Twelfth International Conference on Remediation of Chlorinated and Recalcitrant Compounds

FINAL PROGRAM

May 22-26, 2022 | Palm Springs, California
battelle.org/chlorcon | #Chlorinated2022

BATTELLE

Conference Sponsors

As the Conference organizer and presenter, Battelle gratefully acknowledges support of the following Conference Sponsors. Their financial contributions help defray general operating costs of planning and conducting the Conference. The corporate descriptions they provided appear on pages 76-80.

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Twelfth International Conference on Remediation of Chlorinated and Recalcitrant Compounds

Welcome back to Palm Springs! We are grateful for your participation after the 2020 Conference postponement and eventual cancellation and all the struggles and uncertainties, both personally and professionally, that came along with the COVID pandemic. We are excited to come back together and catch up with old friends, make new acquaintances, and get back to the important work of solving some of the world's most challenging problems!

The 2022 Conference presents the most extensive technical program offered to date with nine wide-ranging technical tracks, educational opportunities, exhibits, live demonstrations, and networking opportunities. With more than 1,200 platform and poster presentations in 82 technical sessions, ten short courses, six panel discussions, and twenty-five Learning Lab demonstrations to choose from, there are untold opportunities to meet, learn, and share ideas with more than 1,500 members of the environmental remediation community from 27 countries over the next few days.

We appreciate the participation of the Conference Sponsors seen to the left 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, who have devoted their time and technical expertise to developing a high-quality program. Our sincere thanks as well to the 1,000+ of platform and poster presenters that are responsible for all the research, hard work, and innovation that have gone into individual presentations. We are eager to see and hear all that we have missed since we gathered last!

We look forward to working together to better understand complex and challenging site conditions and to accelerate cleanups through the expanded use of innovative and sustainable remedial technologies. We hope you enjoy the key features of the conference throughout the week ahead and can take away crucial learning experiences that benefit you in your everyday work.

Michael Meyer, PMP, RG, LEG, LHG
Carolyn Scala, PE
Conference Program Chairs (Battelle)

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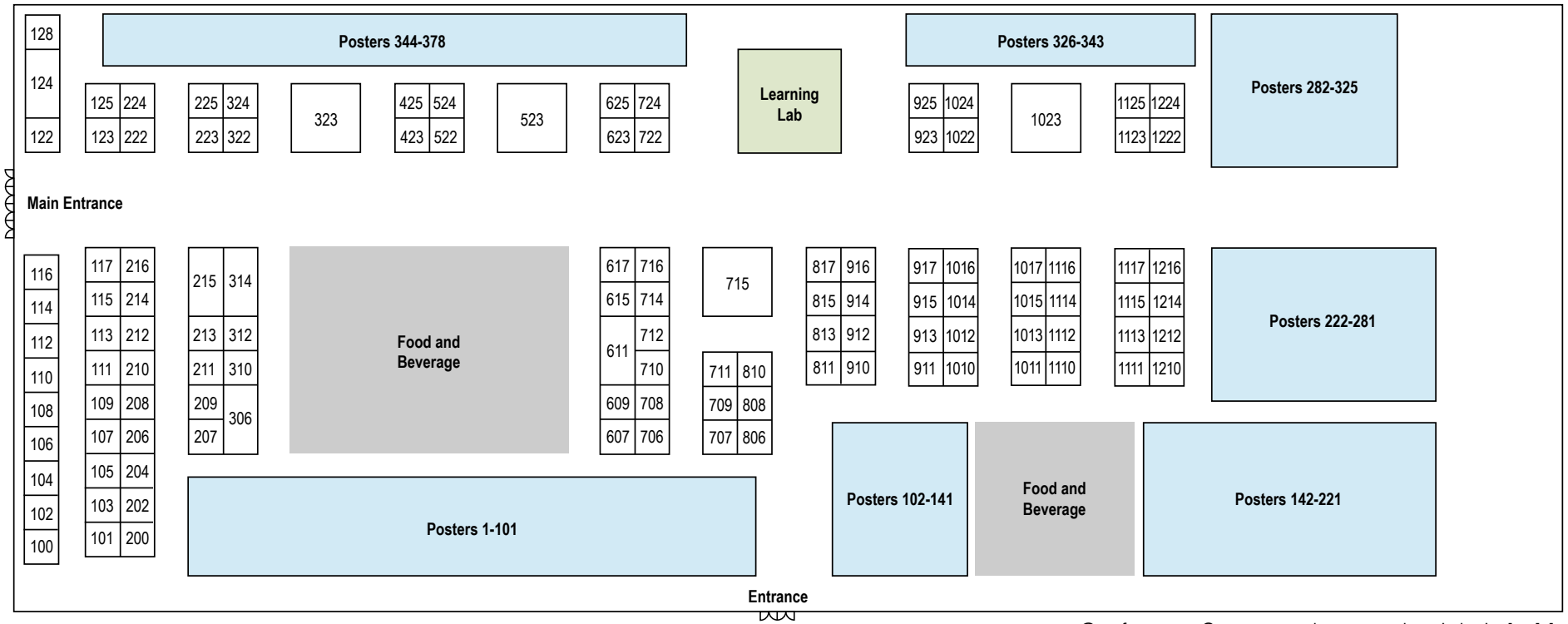
Exhibit Hall Floor Plan



Conference Sponsors shown to the right in **bold**.

Exhibit Hall Hours

Sunday, May 22: 6:00-9:00 p.m.

Monday, May 23: 7:00 a.m.-6:30 p.m.

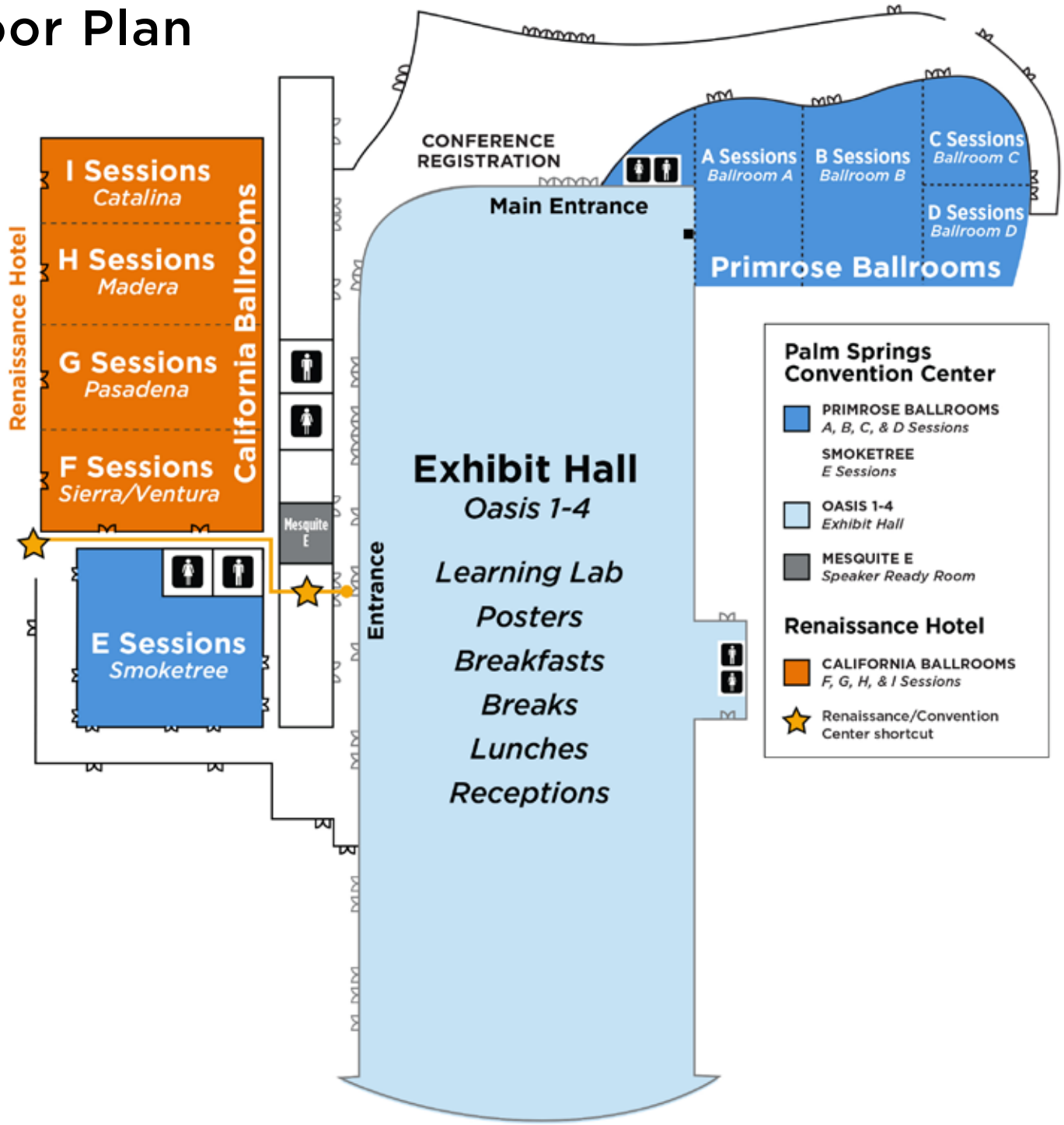
Tuesday, May 24: 7:00 a.m.-1:00 p.m.

Wednesday, May 25: 7:00 a.m.-6:30 p.m.

Thursday, May 26: 7:00 a.m.-1:00 p.m.

Exhibitors

Conference Floor Plan



Plenary Session

Plenary Session Schedule

Monday, May 23, 8:30-10:00 a.m.
(Primrose A/B, PSCC)

Welcome and Opening Remarks
Conference Chairs:
Michael Meyer, PMP, RG, LEG, LHG (Battelle)
Carolyn Scala, PE (Battelle)

Presentation of Student Paper Awards

Lessons from Documenting the Stories of Today's Biggest Environmental Problems and Those Working to Solve Them
Craig Leeson—award-winning filmmaker, journalist, and explorer

Craig Leeson is a passionate oceans and mountain explorer, surfer, diver, aviator and an award-winning filmmaker, television presenter, news correspondent, and entrepreneur. He is the director, explorer/narrator, and writer of the multi-award-winning documentary feature film *A Plastic Ocean* (released 2017) and the producer/director/writer of *The Last Glaciers* (due for release on IMAX 2022). *A Plastic Ocean* was ranked the number one documentary on iTunes in the U.S., the U.K., and Canada shortly after its release. Craig is the 2021 Australian of the Year award recipient.

Craig is the CEO of Leeson Media International, Leeson Global Media and Ocean Vista Films and founder of the I Shot Hong Kong Film Festival. He is the Sustainability Partner to BNP Paribas, an advisor to The Klosters Forum, and was Cathay Pacific's first Change-maker Award recipient. He has advised governments around the world on environment issues and was instrumental in helping frame and introduce legislation banning single use plastics to the Colombian and Mexican congresses. He has also advised and worked with the Asian Development Bank on oceans and single-use plastics-related issues and helped ADB's president launch a US$5billion global healthy oceans initiative in Fiji. He has worked with the world's major broadcasters as a producer and foreign correspondent, including BBC, CNN, Bloomberg, PBS, National Geographic Channel, Discovery Channel, Bio Channel, Universal, Al Jazeera and the Seven Network. He began his career as a newspaper journalist before moving to radio and television as a news correspondent and anchor for ABC TV Australia and later for ATV, RTHK and Star News (Hong Kong).

He has won 17 awards for *A Plastic Ocean*, which has been translated to more than 25 languages and was released on Netflix by Leonardo di Caprio. The film was simultaneously screened on Amazon and iTunes. A Plastic Ocean has been publicly screened in cinemas and at public events in over 70 countries on 6 continents. There have been over 2000 screenings globally hosted by government agencies, non-profits, schools, universities, individuals, multilateral institutions, corporations, aquariums, and others, including the Smithsonian Institute, the Australian and UK Parliaments and the Mexican senate. The film was only the second chosen to be screened in the US Senate (*An Inconvenient Truth* the first) and was selected by the Senate as one of 50 showcase films to be screened in 55 US embassies around the world. A shorter 22-minute version of the film was premiered at the UN General Assembly, in conjunction with the Permanent Mission of Colombia, in 2018 in New York City, to more than 500 people. The film counts among its patrons UNESCO. His new feature film, *The Last Glaciers*, will be screened globally by IMAX and is slated for release in 2021.

Tuesday, May 24, 3:00 p.m. (Smoketree, PSCC)

Film compilation screening and Q&A with Craig Leeson.

General Information

All events will be held at the Palm Springs Convention Center (277 North Avenida Caballeros, Palm Springs, CA 92262) and adjoining Renaissance Palm Springs Hotel (888 East Tahquitz Canyon Way, Palm Springs, CA 92262).

The 82 technical sessions and six panel discussions are organized according to the following major topics.

- Remediation Technology Innovations
- Assessing Remediation Effectiveness
- Green and Sustainable Remediation
- Addressing Challenging Site Conditions
- Fractured Rock and Complex Geology
- Petroleum and Heavy Hydrocarbon Site Strategies
- Per- and Polyfluorinated Alkyl Substances (PFAS)
- Metals
- Vapor Intrusion
- Characterization, Fate and Transport
- Advanced Diagnostic Tools
- Technology Transfer and Stakeholder Communications
- International Environmental Remediation Markets
- Emerging Contaminants

See the following pages for additional information:

- Page 8-9: Short Courses offered on Sunday and Tuesday
- Pages 20 and 52: Poster Sessions in each of the two poster groups.
- Pages 81-82: Overview of the platform sessions and panels to be conducted each day. Times for exhibits, breakfasts, lunches, and receptions.

Program Overview

Sunday, May 22, 2022

- **8:00 a.m.-5:00 p.m.** Short Courses
- **3:00-9:00 p.m.** Registration Desk Open
- **6:00-9:00 p.m.** Welcome Reception, Exhibits, Poster Group 1 Display

Monday, May 23, 2022

- **7:00-8:00 a.m.** Continental Breakfast
- **8:30-10:00 a.m.** Plenary Session
- **10:30 a.m.-12:00 p.m.** General Lunch
- **12:10-4:20 p.m.** Platform Presentations
- **2:00-3:00 p.m.** Afternoon Beverage Break
- **4:30-6:30 p.m.** Group 1 Poster Presentations

Tuesday, May 24, 2022

- **7:00-8:00 a.m.** Continental Breakfast
- **9:00-10:00 a.m.** Morning Beverage Break
- **11:45 a.m.-12:45 p.m.** Afternoon Beverage Break
- **8:00 a.m.-1:50 p.m.** Platform Presentations
- **1:50 p.m.** Technical Program Recesses
- **Lunch on own, general lunch not provided**
- **2:00-4:00 p.m.** Career Kickstarter
- **2:00-6:00 p.m.** Short Courses
- **3:00 p.m.** Film Screening with Craig Leeson

Wednesday, May 25, 2022

- **7:00-8:00 a.m.** Continental Breakfast
- **9:30-10:30 a.m.** Morning Beverage Break
- **8:00 a.m.-4:20 p.m.** Platform Presentations
- **11:30 a.m.-1:00 p.m.** General Lunch
- **2:00-3:00 p.m.** Afternoon Beverage Break
- **4:30-6:30 p.m.** Group 2 Poster Presentations

Thursday, May 26, 2022

- **7:00-8:00 a.m.** Continental Breakfast
- **9:30-10:30 a.m.** Morning Beverage Break
- **8:00 a.m.-4:20 p.m.** Platform presentations
- **11:30 a.m.-1:00 p.m.** General Lunch
- **2:00-3:00 p.m.** Afternoon Beverage Break
- **4:30 p.m.** Closing Reception

Short Courses & Career Roundtable

Pre-registration was required to attend a Short Course or the Career KickStarter. Registered participants may sign in for their course and pick up their Conference badge and course materials at the Conference Registration Desk up to an hour before their course start time. Limited availability for onsite Short Course registration may be available; check at the Registration Desk for details.

Sunday, May 22

8:00 a.m.-5:00 p.m. (all-day)

- ITRC PFAS Training: Managing PFAS Contamination at Your Site

8:00 a.m.-12:00 noon (half-day)

- ITRC: Optimizing Injection Strategies and In Situ Remediation Performance
- Hydrogeochemistry Made Easy for Applied Site Investigation and Remediation

1:00-5:00 p.m. (half-day)

- Introduction to Groundwater Remediation Geochemistry
- ITRC and the Emerging Contaminant 1,4-Dioxane

Tuesday, May 24

2:00-4:00 p.m.

- Career KickStarter

2:00-6:00 p.m. (half-day)

- Leapfrog Works—Implicit 3-D Geologic Modelling: Modelling Your Chlorinated Solvent Plume with the Contaminants Extension
- The ITRC Guidance: Implementing Advanced Site Characterization Tools
- Disposal of PFAS and Other Liquid Chemical Wastes by Underground Injection
- ITRC: Risk Communication Toolkit Training
- Discovering Biodegradation of Emerging Contaminants for Site Management via Bioremediation

Education Sponsor

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itrcweb.org | Booth #101

Presentations

Platform and poster presentations scheduled as of May 3, 2022, are listed by day on pages 16-75.

Platform talks are scheduled at 25-minute intervals. 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 will adhere strictly to the schedule, making it possible for registrants to move between breakout rooms to hear the talks most pertinent to them. To minimize distraction, please confine such movement to the short intervals between talks. Late revisions in platform presentations (speaker changes, withdrawals) will be marked on the daily session lists outside each breakout room.

Posters will be presented on Monday and Wednesday evenings in the Exhibit Hall. During the poster sessions, presenters will be at their posters to discuss their work, and light refreshments will be served. See pages 20-36 and 52-67 for details on the poster presentations.

Audio, video, and still photography is prohibited in session rooms during platform presentations or panel discussions without FIRST securing the speaker(s) permission and notifying the session chair or panel moderator in advance.

Video and still photography of poster board presentations is also prohibited without FIRST securing author/ speaker permission.

Exhibits

Exhibit booths are provided by 116 organizations that conduct remediation activities or supply equipment used in such work. Exhibits are on display Sunday, May 22, from 6:00 p.m. through Thursday, May 26, at 1:00 p.m. in Oasis 1-4 (Palm Springs Convention Center). Access to the Exhibit Hall after 1:00 p.m. Thursday is restricted to Exhibitors for move-out. See page 4-5 for exhibit hours and the list of participating exhibitors.

Ad Hoc Meetings, Speaker Prep Room, & Internet Café

Ad Hoc Meetings. Small meeting rooms (up to 12 people) may be available for ad hoc meetings. Ad hoc rooms are not AV equipped. Sign up for up to a 2-hour time slot at the Registration Desk.

Speaker Prep Room. A speaker prep room will be available for presenters' use. Sign up for a time slot at the Registration Desk.

Internet Café. Computers and charging outlets are available to participants who wish to check email during Exhibit Hall hours Sunday–Thursday in the Internet Café, located near the Learning Lab.

Internet Café Sponsors

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WIFI

Complimentary wireless Internet access is available in the Exhibit Hall and session rooms.

SSID: battelle2022
Password: chlor22

Learning Lab

The Learning Lab, located in the Exhibit Hall, will consist of live demonstrations highlighting specific technologies, tools, and software. The schedule of planned demonstrations is available in the program schedule grid and on the Conference mobile app. Demonstrations begin Monday after the Plenary Session and continue through Thursday afternoon.

Learning Lab Sponsors

BURNS McDONNELL

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Professional Development

General Attendance Certificate. If you would like to receive a general certificate of Conference attendance, inquire at the Registration Desk. PDF certificates will be emailed after the Conference.

Daily Attendance Certificate. If your state licensing board accepts conference attendance for credit and will require documentation of hours attended during the Monday through Thursday technical program, a daily attendance log may be established for you. Please see the compliance instructions.

State of Massachusetts LSP Credits. The Conference and short courses have been approved by the State of Massachusetts for LSP credits. Attendees who wish to receive credit are required to establish and maintain a daily attendance log. Please see the compliance instructions.

- ½ technical credit for each hour of Conference attendance
- 1 technical credit for each hour of short course attendance

Compliance. To log attendance hours for a daily attendance certificate or the State of Massachusetts LSP credits, you are required to sign in and out at the Registration Desk when you arrive at or leave the Conference. A PDF certificate will be emailed after the Conference with the total number of hours logged.

You may not complete or sign a previous days' log. Only those days with complete attendance logs (*i.e.*, sign-in, sign-out, and signature) will be included on your certificate, no exceptions. Sign-out must be completed prior to the Registration Desk closing each evening.

Meals, Breaks, & Receptions

The meals, breaks, and light receptions seen to the right will be provided at no additional cost to program registrants and exhibit booth staff during the food service times listed.

Food service for breakfasts, morning and afternoon beverage breaks, lunches, and receptions will be in Oasis Hall 1-4 (Palm Springs Convention Center).

Guest Tickets. If registrants wish to bring guests to meals or receptions, guest tickets can be purchased at the Conference Registration Desk. Guest tickets will be priced equal to the cost incurred by the Conference for each meal.

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Food Service Times

Breaks in the technical program between sessions may not correspond with food service times. If you wish to attend specific food functions, please plan your schedule accordingly.

Continental Breakfast
Monday-Thursday, 7:00–8:00 a.m.

Morning Beverage Break
Tuesday, 9:00–10:00 a.m.
Wednesday–Thursday, 9:30–10:30 a.m.

Lunch
Monday, 10:30 a.m.–12:00 p.m.
Tuesday, lunch not provided.
Wednesday–Thursday, 11:30 a.m.–1:00 p.m.

Afternoon Beverage Break
Monday, Wednesday, and Thursday, 2:00–3:00 p.m.
Tuesday, 11:45 a.m.-12:45 p.m.

Welcome Reception
Sunday, 6:00–9:00 p.m.

Poster Group 1 Presentations & Reception
Monday, 4:30–6:30 p.m.

Poster Group 2 Presentations & Reception
Wednesday, 4:30–6:30 p.m.

Closing Reception
Thursday, 4:30–5:00 p.m.

Mobile App & Abstract Collection

It is recommended that attendees review the schedule and abstracts available on the Conference mobile app prior to the event. The app is mobile and desktop compatible.

Abstracts are available only through the mobile app. Abstracts are included for all platform and poster presentations and panel discussions. The app may be used to build a personal schedule, take notes on presentations, and favorite exhibitors. In addition, you have the option of creating a personal profile to enhance networking opportunities with other participants, including sending messages and scheduling meetings.

Closing Reception Sponsor

IVEY-SOL® Surfactant Technology www.iveyinternational.com

iveyinternational.com | Booth #711

Proceedings

All presentations given at the Conference will be represented in the proceedings. The one-page abstract will be included supplemented with the slide files for platform presentations. Poster presenters have also been invited to submit PDFs of their poster presentations. After the Conference, the proceedings will be compiled and published only online. A link to access the proceedings will be sent to all technical program registrants when available.

Job Postings, Lost & Found

A message board will be available near the Registration Desk for the use of attendees wishing to contact one another. Notices about jobs available or wanted can be posted here. This board also will be used for messages taken by the registration staff for attendees. Please turn any found items in to the Registration Desk. Lost items may be picked up with a detailed description of the item.

Student/Young Professional Events & Career Opportunities

University students, through Ph.D. candidates, will find participation in the Conference valuable to their career development. 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. Recruitment is a major focus of many participating Exhibitors and Sponsors and the Conference will provide enhanced networking opportunities for student jobseekers. Be sure to check the Message Board near the Registration Desk where job postings may be available from participating companies.

Student/Young Professional Networking Reception. To help students and young professionals (5 years or less in their field) get acquainted, a Networking Reception will be held Tuesday evening, following the Group 1 poster presentations.

Career KickStarter. A Career Kickstarter, organized and hosted by Clemson University alumni, for students and young professionals is scheduled from 2:00-4:00 p.m. on Tuesday afternoon, May 24. Pre-registration was required in order to match mentors and mentees.

It is a program designed to foster networking and mentorship within the environmental sector. New professionals will be matched with an experienced professional in a mentorship relationship, which both mentee and mentor are committed to sustaining for 1 year.

Student Paper Winner

The winning student paper is scheduled for presentation as seen below. The winner is awarded a complimentary registration and a financial award to help cover travel and related costs to attend the Conference.

Bosen Jin
(University of California, Riverside/USA)

Anaerobic Biotransformation and Biodefluorination of Chlorine-Substituted Perfluorinated Carboxylic Acids
(Monday, Session E2, 2:40 p.m.)

Student Event Sponsors

EA Engineering, Science, and Technology, Inc., PBC

eaest.com

GHD

ghd.com

HALEY ALDRICH

haleyaldrich.com | Booth #200

TETRA TECH

complex world | CLEAR SOLUTIONS™

tetratech.com | Booth #1011

Program Committee, Session Chairs, & Panel Moderators

Program Committee

Conference Chairs

Michael Meyer, PMP, RG, LEG, LHG (Battelle)
Carolyn Scala, PE (Battelle)

Steering Committee

Wendy Condit, PE (Battelle)
Stephanie Fiorenza, Ph.D. (Arcadis)
Nick Garson, PG (Boeing)
Christopher Glenn, PE, LEED GA, ENV SP (Langan)
Rosa Gwinn, Ph.D., PG (AECOM)
Paul Randall (U.S. EPA)
Mike Riggle, PG (USACE)
Kent Sorenson, Ph.D., PE (Allonia)
Rick Wice, PG (Battelle)

MONDAY PLATFORM SESSIONS

A1. Emerging Remediation Technologies
Stewart Abrams (Langan Engineering & Environmental Services, Inc.)
Stephen Koenigsberg (Koenigsberg Consulting)

B1. In Situ Technologies: Lessons Learned
Holly Holbrook (AECOM)
Prasad Kakarla (In-Situ Oxidative Technologies, Inc. [ISOTEC])

C1. Remedial Design/Optimization: Applications of Mass Flux and Mass Discharge
Joseph Quinnan (Arcadis)
Craig Sandefur (REGENESIS)

D1. Large, Dilute and Commingled Plume Case Studies
Diana Cutt (U.S. EPA)
John Williams (The Boeing Company)

E1. Advances in the Analysis of Non-Target Per- and Polyfluorinated Alkyl Substances (PFAS)
Bharat Chandramouli (SGS Canada)
Rock Vitale (Environmental Standards, Inc.)

E2. PFAS and Bugs: The Search Continues
Laurie LaPat-Polasko (Matrix New World Engineering)
John Xiong (Haley & Aldrich, Inc.)

F1. PFAS Fate and Transport Properties
Kristen Freiburger (Shannon & Wilson, Inc.)
Maureen Leahy (Wood)

G1. Expedite Site Closure: Innovative Strategies and Approaches
Michael Singletary (U.S. Navy)
Tomas Will (Directional Technologies, Inc.)

G2. Practice of Risk Communication and Stakeholder Engagement
Wendy Condit (Battelle)
Lisa Kammer (Weston Solutions, Inc.)

H1. Improvements in Site Data Collection, Data Management, and Data Visualization
Nicklaus Welty (Arcadis)
Christian Johnson (Pacific Northwest National Laboratory)

I1. Explosives, Perchlorate
Kevin Morris (ERM)
Christopher Jackson Ritchie (Ramboll)

TUESDAY PLATFORM SESSIONS

A2. Abiotic and In Situ Biogeochemical Processes: Applications and Lessons Learned
Charles Schaefer (CDM Smith Inc.)
John Wilson (Scissortail Environmental Solutions, LLC)

A3. ZVI: 25 Years of Groundwater Remediation Applications
Stephanie Fiorenza (Arcadis)
Paul Tratnyek (Oregon Health & Science University)

B2. Thermal Conductive Heating: Best Practices and Lessons Learned
Michael Basel (Haley & Aldrich, Inc.)
Rubens Spina (EBP Brasil)

B3. Thermal Conductive Heating: Case Studies
James Baldock (ERM)
Cary Brown (AECOM)

C2. Remedy Implementation: Assessing Performance and Costs
Jackie Saling (Arcadis)
George Walters (U.S. Air Force)

C3. In Situ Activated Carbon-Based Amendments: Assessing Effectiveness and Performance
Scott Haitz (WSP)
Ed Winner (Remediation Products, Inc.)

C4. Compound-Specific Isotope Analysis: Case Studies in Evaluating Remedy Performance
James Feild (Wood)
Ramona Iery (U.S. Navy)

D2. Landfill Assessment and Remediation
Matthew Ambrusch (Langan)
Omer Uppal (Haley & Aldrich, Inc.)

D3. Adaptive Site Management: Lessons Learned for Site Characterization and Remedy Implementation
Tamzen Macbeth (CDM Smith Inc.)
Kathleen Stetser (GEI Consultants, Inc.)

E3. Ex Situ PFAS Treatment: Soils/Solids and Other Waste Streams
Mack Astorga (Allonnia)
John Santacroce (AECOM)

F2. PFAS Conceptual Site Model Approaches
Kent Sorenson (Allonnia)
Rick Wice (Battelle)

F3. PFAS Program Management in a Rapidly Changing Regulatory Environment
Rula Anselmo Deeb (Geosyntec Consultants)
Shalene Thomas (Wood)

F4. PFAS Source and Forensic Considerations
Michael Bock (The Intelligence Group)
Zachary Neigh (AECOM)

G3. Heavy Hydrocarbons: Characterization and Remediation
Robert Elliott (Remediation Products, Inc.)
Duane Guilfoil (AST Environmental, Inc.)

G4. Natural Source Zone Depletion
Sam Moore (Battelle)
Charles Newell (GSI Environmental Inc.)

H2. Conceptual Site Models: Improvements in Development and Application
Timothy Goist (WSP)
Benjamin Grove, Jr. (Stantec)

I2. Advances in 1,4-Dioxane Biological Treatment Technologies
Francisco Barajas-Rodriguez (AECOM)
Bonani Langan (Wood)

I3. 1,4-Dioxane Remediation Challenges
Tesema Chekol (Battelle)
David Lippincott (APTIM)

WEDNESDAY PLATFORM SESSIONS

A4. Combined Remedies and Treatment Trains
Jim Cummings (U.S. Environmental Protection Agency)
James L'Esperance (Northrop Grumman)

B4. In Situ Chemical Oxidation: Optimized Design Approaches and Lessons Learned
Nancy Hsu (Wintersun Chemical)
Brant Smith (Evonik)

B5. Injectable Activated Carbon Amendments: Lessons Learned and Best Practices
Scott Noland (Remediation Products, Inc.)
Kristen Thoreson (REGENESIS)

B6. Innovations in ZVI Amendment Formulations and Applications
Scott Hubbard (Wintersun Chemical)
Dan Nunez (REGENESIS)

C5. Site Closure: Models Used to Estimate Cleanup Timeframes
Frederick Day-Lewis (Pacific Northwest National Laboratory)
Harvinder Singh (Weston Solutions, Inc.)

C6. Data Analytics: Use of Advanced Decision Analysis Tools, Including AI and Machine Learning for Improved Analysis, Optimization and Decision Making
Nick Machairas (Haley & Aldrich, Inc.)
Victor Vanin Sewaybricker (EBP Brasil)

C7. Optimizing Remedial Systems
David Becker (U.S. Army Corps of Engineers)
Lucas Hellerich (Woodard & Curran)

D4. Evaluating Surface Water/Groundwater Interactions: Innovative Monitoring Approaches and Modeling Applications
Lisa Lefkovitz (Battelle)
Scott Pittenger (In-Situ Oxidative Technologies, Inc. [ISOTEC])

D5. DNAPL Source Zone Remediation: Lessons Learned
Andy Lowy (Provectus Environmental Products, Inc.)
Heather Rectanus (Geosyntec Consultants)

D6. Low-Permeability Zone Challenges, Permeability Enhancements, and Case Studies
J. Greg Booth (Woodard & Curran)
Poonam Kulkarni (GSI Environmental Inc.)

