation	**New Technology Applied at Indiana Industrial DNAPL Site.** *S. Noland, B. Iden, and G. Simpson.* Scott Noland (Remediation Products, Inc./USA)	**Comparison of Enzyme Activity Probe Response with TCE Degradation Rates at Five Contaminated Sites in the U.S.** *B.D. Lee, J. Morad, S. Brooks, J. Powell, M.H. Lee, T.H. Wiedemeier, J. Wilson, B. Wilson, D. Freedman, and J. Mills.* Brady Lee (Pacific Northwest National Laboratory/USA)	**Commingled Plumes, Downgradient Property Status and Privatized Cleanup Programs: Lessons Learned from Two Decades of Practice.** *R.D. Collins.* R. Duff Collins (Woodard & Curran/USA)	**1:25**
	Optimizing In Situ Remediation Amendments Using Innovative Surfactant System Formulations. *G. Birk, D. Alden, J. Harwell, and M. Hasegawa.* David Alden (Tersus Environmental, LLC/USA)	**TCE Co-oxidation Rates and Quantification of Oxygenase Gene Abundances and Expression.** *D. Taggart, B.R. Baldwin, J.T. Wilson, T.H. Wiedemeier, and D. Freedman.* Dora Ogles-Taggart (Microbial Insights, Inc./ USA)	**Early Decision Framework for Integrating Sustainable Risk Management for Complex Remediation Sites: Drivers, Barriers, and Performance Metrics.** *M.A. Harclerode, M.E. Miller, T. Macbeth, and C. Gurr.* Melissa Harclerode (CDM Smith, Inc./USA)	**1:50**
	Tools for Monitoring Contaminant Biodegradation When Combined with Colloidal Activated Carbon. *K. Thoreson, S. Rittenhouse, C. Sandefur, and J. Birnstingl.* Kristen Thoreson (Regenesis/USA)	**Innovative Approach to Determine the Rate of Abiotic Degradation of TCE in a Large Diffuse Plume.** *J. Mills, D.L. Freedman, T.H. Wiedemeier, D. Cutt, L. Thantu, B. Looney, B. Wilson, and J.T. Wilson.* John Wilson (Scissortail Environmental Solutions, LLC/USA)	**Importance of Stakeholder-Developed Technical Guidance in the Successful Implementation of the New Jersey Site Remediation Reform Act.** *S.E. Posten.* Steve Posten (Amec Foster Wheeler/USA)	**2:15**
	Impact of Surface Tension, Zeta Potential, and Droplet Size on Transport of Traditional and Zero Water EVOs. *B. Elkins, B. Yuncu, and R. Borden.* Brad Elkins (EOS Remediation, LLC/USA)	**Efficacy of an In-Well Sonde to Determine Magnetic Susceptibility of Aquifer Sediment as a Predictor of Abiotic Degradation of TCE.** *T.H. Wiedemeier, B.H. Wilson, J.T. Wilson, and M.L. Ferrey.* Todd Wiedemeier (T.H. Wiedemeier & Associates, Inc./USA)	**Bioavailability in Contaminated Soil: ITRC Guidance around the Corner.** *C. Sorrentino and K. Durant.* Claudio Sorrentino (California Department of Toxic Substances Control/USA)	**2:40**
	SESSION BREAK	SESSION BREAK	SESSION BREAK	**3:05**

WEDNESDAY LATE AFTERNOON

	A Sessions Jasmine	B Sessions Orchid	C Sessions Brickell
3:30	SESSION BREAK	SESSION BREAK	SESSION BREAK
3:55	**A5. Enhancements to Biodegradation Strategies** **Thermal In Situ Sustainable Remediation (TISR): Linking Renewable Energy to Sustainable Site Restoration.** *D.S. Randhawa, C. Flanders, P.W. Visser, and D. Rosso.* Rick Ahlers (Arcadis/USA)	**B8. Combined Approaches for the Remediation of Petroleum Hydrocarbons** **Biodegradation of Polycyclic Aromatic Hydrocarbons (PAHs) Employing Plant-Bacterial Consortia Isolated from Oil-Contaminated Soil.** *H. Deka.* Hemen Deka (Institute of Advanced Study in Science & Technology/India)	**C5. High-Resolution Site Characterization** **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)
4:20	**Performance of Thermally-Enhanced Bioremediation for Targeted DNAPL Source Treatment.** *N.L. Smith, T.W. Macbeth, D.J. Giaudrone, R.E. Chichakli, C. Cora, K. Lynch, and T. Powell.* Neil Smith (CDM Smith, Inc./USA)	**In Situ Bioremediation of Biodiesel through Natural Attenuation, Biostimulation, and Bioventing.** *I. Cecchin, C. Reginatto, A. Thomé, K.R. Reddy, and F. Schnaid.* Iziquiel Cecchin (Federal University of Rio Grande do Sul/USA)	**A Passive Method for Measuring Microbial Biomass Flux in Porous Media.** *M. Annable, J. Cho, A. Haluska, L. Huang, E. Morrison, and A. Ogram.* Alex Haluska (University of Florida/USA)
4:45	**Thermally-Enhanced Biodegradation: Final Step to Rapid Site Closure.** *D.K. Nelson, J. Dablow, and J. Baldock.* Denice Nelson (ERM/USA)	**High-Resolution Sampling and Surgical Injection of BOS 200® to Successfully Eliminate LNAPL and Treat Large Hydrocarbon Plume.** *P. Ejlskov and D. Guilfoil.* Duane Guilfoil (AST Environmental, Inc./USA)	**High-Resolution Site Characterization Investigation at Ott/Story/Cordova Superfund Site.** *K. Schuldt, R. Mastrolonardo, J. Edwards, and J. Fagiolo.* Kristi Schuldt (Tetra Tech, Inc./USA)
5:10	**Progressive Remedial Strategy to Guide the Delivery of Biological and Abiotic Reagents for Treating Chloroethenes in Groundwater.** *A.A. Rees, K. Carr, D.E. Cebra, and M. Biton.* Assaf Rees (AECOM/USA)	**When It Comes to Remediation, LNAPL is a Four-Letter Word: Activated Carbon May Provide an Answer.** *S. Noland.* Scott Noland (Remediation Products, Inc./USA)	**Silicon Valley Case Study: Applying Environmental Sequence Stratigraphy and HRSC to Confirm Success of In Situ Bio and Manage Commingled Plumes.** *M. Shultz, R. Cramer, R. Mora, L. Niemeyer, and H. Levine.* Mike Shultz (Burns & McDonnell/USA)

POSTER GROUP 2: SCHEDULE

Display: Wednesday 7:00 a.m.–Thursday 1:00 p.m.
Presentations/Presentation: Wednesday 5:45–7:00 p.m.

The following posters will be on display from Wednesday morning through Thursday afternoon in the Exhibit Hall. During the Presentations/Reception period Wednesday evening, presenters will be at their displays to discuss their work.