E4. PFAS Human Health and Ecological Risk Assessment and Toxicity
Rosa Gwinn (AECOM)
Loren Lund (Jacobs)

E5. Managing PFAS at Publically-Owned Treatment Works (POTWs)
Dorin Bogdan (AECOM)
Peter Murphy (OPEC Systems P/L)

E6. Ex Situ PFAS Water Treatment Technologies
Purshotam Juriasingani (Tetra Tech, Inc.)
Dung (Zoom) Nguyen (CDM Smith, Inc.)

F5. PFAS: Groundwater Treatment Case Studies
Paul Erickson (REGENESIS)
Nathan Hagelin (Wood)

F6. Ex Situ PFAS Destruction Technologies
Matthew Burns (WSP Golder)
Michael Shen (Wintersun Chemical)

F7. Advances in Vapor Intrusion Investigations
Christopher Glenn (Langan)
Mark Kram (Groundswell Technologies, LLC)

G5. In Situ Remediation of Petroleum Hydrocarbons
Arnab Chakrabarti (Terraphase Engineering)
George (Bud) Ivey (Ivey International, Inc.)

G6. LNAPL Recovery/Remediation Technology Transitions
Brad Koons (AECOM)
Stephen Rosansky (Battelle)

G7. LNAPL Sites: Understanding and Managing Risks
Ranga Muthu (Parsons)
Tom Palaia (Jacobs)

H3. Advanced Geophysics and Remote/Direct Sensing Tools and Techniques
Doug Gray (AECOM)
John Sohl (Columbia Technologies, LLC)

H4. Advanced Sampling and Analysis Tools and Techniques
John Dougherty (CDM Smith Inc.)
Sean Gormley (Wood)

I4. Microplastics, Pharmaceuticals, and Other Emerging Contaminants
Alison Cupples (Michigan State University)
John Simon (Gnarus Advisors LLC)

I5. Technical Impracticability: Challenges and Considerations for Evaluation of Fractured Rock Sites
Michael Gefell (Anchor QEA, LLC)
Bernard Kueper (Queen's University)

I6. Depositional Environments and Stratigraphic Considerations for Remediation
Shaun Cwick (Weston Solutions, Inc.)
Mike Shultz (Burns & McDonnell)

I7. Process-Based Conceptual Site Models (CSMs) for Informing Remediation
Michael Bower (The Boeing Company)
Robert J. Stuetzle (Dow)

THURSDAY PLATFORM SESSIONS

A5. Permeable Reactive Barriers: Best Practices and Lessons Learned
Bruce Henry (Parsons)
Clint Jacob (Landau Associates, Inc.)

A6. Thermally Enhanced In Situ Degradation Processes at Sub-Boiling Temperatures
Christopher Hook (Tetra Tech, Inc.)
James Wang (Geosyntec Consultants)

A7. Horizontal Wells: Applications and Lessons Learned in Site Characterization and Remediation
Andrew Madison (WSP Golder)
Mike Sequino (Directional Technologies, Inc.)

A8. Electron Donors: Innovations for Biodegradation
Raphi Mandelbaum (LDD Advanced Technologies, Ltd.)
J. Mark Nielsen (Ramboll)

B7. Innovative and Optimized Amendment Delivery and Monitoring Methods
Will Moody (Provectus Environmental Products, Inc.)
William Slack (FRx, Inc.)

B8. Monitored Natural Attenuation: Innovative Monitoring Approaches/Lines of Evidence and Lessons Learned
Roger Anderson (TRC Companies, Inc.)
Rodrigo Coelho (EBP Brasil)

B9. Advanced and Synthetic Biological Treatment Applications
Elizabeth Edwards (University of Toronto)
Frank Loeffler (University of Tennessee)

B10. Electrical Resistance Heating: Best Practices and Lessons Learned
Jennifer Kingston (Haley & Aldrich, Inc.)
Troy Lizer (Provectus Environmental Products, Inc.)

C8. Setting Cleanup Goal End Points: When Are We Done?
Matthew Alexander (Leidos)
Ronnie Britto (Tetra Tech, Inc.)

C9. GSR Best Practices and Nature-Based Remediation Case Studies
David Burns (EPOC Enviro LLC)
William DiGuiseppi (Jacobs)

C10. Climate Resilience and Site Remediation
Thomas O'Neill (New Jersey Department of Environmental Protection [Retired])
Paul Randall (U.S. Environmental Protection Agency)

C11. Aligning Remediation Goals with Environmental, Social, and Governance (ESG) Considerations
Paul Favara (Jacobs)
Richard Raymond, Jr. (Terra Systems, Inc.)

D7. Precipitation and Stabilization of Metals
Arul Ayyaswami (Tetra Tech, Inc.)
Michael Lee (Terra Systems, Inc.)

D8. Mining and Uranium Site Restoration
Al Laase (RSI Entech)
Herb Levine (U.S. Environmental Protection Agency)

D9. Managing Chromium-Contaminated Sites
Will Caldicott (In-Situ Oxidative Technologies, Inc. [ISOTEC])
Sandip Chattopadhyay (U.S. Environmental Protection Agency)

E7. PFAS Site Characterization
Andrew Barton (Battelle)
Katie Tippin (U.S. Navy)

E8. In Situ PFAS Treatment Approaches
Daniel Cassidy (Western Michigan University)
Dora Chiang (Wood)

F8. Vapor Intrusion Mitigation and Effectiveness
Vitthal Hosangadi (NOREAS, Inc.)
Michael Pound (Naval Facilities Engineering Systems Command Southwest)

F9. Vapor Intrusion Risk Assessment and Site Management
Ryan Miller (Land Science)
Pamela Rodgers (Battelle)

G8. Environmental Forensics: Site Characterization and Source Determinations
Felicia Barnett (U.S. Environmental Protection Agency)
Sam Rosolina (Microbial Insights, Inc.)

G9. Remote Sensing, Drones, and Other Unmanned Systems for Remote Monitoring and Site Assessments
Adam Forsberg (Jacobs)
Bryan O'Reilly (Terraphase Engineering)

G10. Using Omic Approaches and Advanced Molecular Tools to Optimize Site Remediation
Kate Kucharzyk (Battelle)
Usha Vedagiri (Wood)

G11. International Remedy Applications: Regulatory and Logistical Challenges of Remediation Abroad
Souhail R. Al-Abed (U.S. EPA)
James Henderson (Corteva)

H5. Groundwater Modeling: Advancements and Applications
Jason House (Woodard & Curran)
James Schuetz (Parsons)

H6. MIP/HPT/LIF/UVOST—Realtime HRSC Tools and Techniques
Andrew Bullard (CDM Smith, Inc.)
Damon DeYoung (Battelle)

H7. HRSC Suites of Tools to Improve CSMs
Murray Einarson (Haley & Aldrich, Inc.)
David Finney (Jacobs)

I8. Advances in the Application of Geologic Interpretation to Remediation
Rick Cramer (Burns & McDonnell)
J. Mark Stapleton (Noblis)

I9. Remediation Approaches in Fractured Rock and Karst Aquifers
Michael Lamar (CDM Smith, Inc.)
Raymond Lees (Langan)

Panel Discussions

MONDAY

Track I (12:10 p.m.)
How Can Genetically-Modified Organisms Safely Solve Environmental Challenges?
Moderator: Kent Sorenson (Allonnia)

Track D (2:40 p.m.)
Investigating and Remediating a Major Chlorinated Solvent DNAPL Site
Moderator: Bruce Thompson (de maximis, inc.)

TUESDAY

Track G (8:00 a.m.)
Monitored Natural Source Zone Depletion
Moderator: Rick Ahlers (GEI Consultants, Inc.)

Track E (12:10 p.m.)
Should We Develop PFAS Ambient Levels: Why and How?
Moderator: Sheau-Yun (Dora) Chiang (Wood, USA)

WEDNESDAY

Track A (8:00 a.m.)
Thermal Remediation Technology Updates: Eight Experts Discuss Four Years of Innovations in 100 Minutes
Moderators: Grant Geckeler (ISOTEC) and Erin Hauber (U.S. Army Corps of Engineers)

THURSDAY

Track I (8:00 a.m.)
Remediation Geology, Remediation Hydrogeology, and Process-Based CSMs to Support Complex Site Remediation
Moderators: Rick Cramer (Burns & McDonnell) and Robert Stuetzle (Dow Chemical)

NOTES

Monday Platform Sessions—12:10–2:15 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
12:10	A1. Emerging Remediation Technologies **Successful Technologies for Remediation of Groundwater: Lessons Learned from Past Experiences.** *J.T. Wilson.* John Wilson (Scissortail Environmental Solutions, LLC/USA)	B1. In Situ Technologies: Lessons Learned **Iterative Design and Characterization Program to Overhaul Remedial Strategy for Cr(VI) and TCE Plumes under Superfund and Liability Transfer.** *B.J. Lazar, Y. Kunukcu, and N.M. Rabah.* Brendan Lazar (TRC Companies, Inc./USA)	C1. Remedial Design/Optimization: Applications of Mass Flux and Mass Discharge **Remediation Hydraulics 10 Years Later: What We Learned and What's Next.** *F.C. Payne, J.A. Quinnan, and S.T. Potter.* Joseph Quinnan (Arcadis/USA)	D1. Large, Dilute and Commingled Plume Case Studies **Building a Robust Geochemical Model to Evaluate and Manage a Large, Dilute, Commingled Plume.** *K. Leslie, T. Macbeth, E. Ehret, J. Dougherty, M. Gamache, and T. Cook.* Thomas Cook (CDM Smith Inc./USA)	E1. Advances in the Analysis of Non-Target Per- and Polyfluorinated Alkyl Substances (PFAS) **Development of an Equilibrium Passive Sampler for Monitoring PFAS.** *B.G. Pautler, A. Sweett, F. Salim, M. Healey, J. Roberts, B. Medon, A. Pham, F. Risacher, L. D'Agostino, J. Conder, R. Zajac-Fay, P. McIsaac, A. Patterson, and R. Bitzel.* Anh Pham (University of Waterloo/ Canada)
12:35	**Transitioning from Active Remedies to Monitored Natural Attenuation.** *C.J. Newell, D.T. Adamson, and J.T. Wilson.* Charles Newell (GSI Environmental Inc./USA)	**Novel Applications of Anaerobic Bioremediation for In Situ Remediation of Petroleum Hydrocarbons and Arsenic.** *J. Chambert, G. Ulrich, S. Aube, and P. Feshbach-Meriney.* Julien Chambert (Parsons/USA)	**Flux-Informed Remedy Optimization: The Next Generation of Applied Modeling.** *S.T. Potter, M. Killingstad, and M.P. Kladias.* Scott Potter (Arcadis/USA)	**How Groundwater Modeling Helped Remediation Design for Contaminant Plumes Impacting Los Angeles' Municipal Supply Wells.** *M. Trudell, M. Hendrie, S. Winners, N. Blute, C. Cotton, T. Rother, and K. Wells.* Martin Hendrie (WorleyParsons Advisian/USA)	**Rapid Quantitative Analysis and Suspect Screening of Per- and Polyfluorinated Alkyl Substances (PFAS) in Aqueous Film-Forming Foams (AFFFs) by Nano-ESI-HRMS.** *C. Wu, Q. Wang, H. Chen, and M. Li.* Chen Wu (New Jersey Institute of Technology/USA)
1:00	**Simultaneous Treatment of Heavy Metals and Chlorinated Solvents in Groundwater.** *A. Seech, D. Leigh, and J. Molin.* Fayaz Lakhwala (Evonik/USA)	**Pilot-Scale Evaluation of Three In Situ Treatment Technologies at a Former MGP Site.** *B.T. Clement, P. Karkarla, M. Dotto, K. Kobran, and W. Caldicott.* Benjamin Clement (Burns & McDonnell/USA)	**Application of Stratigraphic Flux and the PFAS Mobile Lab to Characterize Migration Pathways and Source Strength.** *P. Curry, J. Quinnan, and M. Rossi.* Patrick Curry (Arcadis/USA)	**Remediation of Large-Scale PCE-Impacted Groundwater: Integration of Tailored Amendments and Injection Approaches.** *M.M. Mejac, J.M. Metzger, and D.M. Lis.* Mark Mejac (Ramboll/USA)	**How to Hit a Moving Target: PFAS Treatment and Analytical Advancements.** *K. Pennell, M. Woodcock, K. Manz, E. Crownover, and G. Heron.* Kurt Pennell (Brown University/USA)
1:25	**Constructed Wetlands Pilot Test for Treatment of a Complex Mixture of Contaminants at a NAPL-Impacted Site in Brazil.** *P. Barreto, J. Arthur, C. Martins, P. Rego, C. Mowder, D. Austin, E.E. Mack, P. Carvalho, and R. Silva.* Paola Barreto Quintero (Jacobs/USA)	**Lessons Learned: Treatment of a New Jersey CVOC Plume in Urban Geology with Combined Remedy Approach.** *J.P. Chiappetta.* Joseph Chiappetta (ECC Horizon/ USA)	**Remedy Optimization through Mass Flux and Mass Discharge Evaluation.** *L. Zeng, A. Boodram, S. Abrams, E. Dieck, A. Quinn, E. Seelman, and S. Ciambruschini.* Aroona Boodram (Langan/USA)	**Evaluation and Remediation of a Commingled Chlorinated Solvents Plume in Wall Township, New Jersey.** *M. Khan and L. Agrios.* Mazeeda Khan (U.S. EPA/USA)	**Total Organofluorine (TOF) Analysis by Combustion Ion Chromatography: A New Tool for Monitoring PFAS Impacts.** *H.L. Lord.* Heather Lord (Bureau Veritas/ Canada)
1:50	**Study of a Reductive Bioelectrochemical Reactor for Perchloroethylene Removal in Synthetic and Real Contaminated Groundwaters.** *E. Dell'Armi, M. Zeppilli, M. Majone, and M. Petrangeli Papini.* Edoardo Dell'Armi (University of Rome "La Sapienza"/Italy)	SESSION BREAK	**Stratigraphic Flux®: A Mass Flux Approach for Focused Cleanup.** *J. Vilar, A. Bustamante, G. Andrade, A. Miranda, B. Rocha, A. Martinho, J. Smith, J. Overgord, K. Haymond, and J. Quinnan.* Julio Vilar (Arcadis/Brazil)	**Complex Contaminant Transport within Folded Sediments and Integrated Threat Reduction Using Packer Isolation Methodology.** *C.G.A. Ross, J.D. Schwall, R.A. Niemeyer, and S.P. Netto.* Christopher Ross (Engineering Analytics, Inc./USA)	SESSION BREAK
2:15	SESSION BREAK	B1. **Laboratory- and Field-Scale Testing for Thermal Remediation: Why, Where, and How.** *E.L. Davis.* Eva Davis (U.S. Environmental Protection Agency/USA)	SESSION BREAK	SESSION BREAK	E2. **Biotransformation of Several Per- and Polyfluoroalkyl Substances by Wood-Decaying Fungi.** *Y. Gao, N. Merino, K. Shah, B. Croze, I. Kwok, S.S. Kalra, M. Wang, S. Mahendra, R. Deeb, and E. Hawley.* Yifan Gao (University of California, Los Angeles/USA)

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Monday Platform Sessions—12:10–2:15 p.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
12:10	**Management and Mitigation of Per- and Polyfluoroalkyl Substances (PFAS) Leaching from Concrete.** *T.A. Key, J. Mueller, P. Thai, C. Barnes, S. Porman, and J. McDonough.* Trent Key (Exxon Mobil Corporation/USA)	**Implementing Remediation to Support Fast Track Redevelopment of an Urban Site.** *B. O'Neal and P. Dombrowski.* Brian O'Neal (PES Environmental, an NV5 Company/USA)	**Standardization and Governance: The Key to Digital Transformation of Boring Logs.** *R.J. Stuetzle and L. Austrins.* Robert Stuetzle (Dow/Canada)		**Unique Web-Based Design Assistant Improves Design and Injection Control for Remediating Hydrocarbon Sites with Microscale Carbon Technology**
12:35	**Evaluation of Stormwater Management Systems for the Removal of Per- and Polyfluorinated Substances.** *T. Hussain, B.A. Rao, C. Gomez-Avilla, H. Zhou, D. Sackey, N. Kumar, J. Guelfo, and D.D. Reible.* Tariq Hussain (Texas Tech University/USA)	**Facilitating Property Transfer through a Combination of Remediation and Risk Assessment: Three Case Studies.** *G. Overbeeke, P. Wilson, W. Lee, L.A. Beese, M. Dotto, and P.M. Dombrowski.* Gavin Overbeeke (AEL Environment/Canada)	**State of the Practice: Immersive Technologies in Environmental Remediation.** *A. Yanites, N. Welty, and J. Horst.* Allison Yanites (Arcadis/USA)	**PANEL DISCUSSION** **How Can Genetically-Modified Organisms Safely Solve Environmental Challenges?** **Moderator** Kent Sorenson (Allonnia) **Panelists** Alexandra Dunn (Baker Botts) Deepti Kulkarni (Sidley) Benjamin Trump (U.S. Army Engineer Research and Development Center and University of Michigan School of Public Health) Wendy Goodson (Ginkgo Bioworks)	
1:00	**PFAS Leaching in an AFFF-Impacted Source Area.** *C.E. Schaefer, D. Nguyen, S. O'Hare, G. Lavorgna, D. Lippincott, E. Christie, J. Field, S. Shea, and C.P. Higgins.* Charles Schaefer (CDM Smith Inc./USA)	**Keeping the Vision: A Small Port's Journey to Comprehensive Remediation of a Wood-Treating Site.** *J.C. Elliott and L. Olin.* Joshua Elliott (Maul Foster & Alongi, Inc./USA)	**Applying the CRATES and ORIGEN Web-Based Tools to Visualize and Interpret Environmental Data.** *C.D. Johnson, V.L. Freedman, P.D. Royer, T.P. Franklin, J.J. Garza, C.B. Woodford, J.Q. Wassing, J.L. Fanning, V. Molina, E.J. Engel, J.P. Loftus, X. He, and P.K. Tran.* Christian Johnson (Pacific Northwest National Laboratory/USA)		**Surface-Active Foam Fractionation Benchtop Apparatus: PFAS Treatability/Feasibility Demonstration**
1:25	**A Mass-Based, Field-Scale Demonstration of PFAS Retention within AFFF-Associated Source Areas.** *D.T. Adamson, C.J. Newell, P.R. Kulkarni, A. Nickerson, C. Higgins, J. Field, A. Rodowa, P.C. de Blanc, J. Popovic, and J. Kornuc.* David Adamson (GSI Environmental Inc./USA)	**Alternative Approach to Pump and Treat/MCLs and Meeting the New EPA Accelerated Closure Directives: A Sustainable Plume Management Approach Using the Arizona WQARF Model and Adaptive Management.** *S. Zachary and E. Pigati.* Scott Zachary (Haley & Aldrich, Inc./USA)	**Remediation 2.0: Using the Internet of Things on Remediation Projects.** *N.R. Welty, J. Gallegos, and C. Hollister.* Nicklaus Welty (Arcadis/USA)		
1:50	**Partitioning and Storage of Per- and Polyfluoroalkyl Substances Considering Precursors and Multi-Bilayer Supramolecular Assemblies in Unsaturated and Saturated Zones of Fire Training Areas.** *I. Ross.* Ian Ross (Tetra Tech/United Kingdom)	SESSION BREAK	**Advanced Geostatistics to Optimize Sampling Approach for Contaminated Soil Investigations and Remediations.** *K. Wyatt, M. Beck, and M. Tonkin.* Kylah Wyatt (Parsons/USA)	SESSION BREAK	**Documenting In Situ Reactive Mineral Formation Using the Min-Trap™: A New Monitoring Well-Based Sampling Tool**
2:15	SESSION BREAK	**The Outrage Effect: Examining the Influence of Public Perception on Emerging Contaminants and Regulations.** *D. Nelson, K. Sellers, and N. Weinberg.* Nancy Miller (ERM/USA)	SESSION BREAK	**I1. Degradation of Insensitive Munitions Constituents in the Environment: Predicting the Products and Their Properties Using In Silico Methods.** *T.L. Torralba-Sanchez, E.J. Bylaska, and P.G. Tratnyek.* Tifany Torralba-Sanchez (Mutch Associates, LLC/USA)	

F1. PFAS Fate and Transport Properties

G1. Expedite Site Closure: Innovative Strategies and Approaches

H1. Improvements in Site Data Collection, Data Management, and Data Visualization

Panel Discussion

Learning Lab

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Monday Platform Sessions—2:40–3:55 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
2:40	**Graphene Oxide-Zirconium Hydroxide ($GO\text{-}ZrO(OH)_2$) Nanocomposite: Effectively Removes Heavy Metals from Aqueous Solutions.** *L.P. Lingamdinne, J.R. Koduru, J.S. Choi, S.H. Lim, J.K. Yang, Y.Y. Chang, and Y.S. Chang.* Lakshmi Prasanna Lingamdinne (Kwangwoon University, Seoul, Republic of Korea/South Korea)	**Off-Site Chlorinated Solvent Plume Reaching Municipality's Water Dam: Successful Approach to Management and Remediation.** *S. Aluani, F. Tomiatti, C. Spilborghs, N. Nascimento, and E. Pujol.* Sidney Aluani (SGW Services/Brazil)	**Application of Innovative Groundwater Flow and Flux Measurement Methods to Inform In Situ Remediation Design and Remediation Endpoints.** *B.A. Green, C.H. Maldenar, J.D. Munn, S.L. Warner, A.E. Ashton, S.W. Murphy, B.L. Parker, S.W. Chapman, and L. Daubert.* Sean Murphy (Sanborn, Head & Associates, Inc./USA)	**PANEL DISCUSSION** **Investigating and Remediating a Major Chlorinated Solvent DNAPL Site** **Moderator** Bruce Thompson (de maximis, inc.) **Panelists** Bernard Kueper (Queens University) Michael Gefell (Anchor QEA) Gorm Heron (TRS Group) Julie Sueker (ARCADIS) Jeffrey Holden (GEI Consultants)	**STUDENT PAPER WINNER** **Anaerobic Biotransformation and Biodefluorination of Chlorine-Substituted Perfluorinated Carboxylic Acids.** *B. Jin, S. Che, and Y. Men.* Bosen Jin (University of California, Riverside/USA)
3:05	**New Integrated Biogeochemical/ Electrochemical Method for Remediation of Contaminated Groundwater.** *E. Elgressy, G. Elgressy, T. Lizer, and W. Moody.* Troy Lizer (Provectus Environmental Products, Inc./USA)	**Remediation of Chlorinated Ethenes Plume in Denmark by Retardation and Enhanced Biodegradation: Challenges and Lessons Learned.** *D. Harrekilde, L. Bennedsen, N. Tuxen, M.M. Broholm, C.B. Ottosen, A.S. Fjordboege, and G. Leonard.* Dorte Harrekilde (Ramboll/Denmark)	**Performance-Based Mass Discharge Assessment Program to Inform Remedy Transition and Site Closure.** *M.A. Harclerode, C.F. Silver, T.W. Macbeth, E.C. Ashley, and H. Brown.* Melissa Harclerode (CDM Smith Inc./ USA)		**Defluorination of Perfluorooctanoic Acid (PFOA), Perfluorooctanesulfonic Acid (PFOS), and Other Perfluoroalkyl Acids (PFAAs) by *Acidimicrobium* sp. strain A6.** *S. Huang, P.R. Jaffé, and T.A. Key.* Shan Huang (Princeton University/ USA)
3:30	**Using UV/AOP to Mineralize PCBs in Groundwater.** *J. Haney and D. Conley.* John Haney (Haley & Aldrich, Inc./ USA)	**Pilot Test for In Situ Aerobic Bioremediation of Complex Mixture of Contaminants at a NAPL-Impacted Site in Brazil.** *P. Barreto, J. Arthur, L. Trento, P. Rego, C. Mowder, E.E. Mack, P. Carvalho, and R. Silva.* Paola Barreto Quintero (Jacobs/USA)	**Improving Reactive Zone Performance by Combining Plume Dimension Analysis and Passive Flux Tool Studies.** *C. Lee and C. Sandefur.* Chris Lee (REGENESIS/USA)		**Aerobic Biotransformation and Biodefluorination of Fluorotelomer Carboxylic Acids (FTCAs) in Municipal Wastewater Treatment Sludge.** *C. Wu, Q. Wang, H. Chen, and M. Li.* Chen Wu (New Jersey Institute of Technology/USA)
3:55	**There's a Method to This Madness: Dynamic Groundwater Recirculation (DGR™).** *M.W. Killingstad, J. Roller, J. Wahlberg, and S.T. Potter.* Marc Killingstad (Arcadis/USA)	**Biorecirculation Best Practices: Lessons Learned from Design, Construction, and Operation of Two Large Temporary Systems.** *J.T. Bamer, M.R. Lamar, R. Subramanian, J.M. Trump, I. Tanaka, and A.F. Reed.* Jeff Bamer (CDM Smith Inc./USA)	**Remediation Modeling of Complex NAPL Sites Using Technology-Specific NAPL Dissolution Rates.** *L. Stewart, M. Widdowson, J. Chambon, R. Deeb, and M. Kavanaugh.* Lloyd Stewart (Praxis Environmental Technologies, Inc./USA)		**Successful Desktop and Field Bioremediation of Perfluoroalkyl Substances.** *T.S. Repas, L. Mankowski, and J. Adams.* Timothy Repas (Fixed Earth Innovations/Canada)

A1. Emerging Remediation Technologies

B1. In Situ Technologies: Lessons Learned

C1. Remedial Design/Optimization: Applications of Mass Flux and Mass Discharge

Panel Discussion

E2. PFAS and Bugs: The Search Continues

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Monday Platform Sessions—2:40–3:55 p.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
2:40	**PFAS Retention in a Weathered Petroleum LNAPL.** *C. Gurr, K. Molloy, Y. Fang, S. Fiorenza, and A. Kirkman.* Chris Gurr (CDM Smith Inc./USA)	**Preparing for Effective, Adaptive Risk Communication about PFAS in Drinking Water.** *S. Baryluk, M. Harclerode, H. Lanza, and J. Frangos.* Sarah Baryluk (CDM Smith Inc./USA)	**Update on Soil Processing and Subsampling for Incremental Sampling Methodology.** *M.L. Bruce, J.L. Clausen, and W.E. Corl.* Mark Bruce (Eurofins Environment Testing America/USA)	**In Situ and Ex Situ Biocell to Treat Perchlorate and Nitroaromatic Explosives in Soil and Groundwater.** *K.A. Morris and J. Mcginty.* Kevin Morris (ERM/USA)	**Groundwater Profiling with the GWP 1.75**
3:05	**Experimental and Modeling Investigations on Accumulation of PFAS at the Air and NAPL-Water Interface.** *M. Arshadi, S. Liao, C. Liu, K.D. Pennell, and L.M. Abriola.* Masoud Arshadi (Tufts University/USA)	**Nantucket Memorial Airport PFAS Risk Communication Case Study.** *N.J. Karberg, T.M. Rafter, and G.M. Nugent.* Georgie Nugent (McFarland-Johnson, Inc./USA)	**Multi-Source Conceptual Models: New 3-D Frontiers Supporting the Remediation Strategies of Contaminated Sites.** *P. Ciampi, C. Esposito, M. Petrangeli Papini, and G. Cassiani.* Paolo Ciampi (University of Rome "La Sapienza"/Italy)	**Treatment of Munitions Constituents Manufacturing Wastes Using a Membrane Bioreactor System.** *P.B. Hatzinger, P. Hedman, M. Fuller, C. Schaefer, T. Webster, and K.-H. Chu.* Paul Hatzinger (APTIM/USA)	
3:30	**How Can We Determine Site-Specific Soil Remedial Goals Which Are Realistic for PFAS?** *A. Lee, S. Corish, and G. Avakian.* Amanda Lee (Sage Environmental Services/Australia)	**Stakeholder Engagement with a Personal Approach: A Large-Scale Vapor Intrusion Assessment Success Story.** *S. Ramsden, S. Gaffin, E. Blodgett, and M. Sands.* Sara Ramsden (Barr Engineering Co./USA)	**Mobile Form Technology and Data Analytics Dashboards for Investigation and Remediation.** *C. Crozier.* Carrie Crozier (Parsons/USA)	**Biological Reduction of Perchlorate and Chlorate with a Slow-Release Substrate in Soils with High Concentration of Sulfate and Varying Characteristics.** *Y. Saedi, R. Britto, D. Grady, and J. Batista.* Yasaman Saedi (University of Nevada, Las Vegas/USA)	**Web Application-Based Digital Conceptual Site Models: The Future of Dynamic, Life Cycle CSMs**
3:55	**Critical Review of PFAS Fate and Transport: Finding Paths through the Fog of Uncertainty.** *M. Shayan and M. Harvey.* Mahsa Shayan (AECOM/USA)	**When Flying under the Radar Isn't an Option: Effective Stakeholder Engagement to Reduce Non-Technical Risks.** *C. Davis and J. Vaillancourt.* Christine Davis (ERM/USA)	**Incorporating 3-D Visualization of Hydrogeology and Environmental Data Greatly Enhances Communication of Complex Concepts.** *J. Youngerman, N. Cass-Hausler, and G. Christians.* Jean Youngerman (Brown and Caldwell/USA)	**Modeling the Reduction Rates of Munitions Constituents in the Subsurface.** *K.P. Hickey, D.M. Di Toro, P.C. Chiu, and R.F. Carbonaro.* Kevin Hickey (University of Delaware/USA)	

F1. PFAS Fate and Transport Properties

G2. Practice of Risk Communication and Stakeholder Engagement

H1. Improvements in Site Data Collection, Data Management, and Data Visualization

I1. Explosives, Perchlorate

Learning Lab

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Group 1 Posters

Display: Sunday 6:00 p.m.–Tuesday 1:00 p.m.
Presentations: Monday 4:30–6:30 p.m.

The following posters will be on display from Sunday evening through Tuesday afternoon in the Exhibit Hall. During the Presentations/Reception period Monday evening, presenters will be at their displays to discuss their work. The poster board number assigned to each presentation appears below.