D Sessions Flagler	E Sessions Monroe	F Sessions Tuttle	
D6. Advances in Amendment Formulation	**E7. Advances in Tools and Techniques for Assessing MNA**	**F7. Incorporating GSR into Remedy**	
Demonstrating Contaminant Biodegradation in Conjunction with Colloidal Activated Carbon Remediation Technologies. *K.A. Thoreson, D. Taggart, C. Brown, and B.R. Baldwin.* Dora Ogles-Taggart (Microbial Insights, Inc./USA)	**Use of Two-Dimensional Gas Chromatography (GCXGC) to Supplement the Evaluation of Natural Attenuation at Petroleum Release Sites.** *C. Espino Devine, R. Magaw, R. Mohler, K. O'Reilly, S. Ahn, A. Tiwary, and D. Zemo.* Catalina Espino Devine (Chevron Energy Technology Company/USA)	**Lowering the Carbon Footprint of Thermal Remediation Systems.** *J. Baldock, J. Brett, S. Tillotson, and J. Dablow.* James Baldock (ERM/United Kingdom)	**3:30**
Use of Controlled Slow-Release Encapsulated Substrates to Enhance In Situ Reductive Dechlorination Processes. *M. Scalzi and A. Karachalios.* Michael Scalzi (Innovative Environmental Technologies, Inc./USA)	**Scrubbing Bubbles: The Importance of Sample Collection Method for Measuring Methane in Groundwater.** *T.E. McHugh, L. Molofsky, J.A. Connor, S.D. Richardson, A. Gorody, and F. Baldassare.* Thomas McHugh (GSI Environmental, Inc./USA)	**Green and Sustainable Remediation Analysis: Coal Ash Surface Impoundment Closure.** *A. Boroumand and K. Herman.* Ali Boroumand (Gradient/USA)	**3:55**
Dispelling Myths and Extolling the Virtues of the Emulsified Zero Valent Iron (EZVI) Technology. *G. Booth, J. Mueller, M. Scalzi, C. Yestrebsky, and C. Clausen.* J. Greg Booth (Provectus Environmental Products, Inc./USA)	**A Multi-Year Evaluation of Natural Attenuation of Chlorinated Ethenes and Methanes Using CSIA.** *A.M. Wilson and E. Schwartz.* Amy Wilson (TRC Companies, Inc./USA)	**Combining Green and Sustainable Remediation Evaluations with Cost/Risk Analysis as Effective Communication Tools to Drive Cleanup Decisions.** *I. Lo, M. Harclerode, and J. Wondolleck.* Ian Lo (CDM Smith, Inc./USA)	**4:20**
Treatment of a Chlorinated Ethene Plume Using Different Biological Amendment Mixtures to Reach Site Closure. *S. Suryanarayanan, P. Srivastav. S. Watson, A. Willmore, and R. Mayer.* Sowmya Suryanarayanan (CB&I Federal Services, LLC/USA)	**Remediation Test Panel: Collecting and Interpreting Contaminant, Geochemical Isotopic, and Molecular Biology Data.** *P.W. McLoughlin and A.D. Peacock.* Patrick McLoughlin (Pace Analytical Energy Services/USA)	**Using Systems' Thinking and Waste Materials to Improve the Sustainability Footprint of a Cleanup: The Drive for a Zero Footprint Cleanup Technology.** *P. Favara and J. Gamlin.* Paul Favara (CH2M HILL/USA)	**4:45**
Optimization and Performance of Aqueous Phase ZVI Remediation Amendments for In Situ Chemical and Biological Reduction. *J. Freim and J. Harvey.* John Freim (OnMaterials/USA)	**Identification of Natural Attenuation Mechanisms of Hexavalent Chromium in Groundwater through Geochemical and Matrix Diffusion Evaluations.** *M.R. Lamar, J.T. Lyons, K. Baker, I. Bowen, R.L. Olsen, N.T. Smith, T. Burgesser, and K. Whiting.* Michael Lamar (CDM Smith, Inc./USA)	**Remedial Alternatives Screening by Incorporating Sustainability Metrics and Using Weighting Triangle Decision Support System.** *H. Singh.* Harvinder Singh (AECOM/USA)	**5:10**

POSTER GROUP 2: SESSION TITLES

A6. Biobarrier Installation and Management
A7. Strategies for Bioremediation Performance Assessment
A8. Successes and Failures of Bioaugmentation and Biostimulation
B7. Remediation and Management of Petroleum-Hydrocarbon Contaminated Sites
B8. Combined Approaches for the Remediation of Petroleum Hydrocarbons
B9. 1,4-Dioxane Treatment Technologies I
B11. Other Emerging Contaminants
C4. Petroleum Hydrocarbon-Related Molecular Diagnostics
C5. High-Resolution Site Characterization
C6. Microbial-Based Alternative Energy
C7. Advances in Biological Wastewater Treatment Processes
D5. Enhanced Methods for Biodegradation of Organic and Inorganic Contaminants
D6. Advances in Amendment Formulation
D7. Cometabolic Bioremediation
D8. Engineering Biogeochemical Transformation
D9. Phytoremediation/Mycoremediation
E5. Bioremediation of Munitions Constituents
E6. Insensitive Munitions: Characterization, Fate, and Transport
E7. Advances in Tools and Techniques for Assessing MNA
E8. Natural Attenuation Processes
E9. MNA for Achieving Site Goals
E10. Groundwater/Surface Water Interaction
F4. Innovative Treatment Technologies for PFAS Compounds
F5. Optimizing Existing Systems
F6. Risk Management Strategies
F7. Incorporating GSR into Remedy
F8. Sustainable Remediation Assessment Tools
F9. Best Practices in GSR

POSTER GROUP 2: PRESENTATIONS

The poster board number assigned to each presentation appears below.

A6. Biobarrier Installation and Management

1. Modeling of Water Quality Downgradient of Mulch Biowall with Nearby Surface Water Receptor. *M.L. Alexander, A. Adewale, and C. Tovar.*
Matthew Alexander (Texas A&M University-Kingsville/USA)

2. 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.*
Cynthia Crane (HydroGeoLogic, Inc./USA)

3. Verification of Fracture Extent Using Surface Deformation Data. *B. Slack and L. Murdoch.*
William Slack (FRx, Inc./USA)

A7. Strategies for Bioremediation Performance Assessment

4. Measuring Biotic Soil Hydrogen Demand as a Strategy for Bioremediation Potential Assessment. *M. Altizer, M. Luna-Aguero, A.G. Delgado, C. Tórres, R. Krajmalnik-Brown.*
Megan Altizer (Arizona State University/USA)

5. Considerations for Improving ERD Design and Implementation Practices. *P. Jin, M.C. McCaughey, and R.C. Oesterreich.*
Caitlin Bell (Arcadis/USA)

6. Performance Benchmarks Using Timelines: A Simple Way of Assessing Performance of In Situ Bioremediation Applications. *D. Davis, O. Miller, and B. Poling.*
Doug Davis (Regenesis/USA)

A8. Successes and Failures of Bioaugmentation and Biostimulation

7. Sustainable and Cost-Effective Destruction of Chlorinated Alkane and Alkene Contaminants via Biostimulation and Enhanced Reductive Dechlorination. *K.C. Armstrong and G. Bell.*
Kent Armstrong (TerraStryke Products, LLC/USA)

8. Sustained Anaerobic Biological Degradation Supported by Endogenous Biomass Decay Following Implementation of Biostimulation and Bioaugmentation in the Piedmont Saprolite. *R.W. Henterly.*
Willard Harms (EHS Support LLC/USA)

9. An Evaluation of Processes for Generating Anaerobic Water for Dhc-Containing Bioaugmentation Cultures. *D. Leigh, S. Vainberg, and N. Hey.*
Daniel Leigh (PeroxyChem, LLC/USA)

10. Comparison of Dry Oxygen Scavengers for Preparing Anaerobic Injection Waters for EISB. *B. McShane and B. Newman.*
Brendan McShane (RNAS Remediation Products/USA)

11. Novel Field Application of a Small-Scale Treatment Trial. *G. Smith, S. Gilliam, and N. Ryan.*
Graham Smith (Parsons Brinckerhoff/Australia)

B7. Remediation and Management of Petroleum-Hydrocarbon Contaminated Sites

12. Ecological Guild of Beneficial Bacteria Associated with Agricultural Soil Polluted by Spent Automobile Engine Oil. *M. Bello-Akinosho, R. Makofane, R. Adeleke, and M. Thantsha.*
Rasheed Adeleke (Agriculture Research Council/South Africa)

13. Successful On-Site Treatability Study Evaluating Feasibility of Biostimulation to Enhance Microbial Degradation of 1,3,5-Trimethylbenzene under Anaerobic Conditions. *K.C. Armstrong and C.L. Cason.*
Kent Armstrong (TerraStryke Products, LLC/USA)

14. Integrating Remedial Infrastructure into a Retail Petroleum Facility Upgrade: Lessons Learned in Long-Term Contaminated Site Management. *A. Madsen and R. Peters.*
Aaron Madsen (Amec Foster Wheeler/Canada)

15. Biodegradation of Naphthalene by *Pseudomonas aeruginosa* SR17 and Simultaneous Production of Biosurfactant. *R. Patowary and S. Deka.*
Rupshikha Patowary (Research fellow in Institute of Advanced Study in Science and Technology [IASST]/India)

B8. Combined Approaches for the Remediation of Petroleum Hydrocarbons

16. Successful Self-Activating ISCO/Enhanced Bioremediation for BTEX Remediation: Soil Mixing Brazil Site. *S. Aluani, C. Spilborghs, E. Pujol, F. Tomiatti, N. Moura, J. Mueller, and G. Booth.*
Sidney Aluani (SGW Services/Brazil)

17. Bioremediation Incorporated into Treatment Train Achieves Closure of an LNAPL Source Area. *K. Morris.*
Kevin Morris (ERM/USA)

B9. 1,4-Dioxane Treatment Technologies I

18. 1,4-Dioxane Vadose Remediation by Extreme Soil Vapor Extraction (XSVE). *R.E. Hinchee, D.R. Burris, P.C. Johnson, and P.R. Dahlen.*
David Burris (Integrated Science & Technology, Inc./USA)