A1. Emerging Remediation Technologies

A2. Abiotic and In Situ Biogeochemical Processes: Applications and Lessons Learned

A3. ZVI: 25 Years of Groundwater Remediation Applications

A4. Combined Remedies and Treatment Trains

B1. In Situ Technologies: Lessons Learned

B2. Thermal Conductive Heating: Best Practices and Lessons Learned

B3. Thermal Conductive Heating: Case Studies

B4. In Situ Chemical Oxidation: Optimized Design Approaches and Lessons Learned

B5. Injectable Activated Carbon Amendments: Lessons Learned and Best Practices

B6. Innovations in ZVI Amendment Formulations and Applications

C1. Remedial Design/Optimization: Applications of Mass Flux and Mass Discharge

C2. Remedy Implementation: Assessing Performance and Costs

C3. In Situ Activated Carbon-Based Amendments: Assessing Effectiveness and Performance

C4. Compound-Specific Isotope Analysis: Case Studies in Evaluating Remedy Performance

C5. Site Closure: Models Used to Estimate Cleanup Timeframes

C6. Data Analytics: Use of Advanced Decision Analysis Tools, Including AI and Machine Learning for Improved Analysis, Optimization and Decision Making

C7. Optimizing Remedial Systems

D1. Large, Dilute and Commingled Plume Case Studies

D2. Landfill Assessment and Remediation

D3. Adaptive Site Management: Lessons Learned for Site Characterization and Remedy Implementation

D4. Evaluating Surface Water/Groundwater Interactions: Innovative Monitoring Approaches and Modeling Applications

D5. DNAPL Source Zone Remediation: Lessons Learned

D6. Low-Permeability Zone Challenges, Permeability Enhancements, and Case Studies

E1. Advances in the Analysis of Non-Target Per- and Polyfluorinated Alkyl Substances (PFAS)

E2. PFAS and Bugs: The Search Continues

E3. Ex Situ PFAS Treatment: Soils/Solids and Other Waste Streams

E4. PFAS Human Health and Ecological Risk Assessment and Toxicity

E5. Managing PFAS at Publically-Owned Treatment Works (POTWs)

E6. Ex Situ PFAS Water Treatment Technologies

F1. PFAS Fate and Transport Properties

F2. PFAS Conceptual Site Model Approaches

F3. PFAS Program Management in a Rapidly Changing Regulatory Environment

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2. Treatment of Organic and Inorganic Contaminants in Groundwater from a Former Landfill Using a Novel Sustainable Electrocoagulation Process.
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5. Groundwater Flow and Transport Modeling: A Sustainable Hydraulic Source Isolation System.
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7. CAT 100: In Situ Chemical Reduction without Depletion of Metallic Iron.
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8. On the Role of Microbial Chain Elongation Substrates and End Products in Promoting Reductive Dechlorination of Chlorinated Solvents.
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9. Chlorinated Hydrocarbon Diffusion through Poly(vinyl alcohol) Hydrogels.
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10. Integrating Multi-Technology Surfactant-Enhanced Bioremediation and Oxidation Approaches for Petroleum Hydrocarbon Remediation.
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15. Laboratory and Field Validation of Min-Traps for Collection and Analysis of Reactive Iron Sulfide Minerals for Abiotic CVOC Degradation.
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21. Can Less Remediation Be More Effective? Combining Targeted Soil Excavation with Passively Dispersed Reductive Amendment in a Source Area over Fractured Bedrock.
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25. Sulfidated ZVI: The Latest Development of ISCR from Laboratory to Field.
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26. Evaluation of the Seven-Year Operation of a Funnel and ZVI Gate System for Containment of VOCs and Chromium(VI) Contamination.
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29. Application of the Novel Sulfidated Iron Nanoparticles (S-nZVI) on a Site Heavily Polluted by Trichloroethene (TCE).
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30. Fundamental Advances in Environmental Science and Engineering from over 25 Years of Research on ZVI and PRBs.
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31. When Failure Is Not an Option: Bench-Scale Study and Targeted Activated Carbon-Based Injection Program Leads to Repair of an Aging ZVI PRB.
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34. Combined Remediation of VOCs, 1,4-Dioxane, and Cr(VI) Using ISCO followed by ERD.
W. Bee, J. Neuhaus, C. Lenker, and V. Ramalingam.
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35. Combined Remedies Evaluation to Treat Residual Contamination at a Former MGP Site.
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36. Microbial Population Changes following Thermal and Enhanced In Situ Bioremediation Treatment Train.
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37. Injectable Activated Carbon Permeable Reactive Barrier to Address Mass Flux from TCE Source Area beneath Buildings.
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M. Wade, K. Dyson, J. LeClair, and J. Spadt.
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45. Use of Remediation Train and Dynamic CSM to Remediate an Area Impacted by Solvents and Oils.
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53. Bioremediation and Redevelopment Combined to Cleanup Large Contaminated Plume.
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54. TCE Treatment in Shallow Groundwater by Sequencing SVE, Chemical Oxidation and Enhanced Reductive Dechlorination.
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62. Large-Scale Bioremediation via Biobarrier and Recirculation Systems for a TCE-Contaminated Site near Sao Paulo, Brazil.
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80. In Situ Thermal Desorption: Case Study for Soil Polluted by a Cocktail of Contaminants.
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84. ISCO Injection Approach in Shallow, Low Permeability Soils with Subsurface Utilities: Optimizing Oxidant Efficiency Using Dynamic Implementation Strategy.
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85. Advantages of Multiple Interval Oxidant Injection for Remediation of TCE.
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86. Carbohydrate (CH) Activation of Persulfate: Evaluation of Safe Application Mix Ratios.
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89. Remedial Safety in In Situ Chemical Oxidation: Crucial to Success.
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91. Large-Scale Plume, Nano-Scale Solution: Remediation of CVOC Using Sodium Persulfate and Ozone Nanobubbles. *G.N. Garcia, A.R. Cervelin, F.A. Campello, G. Van den Daele, G.D.C. de Mello, S.S. Steiner, and M. Bárbara.*
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95. Dynamic Interactions between Sorption and Biodegradation: Implications for Long-Term Performance of Activated Carbon-Based Technology for In Situ Groundwater Remediation of Chlorinated Solvents.
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97. Application in Italy of EHC Plus Technology: Rapid Contaminant Reduction and Accelerated Bioremediation Using an Injectable Reagent Containing Activated Carbon.
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98. Groundwater Remediation Using In Situ Carbon Amendments: Analytical Challenges and Solutions.
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99. Challenge Posed by High TCE and TDS Groundwater Plume Treatment.
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105. Best Practices for the Design and Dosing of Permeable Reactive Barriers Incorporating Sulfidated Zero Valent Iron.
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106. Evaluation of ZVI and Ferric Sulfate for Arsenic Remediation Supports Design of a Permeable Reactive Barrier (PRB).
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107. Use of Zero Valent Iron for Removal of Hexachlorocyclohexanes from Dump Leachate: From Laboratory Test to Large-Scale Prototype.
J. Nemecek, J. Zeman, F. Eichler, P. Hrabak, and M. Cernik.
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108. In Situ Chemical Reduction (ISCR) for Remediation of Groundwater Impacted by Chlorinated Solvents Using ZVI and Antimethanogenic Amendments (Brazil Site).
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R.B. Shah, J.D. Liebig, and F. Lakhwala.
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D.T. Ramos, B. Brandizzi, C. Nogueira, S. Julia, M. Brito, and C. Mowder.
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112. An ISCR Reagent and Its Application in Remediation of Vinyl Chloride-Contaminated Groundwater.
S. Zhang and C. Wang.
Sailor Zhang (Shanghai Greenment Environmental Technology Co., Ltd./China)

C1. Remedial Design/Optimization: Applications of Mass Flux and Mass Discharge

113. Sequence Stratigraphy and Mass-Flux Evaluation to Estimate Risk to a Public Drinking Water Source.
C. Canfield, J. Weidmann, C. Turner, and C. Payne.
Colleen Canfield (Haley & Aldrich, Inc./USA)

114. Mass Discharge and Cleanup Timeframe Estimates at Complex DNAPL Sites Using Upscaled Modeling of DNAPL Dissolution.
L. Stewart, M. Widdowson, J. Chambon, R. Deeb, M. Kavanaugh, and J. Nyman.
Julie Chambon (Geosyntec Consultants/USA)

115. Coupling ESS and Numerical Models to Maximize Mass Flux Reduction and Certainty of Performance.
G. Kenoyer, R. Cramer, C. Plank, J. Hesemann, and C. Chang.
Galen Kenoyer (Burns & McDonnell/USA)

116. Understanding Mass Flux: From MPE System to MNA.
R. Klinger, J. Foster, W. Pence, M. Annable, J. Langenbach, A. Brey, and A. Ramsey.
Rachel Klinger (Geosyntec Consultants/USA)

117. Upfront Design Verification Testing and Predictive Modeling Used for Achieving Remediation Goals.
C. Lee and D. Nunez.
Chris Lee (REGENESIS/USA)

118. Assessing Remedial Success Using Contaminant Mass Flux: A Comparison of Two Approaches.
R. Meinke and K. Schnell.
Robert Meinke (ERM/Germany)

119. Use of Mass Flux to Guide Decision Making in Plume Management.
C.J. Mulry and F. Will.
Christopher Mulry (Groundwater & Environmental Services, Inc./USA)

120. Enhanced Monitored Natural Attenuation to Reduce Contaminant Flux to a Tidal Estuary.
J. Nemesh.
Joseph Nemesh (Tetra Tech, Inc./USA)

121. Evaluation of Benzene Mass Discharge Using the Transect Method to Support Remediation System Shutdowns.
S. Stromberg and K. Waldron.
Michael Purchase (Orion Environmental, Inc./USA)

122. Dynamic Remedy Operation to Address Evolving Mass Flux Patterns.
J.W. Roller, S.T. Potter, F. Lenzo, and D. Scillieri.
Jonathan Roller (Arcadis/USA)

C2. Remedy Implementation: Assessing Performance and Costs

123. Remedial System Operation and Maintenance Is Not Cruise Control.
B. Caldwell, A. Stark, R. McCarthy, and G. Hicks.
Brian Caldwell (Ensafe, Inc./USA)

124. A Comparison of In Situ Bioremediation Substrates (HFCS and EVO) for Use in a Heterogeneous Aquifer.
P.R. Hsieh and A. Cerruti.
Patrick Hsieh (Dalton Olmsted & Fuglevand/USA)

125. Evaluation of Pump-and-Treat System with Horizontal Wells on Surface Water Quality.
G. Lilbaek, A. Christensen, K. Weber, N. Larsson, U. Winnberg, and K. Forsberg.
Gro Lilbæk (NIRAS A/S/Denmark)

126. Quantitative Assessment of Sustained Treatment following In Situ Bioremediation at Chlorinated Solvent Sites.
T.M. McGuire, D.T. Adamson, and K.L. Walker Jr., and M. Rysz.
Travis McGuire (GSI Environmental Inc./USA)

127. The Effects of Source Removal and Secondary Source Area Treatment on Project Cost and Life Span.
E. Meyers, N. Scroggins, and L. Davies.
Ed Meyers (HSW Consulting/USA)

128. Evaluation of In Situ Chemical Reduction as a Treatment Remedy for Recalcitrant Nitro-Aromatic Compounds.
C. Montero, C. Macon, and B. Lundy.
Charles Montero (Wood/USA)

C3. In Situ Activated Carbon-Based Amendments: Assessing Effectiveness and Performance

129. Addressing Key Issues in the Treatability Testing, Numerical Modeling, and Application of Activated Carbon Remedies for Sediment Remediation.
M.A. Ajemigibitse, J. Collins, and J. Hull.
Moses Ajemigbitse (AquaBlok, Ltd./USA)

130. In Situ Remediation of DNAPL Source and Plume at an Active Industrial Facility with Innovative Enhanced Reductive Dichlorination Technology.
G.G. Ceriani.
Duane Guilfoil (AST Environmental, Inc./USA)

131. Overcoming and Quickly Closing Non-Performing Sites with an Innovative, Micron-Scale Activated Carbon and Soluble Electron Acceptors.
T. Herrington and P. Erickson.
Todd Herrington (REGENESIS/USA)

132. Does Activated Carbon Enhance Biodegradation Rates of Petroleum Hydrocarbons in Anaerobic Systems?
B.C. McLaren, A.E. Schneider, A. Marrocco, N.R. Thomson, L.A. Hug, R. Aravena, E.A. Edwards, C.R.A. Toth, S. Dworatzek, and J. Webb.
Bill McLaren (University of Waterloo/Canada)

133. The Overlooked and Revealed: Evidence for Microbial Biodegradation on Activated Carbon.
A.D. Peacock and E.J. Winner.
Aaron Peacock (Microbac Laboratories, Inc./USA)

134. Towards a Better Understanding of Activated Carbon-Based Amendments for In Situ Treatment of Petroleum Hydrocarbons in Anaerobic Groundwater Systems.
A.L. Marrocco, B.C. McLaren, A.E. Schneider, N.R. Thomson, L.A. Hug, R. Aravena, E.A. Edwards, and C. Toth.
Adam E. Schneider (University of Waterloo/Canada)

135. Persistence Saves the Day: Robust Characterization and Injection Techniques Lead to Successful Activated Carbon-Based PRB for Petroleum Hydrocarbons.
B. Tunnicliffe and M. Mazzarese.
Bruce Tunnicliffe (Vertex Environmental, Inc./Canada)

C4. Compound-Specific Isotope Analysis: Case Studies in Evaluating Remedy Performance

136. The Integrated Approach of Biological Molecular Tools (BMTs) and Compound-Specific Isotope Analysis (CSIA) for the Remediation of Eni's Sites.
I. Pietrini, G. Carpani, M. Baric, L. Poppa, F. Villani, G. Bonfedi, M. Marchesi, and L. Alberti.
Ilaria Pietrini (Eni S.p.A./Italy)

137. How Carbon and Chlorine Isotopes Combine Forces to Elucidate a Natural Attenuation Investigation.
N. Durant, H.V. Rectanus, D. Fan, P.M. Stang, E. Rosen, and M. Pound.
Heather Rectanus (Geosyntec Consultants/USA)

138. Compound-Specific Isotope Analysis Data Visualization Methods.
S. Rosolina and D. Taggart.
Sam Rosolina (Microbial Insights, Inc./USA)

139. Assessment of Anaerobic Biodegradation of bis(2-chloroethyl) Ether in Groundwater Using Carbon and Chlorine Compound-Specific Isotope Analysis.
D.C. Segal, T. Kuder, and R. Kolhatkar.
Daniel Segal (Chevron/USA)

C5. Site Closure: Models Used to Estimate Cleanup Timeframes

140. Modeling the Variability in Remedy Complete Attainment Due to Variable Groundwater Conditions.
M.L. Alexander.
Matthew Alexander (Leidos/USA)

141. A Simple Method to Estimate Groundwater Cleanup Time with Back Diffusion.
R.C. Borden and K.Y. Cha.
Robert Borden (EOS Remediation/USA)

142. Modeling Evaluation and Uncertainty Analysis of Remediation Timeframe at a Former Uranium Mill Site Using an Iterative Ensemble Smoother.
R.D. Kent, R.H. Johnson, A. Laase, and J. Nyman.
Ronald Kent (RSI EnTech, LLC/USA)

143. Quantifying the Certainty of Remedial Success: Rethinking the Predictive Modeling Paradigm.
P. Khambhammettu, M. Killingstad, M. Kladias, and S. Potter.
Prashanth Khambhammettu (Arcadis/USA)

144. Accelerating the Path to Site Closure Using a Three-Dimensional Visualization Tool and Two-Dimensional Spreadsheet Model to Revise the Conceptual Site Model and Predict Extent of Groundwater Impacts.
M.G. Sweetenham and A. Riffel.
Fritz Krembs (Trihydro Corporation/USA)

145. Technology Transitions and Site Closure: Use of Multiple Free Software Tools for Multiple Lines of Evidence Approach.
K.L. Walker and T.M. McGuire.
Kenneth Walker (GSI Environmental Inc./USA)

C6. Data Analytics: Use of Advanced Decision Analysis Tools, Including AI and Machine Learning for Improved Analysis, Optimization and Decision Making

146. California Gold (Standard): Use of the GeoTracker Database for Project Management, Public Right to Know, and Contaminated Site Research.
L. Beckley, S. McMasters, M. Cohen, S. Rauch, and T. McHugh.
Lila Beckley (GSI Environmental Inc./USA)

147. Machine Learning for Portfolio Management.
J. Dalton, A. Harrington, and R. Velazquez.
Jason Dalton (Daybreak/USA)

148. Can Artificial Intelligence Lead to Better Portfolio Management?
J.R. Eller, B. Roberts, and J. Srivastava.
Jonathan Eller (GHD/USA)

149. An Artificial Intelligence and Machine Learning (AI/ML) Approach to Mine Documents, toward Faster and More Predictable Site Closures.
J.R. Eller and J. Srivastava.
Jonathan Eller (GHD/USA)

150. Application of Machine Learning in the Site Characterization of a U.S. EPA Superfund Site, the Jadco-Hughes Facility.
A. Harrington and J. Dalton.
Anna Harrington (Daybreak/USA)

151. Remediation Liability Allocation Using Monte Carlo, Risk Magnitude, and GIS.
T.M. McGuire, C.J. Newell, and K.L. Walker, Jr.
Travis McGuire (GSI Environmental Inc./USA)

152. Development of Screening-Level Vapor Intrusion Models Using Statistical and Machine Learning Algorithms.
H. Singh, R. Leatherbury, and M. Kleiner.
Harvinder Singh (Weston Solutions, Inc./USA)

153. Biogeochemical Characterization Optimization through Application of Machine-Learning Algorithms and Molecular Biological Tools.
S.J. Sorsby, A. Madison, D. Taggart, K. Clark, R.E. Beckham, and T. Key.
Skyler Sorsby (WSP/USA)

154. OPytimization: A Python Library to Perform Spatio-Temporal Optimization in Long-Term Monitoring Sites.
A.F. Pessoa and V.A. Malagutti.
Victor Vanin Sewaybricker (EBP Brasil/Brazil)

155. Data Science: A New Approach for the Use of High-Resolution Tools.
A.F. Pessoa and V.V. Sewaybricker.
Victor Vanin Sewaybricker (EBP Brasil/Brazil)

C7. Optimizing Remedial Systems

156. Numerical Simulations for Optimizing an In Situ Injection Remedial Design.
M. Beck, J.W. Schuetz, G. Ulrich, and P. Feshbach-Meriney.
Melanie Beck (Parsons/USA)

157. Stratigraphic Sequencing and Refinement of the Conceptual Site Model to Optimize an Existing Pump-and-Treat System.
E.B. Dieck, B. Bond, and R. Lees.
Eric Dieck (Langan/USA)

158. Optimizing Injection-Based Remediation in Bedrock: Lessons from DNAPL Remediation by Chemical Oxidation.
P.M. Dombrowski, P. Kakarla, and M. Temple.
Paul Dombrowski (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)

159. Pilot Test as a Way to Introduce New Technologies in Sweden.
P. Johansson.
Per Johansson (WSP Golder/Sweden)

160. Biological Treatment of a Complex Chemical Mixture: Results from Ex Situ Biological Pilot Study for 1,4-Dioxane, BCEE, BCEM, 1,2,3-TCP, DCA, and 2-Chloroethanol.
M. Klemmer, A. Harmon, J. Forbort, R.J. Stuetzle, and R. Wenzel.
Mark Klemmer (Arcadis/Australia)

161. Optimizing Enhanced In Situ Biodegradation of Low Levels of Chlorinated Ethenes in Complex Hydrogeology.
L. LaPat-Polasko and J. Donovan.
Laurie LaPat-Polasko (Matrix New World Engineering/USA)

162. Lessons Learned from an Accelerated Groundwater Source Reduction Program for Cr(VI) and TCE via a Liability Transfer Program at a Superfund Site.
N.M. Rabah, B.J. Lazar, and Y. Kunukcu.
Brendan Lazar (TRC Companies, Inc./USA)

163. Taking the Guesswork out of Dynamic Remedy Design: Leveraging Transient Mass Flux for Enhanced Performance.
S.T. Potter, A. Horneman, M.P. Plenge, C. Riis, J. Wahlberg, and M. Killingstad.
Scott Potter (Arcadis/USA)

164. Innovative SVE Design to Allow Optimum Operation to Remediate PCE in Heterogeneous Soil Lithologies.
B. Tabatabai. J.T. Raumin, J.M. Perry, and H. Amini.
Jeffrey Raumin (GSI Environmental Inc./USA)

165. Optimization of Hydraulic Plume Control and Mass Flux under Highly Variable Groundwater Flow Conditions Using MODALL.
J.W. Roller, S.T. Potter, M. Schnobrich, C. Elmendorf, E. Moosbrugger, and J. Cosgrove.
Jonathan Roller (Arcadis/USA)

166. The Salt Life: Reductive Dechlorination of Chlorinated Ethenes and Ethanes in Saline Groundwater.
C.J. Voci and J.D. Roberts.
Christopher Voci (Terraphase Engineering/USA)

D1. Large, Dilute and Commingled Plume Case Studies

167. El Nino/Southern Oscillation-Induced Precipitation Events Causing Groundwater Elevation and Trichlorethylene Spikes at a Superfund Site.
J. Bartos and D. Gallagher.
John M. Bartos (Virginia Tech/USA)

168. Treatment of a Large, Dilute Plume Using Permeable Reactive Barriers in Low pH Aquifer.
P.M. Dombrowski, P. Kakarla, M. Temple, T. Musser, and D. Guilfoil.
Paul Dombrowski (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)

169. Past, Present and Future Predictions: Understanding the Behavior of Contamination at a Complex Former Manufactured Gas Plant.
S.C. Faber, D.C. Aydin, J. Gerritse, and J.A. van Leeuwen.
Suzanne Faber (Utrecht University/Netherlands)

170. Adaptive Strategies for In Situ Remediation of a Large Chlorinated Hydrocarbon Plume via ERD: A Railyard Case Study.
L. Thomas, J. Coughlin, and D. Gabardi.
Dawn Gabardi (Arcadis/USA)

171. Less Bucks for Your Bang: Gauging Network Optimization for Improved Hydraulic Management of Large-Scale Plumes.
M.W. Killingstad, J. Wang, J. Roberts, and J. Fourie.
Marc Killingstad (Arcadis/USA)

172. Environmental Site Investigation and Combined Remediation Strategy for a Complex CVOC Site Neighboring Sensitive Receptors in Brazil.
G. Van den Daele, J.R. Cury, M.H. Roldan, G. de Mello, G.N. Garcia, A.R. Cervelin, and F.A. Campello.
Matheus Roldan (Ramboll Brasil/Brazil)

173. A Unique Application of Dynamic Groundwater Recirculation (DGR™) in a Highly Transmissive Aquifer.
P. Barnett, J. Ferry, E. Fortner, C. Grogan, J. Roller, and M. Schnobrich.
Matthew Schnobrich (Arcadis/USA)

174. Sweet Success: Remediation of a Large TCE Groundwater Plume within a Major Aquifer in Southeast Texas.
J.M. Skaggs.
Jonathan Skaggs (GSI Environmental Inc./USA)

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175. Innovative Pneumatic Modeling Approach for Designing Cost-Effective Landfill Gas Mitigation Systems.
M. Ambrusch, A. Boodram, A. Quinn, S. Abrams, J. Ludlow, and J. Stevens.
Matthew Ambrusch (Langan/USA)

176. Hybrid Landfill Gas Mitigation System Implementation.
A. Boodram, S. Abrams, I. Khan, M. Wenrick, and M. Spievack.
Aroona Boodram (Langan/USA)

177. Pasco Sanitary Landfill NPL Site: Regulatory Overview, Design, and Implementation of the Zone A Drum Removal Action.
M.A. Fleri and J. Massingale.
Mark Fleri (ENTACT/USA)

178. Learnings and Design Considerations from the Application of an Artificial Turf Capping Solution atop Low-Strength Solid Waste Basins.
G. Foust, R.J. Stuetzle, D. Belote, J. Richardson, and A. Ferrari.
Matt Germon (Jacobs/USA)

179. Comparison of Geochemical and Arsenic Speciation Conditions to Evaluate Potential Landfill Impacts to Groundwater.
D. Gray, M. Chambless, D. Musfeldt, and D. Belote.
Doug Gray (AECOM/USA)

180. Using a 3-D Visualization-Centered Approach to Accelerate a Landfill Site Remediation.
J. Jackson.
Jonah Jackson (Environmental Standards, Inc./USA)

181. Liquid Hazardous Waste in Historical Municipal Solid Waste Landfills: Investigation, Characterization, and Remediation.
S. Reinis, H. Farr, and J.F. Ludlow.
Sigrida Reinis (Langan/USA)

182. Landfill Remediation and Redevelopment: A Status Review of the Current Practice and Technology Advancements.
O. Uppal, P. Bennett, J.W. Little, D. Costantini, C. Tsiatsios, and S.P. Zachary.
Omer Uppal (Haley & Aldrich, Inc./USA)

183. Pile Foundation Options for Development over Landfill Sites and Their Environmental Impacts.
J.Y. Uppal and O. Uppal.
Omer Uppal (Haley & Aldrich, Inc./USA)

184. In Situ Treatment of Landfill to Remove 200,000 Pounds of Contaminants in Less Than One Year.
C. Winell, J. Chen, and R. D'Anjou.
Carol Winell (GEO/USA)

D3. Adaptive Site Management: Lessons Learned for Site Characterization and Remedy Implementation

185. Deep Soil Remediation of TSCA-Regulated PCBs.
S. Baryluk, K. Young, C. Silver, and M. Martin.
Sarah Baryluk (CDM Smith Inc./USA)

186. A Case Study in Adaptive Management: In Situ Thermal Treatment at the Velsicol Superfund Site.
J. Cole, S. Pratt, J. Eluskie, D. Ewing, and T. Alcamo.
Jason Cole (Jacobs/USA)

187. Case Study: Using Adaptive Management to Balance Changes in the CSM, Applicable Regulations, and Newly Identified Stakeholders.
S. Cwick.
Shaun Cwick (Weston Solutions, Inc./USA)

188. Use of Pilot Data and Adaptive Project Management to Design and Implement a Large, Full-Scale EISB/ISCR Remedy.
M.R. Harkness, P. Freyer, L. Reusser, D. Carnevale, P. Hare, and L. Scheuing.
Mark Harkness (Ramboll/USA)

189. In Situ Bioremediation of Elevated Levels of Chlorinated Ethenes in Complex Hydrogeologic Conditions.
L. LaPat-Polasko, A. Polasko-Todd, M. Hayes, and P. Lamont.
Laurie LaPat-Polasko (Matrix New World Engineering/USA)

190. Air Sparge Pilot Study in the DNAPL Source Zone at Launch Complex 34, Cape Canaveral Space Force Station, Florida.
D. Johansen, M. Deliz, M. Jonnet, J. Lloyd, and M. Speranza.
James Lloyd (Tetra Tech, Inc./USA)

191. Adaptive Site Management: Lessons Learned, ERH Characterization and Implementation.
M. Palmer and L. Stauch.
Mike Palmer (de maximis, inc./USA)

192. Filling in the Data Gaps at Complex Sites before Focused Remediation: Three Case Studies.
J. Sankey.
John Sankey (True Blue Technologies, Inc./USA)

193. Lessons Learned following Wildland Fire Site Characterization and Time Critical Removal Action.
D. Croteau and K. Sherrard.
Kelsey Sherrard (Terraphase Engineering/USA)

194. Adaptive Site Management to Demonstrate Remedial Success of Chlorinated Ethenes in Groundwater at a New Jersey Site.
T. Silverman, L. Seus, L. LaPat-Polasko, and R. Britton.
Laurel Seus (EHS Support/USA)

195. Demonstrating Adaptive Site Management through Combined Treatment Technologies and Expediting Site Closure with Innovative Strategies.
K.L. Smail and J. Sheldon.
Kirby Smail (Antea Group/USA)

196. The Use of Adaptive Management and High-Resolution Site Characterization to Optimize the Remedial Design at a Superfund Site.
R.A. Wymore, N. Smith, T. Macbeth, and M. Smith.
Thomas Cook (CDM Smith, Inc./USA)

D4. Evaluating Surface Water/Groundwater Interactions: Innovative Monitoring Approaches and Modeling Applications

197. Evaluation of Mass Discharge to Surface Water in a Tidally-Influenced Aquifer by Passive Flux Meters.
H.A. Brown, R. Sillan, and M. Harclerode.
Holly Brown (AECOM/USA)

198. 3-D Model of Surface Water as a Guiding Tool for Environmental Monitoring.
T.F. Noccetti, D.D. Savio, and V.S. Ambrogi.
Rodrigo Coelho (EBP Brasil/Brazil)

199. Efficient Monitoring of COC Degradation and Infiltration with 2-D Fluorescence and of LNAPL Migration with 3-D Fluorescence and Passive Samplers.
T.M. Hurd and M.H. Otz.
Todd Hurd (TMH Tracing/USA)

200. Can Quantifying and Visualizing Canal/Groundwater Interactions at an LNAPL-Impacted Site Lead to a Better Remedy? Yes!
P. Khambhammettu, J. Wang, S.W. Niekamp, L.A. Eastes, and V.S. Maresco.
Prashanth Khambhammettu (Arcadis/USA)

201. Evaluation of Modeled Infiltration from Retention Ponds to Affect an Air Sparge/Soil Vapor Extraction Remediation System.
K.I. Pasternak and J.H. Coll.
Kevin Pasternak (Atlas Technical/USA)

202. Assessing Groundwater-Surface Water Interactions using a Variety of High Resolution Tools and Traditional Methods. *C.G. Patterson, A. Gavaskar, S.A. Lee, A. Danko, L.F. Lefkovitz, E.M. Kaltenberg, J. Sminchak, and A. Jackson.*
Chris Patterson (U.S. Navy/USA)

203. Using Stream Geochemistry to Determine Groundwater/Surface Water Interactions at a Former Uranium/Vanadium Mill Site.
A.R. Reynolds.
Allison Reynolds (RSI EnTech/USA)

204. Discharge of Impacted Groundwater to Surface Water: Monitoring and Modeling Methods to Evaluate Risk to Ecological Receptors.
J. Robb.
Joseph Robb (ERM/USA)

205. Development of a Groundwater Flow and Transport Model to Estimate Solute Loading in the nearby Gaining Stream.
A. Singhal and C. Stubbs.
Chris Stubbs (Ramboll/USA)

D5. DNAPL Source Zone Remediation: Lessons Learned

206. Field-Scale Demonstration of Enhanced DNAPL Dissolution during Bioremediation.
A.D. Fure.
Adrian Fure (Haley & Aldrich, Inc./USA)

207. In Situ Bioremediation Remediates Grossly Impacted Site.
E. Gustafson.
Erik Gustafson (WSP Golder/USA)

208. Phased Biostimulation/Bioaugmentation of a TCE DNAPL Source Area in Fractured Bedrock with Karst Features.
K.A. Morris, P. Beyer, and J. Fiacco.
Kevin Morris (ERM/USA)

209. Decade-Long Monitoring of Enhanced Dechlorination of TCE Present in Groundwater and MGP Waste DNAPL.
C. Savoie, E. Bakkom, P. Wiescher, and M. Murray.
Courtney Savoie (Maul Foster & Alongi, Inc./USA)

210. Complete Dechlorination of Chlorinated Ethenes and Chloroform in a Brackish Environment.
M. Slooijer, M. De Camillis, and J. Dijk.
Martin Slooijer (GreenSoil Group/Belgium)

211. Full-Scale DNAPL Source Zone Remediation with In Situ Bioremediation.
A.G.B. Williams, A. Testoff, and K. Kessler.
Aaron Williams (Montrose Environmental/USA)

D6. Low-Permeability Zone Challenges, Permeability Enhancements, and Case Studies

212. Combining In Situ Chemical Reduction and Big Diameter Vertical Soil Drill as an Alternative Solution for Thermal on a Complex Site Impacted by Chlorinated Solvents (Sao Paulo, Brazil).
S. Aluani, C. Spilborghs, E. Pujol, F. Tomiatti, N. Nascimento, G. Siqueira, and J. Mueller.
Sidney Aluani (SGW Services/Brazil)

213. What Are the Benefits of Steam-Enhanced Extraction in Low Permeability and Fractured Bedrock Settings?
J. Baldock and J. Dinham.
James Baldock (ERM/United Kingdom)

214. Ex Situ Treatment of 345,000 Tonnes of Clay Soil Impacted with CVOCs Using a Novel Treatment Strategy.
M. Cadotte and J. Paquin.
Myriam Cadotte (Sanexen Services Environnementaux/Canada)