19. Biodegradation of 1,4-Dioxane by Three Enriched Consortia. *Y. He and P. Alvarez.*
Ya He (Rice University/USA)
Student Paper Winner

20. Aerobic Cometabolic Degradation of 1,4-Dioxane by Isobutane-Metabolizing Bacteria. *A. McElroy, C. Smith, W. Chen, D. Knappe, M. Hyman, H. Rolston, and L. Semprini.*
Michael Hyman (North Carolina State University/USA)

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

22. Fenton's Oxidation of 1,4-Dioxane in Landfill Leachate. *D.M. Patel, A. Bourgeois, D. Boyadjian, R.T. Clark, and P. Walshe.*
Dan Patel (CDM Smith, Inc./USA)

23. Removal of 1,4-Dioxane via Synergism between Non-Thermal Plasma and Aerobic Biodegradation. *Y. Xiong, Q. Zhang, R.J. Wandell, H. Wang, B.R. Locke, and Y. Tang.*
Youneng Tang (Florida State University/USA)

B11. Other Emerging Contaminants

24. The Biodegradation of the Pharmaceutical Diclofenac over a Range of Redox Conditions in Agricultural Soils and the Identification of the Microorganisms Involved. *J.-R. Thelusmond, A. Cupples, and T. Strathmann.*
Jean-Rene Thelusmond (Michigan State University/USA)

25. Microcosm Study of Aerobic Biodegradation of Bis(2-chloroethyl)ether by Xanthobacter sp. Strain ENV481 Relevant to Remediation of a Former Disposal Area. *M. Whaley, C. Walecka-Hutchison, R. Casselberry, J. Kerbleski, T. Tambling, P. Hatzinger, S. Vainberg, and J. Fenstermacher.*
Matt Whaley (The Dow Chemical Company/USA)

C4. Petroleum Hydrocarbon-Related Molecular Diagnostics

26. Comprehensive Study of Phenol Biodegradation in Activated Sludge. *K. Acharya, J. Dolfing, P. Meynet, W. Mrozik, D. Werner, and R.J. Davenport.*
Kishor Acharya (Newcastle University/United Kingdom)

27. PAH Bioavailability Studies of Skeet-Impacted Soils. *R.D. George, K. Sorensen, A. Obraztsova, J.M. Conder, and M. Grover.*
Robert George (Space and Naval Warfare Systems Center Pacific/USA)

28. Use of CSIA to Understand Risks at Complex Petroleum-Impacted Sites. *F. Muramoto and J. Lu.*
Frank S. Muramoto (AECOM/USA)

29. Metagenomic Characterization of Soil Microbiota in Polluted Mangrove Swamp Using Bioinformatic Approach. *C.C. Nwankwo, C.J. Ogugbue, and G.C. Okpokwasili.*
Chika Christiana Nwankwo (University of Port Harcourt/Nigeria)

30. Tiered Approach for the Application of Diagnostic Tools to Evaluate Remediation Performance at Petroleum-Hydrocarbon Contaminated Sites. *D. Hunkeler, D. Bouchard, V. Ponsin, M. Marchesi, R. Aravena, J.F. Barker, N.R. Thomson, E.L. Madsen, T.E. Buscheck, R. Kolhatkar, E. Daniels, and K. Sra.*
Violaine Ponsin (University of Neuchatel/ Switzerland)

31. Quantifying Presence of Naturally-Occurring Methane Gas at Petroleum Hydrocarbon-Impacted Sites: Implications for Site Restoration Efforts. *J. Sueker, A. Horneman, M. Heintz, M. Klemmer, and W. Parry.*
Julie Sueker (ARCADIS U.S., Inc./USA)

32. Using a Soil Gas Survey to Determine Methane Flux around a Plugged Gas Production Well. *W.J. van Biljon.*
Willem van Biljon (Geo Pollution Technologies/ South Africa)

33. Abundance, Diversity and Biodegradation Patterns of Azaarenes in Polycyclic Aromatic Hydrocarbon Polluted Soils. *J. Vila, Z. Tian, D.R. Singleton, and M.D. Aitken.*
Joaquim Vila (University of North Carolina/USA)

C5. High-Resolution Site Characterization

34. Smart Characterization: An Integrated Approach for Evaluating a Complex 1,4-Dioxane Site. *P.J. Curry, J.A. Quinnan, J. Wright, and D. Favero.*
Patrick Curry (Arcadis-US/USA)

35. Finding TCE in All the Wrong Places: Using Multiple Lines of Evidence to Characterize Contamination in a Glacial Till. *K. Grosinske, C.T. Coonfare, D. DeYoung, D. Nair, and N. Voorhies.*
Sam Moore (Battelle/USA)

36. Novel Mapping of LNAPL Preferential Flow Pathways at a Rail Yard Using Sequence Stratigraphy Analysis. *S. du Pont, and S.D. Pittinger.*
Suzie du Pont (AECOM/USA)

37. Hydrogeology Complications in Urban Environments and the Impact on Remedy Selection. *J.F. Good, J.J. Hayes, and S. Abrams.*
Joseph Good (Langan Engineering & Environmental Services/USA)

38. The Tracer Pulse Flowmeter and Depth Dependent Sampler: High Resolution Groundwater Data from Long-Screened Test Wells and Boreholes. *N. Heller, R. Cramer, and M. Brourman.*
Noah Heller (BESST, Inc./USA)

39. GCL Tie and Treating Superfund Site Supplemental Site Characterization. *S. Majors, S. Rosansky, A. Barton, D. Duda, and J. Mckernan.*
Shawn Majors (Battelle/USA)

40. Application of the HPT-GWS for Hydrostratigraphy and Water Quality Investigations. *W. McCall, T.M. Christy, and M.K. Evald.*
Wesley McCall (Geoprobe Systems/USA)

41. Sedimentological Logging Techniques to Maximize Insight from Borehole Geologic Logs: Making the Most of Your Critical Opportunity to Observe Actual Subsurface Conditions. *C. Plank, M. Shultz, J. Meyer, M. Einarson, and R. Cramer.*
Colin Plank (Burns & McDonnell/USA)

42. An Alternate and Multiuse Method to High Resolution Site Characterization (HRSC) which also allows Multi Technology Treatments. *L.I. Robinson.*
Lance Robinson (EN Rx, Inc./USA)

43. Managing Complex Sites with High Resolution Characterization and Remediation. *J. Sankey.*
John Sankey (True Blue Technologies, Inc./USA)

44. How Advanced Characterization Improved Full-Scale Bioremediation at a Large, Residual DNAPL Site. *N.T. Smith, D.D. Nguyen, M.R. Lamar, N.L. Smith, R.A. Wymore, K.S. Sorenson, and S. Garcia.*
Nathan T. Smith (CDM Smith/USA)

45. Return on Investigation through Smart Characterization of Mass Flux. *N.R. Welty, J.A. Quinnan, and P. Curry.*
Nicklaus Welty (Arcadis/USA)

46. A Comparison of Membrane Interface Probe (MIP) Relative Responses to Field-Collected Screening Data (Color-Tec) and Laboratory Analytical Data, Pueblo Chemical Depot, Pueblo, Colorado. *A. Sagen, S. Wisher, and D. Caputo.*
Scott Wisher (Cascade/USA)

C6. Microbial-Based Alternative Energy

47. Evaluation of Cathodic Assemblages and Monitoring Devices for a Bioelectrochemical Slurry Reactor Treating a Soil Polluted with Lindane. *R.H. Blanco-Mendoza, H.M. Poggi-Varaldo, R. Hernández-Vera, E. Hernandez-Correa, B. Camacho-Perez, and N. Rinderknecht-Seijas.*
Eduardo Hernández-Correa (CINVESTAV/Mexico)

48. Evaluation of Pretreatment of Intermediate Solids from an H-M-Z-S Biorefinery on Biological Hydrogen Production and Saccharification. *L. Romero-Cedillo, T. Ponce-Noyola, H.M. Poggi-Varaldo, and P. Sotelo-Navarro.*
Perla Xochitl Sotelo-Navarro (UAM Azcapotzalco/ Mexico)

C7. Advances in Biological Wastewater Treatment Processes

49. Investigation of Polychlorinated Biphenyls (PCBs) in Effluent Discharged from a Wastewater Treatment Plant during Dry and Rain Periods. *R. Jing, E. Wilson, and B.V. Kjellerup.*
Birthe Kjellerup (University of Maryland/USA)

50. Toxicity of Polychlorinated Biphenyls (PCBs) in Biosolids from a Municipal Wastewater Treatment Plant. *C. Draghi, N. Andrade, and B.V. Kjellerup.*
Birthe Kjellerup (University of Maryland/USA)