215. Lacustrine Soil Fracturing for Soil Vapor Extraction Pilot Testing to Enhance Permeability and Mass Reduction of Trichloroethene-Impacted Soils.
S.F. Calkin, J. Besse, D. Groher, D. Baird, and D. Knight.
Scott Calkin (Wood/USA)

216. Reducing Time of Remediation in Clay and Fractured Rock Sites (Part 1): Fracturing Eyes Wide Open in Low Permeability Conditions.
G. Guest and L. Kessel.
Lowell Kessel (C.E.R.E.S. Corporation/USA)

217. Reducing Time of Remediation in Clay and Fractured Rock Sites (Part 2): Marrying Permeability Enhancement with Bio-Geo-Chem Reagent Resiliency.
L. Kessel and G. Guest.
Lowell Kessel (C.E.R.E.S. Corporation/USA)

218. Pneumatic Fracturing and Proppant Injection to Facilitate Air Sparge-Soil Vapor Extraction of Chlorinated Ethenes in Low Permeability Geology.
E. Moskal, M. Gerber, L. Novello Favero, and G. Jirak.
Eric Moskal (Cascade Environmental/USA)

219. Conventional Bioremediation and In Situ Chemical Oxidation Pilot Tests in an Unconventional Setting.
J.D. Spalding, R. Daprato, M. Burcham, T.N. Creamer, and P. Chang.
James D. Spalding (U.S. Navy/USA)

E1. Advances in the Analysis of Non-Target Per- and Polyfluorinated Alkyl Substances (PFAS)

220. PFAS Data Validation: A Technical Perspective.
S. Wilson, S. Denzer, and S. Cuenco.
Stella Cuenco (LDC, Inc./USA)

221. Analysis of Spent Carbon Media from Ex Situ PFAS Treatment Systems in Support of Disposal Decisions: Analytical Challenges and Solutions.
H.L. Lord.
Heather Lord (Bureau Veritas/Canada)

222. A Holding Time Evaluation of the Stability of "Forever Chemicals" in Wastewater.
C.J. Neslund.
Charles Neslund (Eurofins Environment Testing America/USA)

223. The Analysis for PFAS: An Evaluation of Current Methods, Proposed Methodologies and the Application of New Technologies.
C.J. Neslund.
Charles Neslund (Eurofins Environment Testing America/USA)

224. PFAS, Total Organic Precursors (TOPs) and Total Organic Fluorine (TOF): When to Use One over the Other?
T. Obal.
Terry Obal (Bureau Veritas/Canada)

225. Target and Suspect Screening of Per- and Polyfluorinated Alkyl Substances (PFAS) in Municipal Wastewater Samples by Nano-ESI-HRMS.
C. Wu, Q. Wang, H. Chen, and M. Li.
Chen Wu (New Jersey Institute of Technology/USA)

E2. PFAS and Bugs: The Search Continues

226. Metagenomic Shotgun Sequencing and Microbiology of PFAS-Laden Surface Water Foams.
B.J. Harding, J. Buzzell, M. Jury, L. Bergstrand, and D. Saghattchi.
Barry Harding (AECOM/USA)

227. Presence of Solid Phase Can Prevent Inhibition of *Dehalococcoides mccartyi* by Terminal PFAS.
J.P. Hnatko, J.L. Elsey, C. Liu, L.M. Abriola, K.D. Pennell, J.D. Fortner, and N.L. Cápiro.
Jason Hnatko (ERM/USA)

228. Biodegradation of PFOS with a Dehalogenating Culture in Site Soil, with and without Chlorinated Solvent Co-Contaminants.
M.M. Lorah, K. He, L. Blaney, D.M. Akob, and B.P. Shedd.
Michelle Lorah (U.S. Geological Survey/USA)

229. Bioremediation of Per- and Polyfluoroalkyl Substances (PFAS): Is It Feasible?
J.D. Roberts, S.D. Dworatzek, J. Webb, P. Dennis, and Y. Men.
Yujie Men (University of California, Riverside/USA)

230. Biotransformation of Fluoroalkane Sulfonates by *Pseudomonas* sp. strain 273.
D. Ramirez, Y. Xie, and F.E. Loeffler.
Diana Ramirez (University of Tennessee/USA)

231. High-Throughput Screening of Enzymes for PFAS Biodegradation.
D. Saran, K. Sorenson, and M. Shepherd.
Dayal Saran (Allonnia/USA)

232. Microbial Defluorination of Unsaturated Per- and Polyfluorinated Carboxylic Acids under Anaerobic and Aerobic Conditions: A Structure Specificity Study.
Y. Yu, S. Che, C. Ren, B. Jin, Z. Tian, S. Dworatzek, J. Webb, J. Roberts, J. Liu, and Y. Men.
Yaochun Yu (University of Illinois at Urbana-Champaign/USA)

E3. Ex Situ PFAS Treatment: Soils/Solids and Other Waste Streams

233. A Comprehensive Approach to Characterizing and Cleaning Infrastructure Impacted with Residual PFAS.
J.D. Anderson, J.R. Lang, P. Storch, and C.P. Theriault.
John Anderson (Arcadis/USA)

234. PFAS in Soil: Alternatives in Germany.
J. Buhl.
Jurgen Buhl (Cornelsen Umwelttechnologie GmbH/ Germany)

235. Organically Bonded Fluorine and PFAS: A Treatment Challenge?
J. Buhl and M. Cornelsen.
Jurgen Buhl (Cornelsen Umwelttechnologie GmbH/ Germany)

236. PFAS Soil Washing as Pre-Treatment with SAFF and Site Destruction.
D.J. Burns, P. Murphy, and V. Steffansson.
David Burns (EPOC Enviro LLC/Australia)

237. Sustainable Firefighting System Cleanout and Rinsate Treatment Using PerfluorAd®.
Y. Fang, D. Nguyen, L. Stauch, D. Fleming, E. Crownover, and J. Buhl.
Yida Fang (CDM Smith Inc./USA)

238. Remediation of PFAS-Contaminated Waters and Soils by Foam Fractionation and Gas-Liquid Fluidization.
A.L. Morrison, J. Wang, S. Wilson, V. Strezov, M.P. Taylor, R.K. Niven, P. Murphy, and D. Burns.
Robert K. Niven (The University of New South Wales/ Australia)

239. Life Cycle Analysis of PFAS Treatment in Spent Fire-Extinguishing Liquids.
L. Soos, D. Fleming, L. Stauch, J. Buhl, and M. Cornelsen.
Lauren Soos (TRS Group, Inc./USA)

240. Immobilization of PFAS Soils in a Circular Economy: The Current State of Play.
R. Stewart.
Richard Stewart (RemBind Pty Ltd/Australia)

241. Firefighting Foam Transition to Fluorine Free: What Is a Practical PFAS Decontamination Objective?
P. Storch.
Peter Storch (Arcadis/Australia)

242. Small Batch Treatment of PFAS-Impacted Industrial Wastewater.
K. Wolohan, B. Angerman, and A. McCabe.
Katie Wolohan (Barr Engineering Co./USA)

E4. PFAS Human Health and Ecological Risk Assessment and Toxicity

243. Comparative Analysis of Health-Based Screening Levels for Site Characterization of Groundwater Impacts at Various PFAS Release Sites.
R. Arestides, J. Peters, and G. Sikri.
Ruth Arestides (Haley & Aldrich, Inc./USA)

244. PFAS Bioaccumulation: Comparison of Field Data to Literature Values for Bioaccumulation in Fruits and Vegetables.
R. Bodner, A. Herch, and M. Leahy.
Robert Bodner (ERM/Switzerland)

245. Evaluation of the Development of Health-Based Drinking Water Guidance Values for Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) in North American Regulatory Jurisdictions.
I.J. Collins, F.C. Ramacciotti, W.A. Schew, H. Herring, and A. Kliminsky.
Ian Collins (GHD/Canada)

246. Uncertainties in Estimation of Bioaccumulation Factors in Risk Assessment Studies Related to Per- and Polyfluoroalkyl Substances (PFAS) Exposure.
A. Podder, T. Sorell, and J. Claffey.
Aditi Podder (Brown and Caldwell/USA)

247. Human Health Risk Management Implications Using Predicted versus Measured PFAS in Produce near a Military Base.
A.R. Quintin, T. Cunningham, L. Tierney, H. Plante.
Amy Quintin (Wood/USA)

248. Protecting Human Health from Consumption of PFOS in Deer Meat.
A.R. Quintin, A.M. Rodolakis, and M. Coveney.
Amy Quintin (Wood/USA)

E5. Managing PFAS at Publically-Owned Treatment Works (POTWs)

249. A Case Study of PFAS in Wastewater Influent and Effluent.
L.L. Boone.
Lindsay Boone (USA)

250. A Mass Balance Approach to Estimating Background PFAS Concentrations in California Municipal Wastewater Due to Residential and Commercial Discharges.
S.J. Luis and M. Smith.
Steve Luis (Ramboll/USA)

E6. Ex Situ PFAS Water Treatment Technologies

251. PFAS Landfill Leachate Case Study: SAFF40 Commissioning in Sweden (January 2020).
D.J. Burns, P. Murphy, and V. Steffansson.
David Burns (EPOC Enviro LLC/Australia)

252. Performance Evaluation of PFAS Loading/ Breakthrough in GAC System.
D. Chiang, A. Rodowa, J. Field, Q. Huang, D. Pohlmann, A. Bodour, and C. Varley.
Dora Chiang (Wood/USA)

253. Foam Fractionation Bench-Scale Treatability for Per- and Polyfluoroalkyl Substances Removal.
C.D. Claros, K.P. Molloy, T.A. Key, and G.L. Ghurye.
Carlos Claros (CDM Smith Inc./USA)

254. New Modified Minerals for Remediation of Long- and Short-Chain PFAS Compounds in Water.
M. Donovan, D. Wind, C. Bellona, C. Murray, J. Liu, and B. Yan.
Michael Donovan (CETCO/USA)

255. Treating PFAS-Contaminated Landfill Leachates Using SAFF: Results from Seven Bench-Scale Trials and Two Full-Scale Projects.
P. Murphy and H. Hinrichsen.
Helena Hinrichsen (EnvyTech Solutions AB/Sweden)

256. Treatment of a Wide Range of PFAS-Contaminated Waters Using Only Air, Producing Only Concentrated PFAS as Waste.
P. Murphy and H. Hinrichsen.
Helena Hinrichsen (EnvyTech Solutions AB/Sweden)

257. Comparative Evaluation of Fractionation Treatment Technology for PFAS-Impacted Landfill Leachate at Bench and Pilot Scale.
B. Miatke, C. Theriault, J. Anderson, and D. Liles.
Baxter Miatke (Arcadis/USA)

258. Use of Rapid, Small-Scale Column Tests for Evaluating PFAS Removal Using Granular Activated Carbons/Anion Exchange Resins.
D.D. Nguyen and C.E. Schaefer.
Dung (Zoom) Nguyen (CDM Smith Inc./USA)

259. The Versatility of Surface-Modified Clay Adsorbents for PFAS Treatment.
A. Willett and M. Geary.
Anna Willett (CETCO/USA)

F1. PFAS Fate and Transport Properties

260. Determination of Experimental Henry's Law Constants for 15 Poly- and Per-Fluoroalkyl Substances (PFAS) Using Static Headspace Analysis.
I. Abusallout and D. Hanigan.
Ibrahim Abusallout (CDM Smith/USA)

261. Per- and Polyfluoroalkyl Substances (PFAS) and Solid Matrices: Fractionation between Phases and Influences of Solid Properties on PFAS Recovery.
O. Cawdell, J. Fox, and M. Maier.
Oliver Cawdell (Vista Analytical Laboratory/USA)

262. PFAS Transport in the Presence of Trapped Air Bubbles: Laboratory Column Experiments and Mixture Effects.
J.E.F. Abraham, K.G. Mumford, D.J. Patch, and K.P. Weber.
Kevin Mumford (Queen's University/Canada)

263. Retention of PFAS in Groundwater at Freshwater/Saltwater Interfaces.
C.J. Newell, D.T. Adamson, B.Y. Li, H. Hort, D.F. Roff, and M. Pound.
Charles Newell (GSI Environmental Inc./USA)

264. In Silico Prediction of Fate and Risk-Determining Properties of Per- and Polyfluoroalkyl Substances (PFAS).
T.L. Torralba-Sanchez, O. Dmitrenko, D.M. Di Toro, and P.G. Tratnyek.
Tifany Torralba-Sanchez (Mutch Associates, LLC/USA)

265. Covalent Incorporation of Fluorine into Cellular Lipids in *Pseudomonas* sp. Strain 273.
Y. Xie, G. Chen, A.L. May, S.R. Campagna, and F.E. Loeffler.
Yongchao Xie (University of Tennessee/USA)

F2. PFAS Conceptual Site Model Approaches

266. Advanced Data Analytics to Differentiate PFAS Sources and Transport Pathways.
T. Belanger, B. Badik, D.R. Griffiths, J.T. Moore, and C.T. Gallo.
Todd Belanger (Parsons/USA)

267. A Robust PFAS Fate and Transport Model for a Chrome-Plating Facility.
J. Cuthbertson, J. Buzzell, B. Hoare, and D. Bogdan.
John Cuthbertson (AECOM/USA)

268. Conceptual Site Model and Numerical Model for a Conceptual Drinking Water Supply Plan: Addressing PFAS Contamination in Fourteen Communities.
J. Feild, K. Quast, S. Shaw, S. Thomas, H. Albertus-Benham, A. Dahlmeier, R. Higgins, and G. Krueger.
James Feild (Wood/USA)

269. Using Regulatory Classifications to Assess the Impact of Different Land Use Types on Per- and Polyfluoroalkyl Substance Concentrations in Stormwater Pond Sediments.
J.L. Olmsted, A. Ahmadireskety, B. Ferreira Da Silva, N. Robey, J.-C.J. Bonzongo, J.A. Bowden, and J.J. Aristizabal-Henao.
Jenny Olmsted (CDM Smith Inc./USA)

270. Risk Assessment Challenges Associated with Atmospheric Transport of PFAS.
L. Trozzolo.
Laura Trozzolo (TRC Companies, Inc./USA)

F3. PFAS Program Management in a Rapidly Changing Regulatory Environment

271. Emerging Contaminant Sampling for Sampling Sake.
J. Good, J. Hayes, and S. Abrams.
Joseph Good (Langan/USA)

272. Building a Community-Specific PFAS Cycle to Inform Program Management and Communications.
M.A. Harclerode, A. Miller, E.M. Spargimino, C. Larson, and G. Tivnan.
Melissa Harclerode (CDM Smith Inc./USA)

273. Remediation of PFAS-Impacted Soil: Has Technology Outpaced Regulation? An Australian Perspective.
J. Ho.
Jonathan Ho (AECOM/Australia)

274. The PFAS Challenge and the Response of Drinking Water Systems.
M.C. Leahy, J. Byrd, and M. Dawes.
Maureen Leahy (Wood/USA)

275. Case Study: PFAS Management Plan for Airport Construction Projects.
S.R. Nelson, C. Stefanelli, and K. Cappenter.
Steve Nelson (City of Austin/USA)

276. TRI-Listed PFAS: What We Know about These Chemicals. *L. Kemp, J. Lang, and K. Onesios-Barry.*
Kathryn Onesios-Barry (Arcadis/USA)

277. PFAS Site Characterization in an Ever Evolving Regulatory World. *E. Palko and S. Helgen.*
Erin Palko (Integral Consulting, Inc./USA)

278. Procurement and Risk Management Strategies for Large-Scale Drinking Water PFAS Removal.
C. Parker, J. Hester, and R. Pope.
Rodney Pope (Brown and Caldwell/USA)

F4. PFAS Source and Forensic Considerations

279. PFAS in Landfill Leachate: Extent and Patterns from Recent Studies.
B. Chandramouli.
Bharat Chandramouli (SGS Canada/Canada)

280. LNAPL, 1,4-Dioxane and PFAS: Chemical Partitioning in a Complex Source Mass.
P. Curry, A. Villhauer, and D. Favero.
Patrick Curry (Arcadis/USA)

281. A Defensible Multiple-Lines-of-Evidence Approach for PFAS Source Identification and Liability Allocation. J.*M. Fenstermacher, E.S. Wood, J. Pietari, and J. Wilkinson.*
Jim Fenstermacher (Ramboll/USA)

282. Stack Sampling of PFAS Compounds in Air Emissions from Stationary Sources.
W. Fritz.
Wesley Fritz (Weston Solutions, Inc./USA)

283. PFNA-Dominated Groundwater Contamination Associated with AFFF Use and Manufacturing.
S. Helgen, E. Palko, and C. Hutchings.
Steven Helgen (Integral Consulting, Inc./USA)

284. PFAS Forensics: What Are Data Patterns Telling Us?
C.S. Koll, J. Sheldon, and K. Angel.
Caron Koll (Antea Group/USA)

285. Identification of Aqueous Film-Forming Foam Chemical Fingerprints from Product Concentrates.
A.H. Love, R. Maxwell, and B. Harris.
Adam Love (Roux/USA)

286. Applicability of Diverse Investigative Techniques for PFAS Remedial Investigations and Conceptual Site Model Development.
M.D. Machusick and M.B. Vest.
Matthew Machusick (Leidos/USA)

287. PFAS Sleuthing at Diffuse and Uncertain Release Areas: Combining Tools and Resources for a Fuller Picture.
C. Mitchell, S. Bartlett, R. Gwinn, B. Packer, T. Peck, and J. Edgerly.
Claire Mitchell (AECOM/USA)

288. Pattern Recognition of Large-Scale PFAS Forensic Signature Variations to Identify Emergent Properties of Environmental Fate and Transport.
Z.R. Neigh, M. Borgens, R. Gwinn, N.A. Tavantzis, T. Amentt Jennings, N. Lancaster, and T. Bryant.
Zachary Neigh (AECOM/USA)

289. Source Identification and Management of PFAS in Stormwater.
J. Pietari, J. Wilkinson, and E.S. Wood.
Jaana Pietari (Ramboll/USA)

290. An Evaluation of Potential Background PFOS and PFOA Concentrations in California Groundwater. *K.R. Robrock and B. Drollette.*
Kristin Robrock (Exponent, Inc./USA)

291. PFAS Data Forensic Analysis: California Case Study.
M. Shayan, Z. Neigh, and R. Gwinn.
Mahsa Shayan (AECOM/USA)

G1. Expedite Site Closure: Innovative Strategies and Approaches

292. A Collaborative Stakeholder Success Story: Consent Order Termination at a Pipeline Spill in Rural Idaho.
B.J. Harding, K. Waldron, W. Pineda, and D. Young.
Barry Harding (AECOM/USA)

293. Characterization of Borrow Material Using Incremental Sampling Methodology.
E.M. Huntley, S.J. Kretschman, and M.E. Fleming.
Erin Huntley (WSP Golder/USA)

294. When is Mass Removal Enough: Remediation of a Chlorinated VOC Plume with DNAPL Source.
T. Louviere, P. Hsieh, and T. Gray.
Trevor Wade Louviere (Dalton, Olmsted & Fuglevand, Inc./USA)

295. Application of In Vitro Soil Bioaccessibility Testing in Support of Risk-Based Cleanup Criteria for a Metals-Contaminated Site.
A. Amendola, R. Jayasinghe, J. Coughlin, J. Palo, and M. Bergeon.
Joseph Palo (WSP Golder/USA)

296. Comprehensive Closure Strategy by Removing RCRA Listing and Enhancing the Site's Natural Dechlorination Processes.
K. Ramanand, M. Krishnayya, J. Warburton, and J. Seracuse.
Karnam Ramanand (Brown and Caldwell/USA)

297. Application of Multiple Remedial Techniques and Approaches at a Former Pharmaceutical Manufacturing Facility.
D.J. Russell and C.P. Wong.
David Russell (AECOM/USA)

G2. Practice of Risk Communication and Stakeholder Engagement

298. Orange County North Basin Superfund Site: Navigating the Multi-Agency Regulatory Process to Protect Groundwater Quality.
A.N. Amini, M.S. Gee, and C.A. Nishida.
A. Nick Amini (California Water Boards/USA)

299. The Lost Art of Communication: A Method for Effectively Collaborating around Your Contaminant Model with a Dispersed Project Team and Stakeholders.
S. Buchanan, S. Vanos, G. Plastow, and B. Jordan.
Sean Buchanan (Seequent/USA)

300. Stakeholder Communication Contributes to Successful Implementation of TCE Bioremediation Remedy in Fractured Rock near a Residential Area.
C. Johnson, J. Vondracek, L. Seus, and G. White.
Laurel Seus (EHS Support LLC/USA)

301. Hazard Analysis: Remedial System Design, Installation, and Operation Down Range from a Gun Club.
K.M. Lienau and J. Kennedy.
Kevin Lienau (Groundwater & Environmental Services, Inc./USA)

302. Odor and Emissions Controls and Real-Time Monitoring during Remediation at Two Former Manufactured Gas Plants.
M. Nabors, T. Steffen, and T. Boom.
Melissa Nabors (Barr Engineering Co./USA)

303. Liability Risk Management Technology Solutions for Enhancing Stakeholder Engagement and Acquisition Negotiations.
J. Orris.
Joshua Orris (Antea Group/USA)

304. Enhance Stakeholder Engagement with Technology-Enabled Solutions that Streamline Environmental Lifecycles.
J. Orris and J. Ruf.
Joshua Orris (Antea Group/USA)

305. Fostering Stakeholder and Public Engagement through Innovative GIS and Data Collection Systems during NYC Parks Lead Testing Program.
E. Trumpatori.
Kirk Silver (Woodard & Curran/USA)

306. ENVIRO.wiki: Technology Transfer in the 21st Century.
B. Yuncu, F.J. Hurley, and R.C. Borden.
Bilgen Yuncu (Draper Aden Associates/USA)

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307. Effect of NAPL Mixture Composition and Alteration on ^{222}Rn Partitioning Coefficients: Implications for NAPL Contamination Quantification.
G.J.V. Cohen, M. Le Meur, M. Laurent, O. Atteia, and P. Höhener.
Grégory Cohen (G&E/France)

308. High Mass Hydrocarbon Sites: When NAPL Recovery Governs the Mass Removal during the Thermal Remedy.
S. Griepke, D. Phelan, J. Galligan, J. LaChance, and S. Nienstedt.
Steffen Griepke (TerraTherm, Inc./USA)

309. Rapid Closure of Heavy Crude Oil Site Using In Situ Bioremediation Technology in Low-Permeability Soil and Fractured Bedrock.
T.A. Harp.
Thomas Harp (Remediation Risk Reduction, LLC/USA)

310. Using Technology to Streamline Decision Making during Emergency Response Activities.
D. Horne, T. Gustafson, and N. Kilgore.
David Horne (Burns & McDonnell Engineering Company, Inc./USA)

311. Crude Oil Spill Site Characterization for Remedial Optimization.
J. Knapp and J. Pesicka.
Jacob Knapp (Antea Group/USA)

312. Rhamnolipids Compositions for Hydrocarbon-Contaminated Soil Remediation.
A. Sanders, G. Ren, G. Dado, R. Lang, D.G. Brown, and P. Ni.
Ginger Ren (Stepan/USA)

G4. Natural Source Zone Depletion

313. Microbial Potentiometric Sensors to Determine the Rate of Degradation of Metabolites/Petroleum Hydrocarbons in Saturated and Unsaturated Soils.
S.R. Burge, R.G. Burge, K.D. Hristovski, D.A. Hoffman, and E.D. Taylor.
Scott Burge (Burge Environmental, Inc./USA)

314. Combining Electrical Resistivity Tomography, CO_2 Flux Measurements, and Subsurface Media Sampling to Delineate Hydrocarbon Impacts and NSZD at a Former Fuel Terminal on Hawaii Island.
M.R. Mathioudakis, N. Wood, N. Sihota, M. Dieckmann, and M. Wood.
Max Dieckmann (Arcadis/USA)

315. Natural Source Zone Depletion: Getting Past Perception and into Practice.
T. Palaia and S. Park.
Tom Palaia (Jacobs/USA)

316. Natural Source Zone Depletion Estimation with Multiple Permeable Zones and Confined LNAPL.
L.A. Reyenga and J.M. Hawthorne.
Lisa Reyenga (GEI Consultants, Inc./USA)

317. Comparison of Methods for Assessing NSZD at Paved Fuel Retail Sites.
J. Smith, B. Koons, S. Gaito, and A. Kirkman.
Jonathon Smith (AECOM/USA)

318. Biosensor Electrodes to Estimate Rate of Biodegradation of Petroleum Hydrocarbons in the Subsurface.
K. Sra, R. Kolhatkar, J. Wilson, S. Burge, E. Taylor, K. Karimi, and T. Sale.
Kammy Sra (Chevron/USA)

319. Thermal NSZD: Continuous Remote Monitoring of Natural Source Zone Depletion.
K.L. Walker, P.R. Kulkarni, C.J. Newell, T.M. McGuire, and T.E. McHugh.
Kenneth Walker (GSI Environmental Inc./USA)

320. Integrating Natural Source Zone Depletion into Remediation Optimization at a Long-Term LNAPL Site.
J. Wang, N. Durant, D. Fan, M. Hanna, and W. Kunbargi.
James Wang (Geosyntec Consultants/USA)

321. Measuring NSZD Rates at Sites with Impervious Surfaces: Are We There Yet?
J.A. Zimbron.
Julio Zimbron (E-Flux/USA)

H1. Improvements in Site Data Collection, Data Management, and Data Visualization

322. 3-D Data Visualization and Semi-Analytical Modeling of CVOC Concentration Trends in a Large Plume.
T.V. Adams and T. Zei.
Timothy Adams (Roux/USA)

323. Web-Based Application for Recording Depth to Water Measurements in Monitoring Wells and Well Inspection Documentation.
S. Blanchard, R. Pfendler, and J. Peeples.
Scott Blanchard (T&M Associates/USA)

324. Web-Based Geospatial Viewer and Data Tracking Applications to Support Rapid Soil Vapor Survey Site Characterization.
E.M. Chapa and J.P. Latham.
Michael Chapa (Weston Solutions, Inc./USA)

325. Leveraging 3-D Visualization and Animation Technology to Build a Useful Conceptual Site Model and Design a Cost-Effective Remediation System.
J. Depa and R. St. John.
James Depa (Terracon/USA)

326. Navigating the Digital Transformation of Data Collection, Management and Visualization.
D. De Courcy Bower, M. Eschbaugh, A. Roberts, and S. Wright.
Meghan Eschbaugh (ERM/USA)

327. Remedy Optimization through Use of a 3-D Model.
R. Meinke, M. Piepenbrink, K. Mueller, and K. Schnell.
Robert Meinke (ERM/Germany)

328. Complex Impacted Soil Management Visualization for Real-Time Site Operations.
W. Nolan, T. Kremmin, A. Biczok, W. Andrae, and T. Andrews.
Wyatt Nolan (Jacobs/USA)

329. Superfund Site Case Studies: Data Visualization for Reduced Project Costs and Enhanced Communication.
M. Palmer and M. Packard.
Mike Palmer (de maximis, inc./USA)

330. Mass Estimate for Complex Contaminated Sites.
P. Rasouli, L.A. Taylor, and C. Stubbs.
Pejman Rasouli (Ramboll/USA)

331. Leveraging Innovative GIS and Data Collection Systems to Test for Lead in NYC's Drinking Fountains.
E. Trumpatori.
Kirk Silver (Woodard & Curran/USA)

332. Construction and Validation of a Universal Mid-Infrared Soil TPH Calibration for Small-Scale Remediation Activities.
S. Manning, C. Smith, and T. Zhang.
Richard Stewart (RemBind Pty Ltd/Australia)

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333. Adapting Conceptual Site Models to Address Groundwater Monitoring and Remediation Strategies Under Drought Conditions.
J.S. Aiken, R.J. Davis, and D.M. Levitan.
James Aiken (Barr Engineering Co./USA)

334. Geologic Controls on Vadose Zone Transport in Alluvial Settings.
C.S. Alger and C. Steedman.
Christopher Alger (Terraphase Engineering/USA)

335. Challenges of Implementing ISM Soil Sampling for Human Health and Ecological Remedial Investigation at a Former Metals Refinery.
S. Hellekson and J. Robinson.
Stacey Hellekson (Woodard & Curran/USA)

336. Furthering Hydrologic Characterization by Visual Mapping of Injection Data.
A. Kavanagh and D. Davis.
Andrew Kavanagh (REGENESIS/USA)

337. Suite of Innovative Diagnostic Tools Used to Assess Deep Fractured Bedrock Impacts and Support Remedial Design.
J. LeClair, B. O'Neill, and M. Wade.
Judith LeClair (Brown and Caldwell/USA)

338. Use of Geochemical and Hydraulic Analyses to Investigate and Confirm Counterintuitive Groundwater Migration Pathways and Discharge Areas at a Former MGP Site.
J.M. Marolda, R.L. O'Neill, and S. Stucker.
James Marolda (Brown and Caldwell/USA)

339. Conventional Investigation + High Resolution: Correct Use of Tools to Decipher a High Complexity Hydrogeological Model.
N. Nascimento, S. Aluani, F. Tomiatti, R. Moura, G. Siqueira, and S. Spilborghs.
Natália Cristina Nascimento (SGW Services Engenharia Ambiental Ltda./Brazil)

340. A Conceptual Site Model Application to Understanding Groundwater Contamination Anomalies at the City Industries Superfund Site, Winter Park, Florida.
W.N. O'Steen.
William O'Steen (U.S. Environmental Protection Agency/USA)

341. Identifying a Secondary Source of VOCs, through Passive Vapor Sampling, for Reuse of a Beverage Industry.
A.P. Queiroz, L. Freitas, G. Setti, and R. Pajewski.
Ana Paula Queiroz (Waterloo Brasil/Brazil)

342. Data Management Strategies for Continuously Improving a Megasite Conceptual Site Model.
R.M. Roedel, M. Sousa, E. Galvão, J. Werlang, and E. Fontoura.
Rosialine Marques Roedel (CETREL SA/Brazil)

343. Enhanced Site Characterization and Simulation Using Multiomics Field Data.
R. Versteeg, R.L. Rubinstein, and A.D. Peacock.
Rebecca Rubinstein (Subsurface Insights/USA)

344. The Predictive Power of Sequence Stratigraphy: Developing a Conceptual Site Model for Groundwater from Sparse Data.
M.R. Shultz, C.P. Plank, and J. Gillespie.
Mike Shultz (Burns & McDonnell/USA)

345. Where'd That Come From? Differentiating Soil Gas, Sewer Gas, and Outdoor Air in Vapor Intrusion.
N.S. Wanner.
Nate Wanner (Cox-Colvin & Associates, Inc./USA)

I1. Explosives, Perchlorate

346. Containment and Remediation of Perchlorate and Chlorinated Volatile Organic Compounds in Complex Aquifer Systems: Bermite Facility, Santa Clarita, California.
H. Amini.
Hassan Amini (GSI Environmental Inc./USA)

347. Response Surface Modeling for Reverse Osmosis Remediation of Wastewater Containing Energetic Compounds.
S.J. Cavanaugh and J. Weidhaas.
Stephen Cavanaugh (University of Utah/USA)

348. High-Resolution Site Characterization (HRSC) for Design of Treatment System Remedial Augmentation.
S. Downey, R. Mayer, Z. Parham, S. Smith, and P. Coleman.
Steven Downey (APTIM/USA)

349. Biological Degradation of High Concentrations of 2,4- and 2,6-DNT.
J.A. Dijk, S. Verissimo, M. Slooijer, M. Britto, F. Martins, S. Huysmans, K. Verhoeyen, N. van Belzen, and C. Walecka-Hutchison.
Sergio Verissimo Filho (GreenSoil Group/Brazil)

350. Overcoming Challenging Site Conditions to Remediate High Perchlorate Concentrations in Groundwater Using In Situ Bioremediation.
W.A. Foss, P. Srivastav, and R.E. Mayer.
William Foss (APTIM/USA)

351. Predicting Abiotic Reduction Rates of Munitions Compounds in Soils.
J. Murillo-Gelvez, P.A. Cárdenas, J.C. Rincón, D.M. Di Toro, P.C. Chiu, and R.F. Carbonaro.
Jimmy Murillo Gelvez (University of Delaware/USA)

352. Removal of IMX-101 Constituents from Process Wastewater by Fenton Oxidation and Hydrothermal Treatment.
D.B. Gent, S.L. Larson, and B. Smolinski.
David B. Gent (U.S. Army Corps of Engineers Engineer Research & Development Center/USA)

353. Biotic and Abiotic Reduction of Perchlorate and Co-Contaminants Using Zero-Valent Iron.
J.M. Gonzales, J.R. Batista, U. Patel, and C. Rich.
John Michael Gonzales (University of Nevada, Las Vegas/USA)

354. Removal of Munitions Compounds from Aqueous Solutions via Chitin- and Chitosan-Based Materials.
L.A. Gurtowski, C.S. Griggs, and M.K. Shukla.
Luke Gurtowski (U.S. Army Engineer Research and Development Center/USA)

355. Ex Situ Remedial Innovation for Abatement of White Phosphorus-Impacted Soils.
A. Kenwell, C. Shores, and B. Hodge.
Amy Kenwell (Geosyntec Consultants/USA)

356. Combined Role of Granular Formulations of *Kinneretia asachharophila* and Organic Amendments in Bioremediation of RDX-Contaminated Soils.
M.A. Khan, S. Yadav, A. Sharma, and S. Sharma.
Mohd Aamir Khan (Indian Institute of Technology Delhi/India)

357. Factors Controlling Autotrophic Bioremediation of Perchlorate Using In Situ Hydrogen Generation: Results from Multiple Bench-Scale Tests.
U. Patel and C.J. Ritchie.
Christopher Jackson Ritchie (Ramboll/USA)

358. Serving Potable Water from an "Extremely Impaired" Groundwater Superfund Source.
D. Roff, D. Cebra, J. Duffey, H. Holbrook, E. Lang, and K. Javendal.
Douglas Roff (AECOM/USA)

359. Improving Sustainable Munitions Wastewater Treatment with Ion Exchange.
D. Tran, J. Weidhaas, and R. Goel.
Dana Tran (University of Utah/USA)

I2. Advances in 1,4-Dioxane Biological Treatment Technologies

360. Biodegradation of 1,4-Dioxane by Psychrophilic Propanotrophs.
J. Antunes and M. Li.
Jose Antunes (New Jersey Institute of Technology/USA)

361. Synchronous Biodegradation of 1,4-Dioxane and Trichloroethene by Mycobacterium sp. DT1.
D. Deng, J. Antunes, and M. Li.
Jose Antunes (New Jersey Institute of Technology/USA)

362. Aerobic Cometabolism of Chlorinated Solvents and 1,4-Dioxane in Continuous Flow Columns Packed with Gellan-Gum Hydrogels Co-Encapsulated with ATCC Strain 21198 and TBOS or T2BOS as a Slow Release Compounds.
M. Azizian, L. Semprini, and M. Hyman.
Mohammad Azizian (Oregon State University/USA)

363. First Full-Scale Implementation of Propane Biosparge System for In Situ Remediation of 1,4-Dioxane.
C. Bell, K. Parsons, J. Wong, A. Nelan, and K. Gerber.
Caitlin Bell (Arcadis/USA)

364. Identification of the Phylotypes Involved in cis-Dichloroethene and 1,4-Dioxane Biodegradation in Soil Microcosms.
H. Dang and A.M. Cupples.
Alison Cupples (Michigan State University/USA)

365. EPA Modified Corrective Measures: Re-Aligning Strategy to 1,4-Dioxane.
S. Knox and D. Young.
Sheri Knox (Wood/USA)

366. Laboratory and Field-Scale Evaluation of Multiple Bioremediation Technologies for 1,4-Dioxane. *F.J. Krembs, G.E. Mathes, J. Pruis, K. McDonald, M.G. Sweetenham, and M.R. Olson.*
Fritz Krembs (Trihydro Corporation/USA)

367. Sequential Anaerobic and Aerobic Bioaugmentation for Commingled Groundwater Contamination of Trichloroethene and 1,4-Dioxane.
F. Li, D. Deng, L. Zeng, S. Abrams, and M. Li.
Mengyan Li (New Jersey Institute of Technology/USA)

368. Construction and Characterization of a Bacterial Consortium for Biodegradation of 1,4-Dioxane.
K. Motomura, Y. Hemmi, K. Enomoto, and N. Okutsu.
Kei Motomura (Kurita Water Industries/Japan)

369. RPI's CAT 100 Successfully Treats 1,4-Dioxane and CVOCs.
S. Noland.
Scott Noland (Remediation Products, Inc./USA)

370. Cometabolism of 1,4-Dioxane and Chlorinated Hydrocarbon Mixtures Induced by Multiple Primary Substrates: Laboratory and Modeling Studies.
H.R. Rolston, L. Semprini, M.R. Hyman, D. Lippincott, P.B. Hatzinger, and A.S. Danko.
Hannah Rolston (Oregon State University/USA)

I3. 1,4-Dioxane Remediation Challenges

371. Investigation and Remediation Strategy for a Fast-Moving 1,4-Dioxane Plume at a Military Site.
S. Gopinath, T. Eilber, and G. Geckeler.
Sree Gopinath (Bodhi Group/USA)

372. In Situ Remediation of a 1,4-Dioxane Plume in a Heterogeneous Aquifer, Lessons Learned: Full-Scale Remediation with Activated Sodium Persulfate.
T. Louviere and P. Hsieh.
Trevor Wade Louviere (Dalton, Olmsted & Fuglevand, Inc./USA)

373. Lessons Leaned for Remediation of 1,4-Dioxane at Chlorinated Solvent Sites Using In Situ Thermal Remediation.
G. Mackey, A. Villanueva, J. Winkler, M. Appel, D. Nelson, A. Salvador, and J. Baldock.
Graham Mackey (ERM/USA)

374. Multi-Tool Characterization, Delineation and Capture of a Detached, Commingled, 1,4-Dioxane and Chlorinated Ethenes Plume in Coastal Plain Deposits.
C. Meyn, J. Marolda, and S. MacMillin.
Charles Meyn (Brown and Caldwell/USA)

375. Design-Build Expedites the Remediation of a 1,4-Dioxane Groundwater Plume through Source Removal.
P. Randazzo, K. Dyson, and B. Quann.
Brendan Quann (Brown and Caldwell/USA)

376. Selecting the Most Viable Oxidant to Treat 1,4-Dioxane in Groundwater.
K. Ramanand, R. Ruhmke, K.D. Dyson, and J. Seracuse.
Karnam Ramanand (Brown and Caldwell/USA)

377. Treating 1,4-Dioxane in Commingled Plumes with ISCO.
B.A. Smith and B. Desjardins.
Brant Smith (Evonik/USA)

NOTES

Tuesday Platform Sessions—8:00–10:05 a.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
8:00	**Abiotic Dechlorination by Natural Ferrous Minerals.** *C.E. Schaefer, D. Nguyen, E. Berns, and C. Werth.* Charles Schaefer (CDM Smith Inc./USA)	**Analysis of Work Coil and Casing Dynamics for Induction Heating Applications.** *E. Reid.* Bruce McGee (McMillan-McGee Corporation/Canada)	**Value Engineering for Propane Biosparging of 1,4-Dioxane.** *A.C. Lorenz, A.G. Krevinghaus, and D. Favero.* Andrew Lorenz (Arcadis/USA)	**Utilizing 3-D Geophysics for Detailed Mapping of a Deep Landfill Leachate Plume.** *J.K. Pedersen, S.S. Nielsen, L. Dissing, T.H. Jorgensen, O.F. Nielsen, J. Albinus, B. Germundsson, J.B. Pedersen, R. Kraghede, and F.E. Christensen.* Bastian Germundsson (COWI A/S/Denmark)	**How Much Soil Do You Have: When Does Thermal Become Economical?** *E. Crownover, P. Joyce, L. Stauch, G. Heron, P. Stallings, K. Pennell, and W. Woodcock.* Emily Crownover (TRS Group, Inc./USA)
8:25	**Mineral Phases from In Situ Biogeochemical Processes: The Key to Abiotic Natural Attenuation?** *P.G. Tratnyek, A.S. Pavitt, and R.L. Johnson.* Paul Tratnyek (Oregon Health & Science University/USA)	**Fractured Crystalline Bedrock: Is Thermal an Option or Are We Wrong?** *N. Ploug, J. Holm, N. Törneman, F. Engelcke, A. Bank, and S.G. Nielsen.* Niels Ploug (Krüger A/S/Denmark)	**The Use of Steam Propagation Tests and Thermal Modeling to Develop In Situ Thermal Remediation Design Parameters.** *G. Mackey, M. Dawes, A. Salvador, C. Hurdle, J. Baldock, and J. Dinham.* Graham Mackey (ERM/USA)	**Computational Optimization of a Landfill Gas Collection System.** *A. Boodram, M. Ambrusch, S. Abrams, and L. Adensohn.* Aroona Boodram (Langan/USA)	**Soil Washing: Sustainable, Cost-Effective Treatment for PFAS Source Zones.** *J.A. Quinnan, C. Morrell, and N. Nagle.* Joseph Quinnan (Arcadis/USA)
8:50	**Development of a ^{14}C Assay to Quantify Abiotic Transformation Rates for Chlorinated Ethenes in Water Supply Aquifers.** *D.L. Freedman, A.A. Ramos Garcia, A. Pullen, J.T. Wilson, B. Wilson, and T. Kuder.* David Freedman (Clemson University/USA)	**Non-Routine Volatile and Semi-Volatile Organic Vapor Monitoring at Thermal Remediation Sites: Lessons Learned.** *A. Fortune, S. Griepke, R. McLeod, A. Rezendes, and N. Bryson.* Alyson Fortune (TerraTherm, Inc./USA)	**Increasing Treatment Certainty while Controlling Remediation Cost: Case Studies Using Hydraulic Fracturing to Deliver Amendments at Low-Permeability and Weathered Bedrock Sites.** *D. Baird, C. Shores, T. Kuehster, and C. Ross.* Drew Baird (FRx, Inc./USA)	**Phytoremediation for Management of Leachate at a Closed Landfill.** *F.J. Krembs, J. Pruis, M. Morin, R. Spring, and E. Ballenger.* Fritz Krembs (Trihydro Corporation/USA)	**The 'Ins & Outs' of SAFF™ to Remove PFAS, Concentrate Waste for Destruction.** *D.J. Burns and P. Murphy.* David Burns (EPOC Enviro LLC/Australia)
9:15	**Combined Enhanced Biotic-Abiotic Transformation of Carbon Tetrachloride and Chloroform at the Field Scale: A Biogeochemical Perspective.** *S.D. Justicia-Leon, J. Martin Tilton, C. Divine, S.M. Ulrich, D.L. Freedman, and K. Clark.* Shandra Justicia-Leon (Arcadis/USA)	SESSION BREAK	**Proven On-Site Thermal Desorption Technology Minimizing Environmental Impact and Cost on Large-Scale Remediation Project.** *R. Martin.* Rob Martin (Clean Earth/USA)	**A Novel Approach to Volume Reduction and In Situ Aerobic Treatment of Landfill Leachate.** *R. Welch, H. Goldemund, and B.D. Jacobson.* Regan Welch (Geosyntec Consultants/USA)	**From Waste to Recyclable Material: New Approaches to Dealing with PFAS-Contaminated Soil.** *K. Amstaetter and K. Mittag.* Katja Amstaetter (CDM Smith Consult GmbH/Germany)
9:40	SESSION BREAK	**In Situ Thermal Remediation Market Review from 1988 to 2020.** *M. Klemmer, J. Munholland, P. Hegele, J. Gattenby, and J. Horst.* Mark Klemmer (Arcadis/Australia)	SESSION BREAK	SESSION BREAK	**In Situ and Ex Situ Applications of Surface Active Foam Fraction (SAFF®) Technologies for Treatment of PFAS-Impacted Media.** *D.D. Nguyen, C.E. Schaefer, P. Murphy, and D. Burns.* Dung (Zoom) Nguyen (CDM Smith Inc./USA)
10:05	**In Situ Geochemical Stabilization (ISGS) of DNAPL: Bench-Scale and Pilot-Scale Demonstration Results.** *D. Gray, T. Vannest, S. Lucas, J. Mueller, G. Booth, C. Walecka-Hutchinson, T. Tambling, and J. Sprague.* Doug Gray (AECOM/USA)	**New Approach for Simulating the Vaporization and Removal of Volatile Organic Compounds by Thermal Conductive Heating at Field Scale.** *Q. Xie, K.G. Mumford, and B.H. Kueper.* Kevin Mumford (Queen's University/Canada)	**At the Intersection of Construction, Engineering, and Geoscience: Treatment of a PCE Groundwater Plume.** *A.R. Taylor and J.R. Lanier.* Agnes Taylor (SME/USA)	**In Situ Treatment of a Commingled Carbon Tetrachloride, Chlorofluorocarbon, and Trichloroethene Groundwater Plume in Fractured Bedrock.** *T. Macbeth, E. Ehret, D. Nguyen, T. Cook, S. Ohannessian, D. Janda, and M. Fattahipour.* Emma Ehret (CDM Smith Inc./USA)	SESSION BREAK

A2. Abiotic and In Situ Biogeochemical Processes: Applications and Lessons Learned

B2. Thermal Conductive Heating: Best Practices and Lessons Learned

C2. Remedy Implementation: Assessing Performance and Costs

D2. Landfill Assessment and Remediation

E3. Ex Situ PFAS Treatment: Soils/Solids and Other Waste Streams

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Tuesday Platform Sessions—8:00–10:05 a.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
8:00	F2. PFAS Conceptual Site Model Approaches **Assessing the PFAS Conceptual Site Model.** *D. Chiang, A. Rodowa, J. Field, Q. Huang, D. Pohlmann, A. Bodour, and C. Varley.* Dora Chiang (Wood/USA)	Panel Dissusion **PANEL DISCUSSION** **Monitored Natural Source Zone Depletion** **Moderator** Rick Ahlers, PE (GEI Consultants, Inc.) **Panelists** Lisa Reyenga, PE (GEI Consultants, Inc.) Dr. Natasha Sihota (Chevron) Tom Palaia, PE (Jacobs) Kyle Campbell, PG (Colorado Department of Labor and Employment, Division of Oil and Public Safety) Dr. Barbara Bekins (USGS)	H2. Conceptual Site Models: Improvements in Development and Application **Three-Dimensional Geologic and Contaminant Modeling to Support Site Investigation and Remedial Design.** *M. Tulich and T. Martin.* Mandy Tulich (Integral Consulting, Inc./USA)	I2. Advances in 1,4-Dioxane Biological Treatment Technologies **Untangling the Robust Catalytic Versatility of Soluble Di-Iron Monooxygenases in Initiating the Biotransformation of Legacy and Emerging Groundwater Pollutants.** *D. Deng, D. Pham, F. Li, J. Antunes, and M. Li.* Mengyan Li (New Jersey Institute of Technology/USA)	Learning Lab **Using Augmented Reality for Geological and Groundwater Modelling**
8:25	**Simulation of the Air Deposition Pathway to PFAS Groundwater Contamination.** *A. Janzen, E. Christianson, D. Dahlstrom, E. Edwalds, and R. Wuolo.* Evan Christianson (Barr Engineering Company/USA)		**Development and Testing of Three Alternate CSMs: Things Are Not Always What They First Seem.** *P.L. Lepczyk, M.D. Colvin, and D.G. Greene.* Peter Lepczyk (Fishbeck/USA)	**Bioaugmented Phytoremediation to Degrade 1,4-Dioxane and Co-Contaminants.** *R.A. Simmer, T.E. Mattes, J.L. Schnoor, J. Mathieu, and P.J.J. Alvarez.* Reid Simmer (University of Iowa/USA)	
8:50	**Evaluation of Conservative PFAS Groundwater Plume Lengths at AFFF-Impacted Military Bases.** *E. Ehret, J. Olmsted, and E. Goldberg.* Emma Ehret (CDM Smith Inc./USA)		**Reevaluating the Conceptual Site Model of a Shoreline Chlorinated Solvent Plume in Groundwater.** *C. Cellucci, M. Meyer, and D. DeYoung.* Damon DeYoung (Battelle/USA)	**Treatability and Optimization Studies for 1,4-Dioxane and CVOC-Impacted Groundwater: BioGAC Column Systems and Field Demonstration.** *J. Ngo, N.W. Johnson, P. Ramos, I. Kwok, Y. Miao, S. Mahendra, Y. Liu, E.E. Mack, C. Walecka-Hutchison, J. Popovic, A. Danko, and V. Hosangadi.* Jerry Ngo (GSI Environmental Inc./USA)	**The Optical Image Profiler (OIP) for Detection and Assessment of Fluorescent NAPLs by Direct Push Methods**
9:15	**Developing a Framework for Monitored Natural Attenuation at PFAS Sites.** *D.T. Adamson, C.J. Newell, P.R. Kulkarni, J.A. Connor, J. Popovic, and H. Stroo.* David Adamson (GSI Environmental Inc./USA)		**Reducing Estimated DNAPL Volume by 90% with HRSC.** *N. Welty, J. Wright, and F. Payne.* Nicklaus Welty (Arcadis/USA)	**Field Demonstration of In Situ Bioremediation of 1,4-Dioxane: A Push-Pull Testing Investigation.** *Y. Li, D.T. Adamson, J. Mathieu, A.S. Danko, and C.S. Sorensen.* Yue Li (GSI Environmental Inc./USA)	
9:40	SESSION BREAK	SESSION BREAK	SESSION BREAK	**Evaluation of Natural Attenuation of 1,4-Dioxane in Groundwater Using a ^{14}C Assay.** *D.L. Freedman, A.A. Ramos Garcia, D.T. Adamson, J.T. Wilson, C. Lebrón, and A.S. Danko.* David Freedman (Clemson University/USA)	**Groundwater Flux Measurements: Introduction to the Utility of Passive Flux Devices and Improvements to Available Methods Data Collection**
10:05	F3. **Status of Regulatory Oversight of PFAS Contamination Investigations in the Santa Ana Region.** *M. Behrooz.* Mona Behrooz (California Water Boards/USA)	G3. **Process-Based CSM of a Residual Acid Tar for Remedy Selection.** *D. Collins, R. Andrachek, and N. Johnson.* David Collins (Stantec/USA)	H2. **Groundwater Plume Analytics® Tools for Improved Conceptual Site Models.** *J.A. Ricker and D.C. Winchell.* Joseph Ricker (WSP Golder/USA)	SESSION BREAK	

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Tuesday Platform Sessions—10:30 a.m. –12:35 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
10:30	**In Situ Biogeochemical Reductive Dechlorination: Performance in Complex Low Permeability Formation.** *J. Studer and N. Glenn.* James Studer (InfraSUR, LLC/USA)	**In Situ Thermal Remediation in Hazardous (Classified) Areas.** *J. Galligan, S. Frost, T. Mainer, G. MacLeod, N. Stone, K. Crowder, and C. Jaggie.* James Galligan (TerraTherm, Inc./USA)	**Combining Field Experience with Modelling for Engineering Management of In Situ Activated Carbon Remedial Installations.** *J. Birnstingl and C. Sandefur.* Jeremy Birnstingl (REGENESIS/USA)	**When Innovative Sciences and Lean Tools Combine to Resolve Aggressive Deadlines and Access Challenges.** *K.A. Foster, E. Haddad, J. Kingston, J. Weidmann, and M. Sinnett.* Michael J. (Joe) Weidmann (Haley & Aldrich, Inc./USA)	**Mobile Cleanout of AFFF and PFAS in Fire Suppression Systems.** *I. Godinez, D. Fleming, L. Stauch, and E. Crownover.* Itzel G. Godinez (U.S. Navy/USA)
10:55	**Biogeochemically Enhanced Treatment of Chlorinated Organics and Metals.** *D. Leigh, A. Seech, and J. Molin.* Daniel Leigh (Evonik/USA)	**Thermal Design and Best Practices: Real-Time Solutions to Unexpected Challenges Encountered during Thermal Conductive Heating Projects.** *S. Griepke, J. LaChance, N. Ploug, and P. Negrao.* Steffen Griepke (TerraTherm, Inc./USA)	**Impact of Anaerobic Biofilm Formation on Sorption Characteristics of Powdered Activated Carbon.** *G.R. Rocha Diaz de Leon, N.R. Thomson, C.R.A. Toth, and E.A. Edwards.* Griselda Rocha Diaz de Leon (University of Waterloo/Canada)	**Updating Remedial Action Approach and Developing a Path to Site Closure.** *T. Schott, K. Stetser, J. Kohl, and M. Clifford-Martin.* Tyler Kenneth Schott (GEI Consultants, Inc./USA)	**Stabilization and Reuse of PFAS-Contaminated Soil to Minimize the Cost and Carbon Footprint of Construction Works.** *R. Stewart and H. Hinrichsen.* Helena Hinrichsen (Envytech/Sweden)
11:20	**Using a ^{14}C Assay to Measure Abiotic Degradation of TCE by Magnetic Materials in Aquifer Sediment from the Western USA.** *J.T. Wilson, B. Wilson, D.L. Freedman, and A. Ramos Garcia.* John Wilson (Scissortail Environmental Solutions, LLC/USA)	SESSION BREAK	**Staying Nimble on Urban Brownfield Remediations is Key to Successful Closure: Addressing Field Complications in Stride.** *J. Good, J. Hayes, V. De Paula, S. Abrams, M. Dooley, and A. Miller.* Joseph Good (Langan/USA)	SESSION BREAK	**Ex Situ Stabilization and Solidification (S/S) of PFAS-Contaminated Materials.** *D.P. Cassidy, D.M. Reeves, and M. Jury.* Daniel Cassidy (Western Michigan University/USA)
11:45	SESSION BREAK	**Rehydration of an In Situ Thermal Treatment Zone following Heating to 100°C: Safety, Logistics and Outcomes.** *B. Schultz, J. Fairweather, R. D'Anjou, I. Cowie, and C. Winell.* Ben Schultz (Orica Ltd./Australia)	**Particulate Carbon Amendment Injection into a Fractured Granitic Bedrock Aquifer for Treatment of CVOCs.** *S.D. Richardson, D.M. Hart, and C.M. Mok.* Stephen Richardson (GSI Environmental Inc./USA)	**It Takes Three to Tango: A Well-Choreographed Dance between Site Characterization, Modeling, and Adaptive Management.** *M.W. Killingstad, D. Farber, L. Rodriguez, and S.T. Potter.* Marc Killingstad (Arcadis/USA)	SESSION BREAK
12:10	**A Twenty-Five Year Examination of Zero Valent Iron for Groundwater Remediation: The Elizabeth City, North Carolina Case Study.** *R.T. Wilkin, T.R. Lee, R.W. Puls, D.W. Blowes, C. Kalinowski, J.M. Tilton, and L.L. Woods.* Richard Wilkin (U.S. Environmental Protection Agency/USA)	**In Situ Thermal Remediation to Accelerate Site Redevelopment: Construction to Demobilization in 9 Months.** *M. Dotto, P. Kakarla, W. Caldicott, G. Geckeler, S. Thompson, M. Lambert, and R. Ciukurescu.* Paul Dombrowski (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)	SESSION BREAK	**Adaptative Site Management for a 115-Acre Chlorinated Solvent Plume with Two Separate Source Areas at Kennedy Space Center, Florida.** *A. Chrest, R.C. Daprato, M. Burcham, and J. Langenbach.* Rebecca Daprato (Geosyntec Consultants/USA)	**PANEL DISCUSSION** **Should We Develop PFAS Ambient Levels: Why and How?** **Moderator** Sheau-Yun (Dora) Chiang, Ph.D., PE (Wood, USA) **Panelists** Grant Trigger (Racer Trust, USA) Richard Anderson, Ph.D. (U.S. Air Force, USA) Jinxia Liu, Ph.D. (McGill University, Canada) Usha Vedagiri (Wood, USA) Rebecca Higgins, P.G. (Minnesota Pollution Control Agency, USA)
12:35	**Somersworth Superfund ZVI PRB: Over 20 Years of Performance Monitoring.** *A. Przepiora, S. O'Hara, S. Wadley, and S. Huda.* Shahen Huda (Geosyntec Consultants/USA)	**Thermally-Enhanced Chemical Oxidation and Pump and Treat at a Chlorinated Phenols Site in Eastern China.** *G. Heron, A. Small, A. Wei, P. Song, W. Sun, and L. Wei.* Gorm Heron (TRS Group, Inc./USA)	**Field Evaluation of the Solvent-Based Sampling Method for Collecting Gas-Phase VOC and Performing Compound-Specific Isotope Analysis.** *D. Bouchard, M. Marchesi, D. Hunkeler, R. Aravena, and T. Buscheck.* Daniel Bouchard (Contam-i-sotopes/Canada)	**Adaptive Management for Remediation of a 3-Mile Hexavalent Chromium Plume in Hinkley, California.** *K.M. Sullivan, I. Baker, M.E. Gentile, F. Lenzo, and I. Wood.* Kevin Sullivan (Pacific Gas and Electric Company/USA)	

A2. Abiotic and In Situ Biogeochemical Processes: Applications and Lessons Learned
A3.
B2.
B3. Thermal Conductive Heating: Case Studies
C3. In Situ Activated Carbon-Based Amendments: Assessing Effectiveness and Performance
C4.
D3.
D3. Adaptive Site Management: Lessons Learned for Site Characterization and Remedy
E3. Ex Situ PFAS Treatment: Soils/Solids and Other Waste Streams
Panel Discussion

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Tuesday Platform Sessions—10:30 a.m.–12:35 p.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
10:30	F3. PFAS Program Management in a Rapidly Changing Regulatory Environmen **Impact of Current and Future PFAS Regulations on Manufacturing and Supply Chains.** *M.C. Leahy and K. Sellers.* Maureen Leahy (Wood/USA)	G3. Heavy Hydrocarbons: Characterization and Remediation **Case Study for BOS 200®+ Injection to Remediate Saturated Zone LNAPL at Former Marshall Iron and Metal Site in Michigan.** *G. Simpson and J. Gal.* Gary Simpson (AST Environmental, Inc./USA)	H2. Conceptual Site Models: Improvements in Development and Application **Three-Dimensional Visualization and Volumetric Analysis to Update the Conceptual Site Model for a Former Uranium Mill Site.** *R.D. Kent.* Ronald Kent (RSI EnTech, LLC/USA)	I2. Advances in 1,4-Dioxane Biological Treatment Technologies **Establishing the Prevalence and Relative Rates of 1,4-Dioxane Natural Attenuation to Improve Remedy Evaluations.** *D.T. Adamson, J. Wilson, D. Freedman, A.A. Ramos-Garcia, C. Lebron, and A. Danko.* David Adamson (GSI Environmental Inc./USA)	Learning Lab **Selecting Sustainable Remediation Options Using the SURE Toolbox for Contaminated Land Management: Hands-on Training**
10:55	**A Cost-Benefit Evaluation of PFAS Drinking Water Treatment.** *K. Musgrove, T. Sorell, and J. Claffey.* Kristen Musgrove (Brown and Caldwell/USA)	**Lessons Learned from Large-Scale Applications of Smoldering Remediation.** *G.P. Grant, D. Major, G. Scholes, C. Murray, D. Liefl, L. Kinsman, W. Ferguson, and G. Sabadell.* David Liefl (Savron/Canada)	**The Importance of Preliminary Assessment in the CSM: A Case Study.** *C.D. Maluf and C.V. Witier.* Cristina Deperon Maluf (Ambscience Engenharia Ltda/Brazil)	**Full-Scale In Situ Propane and Oxygen Biosparging for Cometabolic Bioremediaiton of 1,4-Dioxane.** *C. Bell, A. Lorenz, and D. Favero.* Caitlin Bell (Arcadis/USA)	
11:20	**Implication of Per- and Polyflouroalkyl Substances (PFAS) and Other Emerging Contaminants to the Management of Excess Soil during Infrastructure Projects.** *D.B. Smith and J. Hannaford.* Douglas Bruce Smith (GHD/Canada)	**Full-Scale Remediation of the Historic Wood Impregnation Facility Using On-Site Co-Composting.** *O. Lhotský, R. Cervinka, and T. Cajthaml.* Ondrej Lhotsky (DEKONTA, a.s./ Czech Republic)	**Using Advanced Tools and Methods to Develop a Geochemical Model for Remedy Selection of Complex Mixtures of Chlorinated and Nitrated Hydrocarbons.** *S. Mancini, S. Kraus, J. Rayner, G. Wealthall, J. Henderson, E. Mack, and L. Ribeiro.* Silvia Mancini (Geosyntec Consultants/ Canada)	**An Update: Aerobic Fixed Film Biological Treatment Process for 1,4-Dioxane at the Lowry Landfill Superfund Site.** *L. Cordone, D.R. Griffiths, C. Carlson, and A. Biniwale.* Les Cordone (Parsons/USA)	**Navigating Vapor Intrusion and California Development: How to Sample Utilizing Three- Way Manifold and Reusable Shroud to Minimize Cost/Time/Helium Use**
11:45	SESSION BREAK	SESSION BREAK	**High-Resolution Site Characterization to Update a Conceptual Site Model and Optimize In Situ Remediation of Hydrocarbons and Arsenic.** *S. Aube, J. Chambert, P. Feshbach-Meriney, and G. Ulrich.* Stephane Aube (Parsons/USA)	SESSION BREAK	
12:10	F4. **Compound-Specific Stable Isotope Analysis to Determine Sources and Sinks of PFAS.** *K. Kuntze, A. Fischer, L. Qian, S. Sühnholz, S. Kümmel, and A. Georgi.* Kevin Kuntze (Isodetect GmbH, Germany/Germany)	G4. Natural Source Zone Depletion **Long-Term Trends in Vadose Zone Gas Concentrations and Fluxes Indicate Changes in Source Zone Oil Composition and Degradation Rates.** *J.J. Trost, B.A. Bekins, and G.N. Delin.* Jared Trost (U.S. Geological Survey/ USA)	SESSION BREAK	I3. **In Situ Biostimulation and Bioaugmentation of Chlorinated Solvents and 1,4-Dioxane.** *A. Polasko-Todd, L. LaPat-Polasko, and S. Mahendra.* Laurie LaPat-Polasko (Matrix New World Engineering/USA)	**3-D Visualization and Analysis Software Demonstration**
12:35	**Development of a Forensics-Based Approach to Evaluating Impacts of PFAS Contamination in the Environment.** *C.J. Neslund.* Charles Neslund (Eurofins Environment Testing America/USA)	**A Return to the Former Guadalupe Oil Field for Assessment of NSZD.** *B. McAlexander, N. Sihota, C. Smith, and J. Eichert.* Justin Eichert (Trihydro Corporation/ USA)	H2 **Is This Plume Really Ours? Revisiting a 30-Year Old Site Conceptual Model.** *D. Quafisi, A. Fure, E. Bishop, A. Murphy, D. Putz, T. West, E. Clement, S. Barker, A. Kunkel, and J. Smith.* Dimitri Quafisi (Haley & Aldrich, Inc./ USA)	**In Situ Ozone and Hydrogen Peroxide Remediation of 1,4-Dioxane in the Coastal Plain Region of North Carolina.** *C. Krouse, D. Briley, and C. Fitzgerald.* Caleb Krouse (AECOM/USA)	