D5. Enhanced Methods for Biodegradation of Organic and Inorganic Contaminants

51. *Trichoderma asperellum* H15: A Potential Microorganism in PAH Degradation. *G.S. Cortes-Ramirez, A.E. Absalón, G. Gutierrez-Sanchez, and D.V. Cortes-Espinosa.*
Diana V. Cortes-Espinosa (Instituto Politécnico Nacional/Mexico)

52. Immobilization of a Mixed Consortium for Bioremediation of Contaminated Soil with Hydrocarbons. *A. Moreno, A.E. Absalon, and D.V. Cortes-Espinosa.*
Diana V. Cortes-Espinosa (Instituto Politécnico Nacional/Mexico)

53. Effects of Soil Texture on Soil Bioelectrochemical Remediation and Associated Geophysical Monitoring. *L. Lu, Z.J. Ren, D. Mao, P. Fallgren, S. Jin, and Y. Zuo.*
Song Jin (University of Wyoming/USA)

54. 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)

55. Bioremediation of Mixed Pesticide-Contaminated Agricultural Soil Using Biosurfactant-Producing Bacterial Consortium. *O. Greeshma and N. Vasudevan.*
Namasivayam Vasudevan (Anna University/India)

POSTER GROUP 2: PRESENTATIONS

56. A Novel Approach in the Biodegradation of Low Concentration Water Pollutant, Diethylhexyl Phthalate Using Self-Aligned Facile Nanoparticles. *N. Vasudevan and A. Jayshree.*
Namasivayam Vasudevan (Anna University/India)

D6. Advances in Amendment Formulation

57. Transferrable Lessons Learned from Advances in Amendment Formulation. *J. Birnstingl and K. Thoreson.*
Jeremy Birnstingl (Regenesis/United Kingdom)

58. Controlled Methanogenesis during Remediation of a Dry Cleaning Facility in an Urban Setting. *K. Ebbott, J. Ogden, and J. Mueller.*
Jim Mueller (Provectus Environmental Products, Inc./USA)

59. Remedial Amendments with Integrated Control of Methane Production. *J. Mueller, G. Booth, W. Mease, J. Hull, and J. Haselow.*
Jim Mueller (Provectus Environmental Products, Inc./USA)

60. An Approach with Synergistic Advantages of Combining Colloidal Activated Carbon and Zero Valent Iron. *K. Djernes Pappano and K.A. Thoreson.*
Katherine Pappano (Regenesis/USA)

61. How Green Is the Green Synthesis of Iron Nanoparticles Using Exracts of *Eysenhardtia polystachya*? *C.G. Mar-Pineda, O. Flores-Ortiz, R. Hernández-Vera, H.M. Poggi-Varaldo, N.A. Rivera-Casado, B. Camacho-Perez, and N. Rinderknecht-Seijas.*
Hector Poggi-Varaldo (CINVESTAV/Mexico)

62. Use of Various Amendments to Control Methane Production during Environmental Applications. *M. Scalzi and A. Karachalios.*
Michael Scalzi (Innovative Environmental Technologies, Inc./USA)

63. Lessons Learned from Injecting Liquid Activated Carbon Suspension. *J. Sheldon and C. Sandefur.*
Jack Sheldon (Antea Group/USA)

D7. Cometabolic Bioremediation

64. Can TCE, 1,4-Dixoane, and Cr^{6+} in a Dilute Plume Be Treated Concurrently through In Situ Cometabolic Bioreactors? *K. North, M. Chu, P. Bennett, and M.R. Hyman.*
Min-Ying Jacob Chu (Haley & Aldrich, Inc./USA)

65. Novel Approach to Enhance Solubilization of Gaseous Substrates in Contaminated Groundwater to Promote Aerobic Cometabolic Biodegradation. *M. Chu.*
Min-Ying Jacob Chu (Haley & Aldrich, Inc./USA)

66. Treatment of Chlorinated Volatile Organic Compounds and 1,4-Dioxane by Cometabolic Biodegradation. *C. Bucior, S. Dore, D. Pope, R. Thomas, and A. Weston.*
Alan Weston (GHD/USA)

D8. Engineering Biogeochemical Transformation

67. Remediation for Mercury Stabilization by In Situ Chemical Reduction (ISCR) in Groundwater (Brazil Site). *S. Aluani, C. Spilborghs, N.C. Nascimento, and E. Pujol.*
Sidney Aluani (SGW Services/Brazil)

68. Use of Anaerobic Reductive Dechlorination and Cement/Ferrous Iron System for the Remediation of Chlorinated VOCs. *M. Scalzi, A. Karachalios, and B. Gentry.*
Michael Scalzi (Innovative Environmental Technologies, Inc./USA)

69. Long-Term Monitoring Following a Phased Approach to Address CVOCs Using In Situ Chemical Reduction (ISCR) in a historically Stalled Shallow Aquifer. *R. Srirangam, F. Lakhwala, D. Vanettti, and I. McNamara.*
Ravikumar Srirangam (PeroxyChem, LLC/USA)

70. Sulfidation as a Sustainable Method to Engineer the Surface of ZVI for Enhanced Degradation of Chlorinated Ethenes. *W. Yan and Y. Han.*
Weile Yan (Texas Tech University/USA)

D9. Phytoremediation/ Mycoremediation

71. Soil Properties and Growth of Amaranthus on Organically-Amended Spent Engine Oil-Contaminated Soil. *A.J. Adeyemo, I. Bamiduro, and S.O. Agele.*
Adebayo Jonathan Adeyemo (Federal University of Technology/Nigeria)

72. Current Research on Phytoremediation of PFASs. *C. Austin, D. Bogdan, and B. Harding.*
Dorin Bogdan (AECOM/USA)

73. Treatment of Benzene Contamination Using Rhizoremediation at a Petrochemical Facility in Brazil. *F. Coelho.*
Flavio Coelho (ERM Brasil Ltda./Brazil)

74. Integrated Source Isolation and Targeted Phytoremediation to Address a VOC/1,4-Dioxane and Arsenic Plume in Fractured Bedrock. *P.J. Linton, E.G. Gatlif, P. Thomas, and D. Riddle.*
P. James (Jim) Linton (Geosyntec/USA)

75. Sulfur Supply Increases the Cadmium Uptake by *Panicum maximum* cv. Massai. *F.H.S. Rabêlo, L. Borgo, and J. Lavres Junior.*
Flávio Henrique Silveira Rabêlo (University of Sao Paulo/Brazil)

E5. Bioremediation of Munitions Constituents

76. Ex Situ Treatment of Soil with Nitroaromatic Compounds. *L. Zeng, S. Abrams, A. Ciblak, K. McKeever, R. Lees, M. Lewis, and M. Boufadel.*
Lingke Zeng (Langan Engineering & Environmental Services, Inc./USA)

E6. Insensitive Munitions: Characterization, Fate, and Transport

77. Anaerobic Coupling Reactions between Reduced Intermediates of 2,4-Dinitroanisole (DNAN). *J.A. Field, W.M. Kadoya, L. Abrell, E.A. Mash, R. Sierra-Alvarez, and S. Wong.*
Warren Kadoya (University of Arizona/USA)

E7. Advances in Tools and Techniques for Assessing MNA

78. Demonstration of Monitored Natural Attenuation Using Molecular Biological Techniques: A Case Study. *A.O. Thomas.*
James Baldock (ERM/United Kingdom)

79. Statistical Tools for Developing Monitored Natural Attenuation Evidence: Beyond Time-Series Plots. *S. Gupta, A.K. Kammari, and J.G. Savarese.*
Sunila Gupta (Haley & Aldrich, Inc./USA)

80. Using the Remediation Test Panel to Determine Contaminant Fate and Support MNA. *A. Haydt, P. McGuire, P.W. McLoughlin, and A.D. Peacock.*
Adam Haydt (Tetra Tech/USA)

81. Novel Monitoring Data Presentation Method Provides a Simplified View of the Approach to Compliance Levels. *A.H. Bass, L. Porterfield, J.D. Schell, and B.F. Droy.*
Les Porterfield (TEA, Inc./USA)

82. Laboratory Bench-Scale Testing in Support of Monitored Natural Attenuation. *J. Roberts, P. Dollar, S. Dworatzek, P. Dennis, and A. Przepiora.*
Jeff Roberts (SiREM/Canada)

E8. Natural Attenuation Processes

83. A Case Study on Anaerobic Decay at an MGP Site. *A. Chen, J. Chittet, A. Haugen, and J. Gonzalez.*
Adam Chen (Burns & McDonnell Engineering, Inc./USA)