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Tuesday Platform Sessions—1:00–1:25 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
1:00	A3. ZVI: 25 Years of Groundwater Remediation Applications **Long-Term Performance Update on the 17-Year Anniversary of the First Full-Scale EHC® Injection PRB.** *J. Molin, A. Seech, J. Valkenburg, R. Oesterreich, and J. Son.* Josephine Molin (Evonik/USA)	B3. Thermal Conductive Heating: Case Studies **Thermal Conductive Heating of Chlorinated Solvents in Crystalline Rock in Varberg, Sweden: Lessons Learned during Investigations, Delineation, and the Procurement Process.** *A. Bank, P. Hübinette, and L. Nilsson.* Fredric Engelke (Relement Miljö Väst/ Sweden)	C4. Compound-Specific Isotope Analysis: Case Studies in Evaluating Remedy Performance **Assessment of an Integrated Approach to Evaluate Biodegradation after Injection of Activated Carbon and Bioamendments.** *C.B. Ottosen, M.M. Broholm, P.L. Bjerg, D. Hunkeler, J. Zimmermann, N. Tuxen, G. Leonard, and D. Harrekilde.* Mette Broholm (Technical University of Denmark/Denmark)	D3. Adaptive Site Management: Lessons Learned for Site Characterization and Remedy **Effectiveness of Adaptive Strategies and Active Stakeholder Engagement: Knowledge Sharing from a Successful 10-Year Performance-Based Remediation Contract.** *S. Suryanarayanan, P. Srivastav, and R. Mayer.* Sowmya Suryanarayanan (APTIM/USA)	Panel Discussion **CONT. PANEL DISCUSSION**
1:25	**The Practitioner's Perspective of Zero-Valent Iron as a Pragmatic Media for Contaminant Remediation: It's Not 1995 Anymore!** *S.D. Warner and C.J. Ritchie.* Scott Warner (BBJ Group/USA)	**Integrated Thermal Desorption of SVOCs Using Heating Network and Vapor Recycling.** *X. Chen, R. D'Anjou, S. Guan, C. Zhou, C. Winell, Y. Shen, and Y. Liu* Xiaosong Chen (GEO/USA)	**How to Find the Most Convenient Remediation Strategy at a Former Industrial Site.** *A. Fischer, K. Kuntze, H. Eisemann, and A. Beckmann.* Kevin Kuntze (Isodetect GmbH/ Germany)	**Using Three-Dimensional Modeling and Real-Time Field Monitoring for an Optimized Remedial Injection Program at a CVOC-Contaminated Site.** *S. Sherman, M. Tulich, and A. Frankel.* Stephen Sherman (Integral Consulting, Inc./USA)	

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Tuesday Platform Sessions—1:00–1:25 p.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
1:00	F4. PFAS Source and Forensic Considerations **The Unique Challenges Associated with Applying Statistical Fingerprinting to PFAS.** *M.J. Bock, N. Rose, and T. Negley.* Michael Bock (The Intelligence Group/USA)	G4. Natural Source Zone Depletion **TBD**	H2. Conceptual Site Models: Improvements in Development and Application **Evaluation and Definition of Non-Aqueous Phase Materials Using a Multiple Lines of Evidence Approach.** *P. Barreto, C. Mowder, M. Sherrier, W. LeFevre, J. Henderson, P. Rego, and A. Ansara.* Paola Barreto Quintero (Jacobs/USA)	I3. 1,4-Dioxane Remediation Challenges **Addition of 1,4-Dioxane Removal System to Municipal Water Treatment Plant: Pilot to Operation.** *K. Wolohan, J. Macejkovic, and A. Ling.* Katie Wolohan (Barr Engineering Co./USA)	Learning Lab **UV-Transparent Wells for Non-Destructive Monitoring of LNAPL Distribution in the Ground Using HRSC Optical Techniques**
1:25	F4. PFAS Source and Forensic Considerations **PFAS Signature®: A Forensic Approach for PFAS Source Tracking.** *K. Dasu, L. Mullins, B. Seay, D. Friedenberg, S. Dufek, and J. Thorn.* Kavitha Dasu (Battelle/USA)	G4. Natural Source Zone Depletion **A Metadata Study: Soil Type/Moisture, Seasonal and Site Location Effects on Field-Measured NSZD Rates.** *J.A. Zimbron and V. Doebley.* Julio Zimbron (E-Flux/USA)	H2. Conceptual Site Models: Improvements in Development and Application **How to Combine Legacy Datasets with HRSC to Develop Flux-Based CSMs.** *R. Stuetzle, J. Nail, N. Welty, and M. Klemmer.* Robert Stuetzle (Dow/Canada)	I3. 1,4-Dioxane Remediation Challenges **The Innovative Case for Monitored Natural Attenuation as a Remedy for 1,4-Dioxane in a Complicated Geologic Regime.** *L.L. Kammer, M.R. Kanarek, J.J. Soukup, C.L. Sprague, and M.D. Summerlin.* Lisa Kammer (Weston Solutions, Inc./USA)	Learning Lab

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Wednesday Platform Sessions—8:00–10:05 a.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
8:00	Panel Discussion **PANEL DISCUSSION** **Thermal Remediation Technology Updates: Eight Experts Discuss Four Years of Innovations in 100 Minutes** **Moderators** Grant Geckeler (ISOTEC) Erin Hauber (U.S. Army Corps of Engineers) **Panelists** Steffen Griepke (TerraTherm) Gorm Heron (TRS Group) Clayton Campbell (McMillan-McGee) Jonah Munholland (Arcadis) Xiaosong Chen (GEO) Dave Liefl (Savron)	B4. In Situ Chemical Oxidation: Optimized Design Approaches and Lessons Learned **Optimizing Activated Persulfate Application to Address Density Effects and Geological Inhomogeneities at the Kaergaard Plantation Megasite.** *M. Christophersen, L. Bennedsen, T.H. Jørgensen, L. Nissen, L. MacKinnon, F. Solano, N.D. Durant, J.F. Christensen, I.H. Olesen, and L. Lévy.* Mette Christophersen (Ramboll Denmark/ Denmark)	C5. Site Closure: Models Used to Estimate Cleanup Timeframes **Application of New Modeling Tool to Estimate the Cleanup Time in Highly Heterogeneous Aquifers with Matrix Diffusion.** *D.K. Burnell and J. Xu.* Daniel Burnell (Tetra Tech, Inc./USA)	D4. Evaluating Surface Water/Groundwater Interactions: Innovative Monitoring Approaches and Modeling Applications **Mapping Contaminated Groundwater Discharges with Thermal Infrared-Sensing Unmanned Aerial Vehicles.** *M.R. Mathioudakis, C.R. Glenn, and D.E. Dores.* Michael Mathioudakis (GSI Environmental Inc./USA)	E4. PFAS Human Health and Ecological Risk Assessment and Toxicity **Contribution of Background PFAS Levels in Soils to Population Level Exposures and Effects on Environmental Risk Assessment.** *H.A. Lanza and A.T. Mikkonen.* Heather Lanza (CDM Smith Inc./ USA)
8:25			**Modeling Depletion of Mixed NAPLs to Evaluate Risk to Groundwater and Remediation Timeframe.** *R.K. Sillan.* Randall Sillan (AECOM/USA)	**Measuring Groundwater to Surface Water Emissions on Basalt Embankment with a Novel Partition Sampler.** *C.G.J.M. Pijls and D. Giesen.* C. Pijls (Tauw/Netherlands)	**Application of Toxicity-Based, Read-Across Methods for PFAS Hazard Identification in Risk Assessments.** *B. Selcoe, L. Lund, and N. Gowadia.* Barrie Selcoe (Jacobs/USA)
8:50		**Achievement of Regulatory Closure at a VOC-Impacted Site Using Soil Mixing with Sodium Persulfate.** *E. Filc and M. Perlmutter.* Emil Filc (Jacobs/USA)	**Pursuing a Mass Flux-Based Site Closure Using the Three-Compartment Model.** *J. Wahlberg, S. Potter, J. Roller, and J. Shonfelt.* Jennifer Wahlberg (Arcadis/USA)	**Use of Distributed Temperature Sensing Technologies in Evaluating Surface Water/Groundwater Interaction.** *H. Tahon.* Heather Tahon (Geosyntec Consultants/USA)	**Evaluation of the Reliability of PFAS Ecological Screening Levels.** *M. Frenchmeyer, K. Dally, and D. Rigg.* Meredith Frenchmeyer (Arcadis/USA)
9:15		**Lessons Learned from Multiple Technology Evaluation to Treat Residual Contamination at a Former MGP Site.** *J. Bergman, H. Nord, P. Elander, S. Moeini, J. Molin, and B. Smith.* Jonny Bergman (RGS Nordic/ Sweden)	**Necessary Geochemical Data for a Uranium Reactive Transport Model to Simulate Cleanup Timeframes and Achieve Site Closure at the Monticello, Utah, CERCLA Site.** *R.H. Johnson, R.D. Kent, A. Reynolds, and J. Nyman.* Raymond Johnson (RSI EnTech, LLC/ USA)	**Demonstrating a Toolbox of Technologies for Mapping and Monitoring of Contaminated Groundwater Discharges to Surface Water Background and Objective.** *R. Iery, L. Slater, D. Ntarlagiannis, M. Briggs, and F. Day-Lewis.* Ramona Iery (U.S. Navy/USA)	**Trends and Findings: Human Blood Serum Levels of PFAS in Relation to Regulatory Target Levels.** *U. Vedagiri and S. Tiscione.* Usha Vedagiri (Wood/USA)
9:40	SESSION BREAK	B4. In Situ Chemical Oxidation: Optimized Design Approaches and Lessons Learned **Successful Treatment of Trichloroethene in Deep Fractured Bedrock Using ISCO Recirculation.** *J. Hickey, J. LeClair, J. Marolda, J. Spadt, and K. Dyson.* James Marolda (Brown and Caldwell/ USA)	SESSION BREAK	SESSION BREAK	SESSION BREAK
10:05	A4. **Management of a PCE Plume in an Urban Area with Complex Hydrogeological Settings Using a Combined Strategy with Physical, Chemical, Biological and Natural Processes.** *M. Petrangeli Papini, C. Nielsen, L. Ledda, P. Ciampi, P. Goria, M. Carboni, E. Alesi, M. Donati, and E. Bartsch.* Marco Petrangeli Papini (University of Rome "La Sapienza"/Italy)	B4. In Situ Chemical Oxidation: Optimized Design Approaches and Lessons Learned **In Situ Chemical Oxidation Bench-Scale Column Testing Using Base-Activated Potassium Persulfate.** *S. Dworatzek, J. Roberts, and K. Ashworth.* Sandra Dworatzek (SiREM/Canada)	C6. **Advancements in Environmental Data Science Frameworks: Integrating Data Sources, Analytics, and Stakeholder Access.** *A. Forsberg, J.R. Butner, M. Germon, T. Palaia, A. Sidebottom, and R.J. Stuetzle.* Adam Forsberg (Jacobs/USA)	D5. **The Progression of EZVI Technology for In Situ DNAPL Destruction in Saturated and Vadose Soils: Lessons Learned and Recent Advancements.** *G. Booth.* J. Greg Booth (Woodard & Curran/ USA)	E5. **PFAS Fate and Transport at a Wastewater Treatment Plant and Collocated Sewage Sludge Incinerator.** *I.C. MacGregor, B.A. Seay, A. Frank, S.S. Buehler, M. Austin, R. Krile, G.A. Fenton, J.T. Eastep, J.R. Thorn, M. Schumitz, D.M. Schumitz, D. Heiss, R. Williamson, C. Cucksey, M.W. McCauley, K. Abrams, K. Dasu, W. Fritz, L. Kammer, W.C. Anderson, C. Adkins.* Brannon Seay (Battelle/USA)

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Wednesday Platform Sessions—8:00–10:05 a.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
8:00	F5. PFAS: Groundwater Treatment Case Studies **Improved Longevity and Selectivity of PFAS Groundwater Treatment: Super-Fine Powdered Activated Carbon and Ceramic Membrane Filter (SPAC-CMF) System.** *J.A. Quinnan, T. Reid, J. McDonough, and C. Bellona.* Terence K. Reid (Aqua-Aerobic Systems, Inc./USA)	G5. In Situ Remediation of Petroleum Hydrocarbons **Long-Term Anaerobic Bioremediation of MGP Contaminants by Iron- and Sulfate-Reducing Bacteria following Combined ISCO/ISS Treatment.** *D.P. Cassidy and V.J. Srivastava.* Daniel Cassidy (Western Michigan University/USA)	H3. Advanced Geophysics and Remote/Direct Sensing Tools and Techniques **Recent Developments in Nuclear Magnetic Resonance Logging for Site Characterization.** *G. Liu, S. Knobbe, J. Butler, E. Grunewald, D. Walsh, and R. Knight.* Gaisheng Liu (Kansas Geological Survey/USA)	I4. Microplastics, Pharmaceuticals, and Other Emerging Contaminants **Emerging Contaminants: Anticipating Developments.** *D. Nelson, K. Sellers, and N. Weinberg.* Nadine Weinberg (ERM/USA)	Learning Lab **Successful Sub-Slab Vapor Data Collection, Best Practices**
8:25	**The In Situ Treatment of TCE- and PFAS-Impacted Groundwater Using Anaerobic and Sorptive Techniques.** *R. McGregor and L. Benevenuto.* Rick McGregor (InSitu Remediation Services Ltd./Canada)	**Subgrade Biogeochemical Reactors for Treatment of Petroleum Hydrocarbon Contamination.** *J. Gamlin and L. Duke.* Jeff Gamlin (Jacobs/USA)	**Field Testing of a Direct Push Deployed NMR Logging System for Geohydrologic Site Characterization.** *T.M. Christy, E. Grunewald, and W. McCall.* Thomas Christy (Geoprobe Systems/USA)	**In Situ Reduction of 1,2,3-Trichloropropane in Groundwater: Advancements and Case Studies.** *M. Asher, S. Varadhan, E. Suchomel, L. Kane, and S. Dworatzek.* Melissa Asher (Geosyntec Consultants/USA)	
8:50	**Field Demonstrations of Enhanced Contact Plasma for PFAS Destruction: Lessons Learned.** *S. Mededovic Thagard, T.M. Holsen, S.D. Richardson, and P.R. Kulkarni.* Thomas Holsen (Clarkson University/USA)	**Use of Surfactants and Surfactant-Enhanced In Situ Chemical Oxidation (S-ISCO®) for NAPL Remediation at the Kaergaard Plantation Megasite.** *L. MacKinnon, F. Solano, N.D. Durant, L.R. Bennedsen, M. Christophersen, T.H. Jørgensen, B. Germundsson, J. Muff, J.F. Christensen, and I. Holm Olesen.* Felipe Solano (Geosyntec Consultants/Canada)	**High-Resolution Redox Monitoring to Evaluate and Optimize the Remediation of Redox-Sensitive Solutes in Dynamic Hydrogeologic Environments.** *C.D. Wallace and M.R. Soltanian.* Corey Wallace (Geosyntec Consultants/USA)	**FDOM as a Screening Technique for Fluorescent Pharmaceuticals in a Contaminant Plume.** *M.M. Broholm, L. Vinther, C.H.H. Hansen, H. Draborg, U. McKnight, A.-R. Schittich, P.L. Bjerg, C. Stedmon, U. Wünch, L. Dissing, and J.K. Pedersen.* Mette Broholm (Technical University of Denmark/Denmark)	**PFAS Rapid Data Analysis and Insight Dashboard**
9:15	**What Is the Best Treatment Configuration for My PFAS Groundwater Treatment System? Lessons Learned from Six Years of Research and Development.** *S. Sharma, N. Hagelin, E. Thompson, M. Crimi, T. Holsen, S. Mededovic, J. Guelfo, S. Woodard, and B. Newman.* Sachin Sharma (Wood/USA)	SESSION BREAK	**High-Resolution Delineation of Facility-Scale Subsurface Heterogeneity by Hydraulic and Geophysical Tomography.** *C.M.W. Mok, T.-C.J. Yeh, W.A. Illman, and B.A. Carrera.* Chin Man Bill Mok (GSI Environmental Inc./USA)	**Still Haven't Found What You're Looking For? Integrated Interdisciplinary Analyses May Be the Solution.** *S.T. Glassmeyer, M.A. Mills, A.L. Batt, E.K. Medlock Kakaley, Q. Teng, E.T. Furlong, and D.W. Kolpin.* Susan Glassmeyer (U.S. Environmental Protection Agency/USA)	
9:40	SESSION BREAK	G5. In Situ Remediation of Petroleum Hydrocarbons **Soil and Groundwater Bioremediation Using ORC® and Organic Fertilizer at a Tidally-Influenced Site.** *H. Benfield, C. Ferrell, and R. Brenner.* Heather Benfield (Tetra Tech, Inc./USA)	SESSION BREAK	SESSION BREAK	**Supercritical Water Oxidation: Successfully Destroying Per- and Polyfluoroalkyl Substances (PFAS) in the Environment**
10:05	F6. **Field Demonstration of Pilot-Scale Treatment System Using a Sonolysis Reactor for PFAS Removal.** *P. Kulkarni, S.D. Richardson, B. Nzeribe, D.T. Adamson, S.S. Kalra, S. Mahendra, J. Blotevogel, A. Hanson, G. Dooley, S. Maraviov, and J. Popovic.* Poonam Kulkarni (GSI Environmental Inc./USA)	G5. In Situ Remediation of Petroleum Hydrocarbons **Addressing Residual Hydrocarbon Concentrations Using Micron-Scale Carbon Injections at Three North Carolina Sites.** *T.A. Tapley and K.E. Moon.* Tracey A. Tapley (U.S. Army Corps of Engineers/USA)	H2. **The Grindsted Plume: Screening for Main Discharge Zones of a Large and Complex Plume with Chlorinated Ethenes and Pharmaceuticals to Grindsted Stream.** *D. Harrekilde, B.B. Thrane, J.K. Pedersen, L. Dissing, P.L. Bjerg, M.M. Broholm, C.B. Ottosen, and H. Draborg.* Dorte Harrekilde (Ramboll/Denmark)	I5. **Deep Enough: Limitations on Vertical Delineation in Fractured Bedrock Aquifers.** *M. Cobb, W. Plasket, and M. Webb* Michael Cobb (Arcadis/USA)	

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Wednesday Platform Sessions—10:30 a.m.–12:35 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
10:30	A4. Combined Remedies and Treatment Trains **Combining Slurry-Supported Soil Excavation, Air/Biosparging, and Enhanced Reductive Dechlorination to Accelerate Remediation of a Commingled Plume with LNAPL.** *M. Perlmutter, J. Persons, K. Rosebrook, M. Strong, and D. Williamson.* Mike Perlmutter (Jacobs/USA)	B4. **ISCO Using Sequential Activation Methods for Sodium Persulfate for Treatment of PCP and DRO.** *A.A. Rees, D.C. Phelps, P.M. Dombrowski, P. Karla, and M. Tempe.* Assaf Rees (AECOM/USA)	C6. Data Analytics: Use of Advanced Decision Analysis Tools **Using Advanced Data Analytics to Reduce Management Cost, Compliance and Operational Risks of a Groundwater Source Control Remedy.** *E. Whiting, B. Robinson, T.J. Slater, K. Deeny, and M. LeFrancois.* Erica Whiting (ERM/USA)	D5. DNAPL Source Zone Remediation: Lessons Learned **Sequenced S-ISCO®, ISCO and Bioremediation for Treatment of a Pharmaceutical Waste Mixture: Full-Scale Application.** *T.H. Jørgensen, L. Nissen, L. MacKinnon, F. Solano, N.D. Durant, L.R. Bennedsen, M. Christophersen, J.F. Christensen, and I. Holm Olesen.* Torben Højbjerg Jørgensen (COWI AS/Denmark)	E5. Managing PFAS at Publically-Owned Treatment Works (POTWs) **Assessing the Release of PFAS from Municipal Wastewater Finished Biosolids through Bench and Field Aging Experiments.** *J. Hooper, C. Schaefer, L. Lee, N. Beecher and D.M. Drennan.* Jennifer Hooper (CDM Smith Inc./USA)
10:55	**Combining In Situ Thermal Treatment and In Situ Chemical Reduction to Leverage Synergistic Processes.** *G. Booth, K. Lauer, R. Hogdahl, and R. Simon.* J. Greg Booth (Woodard & Curran/USA)	SESSION BREAK	**Benefits of an Integrated Data Information, Visualization, and Analytics System for Environmental Site Management.** *V.L. Freedman, C.D. Johnson, and P.D. Royer.* Christian Johnson (Pacific Northwest National Laboratory/USA)	**When Dilution Is the Solution to Pollution: How Mobilizing DNAPL Resulted in a More Successful Injection-Based Remedial Treatment Approach.** *C. Martin and M. Murday Pariso.* Collin Martin (Ash Union, LLC/USA)	**In-Depth Characterization of PFAS in Wastewater: A More Comprehensive Analysis.** *T. McKnight, C. Neslund, and A. Patterson.* Taryn McKnight (Eurofins Environment Testing America/USA)
11:20	**Innovative Treatment of a Large, Dilute, and Commingled Plume Using a Solar-Powered In Situ Bioremediation and Phytoremediation System.** *M.G. Sweetenham, F.J. Krembs, S.L. Lombardo, and G. Risse.* Fritz Krembs (Trihydro Corporation/USA)		**Harnessing the Power of Big Datasets to Optimize Bioremediation.** *D. Taggart, K. Clark, and S. Rosolina.* Sam Rosolina (Microbial Insights, Inc./USA)	**In Situ Thermal Remediation of a Highly-Impacted DNAPL Source Zone.** *M. Kluger, R. Glass, J. van Rossum, J. Binon, T. Keijzer, T. Ruffenach, and B. Souffre.* Mark Kluger (TRS Group, Inc./USA)	**A Statewide PFAS Assessment of Wastewater Treatment Plants in Michigan: Occurrence and Temporal Variations.** *D. Bogdan.* Dorin Bogdan (AECOM/USA)
11:45	SESSION BREAK	B5. Injectable Activated Carbon Amendments: Lessons Learned and Best Practices **Injectable Activated Carbon Amendments: Lessons Learned and Best Practices from Solicited Expert Experience with Examples.** *E.J. Winner.* Ed Winner (Remediation Products, Inc./USA)	SESSION BREAK	SESSION BREAK	SESSION BREAK
12:10		**Site Assessment, Design Considerations, and Performance Results from a Colloidal Activated Carbon Barrier Application at a Large Chlorinated Plume in Texas.** *T. McMillan, V. Mustafin, J. Snyder, C. Lee, and C. Ortiz.* Teri McMillan (EA Engineering, Science, and Technology, Inc., PBC/USA)			
12:35	A4. **In Situ Chemical Reduction and Enhanced Anaerobic Bioremediation to Treat Groundwater TCE Plume Commingled with Cr(VI).** *J. Leu, K. Diller, and D. Griffiths.* Jim Leu (Parsons/USA)	**Results of Several Activated Carbon Installations.** *T. Sorrells.* Tree Sorrells (Alpine Remediation, Inc./USA)	C7. **Keys to Success from 20 Years of Optimization.** *M.A. Barba, J.D. Horin, and J. Santillan.* Michael Barba (Noblis/USA)	D6. **DPT Jet Injection for Remediation of Low-Permeability Zones: Two Full-Scale Case Studies in Two States.** *C.M. Ross, C.S. Martin, C. Shores, and D.M. Baird.* Chapman Ross (FRx, Inc./USA)	E6. **Removal of PFAS from Groundwater: Comparing an Emerging Novel Adsorbent with a Traditional Granular Activated Carbon.** *C.M.G. Carpenter, E. Conti, K. Gruebel, Y. Ling, and M. Payne.* Corey Carpenter (EKI Environment & Water, Inc./USA)

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Wednesday Platform Sessions—10:30 a.m.–12:35 p.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
10:30	F6. Ex Situ PFAS Destruction Technologies **Development of a Supercritical Water Oxidation Technology to Treat Per- and Polyfluoroalkyl Substances in Impacted Media.** *S. Rosansky, C. Scheitlin, J. Stowe, and K. Dasu.* Stephen Rosansky (Battelle/USA)	G5. In Situ Remediation of Petroleum Hydrocarbons **Remediation and Closure of an LNAPL-Contaminated Site Using an Innovative Three-Step Approach from Remedial Design to In Situ Remediation.** *G.G. Ceriani.* Mike Mazzarese (AST Environmental, Inc./USA)	H3. Advanced Geophysics and Remote/Direct Sensing Tools and Technique **Use of Hyperspectral Imaging to Detect Trichloroethylene and Per- and Polyfluoroalkyl Substances in the Environment.** *M.D. Lewis, L. Newman, A. Kenyon, and A.G. Keith.* Amy Keith (NASA/USA)	I5. Technical Impracticability: Challenges and Considerations for Evaluation of Fractured Rock Sites **Adaptive Management for Characterization and Remediation of DNAPL in Fractured Crystalline Bedrock.** *E.C. Ashley, R.A. Wymore, and N.J. Castonguay.* Ernest Ashley (CDM Smith Inc./USA)	Learning Lab **The Application of Indicators and Tracers for Vapor Intrusion Sampling Strategies with a Scale Building**
10:55	**PFAS Destruction in Concentrated Waste Streams with Hydrated Electrons.** *J. Xiong.* John Xiong (Haley & Aldrich, Inc./USA)	**Laboratory Demonstration of Successful Anaerobic Benzene, Toluene and *o*-Xylene Bioremediation Using Mixed Bioaugmentation Cultures.** *C.R.A. Toth, N. Bawa, S. Guo, E.A. Edwards, J. Webb, C. Scales, K. Finney, and S. Dworatzek.* Courtney Toth (University of Toronto/Canada)	**Application of Nuclear Magnetic Resonance Logging to Develop a Three-Dimensional Model of Aquifer Hydraulic Conductivity to Support Evaluation of Remedial Alternatives.** *J.N. Dougherty, T. Cook, M. Gamache, K. Heisen, T. Macbeth, W. Treadway, M. Goldberg, and M. Simon.* John Dougherty (CDM Smith Inc./USA)	**Evaluation of High-Resolution Methods for VOC Contaminant and Flux Distributions in Igneous Rock.** *L. Davidsson, S. Chapman, B. Parker, P. Pehme, C. Maldaner, and E. Bergstedt.* Per Johansson (WSP/Sweden)	
11:20	**Destructive PFAS Technology Niche and Life Cycle Costs for Water Treatment.** *T.W. Macbeth, M. Harclerode, N. Pica, J. Bamer, C. Schaefer, D. Nguyen, P. Murphy, and D. Burns.* Tamzen Macbeth (CDM Smith Inc./USA)	**Leveraging Fractures to Access and Treat Recalcitrant In Situ Hydrocarbons.** *W. Slack, C. Ross, and D. Baird.* William Slack (FRx, Inc./USA)	**Investigation of Contaminant Leakage from Mink Mass Graves and Risk to Groundwater and Surface Water.** *B.B. Thrane, D. Harrekilde, J.S. Jensen, and C. Moosdorf.* Britt Boye Thrane (Ramboll Denmark/Denmark)	**Multiple, Short-Term, Cross-Hole Aquifer Tests to Three-Dimensionally Map Hydraulic Conductivity in Metamorphic Rocks.** *R.D. Mutch, K.J. Rader, C.J. Fanelli, and E. Meeks.* Robert Mutch (Mutch Associates, LLC/USA)	**Electrical Geophysical Monitoring and Characterization of Contaminant Storage and Release in Low Permeability Zones**
11:45	**Pilot-Scale Ball Milling of PFAS-Impacted Soil from a Firefighting Training Area: Key Operational Parameters.** *N. Battye, D. Patch, D. Roberts, K. Weber, L. Turner, B. Kueper, S. Marconetto, T. Lyon, and B. Harris.* David Patch (Royal Military College of Canada/Canada)	SESSION BREAK	SESSION BREAK	SESSION BREAK	
12:10	SESSION BREAK				**SOCRATES: A Web-Based Application for Environmental Data Analytics**
12:35		G6. **Mining Valuable Data from Periodic LNAPL Recovery.** *A. Pennington and T. Duffy.* Andy Pennington (Arcadis/USA)	H3. **Development of a Borehole Electrical Technology for Assessing Diffusion and Dual Domain Mass Transfer.** *R. Iery, L. Slater, D. Ntarlagiannis, S. Falzone, F. Day-Lewis, C. Johnson, and N. Terry.* Ramona Iery (U.S. Navy/USA)	I6. **Application of Environmental Sequence Stratigraphy (ESS) Using High-Resolution Site Characterization (HRSC) Tools.** *L.J. Mastera and R.J. Fiacco.* Larry Mastera (ERM/USA)	