E9. MNA for Achieving Site Goals

84. Negotiating a Natural Attenuation Remedy and Mitigating Risk for a Large (400-acre) Plume. *M. Klemmer and E. Cohen.*
Elizabeth Cohen (Arcadis/USA)

E10. Groundwater/Surface Water Interaction

85. From Source to Surface Water: Using Groundwater Geochemistry and Age Dating to Assess the Natural Attenuation of Chlorinated-Ethene Contaminated Groundwater. *J.E. Landmeyer, B.G. Campbell, F.H. Chapelle, E.D. Swain, A.L. Eddington, A. Olsen, and M.A. Singletary.*
James Landmeyer (U.S. Geological Survey/USA)

F4. Innovative Treatment Technologies for PFAS Compounds

86. Remediation of Poly- and Per-Fluoroalkyl Substances: New Remediation Technologies for Emerging Contaminants. *J. McDonough, I. Ross, P. Storch, J. Miles, E. Houtz, K. Nowack, and J. Burdick.*
Jeff McDonough (ARCADIS/USA)

87. Ability of Aluminum-Based Adsorbent to Remove PFAS from Groundwater. *S.-Y. Chiang, R. Stewart, G. Birk, Q. Huang, J. Field, and A. Bodour.*
Dora Chiang (AECOM/USA)

F5. Optimizing Existing Systems

88. Leveraging Big Data and Cognitive Computing for Remediation Selection, Benchmarking, and Environmental Portfolio Optimization. *C.E. Divine, M. Paquet, D. Fortin, A. Rolland, and M. Beaudoin.*
Martin Beaudion (Arcadis/Canada)

89. An Alternative to Side-by-Side Comparative Studies for Implementing Passive Groundwater Sampling. *E. Cohen, K. Gerber, and K. Houston.*
Elizabeth Cohen (Arcadis/USA)

90. Solar-Powered ISB System Leveraging Existing Infrastructure. *F.J. Krembs, S. Lomdardo, G. Risse, and G. Mathes.*
Friedrich Krembs (Trihydro Corporation/USA)

91. Silencing the Noise: New Technology to Obtain Time-Integrated Average Groundwater Concentrations over Months. *T.E. McHugh, H. O'Neill, and C.J. Newell.*
Thomas McHugh (GSI Environmental, Inc./USA)

92. Superfund Optimization Strategy: Extracting Lessons Learned form 640 Optimization Recommendations. *K. Biggs, E. Gilbert, M. Jefferson, C. Pachon, P. Sinksi.*
Carlos Pachon (U.S. EPA/USA)

93. Life-Cycle Optimization of an Existing Remediation System for Treatment of Perchlorate-Contaminated Groundwater. *M.A. Singletary, H. Lockard, A.K. Jacobs, and J. James.*
Michael Singletary (U.S. Navy/USA)

F6. Risk Management Strategies

94. Sustainable Management of a Former Waste Disposal Area. *R. Coelho and R.J. Spina.*
Rodrigo Otavio Coelho (GEOKLOCK/Brazil)

95. An Alternate Approach to Risk Assessment and Plume Estimates Using Incremental Sampling Methodology. *K. Hyde, W. Ma, S.D. Siciliano, T. Obal, and T. Carlson.*
Kathlyne Hyde (University of Saskatchewan/Canada)

96. Sustainable Risk Management Strategies Associated with Reuse and Redevelopment of Uncontrolled Landfill Sites. *C.A. Kehres-Dietrich and J.R. Lanier.*
Cheryl Kehres-Dietrich (SME/USA)

97. Challenges and Successes of Implementing Land Use Restrictions in a Licensed Site Remediation Program. *J.J. Oberer.*
John Oberer (GZA GeoEnvironmental, Inc./USA)

98. Remedy Design Optimization at a Range Site Contaminated with PAHs from Skeet Fragments. *J. Schoolfield, K. Sorensen, R. George, H.V. Rectanus, and D. DeYoung.*
Heather Campbell Veith Rectanus (Battelle/USA)

F7. Incorporating GSR into Remedy

99. Use of Sustainable Remediation to Achieve Source Area Polishing. *M.T. Jordan.*
Michael Jordan (Terracon Consultants, Inc./USA)

100. Application of LCA to Compare Sustainability of Novel Evaporative Desorption Technology for Soil Remediation to Conventional Dig and Haul. *J. Muzzio, J. Sinistore, and G. Burks.*
Joe Muzzio (Reterro/USA)

101. An Adaptive, Green and Sustainable Outlook on Bioventing-Based Remediation. *D.S. Randhawa, C. Flanders, K. Jay, and J. Burdick.*
Rick Ahlers (Arcadis/USA)

F8. Sustainable Remediation Assessment Tools

102. Sustainable Treatment Optimization. *G. Smith, S. Giliam, and C. Howell.*
Graham Smith (Parsons Brinckerhoff/Australia)

F9. Best Practices in GSR

103. Hidden Benefits and Scalability Opportunities for Sustainable Remediation at Hydrocarbon-Impacted Sites. *C.M. Espino Devine, N.J. Sihota, L. Hay Wilson, and J. Rocco.*
Catalina Espino Devine (Chevron Energy Technology Company/USA)