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Wednesday Platform Sessions—1:00–3:05 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
1:00	A4. Combined Remedies and Treatment Trains **Combined Remedial Technologies: Electrical Resistance Heating (ERH) Bioremediation Injections and Groundwater Extraction with Activated Carbon Treatment and Soil Vapor Extraction (SVE) and Soil Removal.** *J.R. Kane.* John Kane (Kane Environmental, Inc./USA)	B5. Injectable Activated Carbon Amendments: Lessons Learned and Best Practices **A Novel In Situ Carbon (ISC) Injection Technology Suited to Site Closure.** *J.K. Sheldon and T. Herrington.* Jack Sheldon (Antea Group/USA)	C7. Optimizing Remedial Systems **Improving Remedial Outcomes: Lessons Learned from Pre-Application Assessments at 50 Sites.** *C. Sandefur, R. Hardenburger, and C. Lee.* Craig Sandefur (REGENESIS/USA)	D6. Low-Permeability Zone Challenges, Permeability Enhancements, and Case Studies **Enhanced Amendment Delivery into Low Permeability Zone Using Xanthan Gum.** *A. Boodram, L. Zeng, M. Wenrick, D. Hopper, S. Abrams, and R. LoCastro.* Aroona Boodram (Langan/USA)	E6. Ex Situ PFAS Water Treatment Technologies **Process to Separate PFAS from Groundwater Using Colloidal Gas Aphrons.** *P.R. Kulkarni, H. Javed, N.W. Johnson, S.D. Richardson, and C.J. Newell.* Charles Newell (GSI Environmental Inc./USA)
1:25	**Excavation, Groundwater Extraction, In Situ Bioremediation, and In Situ Chemical Oxidation to Treat Large Commingled cVOC Plumes.** *R.E. Mayer, J. Koelsch, K. Chambers, and M. Gunderson.* Robert Mayer (APTIM/USA)	**Fiscally Responsible Characterization and Remediation of a DNAPL and Solute Plume in Low-Permeability Clay.** *B. Brab and K. Thompson.* Bill Brab (AST Environmental, Inc./USA)	**ITRC Regulatory Guidance: Optimizing Injection Strategies and In Situ Remediation Performance.** *D.A. Scheer, T. Macbeth, and J. Waldron.* Tamzen Macbeth (CDM Smith Inc./USA)	**Replacing Pump and Treat with Sustainable In Situ Bioremediation for Chlorinated Solvent Plume in Low Permeability Matrix.** *K.A. Morris, J.E. Vondracek, P. Mori, and G. Barozza.* Kevin Morris (ERM/USA)	**Passive Treatment of PFAS-Impacted Stormwater.** *J. Cuthbertson, J. McDermott, M. Shore, R. Mora, M. Ajemigbitse, and J. Collins.* John Cuthbertson (AECOM/USA)
1:50	**Selection of Combined Treatment Remedy Approaches Based on Site Constraints and Redevelopment Timelines: Three Case Studies.** *M. Temple, P. Kakarla, and P.M. Dombrowski.* Mike Temple (In-Situ Oxidative Technologies, Inc. [SOTEC]/USA)	SESSION BREAK	SESSION BREAK	**Overcoming a Vexing Problem of In Situ Remediation within Complex Geology: EK-Enhanced In Situ Chemical Oxidation.** *J. Wang, A. Montgomery, A. Callaway, and J. Ferreira.* James Wang (Geosyntec Consultants/USA)	**Lessons Learned: Design Comparison of a Municipal and Groundwater Treatment Systems Utilizing GAC for the Removal of Perfluoroalkyl Substances in Groundwater.** *B.L. Porter, M.G. Quinlan, G. Watson, M. Powers, and C. Buerkle.* Benjamin Porter (APTIM/USA)
2:15	SESSION BREAK	B6. Innovations in ZVI Amendment Formulations and Applications **Performance Advantages Provided by the Combined Use of Sulfidated Zero Valent Iron and Other Synergistic Remediation Amendments.** *J. Freim.* John Freim (REGENESIS/USA)	C7. Optimizing Remedial Systems **Financial Forecast Tools for Remediation: Can You Afford to Change Your Cleanup Remedy?** *P. Favara and J. Butner.* Paul Favara (Jacobs/USA)	**Low Permeability: ISCO Optimization Using Groundwater Recirculation.** *R.D. Desrosiers and B.D. Rach.* Richard Desrosiers (GZA GeoEnvironmental, Inc./USA)	**Lessons Learned through Novel Treatment of PFAS-Impacted Stormwater at a National Guard Base.** *B.F. Fletcher, R. Wagner, L. Kammer, D. Close, M.A. Lordemann, J.L. Frehse, and R.J. Subasavage.* Bryce Fletcher (Weston Solutions, Inc./USA)
2:40	A4. Combined Remedies and Treatment Trains **Combined In Situ Treatment Methods and Technologies Reduce Mass at a Large DNAPL Solvent Site.** *M. Mazzarese and G. Simpson.* Mike Mazzarese (AST Environmental, Inc./USA)	**Colloidal Zero-Valent Iron Injection for Enhanced Biotic/Abiotic Degradation of a TCE DNAPL Source.** *C.L. Jacob and E.M. Waibel.* Clint Jacob (Landau Associates, Inc./USA)	**Combining and Optimizing Remedies Spatially and Temporally to Lower the Cost of Thermal Remediation.** *T. Kinney, L. Soos, C. Blundy, and C. Thomas.* Thomas Kinney (GHD/USA)	SESSION BREAK	SESSION BREAK
3:05	A4. Combined Remedies and Treatment Trains **Application of Multiple Remediation Techniques to Achieve Full Site Closure Abroad.** *M. van den Brand, G. Heron, J. van Rossum, and H. Boden.* Marco van den Brand (HMVT/Netherlands)	**Old ZVI and New ZVI: Enhanced Reductive Dechlorination and PlumeStop® Form Effective Backstop to ZVI PRB.** *T. Huff, J. Bowie, D. Sarr, S. Haitz, M. Burns, and A. Bakenne.* Timothy Huff (WSP/USA)	**Evolution of Groundwater Treatment Systems: From Design and Installation to Post-Closure.** *J.A. Boylan.* John Boylan (RSI EnTech/USA)	D6. **Mitigate Long-Term Back-Diffusion from Low-K Unit with Horizontal ISCO Barriers.** *H. Huang, D. Kistner, D. Baird, D. Knight, J. Cibrik, and A. Lee.* He Huang (AECOM/USA)	E6. **PFAS Treatment with Ion Exchange: A Review of Case Histories and Best Practices for Optimal Economics and Efficiencies.** *C. Swanson and F. Boodoo.* Cathy Swanson (Purolite Corporation/USA)

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Wednesday Platform Sessions—1:00–3:05 p.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
1:00	F7. Advances in Vapor Intrusion Investigations **A Practical Protocol for Integrating Indicator and Tracer Data into Vapor Intrusion Assessments.** *L. Lund, K.E. Hallberg, C. Lutes, L. Levy, D. Caldwell, T. Lewis, and T. Walker.* Loren Lund (Jacobs/USA)	G6. LNAPL Recovery/Remediation Technology Transitions **Transmissivity-Based Remedial Strategy Development and Implementation for a Large-Scale LNAPL Plume.** *M.J. Weidmann, S. Zachary, A. Fure, and R. Keeler.* Michael J. (Joe) Weidmann (Haley & Aldrich, Inc./USA)	H3. Advanced Geophysics and Remote/Direct Sensing Tools and Techniques **Improving Groundwater Contamination Investigations Using the tTEM Mapping Technique.** *J. Simensen, F. Jørgensen, C.B. Nielsen, and A. Edsen.* Jesper Simensen (Central Denmark Region/Denmark)	I6. Depositional Environments and Stratigraphic Considerations for Remediation **Application of Geology-Focused Approach in the Implication at a Site with Complex Geology and Site Logistics.** *K. Carr, S. Price, A. Rees, and J. Sadque.* Katharine Carr (AECOM/USA)	Learning Lab
1:25	F7. Advances in Vapor Intrusion Investigations **The Importance of Sanitary Sewers as the Expected Preferential Pathway in Vapor Intrusion Evaluations.** *C.A. Cox.* Craig Cox (Cox-Colvin & Associates, Inc./USA)	G6. LNAPL Recovery/Remediation Technology Transitions **Which Technology and When? A Comparison of Natural versus Mechanical Petroleum Remediation Rates.** *T. Palaia.* Tom Palaia (Jacobs/USA)	H3. Advanced Geophysics and Remote/Direct Sensing Tools and Techniques **Use of Innovative Crosshole Georadar to Understand Contaminant Transport at an Industrial Site Investigation.** *B.B. Jensen, M.C. Looms, L. Nielsen, K. Tsitonaki, T.M. Hansen, L. Rosenberg, P.L. Bjerg, and N. Tuxen.* Bolette Badsberg Jensen (Capital Region of Denmark/Denmark)	I6. Depositional Environments and Stratigraphic Considerations for Remediation **Optimizing the Level of Detail in Stratigraphic Interpretations.** *J.P. Brandenburg and M.D. Einarson.* J.P. Brandenburg (Haley & Aldrich, Inc./USA)	
1:50	F7. Advances in Vapor Intrusion Investigations **Vinyl Chloride (VC) in Sewer Systems: A Neglected Problem When Ensuring a Solid Risk Assessment towards Indoor Air?** *W. Hyldegaard, K.B. Nielsen, A. Riishoej, E.B. Weeth, and K.B. Mortensen.* Klaus Bundgaard Mortensen (Region of Southern Denmark/Denmark)	G6. LNAPL Recovery/Remediation Technology Transitions **A Compendium of Tools and Methods to Support the Optimization and Sustainable Transition of Active Remediation to Natural Attenuation.** *I. Hers, P. Jourabchi, and M. Lahvis.* Matthew Lahvis (Shell Global Solutions/USA)	H3. Advanced Geophysics and Remote/Direct Sensing Tools and Techniques **Novel Applications of the Hydraulic Profiling Tool and Tandem Electrical Conductivity Logs for Site Investigation and Remediation.** *W. McCall, T. Christy, J. Fontana, and A. Kirsch.* John Fontana (Vista GeoScience/USA)	I6. Depositional Environments and Stratigraphic Considerations for Remediation **Bringing it All Back Home: The Depositional Systems Approach to Remediation Geology and the Current Status of Stratigraphic Practice.** *C. Plank, R. Cramer, M.R. Shultz, and J. Gillespie.* Colin Plank (Burns & McDonnell/USA)	
2:15	SESSION BREAK	SESSION BREAK	SESSION BREAK	SESSION BREAK	
2:40	F7. Advances in Vapor Intrusion Investigations **Overcoming Shortcomings of Traditional Vapor Intrusion Sampling Approaches via Continuous Automated Monitoring and Response.** *B. Hartman, M. Kram, and C. Frescura.* Blayne Hartman (Hartman Environmental Geoscience/USA)	G7. LNAPL Sites: Understanding and Managing Risks **Managing Compositional-Based LNAPL Risk and Concerns at a Legacy Petroleum-Impacted Site in Phoenix, Arizona.** *R. Frank, T. Palaia, and V. Gamez Grijalva.* Robert Frank (Jacobs/USA)	H4. Advanced Sampling and Analysis Tools and Techniques **A Comparison of In-Well Flux Tools to Conventional Approaches to Determine Groundwater Flow for Successful Design of In Situ Treatment Zones.** *C. Sandefur and J. Wilson.* Craig Sandefur (REGENESIS/USA)	I7. Process-Based Conceptual Site Models (CSMs) for Informing Remediation **Identifying Natural and Anthropogenic Groundwater Discharge Areas in a Fractured Rock System and Use of Mass Flux to Support Remedy Selection.** *R. O'Neill, J. Marolda, and S. Stucker.* Robert O'Neill (Brown and Caldwell/USA)	
3:05	F7. Advances in Vapor Intrusion Investigations **Gases Fluxes to Atmosphere: Soil Diffusion Parameters and Rainfall Effect.** *I. Delsarte, G. Cohen, M. Momtbrun, P. Höhener, and O. Atteia.* Olivier Atteia (Bordeaux University/France)	G7. LNAPL Sites: Understanding and Managing Risks **Application of a LNAPL Risk Assessment at a Complex Site: An Innovative Tool for Risk-Based Management in Brazil.** *A.C. Chirmici, G.D.C. Mello, and R.G.S. Taga.* Alyne Cetrangolo Chirmici (Ramboll Brazil/Brazil)	H4. Advanced Sampling and Analysis Tools and Techniques **A New Method for Assessing Back Diffusion of Volatile Organic Compounds in Fractured Bedrock Aquifers.** *W.C. Brandon and P.T. Harte.* William C. Brandon (U.S. EPA/USA)	I7. Process-Based Conceptual Site Models (CSMs) for Informing Remediation **Conceptual Site Model for a Complex Mixed-Composition NAPL Site in Fractured Sedimentary Rock under Hydraulic Control.** *J.J. Frederick, P.R. Trudell, and K. Goldstein.* Paul Trudell (WSP/USA)	**In Situ Bioreactor: A Unique Remediation Tool Delivering Sustained Biostimulation**

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Wednesday Platform Sessions—3:30–3:55 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
3:30	A4. Combined Remedies and Treatment Trains **Optimized Reagent Blends for a Combined ISCO-ISS Remedy.** *B.A. Smith and B. Desjardins.* Brant Smith (Evonik/USA)	B6. Innovations in ZVI Amendment Formulations and Applications **Innovative ZVI Application for Sustainable Remediation of Chlorinated Solvent Plumes.** *K. Rügge, M. Dreyer, L. Brabæk, T.H. Jørgensen, J. Wang, D. Fan, N. Durant, R. Thalund-Hansen, P.L. Bjerg, M.T. Hag, and N. Tuxen.* Kirsten Rugge (COWI A/S/Denmark)	C7. Optimizing Remedial Systems **Evaluation of Remediation Flow Cell System Remediating Trichloroethylene at a Superfund Site in the Southwestern United States.** *J. Bartos, P. Jeffers, R. Landis, S. Koehne, E. Marks, and N. Goulding.* John Bartos (EHS Support/USA)	D6. Low-Permeability Zone Challenges, Permeability Enhancements, and Case Studies **Using High-Resolution Characterization and Hydraulic Permeability Enhancement to Improve Remedy Performance in a Downgradient Plume.** *N.T. Smith, D. Nguyen, N.L. Smith, R.A. Wymore, S. Garcia, and I. Bowen.* Nathan Smith (CDM Smith Inc./USA)	E6. Ex Situ PFAS Water Treatment Technologies **Effective Adsorption Removal of Polyfluoroalkyl and Perfluoroalkyl Substances (PFAS) by Reed Straw-Derived Biochar (RESCA).** *N. Liu and M. Li.* Mengyan Li (New Jersey Institute of Technology/USA)
3:55	A4. Combined Remedies and Treatment Trains **Bioaugmentation after Thermal Conductive Heating and Comparison with Conventional Bioaugmentation in Passaic Formation.** *L. Zeng, M. Wenrick, S. Abrams, L. Antonetti, and J. Smith.* Stewart Abrams (Langan Engineering & Environmental Services, Inc./USA)	B6. Innovations in ZVI Amendment Formulations and Applications **From Bare to Sulfidated nZVI Particles: How the Surface/ Chemical Modification of Iron Nanoparticles Influences Their Performance at Field Sites Polluted by CHCs and Cr(VI).** *J. Filip, M. Brumovský, J. Oborná, J. Semerád, J. Slunský, P. Lacina, and O. Lhotský.* Jan Filip (Palacký University/Czech Republic)	C7. Optimizing Remedial Systems **Preventing LNAPL Migration to Adjacent Receptors during Thermal Treatment Using Steam: A Case Study Monitoring External Heat Migration and Variations in Groundwater Conditions Outside the Treatment Area.** *C. Rockwell, K. Hadley, and S. Griepke.* Cathy Rockwell (Woodard & Curran/ USA)	D6. Low-Permeability Zone Challenges, Permeability Enhancements, and Case Studies **Remediation in Low-Permeability Soil: Four Case Studies.** *M. Fulkerson, C. Mowder, and M. Perlmutter.* Mike Perlmutter (Jacobs/USA)	E6. Ex Situ PFAS Water Treatment Technologies **Electrochemical-Based Coagulation and Foam Fractionation for PFAS Treatment.** *D. Chiang, Q. Huang, S. Liang, and J. Zhou.* Dora Chiang (Wood/USA)

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Wednesday Platform Sessions—3:30–3:55 p.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
3:30	F7. Advances in Vapor Intrusion Investigations **Non-Target Chemicals as Source Area Tracers: Two Case Studies Using Freon-113 to Assist PCE/TCE/TCA Plume Delineation.** *S.R. Irvin and R.H. Christensen.* Steven Irvin (Acuity Environmental Solutions, LLC/USA)	G7. LNAPL Sites: Understanding and Managing Risks **Risk-Based LNAPL Management at the Former Willow Run Manufacturing Facility.** *B. Landale, M. Rousseau, and G. Trigger.* Matthew Rousseau (GHD/Canada)	H4. Advanced Sampling and Analysis Tools and Techniques **High-Resolution Passive Sampling of Chlorinated Solvents to Assess the Performance of a Biowall.** *U. Garza-Rubalcava, W.A. Jackson, P.B. Hatzinger, G. Lavorgna, P. Hedman, and D. Schanzle.* Uriel Garza-Rubalcava (Texas Tech University/USA)	I7. Process-Based Conceptual Site Models (CSMs) for Informing Remediation **Use of a Conceptual Site Model to Enhance DNAPL Recovery from Low-Permeability Glacial Soils.** *M.L. Schmidt and A. Heitger.* Martin Schmidt (EHS Support/USA)	Learning Lab
3:55	**Re-Evaluating Vapor Intrusion "Cold Case" Sites Using Rapid, Community-Wide Indoor Air Screening.** *J. Mundell, R. Walker, and S. Lisa.* John Mundell (Mundell & Associates, Inc./USA)	**Holistic Evaluation Risks and Benefits of Large LNAPL and Petroleum Hydrocarbon Site Closure in California.** *R. Ahlers, J. Haworth, and T. Daigle.* Rick Ahlers (GEI Consultants, Inc./USA)	**Use of Non-Intrusive Ground-Surface CO_2 Efflux Measurements for Lateral Petroleum NAPL Delineation.** *T. Palaia, A. Hachkowski, and N. Mahler.* Tom Palaia (Jacobs/USA)	**Expedited High-Resolution Characterization and Mass Discharge Evaluation of Dissolved Metals Emanating from a Former Vanadium Extraction Facility, Soda Springs, Idaho.** *N. Tucci, M. Einarson, C. Payne, J. Chu, L. Peterson, and T. Lewis.* Murray Einarson (Haley & Aldrich, Inc./USA)	

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Group 2 Posters

Display: Wednesday 7:00 a.m.–Thursday 1:00 p.m.
Presentations: Wednesday 4:30–6:30 p.m.

The following posters will be on display from Wednesday evening through Thursday afternoon in the Exhibit Hall. During the Presentations/Reception period Wednesday evening, presenters will be at their displays to discuss their work. The poster board number assigned to each presentation appears below.

A5. Permeable Reactive Barriers: Best Practices and Lessons Learned

A6. Thermally Enhanced In Situ Degradation Processes at Sub-Boiling Temperatures

A7. Horizontal Wells: Applications and Lessons Learned in Site Characterization and Remediation

A8. Electron Donors: Innovations for Biodegradation

B7. Innovative and Optimized Amendment Delivery and Monitoring Methods

B8. Monitored Natural Attenuation: Innovative Monitoring Approaches/Lines of Evidence and Lessons Learned

B9. Advanced and Synthetic Biological Treatment Applications

B10. Electrical Resistance Heating: Best Practices and Lessons Learned

C8. Setting Cleanup Goal End Points: When Are We Done?

C9. GSR Best Practices and Nature-Based Remediation Case Studies

C10. Climate Resilience and Site Remediation

C11. Aligning Remediation Goals with Environmental, Social, and Governance (ESG) Considerations

D7. Precipitation and Stabilization of Metals

D8. Mining and Uranium Site Restoration

D9. Managing Chromium-Contaminated Sites

E7. PFAS Site Characterization

E8. In Situ PFAS Treatment Approaches

F5. PFAS: Groundwater Treatment Case Studies

F6. Ex Situ PFAS Destruction Technologies

F7. Advances in Vapor Intrusion Investigations

F8. Vapor Intrusion Mitigation and Effectiveness

F9. Vapor Intrusion Risk Assessment and Site Management

G5. In Situ Remediation of Petroleum Hydrocarbons

G6. LNAPL Recovery/Remediation Technology Transitions

G7. LNAPL Sites: Understanding and Managing Risks

G8. Environmental Forensics: Site Characterization and Source Determinations

G9. Remote Sensing, Drones, and Other Unmanned Systems for Remote Monitoring and Site Assessments

G10. Using Omic Approaches and Advanced Molecular Tools to Optimize Site Remediation

G11. International Remedy Applications: Regulatory and Logistical Challenges of Remediation Abroad

H3. Advanced Geophysics and Remote/Direct Sensing Tools and Techniques

H4. Advanced Sampling and Analysis Tools and Techniques

H5. Groundwater Modeling: Advancements and Applications

H6. MIP/HPT/LIF/UVOST—Realtime HRSC Tools and Techniques

H7. HRSC Suites of Tools to Improve CSMs

I4. Microplastics, Pharmaceuticals, and Other Emerging Contaminants

I5. Technical Impracticability: Challenges and Considerations for Evaluation of Fractured Rock Sites

I6. Depositional Environments and Stratigraphic Considerations for Remediation

I7. Process-Based Conceptual Site Models (CSMs) for Informing Remediation

I8. Advances in the Application of Geologic Interpretation to Remediation

I9. Remediation Approaches in Fractured Rock and Karst Aquifers

Evolution of the U.S. Environmental Consulting Industry from 1990 to the Present.
W.H. DiGuiseppi and D. Maslonkowski.
William DiGuiseppi (Jacobs/USA)

A5. Permeable Reactive Barriers: Best Practices and Lessons Learned

1. Unclogging Clogged EVO Injection Wells in a Saline Environment.
V. Hosangadi, P. Chang, B. Shaver, and M. Pound.
Pamela Chang (Battelle/USA)

2. Removing Nitrogen from Groundwater: Evaluating Biokinetics of Denitrification for Effective Treatment.
V.L. Gonsalez, C.A. Ramsburg, P.M. Dombrowski, and M. Lee.
Paul Dombrowski (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)

3. Performance and Life Cycle of a Full-Scale Biowall System to Treat Chlorinated Solvents in Groundwater.
D.R. Griffiths, B. Badik, T. Belanger, J. Moore, and C. Gallo.
Dan Griffiths (Parsons/USA)

4. Optimization Study for Chlorinated Solvent Permeable Reactive Barriers.
B.M. Henry, E. Heyse, and C. Hewitt.
Bruce Henry (Parsons/USA)

5. Bench-Scale Testing for Zero-Valent Iron Bedrock Application.
L. Crawford, M.C. Marley, and D. Keane.
Dennis Keane (XDD Environmental/USA)

6. Eliminating Contaminant Flux through Combined Sorption-Enhanced Anaerobic Bioremediation and In Situ Chemical Reduction Treatment in a Barrier.
R. Moore, O. Miller, and E. Blodgett.
Ryan Moore (REGENESIS/USA)

7. Characterization of Heterogeneous Treatment Zones Using Direct Mass Flux Measurements.
C. Sandefur, C. Lee, and R. Hardenburger.
Craig Sandefur (REGENESIS/USA)

8. Understanding a Site's Conceptual Site Model to Prolong the Life Expectancy of an In Situ ZVI PRB.
D.L. Schnell.
Deborah Schnell Shaffer (Cascade Environmental/USA)

9. Scoping Tools for Construction of Passive Reactive Capture Systems.
W. Slack, C. Ross, and D. Baird.
William Slack (FRx, Inc./USA)

10. Construction of a Pilot-Scale In Situ Permeable Reactive Barrier along a Tidally Influenced Shoreline.
A. Weinstein, M. Wade, K. Dyson, and J. Spadt.
Andrew Weinstein (Brown and Caldwell/USA)

A6. Thermally Enhanced In Situ Degradation Processes at Sub-Boiling Temperatures

11. Thermal Soil Mixing and ZVI Injection Using Large Diameter Augers at a Former Drycleaner.
J.C. Brown and M.C. Crews.
Jesse Brown (WSP Golder/USA)

12. Spatial and Temporal Staging of Heating and Vapor Treatment Strategies for DNAPL Sites with Highly Volatile Organic Compounds.
X. Chen, R. D'Anjou, A. Swift, S. Guan, C. Zhou, and C. Winell.
Xiaosong Chen (GEO/USA)

13. Evaluation of In Situ Thermal Hydrolysis of Haloalkanes.
J.D. Cole, J. Krueger, G. Dyke, and J. Strunk.
Jason Cole (Jacobs/USA)

14. Design Tool for Low-Temperature Solar Thermal Remediation Systems.
R.W. Falta, A. Ornelles, and C. Divine.
Ronald Falta (Clemson University/USA)

15. Enhanced Biotic and Abiotic Degradation Using Low Temperature Thermal Remediation.
A. Fortune, J. LaChance, and S. Griepke.
Alyson Fortune (TerraTherm, Inc./USA)

16. Treatability and Design for Thermally Enhanced Bioremediation.
D. Keane, M.C. Marley, L. Crawford, K. Cowan, and A. Fortune.
Dennis Keane (XDD Environmental/USA)

17. Use of In Situ Thermal Desorption at a Confidential Site in Washington, DC.
J. Kehs, C. Christian, J. Travis, and A. Patil.
Jimmy Kehs (Tetra Tech, Inc./USA)

18. Advancements in Thermal In Situ Sustainable Remediation TISR℠ Utilizing Solar and Waste Heat Integrated Systems to Treat Saturated Source Zone Soil.
D. Rosso, J. Munholland, D. Randhawa, and J. Wyckoff.
Derek Rosso (Arcadis/USA)

19. Biological Anaerobic Degradation of VOCs Combined with Recirculated Groundwater Heating.
M. Slooijer, M. De Camillis, and J. Dijk.
Martin Slooijer (GreenSoil Group/Belgium)

A7. Horizontal Wells: Applications and Lessons Learned in Site Characterization and Remediation

20. Use of a Horizontal Well for Amendment Injection for In Situ Biotreatment of an Inaccessible Area at a Chlorinated Solvent Superfund Site.
M.L. Alexander.
Matthew Alexander (Leidos/USA)

21. Soil Vapor Extraction Using a Horizontal Remediation Well to Remediate Biogenic Methane and VOCs: A Two-Year Review.
S. Bailey and M. Pate.
Sam Bailey (Kleinfelder/USA)

22. Strategic Use of Horizontal Injection Wells to Design a Bioremediation/ZVI Permeable Reactive Barrier.
G. Cronk.
Gary Cronk (JAG Consulting Group/USA)

23. Combined Innovative Remedial Technologies to Facilitate Active Remediation System Replacement and Property Transfer.
D. Gray, G. Arbogast, and A. Lee.
Doug Gray (AECOM/USA)

24. Distribution Analysis of the Injection of In Situ Chemical Reduction Amendments via Discrete Intervals of a Horizontal Well.
J.G. Long and R.W. Blackmer.
Joshua Long (Equipoise Corporation/USA)

25. Design and Construction Aspects of Horizontal Reactive Media Treatment (HRX™) Wells.
M. Lubrecht, C. Divine, J. Wright, and D. Ombalski.
Michael Lubrecht (Ellingson - DTD/USA)

26. Delivering the Goods: How Horizontal Wells Delivered ISCO Success under Challenging Conditions.
M. Pena, C. Spooner, J. Wright, and M.W. Killingstad.
Maria Pena (Arcadis/USA)

27. Changing Long-Standing Conceptual Site Models and Risk Perception with High Resolution Contaminant Distribution (HRCD).
L.I. Robinson, E.R. Piatt, S.S. Koenigsberg, and W.F. Wiley.
Lance Robinson (EN Rx, Inc./USA)

28. Horizontal Biosparging of Jet Fuel Plumes Expedites DoD Site Remediation.
G. Atik, D. Forse, T. Will, and M. Sequino.
Tomas Will (Directional Technologies, Inc./USA)

29. Chlorinated Vapor Mitigation with Horizontal Vapor Extraction Wells Prevents Interior Disruption of Residential, Commercial, and Industrial Sites.
T. Will and M. Sequino.
Tomas Will (Directional Technologies, Inc./USA)

A8. Electron Donors: Innovations for Biodegradation

30. Microbiome Composition Resulting from Different Substrates Influences Trichloroethene Dechlorination Performance.
W.Y. Chen and J.H. Wu.
Wei-Yu Chen (National Chen Kung University/Taiwan)

31. Biotic/Abiotic Remediation of DNAPL Source and Plume Using Innovative Solid Substrates in Source Excavation Backfill.
J.K. Green and C.L. Jacob.
Jenny Green (Landau Associates, Inc./USA)

32. A Coupled Adsorption and Biodegradation (CAB) Process Employing Polyhydroxybutyrate and Biochar as Bio-Based Materials for TCE-Contaminated Groundwater Bioremediation.
M.M. Rossi, N. Amanat, M. Petrangeli Papini, and B. Matturro.
Laura Lorini (La Sapienza University of Rome/Italy)

33. PHA from Mixed Culture as an Innovative Source of Electron Donors for Sustainable Bioremediation: Preliminary Studies and Scaleup.
N. Amanat, M.M. Rossi, M. Majone, M. Petrangeli Papini, and B. Matturro.
Laura Lorini (La Sapienza University of Rome/Italy)

34. Enhanced Control of Biomass Production and Microbial Activity via Acetylene Inhibition during TCE Aerobic Cometabolism.
J.P. Skinner, S. Palar, P. Blake, N. Hamdan, A.G. Delgado, and M. Chu.
Justin Paul Skinner (Arizona State University/USA)

35. Evolving In Situ Bioremediation of a Former TCE Vapor Degreaser Source.
E.M. Waibel, E. Ives, and C.L. Jacob.
Erin Waibel (Landau Associates/USA)

B7. Innovative and Optimized Amendment Delivery and Monitoring Methods

36. Impressive Models and Photographs of Subsurface Carbon Slurry Injectate Distribution: How We Did It and Why It Matters.
B. Brab and R. Boyle.
Bill Brab (AST Environmental, Inc./USA)

37. The Transition to Colloidal from Micro-Scale Solids with Further Optimization through Automated Injection.
E.D. Cooper.
Eliot Cooper (Cascade Environmental/USA)

38. Fundamentals of Applying Subsurface Direct-Current (DC) Electric Fields for In Situ Remediation and Geo-Environmental Applications.
D.B. Gent and J. Wang.
David B. Gent (U.S. Army Corps of Engineers Engineer Research & Development Center/USA)

39. Monitoring Substrate Injection Distribution for Successful Remediation Outcome.
T. Halihan, S.W. McDonald, and C. Pickens.
Todd Halihan (Oklahoma State University/USA)

40. Development of an Innovative In Situ Remediation Technique Using Polymer Gel as a Reagent Carrier: Results at Field Scale.
J. Maire, A. Joubert, L. Mansuelle, I. Bouzid, N. Fatin-Rouge, H. Bertin, S. Colombano, H. Davarzani, F. Laurent, and M. Broquaire.
Julien Maire (SERPOL/France)

41. Hydraulic Building Blocks for Enhanced Groundwater Remediation.
L.J. Sather, E.J. Roth, J.P. Crimaldi, R.M. Neupauer, and D.C. Mays.
David Mays (University of Colorado Denver/USA)

42. Methodology and Lessons Learned Conducting In Situ Bioremediation Using Emulsified Vegetable Oil in Phoenix, Arizona.
J. Rackow, T. Titus, and M. Morales.
Mikel Morales (Arizona Department of Environmental Quality/USA)

43. Innovative Monitoring and Visualization Approaches in a Recirculatory ISCO System.
S.W. Murphy, S.L. Warner, S.N. Jacobson, B.A. Green, L. Daubert, and S. Gallo.
Sean Murphy (Sanborn, Head & Associates, Inc./USA)

44. A Critical Review of Bioaugmentation Best Practices: What We Really Know versus What We Have Just Accepted.
R. Oesterreich and S. Justicia-Leon.
Ryan Oesterreich (Arcadis/USA)

45. Limitations and Lessons Learned in Adjusting ORP and Extreme pH for ISCR-Driven Groundwater Remediation of VOCs and Metals.
T.J. Patterson and R. Srirangam.
Thomas Patterson (Roux/USA)

46. Optimizing Injection and Monitoring of Electron Donors and Bioaugmentation Cultures for In Situ Bioremediation.
J.D. Roberts, C. Scales, P. Dennis, and S. Dworatzek.
Jeff Roberts (SiREM/Canada)

47. Lessons Learned about Activated Carbon Injections on a Site in Wyoming.
T. Sorrells and J. Skogman.
Tree Sorrells (Alpine Remediation, Inc./USA)

48. Biosparging for Remediation of Substituted Nitroaromatic Compounds and Remote Monitoring Using Multi-Depth Real-Time Sensors.
C. Mowder, B. Carling, J. Blotevogel, A. Hanson Rhoades, K. Karimi Ashkarani, J. Spain, and A. Hartten.
Jim Spain (University of West Florida/USA)

49. Facilitating In Situ Remediation of Deep DNAPL and Dissolved-Phase cVOC Impacts in Challenging Lithology Using an Innovative Multi-Step Injection Approach.
B. Tunnicliffe.
Bruce Tunnicliffe (Vertex Environmental, Inc./Canada)

50. Predicting Site Biogeochemistry Influence on EVO Fouling and Injection Well Failure.
A. Wadhawan, M. Schnobrich, and M. Hay.
Amar Wadhawan (Arcadis/USA)

51. Searching for In Situ Remediation Alternative Addressing Complex Geology: EK-Enhanced In Situ Remediation of Contaminant Source Mass.
J. Wang, T. DeJournett, S. Cushing, E. Tollefsrud, D. Scheer, and J. Jevnisek.
James Wang (Geosyntec Consultants/USA)