THURSDAY MORNING

	A Sessions Jasmine	B Sessions Orchid	C Sessions Brickell
8:00	**EVO/Bioaugmentation for Treatment of Trichloroethene by Biobarrier and Source Injection Approach.** *B.P. Bakrania, C.A. Fogas, M.S. Kozar, and E.T. Schleicher.* Christine Fogas (OBG/USA)	**Practical Review and Guidance on 1,4-Dioxane Field-Scale Biodegradation Potential and Characterization.** *D. Chiang and C. Walecka-Hutchison.* Claudia Walecka Hutchison (Dow Chemical Company/USA)	**Microbial Electrosynthesis of CO_2 to Fuels and Chemicals: Improving Productivity and Efficiency.** *H.D. May and E.V. LaBelle.* Harold May (Medical University of South Carolina/USA)
8:25	**Multiple Large-Scale Biobarriers for Multi-Contaminant, High-Concentration Plume in Brackish Water, Naval Air Station North Island.** *V. Hosangadi and M. Pound.* Vitthal Hosangadi (NOREAS, Inc./USA)	**Evaluation of In Situ Bioremediation of 1,4-Dioxane by Metabolic and Cometabolic Bacteria by Using a Contaminant Transport Model.** *F. Barajas, D. Chiang, D.L. Freedman, and L.C. Murdoch.* Francisco Barajas (AECOM/USA)	**Evaluation of Microbial Fuel Cells for Potential Implementation at Blue Plains Advanced Wastewater Treatment Plant.** *W.-M. Ko, M. Ramirez, and B.V. Kjellerup.* Birthe Kjellerup (University of Maryland/USA)
8:50	**Field Application of Dual-Biofilm Barriers for In Situ Remediation of Chlorobenzenes in Groundwater and Wetland Sediments.** *A.R. Wadhawan, N.D. Durant, M.M. Lorah, S. Chow, and E.J. Bouwer.* Michelle Lorah (U.S. Geological Survey/USA)	**Laboratory Evaluation of Alternative Substrates for Enhancing the Cometabolic Biodegradation of 1,4-Dioxane and Tetrahydrofuran.** *D.R. Lippincott, P.B. Hatzinger, S.H. Streger, R. Rezes, A. Madison, and T. Richards.* David Lippincott (CB&I Federal Services, LLC/USA)	**Production of Value-Added Products and Commodities by Electrofermentation and Its Integration to Biorefineries.** *E. Hernández-Correa, H.M. Poggi-Varaldo, M.T. Ponce-Noyola, L. Romero-Cedillo, E. Rios-Leal, and O. Solorza-Feria.* Eduardo Hernández-Correa (CINVESTAV/Mexico)
9:15	**Denitrifying Permeable Reactive Barriers on Cape Cod: Bench-Scale Studies and Implementation of the First In Situ EVO PRB.** *P.M. Dombrowski, M. Temple, M. Lee, D. Raymond, J. Begley, T. Parece, J. Marrion, B. Shreve, and F. Hostrop.* Paul Dombrowski (In-Situ Oxidative Technologies [ISOTEC]/USA)	**Application of Bioreactors in 1,4-Dioxane Treatment: A Perspective.** *C. Zhou, B. Petty, and A. Barnes.* Chao Zhou (Geosyntec Consultants, Inc./USA)	**Feasibility of Application of a Low-Cost Potential Monitoring Device and Enrichment of Microbial Cultures for Denitrifying Biocathode Fuel Cells.** *J.E. Borbolla-Gaxiola, H.M. Poggi-Varaldo, M.T. Ponce-Noyola, O. Solorza-Feria, and G. Hernández-Flores.* Hector Poggi-Varaldo (CINVESTAV/Mexico)
9:40	SESSION BREAK	**Biodegradation of 1,4-Dioxane in a Fixed-Film Bioreactor.** *C. Bell, J.C. Stanfill, A. Lorenz, M. Heintz, and D. Favero.* Caitlin Bell (Arcadis/USA)	SESSION BREAK
10:05	**Dissolved Hydrogen Dynamics Associated with Emulsified Vegetable Oil Bioremediation of Chlorinated Ethene-Contaminated Groundwater.** *F.H. Chapelle, J.L. Landmeyer, J. Schoolfield, and M.A. Singletary.* Francis Chapelle (U.S. Geological Survey/USA)	**Comparison of 1,4-Dioxane Cometabolism with the Amendment of Different Alkane Gases.** *M. Li, Y. Liu, J. Mathieu, and P.J.J. Alvarez.* Mengyan Li (New Jersey Institute of Technology/USA)	**Comparative Demonstration of Gas-Sparged and GAC-Fluidized Anaerobic Membrane Bioreactors for Sustainable Wastewater Treatment and Resource Recovery.** *P.J. Evans, P. Parameswaran, P. McCarty, and J. Bae.* Patrick Evans (CDM Smith, Inc./USA)
10:30	**Innovative Use of Tetrahedral Plots to Evaluate Remedial Performance and Pre-Screen Monitoring Wells at Petroleum Hydrocarbon-Contaminated Sites.** *K. Sra, E. Daniels, and T. Buscheck.* Kammy Sra (Chevron Energy Technology Company/USA)	**1,4-Dioxane Treatment Technologies: What's New and What's Proven.** *W. DiGuiseppi, J. Hatton, and A. Salter-Blanc.* William DiGuiseppi (CH2M HILL/USA)	**Bioremediation of Chlorinated Emerging Contaminants in Wastewater Digesters.** *S.J. Fischer, E.M. Healey, B.V. Kjellerup, and A. Torrents.* Sarah Jane Fischer (University of Maryland/USA)
10:55	**Using Positive Matrix Factorization to Investigate Microbial Dechlorination of Contaminants in Groundwater.** *S.L. Capozzi, L.A. Rodenburg, V. Krumins, D.E. Rennell, and E.E. Mack.* Staci Capozzi (Universtiy of Maryland/USA)	SESSION BREAK Lunch available from 11:00 a.m.-1:00 p.m.	**Micropollutant Removal in Sustainable Biological Wastewater Treatment Systems.** *O. Komolafe, P. Meynet, W. Mrozik, J. Dolfing, and R. Davenport.* Oladapo Komolafe (Newcastle University/United Kingdom)
11:20	**Real-time Field Monitored Soil Gas Data as Inexpensive Line of Evidence for In Situ Bioremediation.** *K.A. Morris, S. Walsh, and G.P. Smoot.* Kevin Morris (ERM/USA)		**Biogeochemical Conversion of Calcium Sulfite into Gypsum in Flue Gas Desulfurization Waste.** *D. Graves, L. Chen, J. Smith, R. White, B. Wallace, and S. Herr.* Linxi Chen (Geosyntec Consultants/USA)

A6. Biobarrier Installation and Management

A7. Strategies for Bioremediation Performance Assessment

B9. 1,4-Dioxane Treatment Technologies I

C6. Microbial-Based Alternative Energy

C7. Advances in Biological Wastewater Treatment Processes

D Sessions Flagler	E Sessions Monroe	F Sessions Tuttle	
D7. Cometabolic Bioremediation **Overview of Approaches for Applying Gases to Groundwater for Cometabolic Bioremediation.** *P.B. Hatzinger, D.L. Lippincott, and J.F. Begley.* Paul Hatzinger (CB&I Federal Services, LLC/USA)	**E8. Natural Attenuation Processes** **Evaluation of Trichloroethylene Attenuation Rates and Mechanisms in Support of Monitored Natural Attenuation.** *J. Pietari, P. Mesard, and T. Muelhoefer.* Jaana Pietari (Exponent, Inc./USA)	**F8. Sustainable Remediation Assessment Tools** **Database System Utilizing a Fillable Best Management Practice Spreadsheet to Follow and Upward Report Army Green and Sustainable Remediation.** *C.L. Dona, R.J. Meyer, K.P. Roughgarden, L.B. Haines-Eklund, and M.L. Williams.* Carol Lee Dona (U.S. Army Corps of Engineers/USA)	**8:00**
Successful Bioremediation of 1,4-Dioxane and 1,2-Dichloroethane in a Dilute Plume. *M. Chu, P. Bennett, M. Dolan, R. Anderson, A. Bodour, M. Hyman, and A. Peacock.* Min-Ying Jacob Chu (Haley & Aldrich, Inc./USA)	**Microbial Dynamics and Biofilm Development in Contaminated Aquifers.** *J.F. Mujica, S.A. Rolfe, and S.F. Thornton.* Juan Francisco Mujica (The University of Sheffield/United Kingdom)	**Can Thermal Remediation Be Sustainable? Use of Modelling to Optimize Design.** *J. Baldock, J. Pennell, and J. Dablow.* James Baldock (ERM/United Kingdom)	**8:25**
Distinct Effects and Molecular Basis of Inducing and Non-Inducing Auxiliary Substrates on 1,4-Dioxane Biostimulation. *M. Li, Y. Liu, Y. He, J. Mathieu, J. Hatton, W. DiGuiseppi, and P.J.J. Alvarez.* Mengyan Li (New Jersey Institute of Technology/USA)	**Who Says Chlorinated Solvents Can't Biodegrade in the Presence of High Sulfate in Marine Sediments?** *N.D. Durant, A. Wadhawan, S. Smith, J. Roberts, J. Webb, P. Stang, P. Sones, G. Alyanakian, B. Chadwick, and M. Pound.* Neal Durant (Geosyntec Consultants/USA)	**Comparison of Environmental Evaluation Tools and Incorporation of Monetized Socioeconomic Damages for Sediment Remediation Projects.** *M.E. Miller and M.A. Harclerode.* Melissa Harclerode (CDM Smith, Inc./USA)	**8:50**
Comparing Effects of Chemical Amendments on 1,4-Dioxane Biodegradation. *Y. Xiong, A. Hubert, G. Chen, O.U. Mason, Y. Tang, and C. Zhou.* Youneng Tang (Florida State University/USA)	**Delineating Background to Support Reliable Selection of MNA for Inorganic Contaminant Remediation.** *R.G. Ford.* Robert G. Ford (U.S. EPA/USA)	**Using Lifecycle Analysis to Select Remediation Technologies for Petroleum-Impacted Sites.** *H. Jin, R. Kamath, A.N. Gropp, and S. McMillen.* Hong Jin (Chevron Corporation/USA)	**9:15**
SESSION BREAK	**Radioiodine/Iodine Attenuation Mechanisms in Hanford Groundwater.** *B. Lee, M. Truex, J. Szecsody, and N. Qafoku.* Brady Lee (Pacific Northwest National Laboratory/USA)	SESSION BREAK	**9:40**
D8. Engineering Biogeochemical Transformation **Does Surface Matter? Bacterial Response to Amendments and Benzene Adsorbed to Iron Oxides.** *K. Hyde, D. Peak, and S.D. Siciliano.* Kathlyne Hyde (University of Saskatchewan/Canada)	SESSION BREAK	**F9. Best Practices in GSR** **Tesoro's Sustainable Remediation Program: Current and Future Sustainability Considerations and Interplays.** *K. Waldron, K. Holland, and B. Zinni.* Kyle Waldron (Tesoro/USA)	**10:05**
Bench-Scale Evaluation of the Formation and Reactivity of Iron Sulfide Minerals for Treatment of CVOCs. *J. Molin, D. Leigh, and A. Seech.* Josephine Molin (PeroxyChem, LLC/USA)	**E9. MNA for Achieving Site Goals** **Optimizing the Transition from Active to Passive Remediation.** *E. Cohen.* Elizabeth Cohen (ARCADIS-US/USA)	**District-Wide Incorporation of Green and Sustainable Remediation (GSR) into Formerly Used Defense Site (FUDS) Program Projects in the USACE Louisville District.** *C.D. White, J.O. VanBogaert, and C.L. Dona.* Carol Lee Dona (U.S. Army Corps of Engineers/USA)	**10:30**
In Situ Chemical Reduction with ZVI and ZVI-Sulfide. *M.D. Lee, R.L. Raymond, and P. Randall.* Michael Lee (Terra Systems, Inc./USA)	**Demonstrating Plume Stability to Support Risk-Based Closure.** *E. Meyers and N. Scroggins.* Ed Meyers (UCPM Environmental/USA)	**EPA Strategies, Policies, and Tools to Advance Greener Cleanups: Evaluating Progress to Date.** *D. Goldblum, D. Kaufman, C. Pachon, K. Scheuermann, H. Thornton, and S. Wolf.* Carlos Pachon (U.S. EPA/USA)	**10:55**
Iron-Laden Mineral Colloids as Naturally Abundant Catalysts for Peroxide-Based In Situ Chemical Oxidation. *Y. Li, W. Yan, and L. Machala.* Yue Li (Texas Tech University/USA)	**Monitored Natural Attenuation and Health Risk Assessment for TPH.** *R. Scofield and T. Hoang.* Robert Scofield (GSI Environmental, Inc./USA)	**Consideration of Risk Perception as a Sustainable Remediation Best Practice: Case Study on Lead-Impacted Residences.** *M.A. Harclerode, P. Lal, N. Vedwan, B. Wolde, and M.E. Miller.* Melissa Harclerode (CDM Smith, Inc./USA)	**11:20**

THURSDAY AFTERNOON

	A Sessions Jasmine	B Sessions Orchid	C Sessions Brickell
11:45	SESSION BREAK Lunch served from 11:00 a.m.-1:00 p.m.	**B10. 1,4-Dioxane Treatment Technologies II** **Evaluating Enhanced Bioremediation of 1,4-Dioxane following Bioaugmentation with CB1190.** *D. Taggart, K. Clark, B.R. Baldwin, and L. LaPat-Polasko.* Sam Rosolina (Microbial Insights, Inc./USA)	**C7. Advances** **Changes in the Abundance of Antibiotic Resistance Genes in Biosolids during Wastewater Treatment Processes.** *J. Holt and B.V. Kjellerup.* Sarah Jane Fischer (University of Maryland/ USA)
12:10		**B10. 1,4-Dioxane Treatment Technologies II** **Bioaugmentation of TreeWells® to Enhance the Aerobic Degradation of 1,4-Dioxane at High Concentrations.** *B. Witt, R.G. Riefler, C. Pijls, S. Mahendra, Y. Miao, P. Gedalanga, T. Tambling, and C. Walecka-Hutchison.* Betsy Witt (AECOM/USA)	SESSION BREAK Lunch served from 11:00 a.m.-1:00 p.m.
12:35	**A8. Successes and Failures of Bioaugmentation and Biostimulation** **Augmenting Microbial Populations to Enhance Treatment.** *G. Smith, S. Gilliam, and N. Ryan.* Graham Smith (Parsons Brinckerhoff/Australia)	**B10. 1,4-Dioxane Treatment Technologies II** **Evaluation and Enhancement of Intrinsic 1,4-Dioxane Biodegradation.** *A. Madison, T. Richards, P. Gedalanga, and S. Mahendra.* Andrew Madison (Golder Associates, Inc./USA)	
1:00	**A8. Successes and Failures of Bioaugmentation and Biostimulation** **Lessons Learned from Detailed Post-Injection Evaluations of Two EVO Projects.** *B. Yuncu, R.C. Borden, and M.A. Singletary.* Bilgen Yuncu (Solutions-IES, a Division of Draper Aden Associates/USA)	**B10. 1,4-Dioxane Treatment Technologies II** **Modeling Aerobic Cometabolism of 1,4-Dioxane and Chlorinated Solvents by Isobutane-Utilizing Bacteria.** *H. Rolston, M. Azizian, L. Semprini, and M. Hyman.* Hannah Rolston (Oregon State University/USA)	**Panel** **Using Geology to Follow the Groundwater, Follow the Flow to Successful Remediation** **Moderators** Rick Cramer (Burns & McDonnell) John Wilson (Scissortail Environmental Solutions, LLC) **Panelists** Adria Bodour (U.S. Air Force/AFCEC) Herb Levine (U.S. EPA) Tamzen Macbeth (CDM Smith)
1:25	**A8. Successes and Failures of Bioaugmentation and Biostimulation** **Biostimulation of a TCE Source Area with Amendment and Municipal Water.** *M.S. Kovacich, A. Cuellar, S. Bagby, and D. Beck.* Michael Kovacich (Tetra Tech, Inc./USA)	SESSION BREAK	
1:50	**A8. Successes and Failures of Bioaugmentation and Biostimulation** **Enhancing Reductive Dechlorination Combining Emulsified Vegetable Oil and Iron Products.** *R.E. Mayer, P. Srivastav, S. Watson, and S. Suryanarayanan.* Robert Mayer (CB&I Federal Services, LLC/ USA)	**B11. Other Emerging Contaminants** **Contaminants Emerging from a New Look at Old Chemicals: Effects of TSCA Reform.** *K. Sellers, N. Weinberg, and D. Nelson.* Denice Nelson (ERM/USA)	
2:15	**A8. Successes and Failures of Bioaugmentation and Biostimulation** **Field-Scale Application of Biostimulation and Bioaugmentation of Chlorinated Ethenes in Groundwater.** *L. Conlan, S. Baffert, and L. LaPat-Polasko.* Linda Conlan (Amec Foster Wheeler/USA)	**B11. Other Emerging Contaminants** **Phytoremediation of 1,4-Dioxane Contaminated Aquifers: Case Studies and Lessons Learned.** *R. Gestler, E. Gatliff, P. Thomas, and P.J. Linton.* Ron Gestler (Geosyntec Consultants/USA)	
2:40	**A8. Successes and Failures of Bioaugmentation and Biostimulation** **"Better Late than Never!": Delayed Successes of an Enhanced In Situ Bioremediation (EISB) Pilot Test.** *R. Klinger, D. Reynolds, E. Cox, S. Rosansky, M. Singletary, and A. Wilson.* Rachel Klinger (Geosyntec Consultants/USA)	**B11. Other Emerging Contaminants** **Potential for Natural or Enhanced Biodegradation of 1,4-Dioxane with Methane and Ethane as Cosubstrates.** *P.B. Hatzinger, P. Koster van Groos, S.H. Streger, and C. Schaefer.* Paul Hatzinger (CB&I Federal Services, LLC/ USA)	
3:05	**A8. Successes and Failures of Bioaugmentation and Biostimulation** **Environmental Restoration Wiki: Tech Transfer in the 21st Century.** *R. Borden, A. Stenger, C.J. Newell, R.A. Deeb, and K. Finneran.* Robert Borden (EOS Remediation, LLC/USA)	**B11. Other Emerging Contaminants** **Persistence and Bioremediation of Endosulfan in Agricultural Soil.** *N. Vasudevan and O. Greeshma.* Namasivayam Vasudevan (Anna University/ India)	

D Sessions Flagler	E Sessions Monroe	F Sessions Tuttle	
D8. Engineering **Role of Iron and Vitamin B12 Amendments in Stimulating Reductive Dechlorination of TCE in High Sulfate Groundwater.** *M. Harkness, P. Hare, H. Matis, and J. Uruskyj.* Mark Harkness (OBG/USA)	**E9. MNA for Achieving Site Goals** **Engineered Retardation Factor Manipulation Using PlumeStop® Liquid Activated Carbon™ for Passive Management of Plume Dynamics.** *J. Birnstingl, C. Sandefur, and K. Thoreson.* Jeremy Birnstingl (Regenesis/United Kingdom)	SESSION BREAK Lunch served from 11:00 a.m.-1:00 p.m.	**11:45**
SESSION BREAK Lunch served from 11:00 a.m.-1:00 p.m.	**Assessment of Plume Stability in Monitored Natural Attenuation Assessments Using the Center of Mass and Total Plume Mass Approach.** *S.D. Mohr and K. Naude.* Samuel Mohr (Environmental Resources Management/South Africa)		**12:10**
	SESSION BREAK Lunch served from 11:00 a.m.-1:00 p.m.	**F10. Incorporating Sustainability Considerations into Remediation Projects** **Quantitative Evaluation of Ecosystem Services for Superfund Cleanups.** *J. Lipps, C. Pachon, and M. Mahoney.* Jewel Lipps (U.S. EPA/USA)	**12:35**
D9. Phytoremediation/Mycoremediation **Phytoremediation Coupled with Agro-Production of Cadmium and Nitrate Cocontaminated Soil via Rotation Hyperaccumulator and Low Accumulator.** *L. Tang, W.J. Luo, K.Y. Khan, and X.E. Yang.* Xiaoe Yang (Zhejiang University/China)		**Consideration of Ecosystem Services Provided through Remediation Approaches at Large-Scale Mining Sites.** *S. Brown, M. Mahoney, M. Sprenger, and J. Lipps.* Sally Brown (University of Washington/USA)	**1:00**
Enumeration of Toluene-Degrading Microorganisms in Combination with Vegetation Hydrocarbon Phytoscreening to Assess Phytoremediation of Toluene in a Shallow Fractured Bedrock Aquifer. *M. Ben-Israel, B.L. Parker, K.E. Dunfield, R. Aravena, E.A. Haack, D.T. Tsao, and J.G. Burken.* Michael Ben-Israel (University of Guelph/Canada)	**E10. Groundwater/Surface Water Interaction** **Delineating Groundwater Discharge Inputs to Surface Waters Using Thermal Methods.** *D.K. Hare, R. Henderson, Z. Smith, and D.F. Boutt.* Danielle Hare (AECOM/USA)	**The Application of GSR Evaluation Tools in Taiwan and Prospects.** *C.S. Chen, B.N. Wang, T.W. Chiang, Y.T. Wu, Y.-Y. Lai, and H.-C. Hung.* Bing-Nan Wang (SINOTECH Environmental Technology, Ltd./Taiwan)	**1:25**
Assessment of Toluene Biodegradation Activity in Groundwater from a Shallow Bedrock Aquifer with Phytoremediation. *A. Roebuck, K. Khosla, K. Dunfield, J. Fernandes, B. Parker, S. Chapman, and R. Aravena.* Andrea Justine Roebuck (University of Guelph/Canada)	**How to Map the GSI of a One-Mile Long, 10 PPM TCE Plume.** *N.R. Welty, D.T. Rogers, I. Drost, and K. Trestrail.* Nicklaus Welty (Arcadis/USA)	**Sustainability Considerations for 1,4-Dioxane Treatment Technologies.** *W. DiGuiseppi, P. Favara, and J. Hatton.* William DiGuiseppi (CH2M HILL/USA)	**1:50**
Phytoremediation and Microbial Degradation Pilot Studies for a Former Waste Water Pond in Northern California. *B. LePage, B. Gray, J. Warner, A. Breckenridge, and K. Morris.* Ben LePage (PG&E/USA)	**A Simple Assessment Reveals Discrete VOC-Contaminated Groundwater Discharges to a Piedmont Stream.** *B. Bentkowski.* Ben Bentkowski (U.S. EPA/USA)		**2:15**
Wind-Powered Constructed Wetland for PCE Dechlorination. *J.P.A. de Weert, E. Drenth, C. Bus, J.A. van Leeuwen, B. van der Zaan, N.K. Hoekstra, and J. Gerritse.* Jasperien de Weert (Deltares/Netherlands)	**Friend or Foe? Assessing the Effect of the Freshwater-Saltwater Interface on the Natural Attenuation of Chlorinated-Ethene and Chlorobenzene-Contaminated Groundwater.** *J.E. Landmeyer, F.H. Chapelle, W.S. McBride, J. Schoolfield, and M.A. Singletary.* James Landmeyer (U.S. Geological Survey/USA)		**2:40**
Application of Phytoforensics and Phytoscreening for a PCE-Contaminated Site. *B.N. Wang, M.Y. Wu, T.W. Chiang, S.K. Huang, B.T. Guan, Y.T. Wu, J.E. Landmeyer, and H.-C. Hung.* Bing-Nan Wang (SINOTECH Environmental Technology, Ltd./Taiwan)	**Implications of Refining Vertical Resolution of Hydraulic Conductivity in the Numerical Modeling of Groundwater Flow to Surface Water, NAS Whiting Field, Florida.** *E.D. Swain, B.G. Campbell, and J.E. Landmeyer.* Eric Swain (U.S. Geological Survey/USA)		**3:05**

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TUESDAY, MAY 23, 2017

7:00 a.m.-7:00 p.m. Registration, Exhibits, Poster Group 1 Display
7:00-8:00 a.m. Continental Breakfast
11:00 a.m.-1:00 p.m. Lunch
11:45 a.m.-12:35 p.m. Student & Young Professional Elevator Pitch

8:00 a.m.-5:35 p.m. Platform Sessions

A1. Amendment Delivery Strategies
A2. Combined Remedies for VOCs
PANEL. A Model for Combined Remedies at Well 12A Superfund Site, Tacoma, Washington

B1. Bioremediation in Marshes and Deep-Sea Environments
B2. Biodegradation and Remediation of Crude Oil in Cold Regions
B3. Remediation of Heavy Hydrocarbon-Contaminated Soils
B4. Remediation of Hydrocarbon Spills

C1. Modeling and Monitoring Approaches to Improve Remedy Design and Implementation
C2. Compound-Specific Isotope Analysis
C3. Next Generation MBTs: A Pathway to Precision Bioremediation

D1. Biodegradation in Fractured Bedrock Sites
D2. Managing Large and Dilute Plumes
D3. Amendment Distribution Challenges for Large Bioremediation Sites
D4. Bioremediation of Sediments

E1. Inhalation Exposures from Subsurface Contamination
E2. Innovative Tools for Evaluating Vapor Intrusion Risk
E3. Vapor Intrusion Mitigation Methods
E4. VOC Vapor Intrusion

F1. Fate and Transport of PFAS
F2. Sorption Technologies for PFAS
F3. Toxicological Impacts of PFAS in Human Health and the Environment
PANEL. Sampling and Analysis of PFAS Componds: Lessons Learned and State of the Science

5:45-7:00 p.m. Poster Group 1 Presentations and Reception
See page 19 for sessions in Poster Group 1.
7:30-8:45 p.m. Student & Young Professional Reception

WEDNESDAY, MAY 24, 2017

7:00 a.m.-7:00 p.m. Registration, Exhibits, Poster Group 2 Display
7:00-8:00 a.m. Continental Breakfast
11:00 a.m.-1:00 p.m. Lunch

8:00 a.m.-5:35 p.m. Platform Sessions

A3. Case Studies
A4. Bioremediation of Heavy Metals
A5. Enhancements to Biodegradation Strategies

B5. Natural Source Zone Depletion
B6. LNAPL Mobility, Transmissivity, and Recoverability
B7. Remediation and Management of Petroleum-Hydrocarbon Contaminated Sites
B8. Combined Approaches for the Remediation of Petroleum Hydrocarbons

C4. Petroleum Hydrocarbon-Related Molecular Diagnostics
C5. High-Resolution Site Characterization

D5. Enhanced Methods for Biodegradation of Organic and Inorganic Contaminants
D6. Advances in Amendment Formulation

E5. Bioremediation of Munitions Constituents
E6. Insensitive Munitions: Characterization, Fate, and Transport
E7. Advances in Tools and Techniques for Assessing MNA

F4. Innovative Treatment Technologies for PFAS Compounds
F5. Optimizing Existing Systems
F6. Risk Management Strategies
F7. Incorporating GSR into Remedy

5:45-7:00 p.m. Poster Group 2 Presentations and Reception
See page 29 for sessions in Poster Group 2.

THURSDAY, MAY 25, 2017

7:00 a.m.-1:00 p.m. Registration, Exhibits, Poster Group 2 Display
7:00-8:00 a.m. Continental Breakfast
11:00 a.m.-1:00 p.m. Lunch

8:00 a.m.-3:30 p.m. Platform Sessions

A6. Biobarrier Installation and Management
A7. Strategies for Bioremediation Performance Assessment
A8. Successes and Failures of Bioaugmentation and Biostimulation

B9. 1,4-Dioxane Treatment Technologies I
B10. 1,4-Dioxane Treatment Technologies II
B11. Other Emerging Contaminants

C6. Microbial-Based Alternative Energy
C7. Advances in Biological Wastewater Treatment Processes
PANEL. Using Geology to Follow the Groundwater, Follow the Flow to Successful Remediation

D7. Cometabolic Bioremediation
D8. Engineering Biogeochemical Transformation
D9. Phytoremediation/Mycoremediation

E8. Natural Attenuation Processes
E9. MNA for Achieving Site Goals
E10. Groundwater/Surface Water Interaction

F8. Sustainable Remediation Assessment Tools
F9. Best Practices in GSR
F10. Incorporating Sustainability Considerations into Remediation Projects

3:30 p.m. Symposium adjourns