52. The Devil Is in the Details: Practical Considerations for Successful Horizontal Injection Well Design.
J. Wright, M. Killingstad, C. Spooner, and M. Pena.
Jesse Wright (Arcadis/USA)

B8. Monitored Natural Attenuation: Innovative Monitoring Approaches/Lines of Evidence and Lessons

53. ^{14}C Assays to Derive Degradation Rates in Support of MNA.
M. Burns, P. Robertson, C. Myers, and D. Sarr.
Matthew Burns (WSP Golder/USA)

54. Chlorinated Solvent Biodegradation in Low pH Aquifers.
P.B. Hatzinger, R. Rezes, E. Farquharson, K.-H. Chu, N. Szwast, and D. Freedman.
Paul Hatzinger (APTIM/USA)

55. Using Depth-Discrete, High-Resolution Biogeochemical Methods to Assess Degradation Mechanisms Occurring in a Mixed Organic Plume in Fractured Sedimentary Bedrock.
G.T. Hook, B.L. Parker, S. Shafieiyoun, J. Bulova, J.R. Meyer, R. Aravena, F. Loeffler, and S.R. Campagna.
Glen Hook (University of Guelph/Canada)

56. Successful Application of Long-Term Monitoring Optimization.
E.M. Huntley, G.E. Rieger, C.B. Myers, and M.J. Gentoso.
Erin Huntley (WSP/USA)

57. ORP Kit: A New Tool for Predicting Contaminant Degradation through Improved Reduction Potential Measurement.
C. Kocur, D. Fan, A. Pavitt, R. Johnson, and P. Tratnyek.
Chris Kocur (Royal Military College of Canada/USA)

58. MBTs for MNA.
F.E. Loeffler, A.L. May, S.R. Campagna, F. Kara Murdoch, R.W. Murdoch, K.H. Kucharzyk, P.B. Hatzinger, J.T. Wilson, and M.M. Michalsen.
Frank Loeffler (University of Tennessee/USA)

59. Using qPCR Assays for Oxygenase Enzymes to Predict Rate Constants for Cometabolism of TCE in Aerobic Groundwater.
J.T. Wilson, B. Wilson, D. Taggart, D.L. Freedman, and J. Mills, IV.
John Wilson (Scissortail Environmental Solutions, LLC/USA)

60. Simultaneous Aerobic and Anaerobic Biodegradation of Vinyl Chloride under Low Dissolved Oxygen Conditions.
W. Zhao and T.E. Mattes.
Weilun Zhao (The University of Iowa/USA)

B9. Advanced and Synthetic Biological Treatment Applications

61. Bioremediation 4.0: What Procaryotic Microbes Can Really Accomplish and the Roll Quorum Sensing and Signaling (QSS) Plays.
K.C. Armstrong and K. Rapp.
Kent C. Armstrong (TerraStryke Products, LLC/USA)

62. Avoiding a cis-DCE Stall during the ERD of TCE DNAPL in Bedrock Groundwater via Biostimulation Alone.
K.C. Armstrong and G. Bell.
Kent C. Armstrong (TerraStryke Products, LLC/USA)

63. Anaerobic Microbial Degradation of Dichloromethane.
G. Chen, R.W. Murdoch, S.R. Campagna, E.S. Seger, E.E. Mack, and F.E. Loeffler.
Gao Chen (University of Tennessee/USA)

64. Field Testing Reductive Dechlorination Bioaugmentation Cultures in a Low pH Groundwater Setting.
D.L. Freedman, H. Wang, and R.L. Lehmicke.
David Freedman (Clemson University/USA)

65. Increasing the Rate of Anaerobic Benzene Degradation in Enrichment Cultures.
S. Guo, J. Liang, C.R.A. Toth, X. Chen, F. Luo, B.E. Sleep, E.A. Edwards, B.C. McLaren, and N. Thomson.
Shen Guo (University of Toronto/Canada)

66. Biokinetics Modeling on the Syntrophic Growth of Anaerobic Benzene-Degrading Enrichment Cultures under Methanogenic Conditions.
J. Liang, S. Guo, X. Chen, C.R.A. Toth, E.A. Edwards, and B.E. Sleep.
Shen Guo (University of Toronto/Canada)

67. The Benefits of Using Antimethanogenic Reagents for Chlorinated Solvent Remediation in Solid and Liquid Amendments.
A. Lowy, W. Moody, and T. Lizer.
Andy Lowy (Provectus Environmental Products, Inc./USA)

68. Separating Emulsification from Degradation in the Bioremediation of Soil-Associated Arochlors.
R.N. Sambrotto and D. Tanner.
Ray Sambrotto (Allied Microbiota/USA)

69. Systems Biology Unravels the Naphthenic Acid Degradome in Oil Sands Process Wastewater.
P. Chenougian, V. Yadav, B. Gramlich, and D. Saran.
Dayal Saran (Allonnia/USA)

70. Characterization of a Predicted Necromass-Recycling Bacterium and Its Impact on Benzene Degradation in a Methanogenic Benzene-Degrading Enrichment Culture.
X. Chen, C.R.A. Toth, S. Guo, F. Luo, O. Molenda, J. Liang, J. Howe, and E.A. Elizabeth.
Courtney Toth (University of Toronto/Canada)

71. Living Room, Transportation, and Community: The Overlooked Infrastructure in Subsurface Microbial Biodegradation.
E.J. Winner.
Ed Winner (Remediation Products, Inc./USA)

B10. Electrical Resistance Heating: Best Practices and Lessons Learned

72. Lessons Learned: ERH-MPE System Operations and Performance Assessment.
K.M. Kolibas, A.C. Bumb, and R.C. Peterson.
Amar Bumb (APTIM/USA)

73. Mitigating Risk from Subsurface Metal Discovered during an ERH Installation.
N. Dumaresq and B. McGee.
Nicholas Dumaresq (McMillan-McGee Corp./Canada)

74. In Situ Thermal Remediation to Reduce TCE with Rapidly Increasing Water Table.
M. Wallace, J. Feild, E. Crownover, and C. Blundy.
James Feild (Wood/USA)

75. Bench-Scale Electrical Resistance Heating and Heat-Enhanced Microcosm Studies to Establish Endpoints for Thermal Treatment.
P.R. Hegele, D.A. Rountree, C. Wong, and J. LaChance.
Paul Hegele (Arcadis/Canada)

76. In Situ Thermal Remediation Technologies: TCH versus ERH: Which Is Best and Why?
J. LaChance, J. Galligan, and S. Griepke.
John LaChance (TerraTherm, Inc./USA)

77. Electrical Resistance Heating Trials: Lessons Learned at a Site in Germany.
R. Meinke, O. Kohnen, M. Stumbaugh, and S. van Wert.
Robert Meinke (ERM/Germany)

78. Application of ERH on a Large Site.
B.A.M. Ribeiro, T.L. Gomes, and J. Seeman.
Bruno Ribeiro (TRS Doxor/Brazil)

79. Flexible Electrical Resistance Heating Design and Implementation under an Active Auto Repair Shop.
J. Root, L. Stauch, W. Carroll, and J. Harrington.
Jeffrey Root (TRS Group, Inc./USA)

80. Integrated Remediation System in Residential Neighborhood: ERH and SVE at a Former Industrial Laundry Site.
C. Calderon, B. Agostinho, and D. Danezi.
Rubens Spina (EBP Brasil/Brazil)

81. Enhanced Field Screening Tools and Pilot Test Development in Support of Complex Remediation at a Confidential Superfund Site.
L. Stauch, P. Joyce, and M. Palmer.
Lynette Stauch (TRS Group, Inc./USA)

82. Remediation of 1,4-Dioxane Using Electrical Resistance Heating.
L. Stauch and E. Crownover.
Lynette Stauch (TRS Group, Inc./USA)

83. A Geological Engineering Perspective of In Situ Thermal Remediation.
J.P. Yoder, M. Basel, and J. Kingston.
Jarrod Yoder (Haley & Aldrich, Inc./USA)

84. Thermal Remediation of Impacted Clay Layer and In Situ Hydrolysis of 1,2-DCA at a Former Industrial Site in Brazil.
R. Zeitune, S. Hart, R. Feig, M. Klemmer, R. Santini, L. Valle, and F. Silveira.
Raoni Zeitune (Arcadis/Brazil)

C8. Setting Cleanup Goal End Points: When Are We Done?

85. Use of a Visual Cleanup Standard for PCB Bulk Product Paint Abatement under a Risk-Based TSCA Cleanup Application.
A.C. Aranha, D.H. Gandhi, and M.K. King.
Alexandra Aranha (EKI Environment & Water, Inc./USA)

86. The Thermal Remediation System Has Been Turned Off: How Will Groundwater Concentrations Respond?
E.L. Davis.
Eva Davis (U.S. Environmental Protection Agency/USA)

87. Cleanup and Redevelopment of a Former Transformer Manufacturing Facility under a Risk-Based TSCA Cleanup Application.
D. Gandhi and M.K. King.
Deepa Gandhi (EKI Environment & Water, Inc./USA)

88. Arsenic Oral Bioavailability and Site-Specific Direct Contact Criteria Development for Soils at a Former Orchard, Now City Park.
P.J. McCall and M.F. Gillie.
Patti McCall (Tetra Tech, Inc./USA)

89. Defining Cleanup Goals Based on DNAPL Mobility in Soil.
M. Palmer, L. Stauch, K. King, K. Hewlett, and P. Joyce.
Mike Palmer (de maximis, inc./USA)

C9. GSR Best Practices and Nature-Based Remediation Case Studies

90. Full-Scale Remediation of Chlorinated Solvents in Ørnegård Electrical Substation Using Enhanced Reductive Dechlorination with Organic Molasses.
J.U. Bastrup, S.K. Schultz, D. Isager, and M. Rydam.
John Ulrik Bastrup (GEO/Denmark)

91. Do Landfills Still Need Compressed Air?
M. Bertane.
Mark Bertane (Blackhawk Technology Company/USA)

92. Sustainable Remediation via Bioelectrochemical Degradation at an Active Facility Impacted by Petroleum Products.
L. Zeng, A. Boodram, M. Spievack, S. Sherman, V. Yarina, S. Abrams, and S. Jin.
Aroona Boodram (Langan/USA)

93. Adaptive Remedial Design at a Former Smelter Superfund Site Results in Increased Green and Sustainable Remediation Opportunities.
M. Crawford and J. Hesemann.
Matt Crawford (Burns & McDonnell/USA)

94. A Five-Year Review: Annual Monitoring, Performance Trends and New Sampling Approaches to Optimize an Endophyte-Enhanced Hybrid Poplar Phytoremediation Program for TCE at an Arid, Fractured Bedrock Site.
J. Duffey, D. Rowe, E. Pearson, C. Serlin, J. Freeman, G. O'Toole, and C. Cohu.
Johnston Duffey (Ramboll/USA)

95. Sustainable PHYTO-INTEGRATED® Remediation System to Treat Chlorobenzene-Contaminated Groundwater in a Saprolite/PWR Aquifer in South Carolina.
E.B. Hollifield and J.G. Byrd.
Edward Hollifield (Environmental Resources Management/USA)

96. Recent Advances in Subgrade Biogeochemical Reactors with Treatment of ~15 mg/L of 1,2-DCA to near Non-Detect Levels.
C. Walecka-Hutchison, J. Gamlin, J. Strunk, R.J. Stuetzle, and A. Sidebottom.
Claudia Walecka Hutchison (Dow/USA)

97. Measuring Remediation's Influence on United Nations Sustainable Development Goals.
C. Walecka-Hutchison, J. McKinnon, M. Germon, and B. Collins.
Claudia Walecka Hutchison (Dow/USA)

98. Proof That the Most Aggressive Remedial Action Can Also Be the Greenest.
I. Lo, M. Harclerode, G. Stuesse, and M. Ryan.
Ian Lo (CDM Smith Inc./USA)

99. In Situ Thermal Remediation Application in South Africa: Incorporating Sustainable Elements.
N. Moller, S. McKeown, M. Nel, and J. Baldock.
Graham Mackey (ERM/USA)

100. Adaptive Utilization of Natural Site Conditions to Facilitate Effective Remediation: Be Like Water.
T.J. Patterson.
Thomas Patterson (Roux/USA)

101. Tackling Groundwater Remediation Leads to Water Conservation, Wildlife Habitat Restoration, and Engagement with the Surrounding Community.
C. Rockwell, K. Lauer, and K. Elich.
Cathy Rockwell (Woodard & Curran/USA)

102. Concentrated Solar: Sustainable Energy Source for Thermal Remediation. *D.C. Segal, C.W. Lam, C. Trujillo, and K. Linden.*
Daniel Segal (Chevron/USA)

103. Validating a Green and Sustainable LNAPL Recovery/Remediation Technology.
C.J. Vandegrift and S. Bouzrara.
Christopher Vandegrift (Antea Group/USA)

104. Maximizing Sustainable Actions for a Site Closure in Brazil.
J. Vilar, A. Bustamante, G. Andrade, A. Miranda, B. Rocha, A. Martinho, J. Smith, J. Overgord, and K. Haymond.
Julio Vilar (Arcadis/Brazil)

105. Evaluating Native and Naturalized Plant Species for the Phytoextraction of DDT and Dieldrin at a National Park in Ontario, Canada.
B. Zeeb, R. Bergin, and A. Rutter.
Barbara Zeeb (Royal Military College of Canada/Canada)

C10. Climate Resilience and Site Remediation

106. More Sustainable In Situ Remediation in Bedrock and Quantifying Actual Footprint Reduction with SiteWise™.
P.M. Dombrowski, P. Kakarla, M. Dotto, J. Tartaglia, F. Hostrop, and D. Raymond.
Paul Dombrowski (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)

107. Climate Change Analysis of Remedies for Terrestrial Operable Units at Naval Base Kitsap Bremerton, Bremerton, WA.
J. Gryzenia, S. McKnight, B. Mintz, J. Vandever, and G. Burgess.
Steve McKnight (AECOM/USA)

108. Sustainable and Resilient Remediation at the Intersection of Climate Variability and Contaminated Site Management.
K.A. Morris and V. Kolluru.
Kevin Morris (ERM/USA)

109. ANTHYM: The Anthrohydrologic Conceptual Model for Groundwater Remedy Design under Climate Change.
S.D. Warner and C.J. Ritchie.
Scott Warner (BBJ Group/USA)

C11. Aligning Remediation Goals with Environmental, Social, and Governance (ESG) Considerations

110. Remediation as Resource Recovery: Opportunities in the Copperbelt Region of Zambia.
P. Chisala, C. Switzer, and J. Renshaw.
Precious Chisala (University of Strathclyde/Scotland)

111. Using Sustainable Remediation to Align with Corporate ESG Goals.
M. Schlosser and M. Harclerode.
Melissa Harclerode (CDM Smith Inc./USA)

112. High-Resolution Investigation as a Key Element for the Sustainable Approach of the Remediation of Contaminated Sites.
C. Jorge, C. Malta-Oliveira, S. Souto, and M. Evald.
Cesar Malta-Oliveira (FINKLER Ambiental/Brazil)

113. A Successful Brownfield Cleanup Site.
B.J. Parekh and D. Winslow.
Bhuvnesh Parekh (GZA GeoEnvironmental, Inc./USA)

114. Phytoremediation in Paradise: Remediation of Soil Fumigants in Hawaii.
G. Zimmerman.
Gary Zimmerman (WSP Golder/USA)

D7. Precipitation and Stabilization of Metals

115. Overcoming Numerous Site Constraints to Complete Successful Implementation of a Large-Scale In Situ Chemical Reduction (ISCR) Injection Program.
W. Caldicott, M. Temple, P. Kakarla, T. Musser, and E. Mott-Smith.
Will Caldicott (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)

116. Progress in the Management and Securing of Mercury-Polluted Sites.
B. Devic-Bassaget and A. Turck.
Boris Devic-Bassaget (SUEZ Remediation/France)

117. In Situ Chemical Immobilization of Arsenic in Groundwater Using Hydrogen Peroxide and Chelated Iron.
T. Eilber, K. Hartman, and P. Dombrowski.
Paul Dombrowski (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)

118. Fluoride Removal from Groundwater through Fluorapatite Precipitation.
D. Graves, K. Rhonehouse, A. DeSantis, and C. Herin.
Duane Graves (SiREM/USA)

119. Introducing a Novel Amendment Technology in the Remediation of Mercury-Contaminated Soils at a Legacy Munitions Production Site.
D. Gray, D. Griffin, J. Miller, S. Kim, W. Neese, P. Martus, and A. Mickein.
Doug Gray (AECOM/USA)

120. Combined Remedial Approach Based on Geochemical Stabilization of Copper in a Source Area and Dissolved-Phase Groundwater Plume.
L. Hellerich and N. Hastings.
Lucas Hellerich (Woodard & Curran/USA)

121. Continuous-Mode Acclimation and Operation of Lignocellulosic Sulfate-Reducing Bioreactors for Enhanced Metal Immobilization from Acidic Mining-Influenced Water.
E.M. Miranda, C. Severson, J.K. Reep, D. Hood, N. Hamdan, A.G. Delgado, S. Hansen, and L. Santisteban.
Evelyn Miranda (Arizona State University/USA)

122. In Situ Stabilization of Metals (Nickel, Cobalt and Zinc) in a Former Industrial Facility in Brazil.
M.Q. Omote, R. Campos, A.C. Gatti, and G.D.C. Mello.
Mariana Omote (Ramboll Brasil/Brazil)

123. Effectiveness of ZVI and Other Iron-Based Amendments for Arsenic Remediation in Highly Alkaline Groundwater.
P. Roelen and E. Ives.
Piper Roelen (Landau Associates, Inc./USA)

124. Enhanced In Situ Bioremediation to Sequester and Immobilize Cadmium and Lead in Groundwater.
S.J. Sorsby, A. Madison, M. Lewis, and C. Hemingway.
Skyler Sorsby (WSP/USA)

125. Biogeochemical Stabilization of Divalent Metals: A Comprehensive Multi-Phase Treatability Study.
R. Srirangam, A. Seech, L. Hellerich, N. Hastings, and Z. Smith.
Ravikumar Srirangam (Evonik/USA)

126. Chemical Oxidation of Arsenic in Groundwater.
C. Yi, N. Rodriguez, A. Breckenridge, and A. Chemburkar.
Chimi Yi (ERM/USA)

127. Treatment Process for Precipitation of Recalcitrant Organic Arsenic Species.
W.M. Young, C. Hand, W.J. Malyk, and K. Falk.
William Young (Wood/USA)

D8. Mining and Uranium Site Restoration

128. Development of an In Situ Leaching Technology for Extracting Residual Uranium from Remediated Soil.
D.L. Bhojwani and G.P. Anderson.
Deepak Bhojwani (Weston Solutions, Inc./USA)

129. Carbon Nitride/MgFe-Layered Double Hydroxide Nanocomposite: One-Pot Solvothermal Synthesis, Adsorption Performance and Mechanisms for Uranium and Cadmium.
J.R. Koduru, L.P. Lingamdinne, J.S. Choi, G.K.R. Angaru, S.H. Lim, J.K. Yang, and Y.Y. Chang.
Janardhan Reddy Koduru (Kwangwoon University, Seoul, Republic of Korea/South Korea)

130. Collaborative Development of Conceptual Remediation Portfolios for an Abandoned Uranium Mill Site.
P. Lemke, B. Looney, and M. Kautsky.
Peter Lemke (Geosyntec/USA)

131. Gravel Bed Reactors: Semi-Passive Water Treatment of Metals and Inorganics.
S. Mancini, R. James, and E. Cox.
Silvia Mancini (Geosyntec Consultants/Canada)

132. Reconstructing Historical Three-Dimensional Plume Capture and Performance at an Actively Remediated Former Uranium Mill Site.
M.S. Morse, P. Schillig, R.D. Kent, P. Lemke, and A. Laase.
Michael S. Morse (RSI Entech, LLC/USA)

133. Risks in Planning and Designing for Mine Closure.
M. Nahir.
Michael Nahir (Parsons/Canada)

D9. Managing Chromium-Contaminated Sites

134. In Situ Chemical Reduction on Metallurgical Industry Impacted by Hexavalent Chromium (Sao Paulo, Brazil).
S. Aluani, C. Spilborghs, E. Pujol, F. Tomiatti, and J. Mueller.
Sidney Aluani (SGW Services/Brazil)

135. Remediation of Hexavalent Chromium from a Former Chrome Plating Facility Using Ferrous Sulfate and Zero Valent Iron.
D. Beck and A. Cuellar.
David Beck (Tetra Tech, Inc./USA)

136. ISCR Treatment of Hydraulically Complex Hexavalent Chromium and Chlorinated Volatile Organic Plumes.
R.D. Desrosiers and B.D. Rach.
Richard Desrosiers (GZA GeoEnvironmental, Inc./USA)

137. Adapting Treatment to Optimize Capture of a Hexavalent Chromium Plume in Perched Aquifer with a Discontinuous Silt Layer.
P.R. Hsieh and T. Gray.
Patrick Hsieh (Dalton Olmsted & Fuglevand/USA)

138. Investigation and Remediation of a Former Hard Chrome Site with High Salinity and Unusual Geology.
T.T. Hubbard, W. Caldicott, P. Kakarla, and Y. Chin.
Thais Hubbard (Troy Risk, Inc./USA)

139. Remediation of Hexavalent Chromium Contamination at a Site in Los Angeles by In Situ Chemical Reduction.
L. Kessel and G. Cronk.
Lowell Kessel (C.E.R.E.S. Corporation/USA)

140. Effective In Situ Source Remediation of Hexavalent Chromium at a Chrome-Plating Operation.
D.A. Nemetz.
David Nemetz (Shannon & Wilson, Inc./USA)

141. Development of Mixed Microbial Culture Enriched with Cr(VI)-Reducing Bacteria from Soil.
S. Mohana Rangan, I. Ibrahim, A. Sachs, A.G. Delgado, and R. Krajmalnik-Brown.
Srivatsan Mohana Rangan (Arizona State University/USA)

142. Managing the Remediation and Redevelopment of a Chromium Plating Operation, Indianapolis, Indiana.
B.W. Rehm and C. Gill.
Bernd Rehm (Resolution Partners, LLC/USA)

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143. Complexities in Understanding Multiple Source Areas for Per- and Polyfluoroalkyl Substances (PFAS) in Groundwater.
G. Calderone.
Gina Calderone (Tetra Tech, Inc./USA)

144. Development and Testing of the Sentinel™ Passive Sampler for PFAS Measurement in Environmental Waters.
E.W. Carter, C. Divine, P. Edmiston, H. Hartmann, C. Hefner, R. Hershberger, D. Liles, R. Prigge, K. Toth, and M. Riggle.
Erika L. Williams Carter (Arcadis/USA)

145. PFAS: Smart Characterization for an Emerging Contaminant.
P. Curry, J. Quinnan, and M. Rossi.
Patrick Curry (Arcadis/USA)

146. Investigation of PFAS Impacts in Multiple Media at Portland International Airport (PDX), Oregon.
H. Gosack.
Kelsi Evans (Apex Companies, LLc/USA)

147. Distribution of PFAS in Paper Waste Residuals, Fill, Groundwater and Surface Water at a Former Paper Mill.
M.S. Kovacich, D.S. Wilson, B.K. Loffman, D.R. Beck, M. Capodivacca, and B.W. Giese.
Michael Kovacich (Tetra Tech, Inc./USA)

148. PFAS Site Characterization in Soil and Groundwater at a California Airport.
A.J. Lizzi and K.F. Gilbert.
Anthony Lizzi (Ninyo & Moore/USA)

149. Implementation of Geospatial Analytical Tools to Improve Fate and Transport Evaluations and Risk Communication at PFAS Investigation Sites.
M. Radford, M. Brown, L. Cook, and K. Murphy.
Maggie Radford (Jacobs/USA)

150. Per- and Polyfluoroalkyl Substances in Products Used during Monitoring Well Installation.
M.C. Rigby, T. Mehraban, S.J. Rembish, and K.L. LaPierre.
Mark Rigby (Parsons/USA)

151. Developing Novel Biosensors for PFAS Constituents.
D. Saran, K. Sorenson, and A. Meyer.
Dayal Saran (Allonnia/USA)

E8. In Situ PFAS Treatment Approaches

152. Bench-Scale Treatability Study Results for Treatment of PFOA and PFOS Commingled with Volatile Organic Compounds in Groundwater.
L. Cook, S. Grieco, J. Persons, and D. Gustafson.
Laura Cook (Jacobs/USA)

153. Investigation and Remediation of AFFF: A Case Study.
R.D. Desrosiers and B.D. Rach.
Richard Desrosiers (GZA GeoEnvironmental, Inc./USA)

154. Green Remediation Benefits Lead to Multi-Phase, In Situ Activated Carbon Treatments at New York Brownfield Site.
M. Dooley and A. Miller.
Maureen Dooley (REGENESIS/USA)

155. In Situ Thermal Treatment of Per- and Polyfluoroalkyl Substances in the Vadose Zone.
R. Iery, B. DiGuiseppi, J. Cole, A. Struse, N. Fitzgerald, H. Rectenwald, G. Heron, E. Crownover, and L. Stauch.
Ramona Iery (U.S. Navy/USA)

156. Evaluation of Treatment of MGP-Impacted Soils and Groundwater Commingled with PFAS Using ISCO.
P. Kakarla, Y. Chin, W. Caldicott, K. Paradise, and M. Pierdinock.
Prasad Kakarla (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)

157. ISS of Source Areas Contained with Per- and Polyfluorinated Alkyl Substances: Is It Possible?
P.R. Lear.
Paul Lear (Forgen/USA)

158. Field-Scale Demonstration Data Verifying Reduced PFAS Leachability over Time Following In Situ Soil Stabilization.
J. McDonough, J. Lang, R.H. Anderson, D. Liles, and A. Baumeister.
Joseph Quinnan (Arcadis/USA)

159. Five-Year Results from a Full-Scale In Situ Program to Treat PFAS-Impacted Groundwater Using Colloidal Activated Carbon.
R. McGregor.
Rick McGregor (InSitu Remediation Services Ltd./ Canada)

160. Large Full-Scale In Situ Remediation of PFAS in Groundwater Using PlumeStop™.
R. Mora, J. Cuthbertson, J. Buzzell, S. Krenz, R. Moore, K. Gaskill, and A. Kavanaugh.
Rebecca Mora (AECOM/USA)

161. In Situ Treatment of PFAS in Groundwater and Other Tall Tales.
C. Nelson, D. Reynolds, Y. Shrestha, R. Spehar, A. Danko, and A. DaCruz.
Christopher Nelson (eMinus, LLC/USA)

162. Factors Affecting the In Situ Immobilization of Per- and Polyfluoroalkyl Substances by Activated Carbon.
S. Gilak Hakimabadi, A. Taylor, A. Pham, N.R. Thomson, and B. Sleep.
Anh Pham (University of Waterloo/Canada)

163. TCH Removes PFAS from Soil, But Where Does It Go? Removal and Fate of PFAS during Thermal Soil Remediation.
N. Ploug, S. Eriksen, and A. Schultz.
Niels Ploug (Krüger A/S/Denmark)

164. Degradation and Mechanism of Hexafluoropropylene Oxide Dimer Acid by Thermally-Activated Persulfate in Aqueous Solutions.
X. Ding and X. Song.
Xin Song (Chinese Academy of Sciences/China)

165. Management and Remediation of AFFF-Related Per- and Polyfluoroalkyl Substances.
T. Tyler and H. Lynch.
Edward (Ted) Tyler (Cardno now Stantec/USA)

166. In Situ PFAS Treatment Using Colloidal Activated Carbon: A Comprehensive Summary of Performance from 20+ Project Sites.
S. Wilson and J. Birnstingl.
Scott Wilson (REGENESIS/USA)

F5. PFAS: Groundwater Treatment Case Studies

167. PFAS Groundwater Remediation Case Study: Surface-Active Foam Fractionation (SAFF40).
D.J. Burns, P. Murphy, and J. Heffer.
David Burns (EPOC Enviro LLC/Australia)

168. Evaluation of Short-Chain Per- and Polyfluoroalkyl Substance Removal via Adsorptive Treatment Technologies.
S.C. Crawford, L.B. Crawford, M.C. Marley, R. Thomas, S. Dore, F. Taylor, J. Occhialini, T. McKnight, and N. Farmer.
Scott Crawford (XDD Environmental/USA)

169. Successful Pilot Test for the In Situ Treatment of PFAS at an Alaska Airport.
K. Freiburger, M. Nadel, A. Punsoni, R. Hardenburger, and C. Sandefur.
Kristen Freiburger (Shannon & Wilson, Inc./USA)

170. Immediate and Effective PFAS Treatment in Bedrock Aquifer at a Hazardous Site.
G. Iosue, J. Dziekan, L. Strobridge, and C. Wade.
Glenn Iosue (REGENESIS/USA)

171. Installation, Commissioning and Operation of an Injectable In Situ Permeable Reactive Barrier to Prevent the Advection of Per- and Polyfluoroalkyl Substances at a UK Airport.
G. Leonard, J. Shore, and S. George.
Gareth Leonard (Regenesis/United Kingdom)

172. In Situ Carbon-Based PFAS Immobilization and Beyond: Case Study at a Suspected AFFF Site in Alpena, Michigan.
L. Mankowski, J. Adams, and T. Repas.
Leonard Mankowski (Wood/USA)

173. From Bench to Field: Foam Fractionation and Electrochemical Oxidation Performance on Source Zone and Plume PFAS Treatment.
J.R. Beattie, M.A. Harclerode, M.J. Salvetti, S.F. Baryluk, D.D. Nguyen, and Y. Fang.
Dung (Zoom) Nguyen (CDM Smith Inc./USA)

174. Passive Remediation: Cleaning Up PFAS-Impacted Surface Water.
M. Vanderkooy, C. Shores, B. Hodge, and M. McMaster.
Matt Vanderkooy (Geosyntec Consultants/Canada)

175. PFAS Treatment Pilot Study Using Granular Activated Carbon at Kennedy Space Center, Florida.
M. Deliz, M. Jonnet, and M. Speranza.
Andrew Walters (Tetra Tech, Inc./USA)

F6. Ex Situ PFAS Destruction Technologies

176. Electrochemical Degradation of PFAS Mass in Redundant Stocks of AFFF Concentrate and First Flush Wash Water: Pilot-Scale Field Demonstration.
R. Casson and S. Liang.
Rachael Casson (AECOM/Australia)

177. Destruction of PFOS: Are pH Adjustment and Ozone the Answer? How Can You Tell?
G. Trigger, S. Dore, R. Thomas, and B. Landale.
Sophia Dore (GHD/USA)

178. Electrochemical Oxidation of AFFF and PFEAs in Still Bottoms Generated after Anionic Exchange Resin Column Regeneration.
Y. Fang, C. Schaefer, P. Meng, D. Knappe, S. Choyke, C. Higgins, and T. Strathmann.
Yida Fang (CDM Smith Inc./USA)

179. Ultrasonic Degradation of Per- and Polyfluorinated Alkyl Substances: Power Density Effect.
J.A. Kewalramani, R. Marsh, P. Juriasingani, and J. Meegoda.
Purshotam Juriasingani (Tetra Tech, Inc./USA)

180. Low Temperature Thermal Decomposition of PFAS and Amendments for Enhanced Mineralization.
P. Koster van Groos, P. Hedman, A. Soto, N. Thakur, C. Condee, T. Johnson, T. Myers, M. Dunlap, and A. Pham.
Paul Koster van Groos (APTIM/USA)

181. A Sustainable Treatment Train Approach for Complete Destruction of PFAS in Contaminated Water.
N. Pica, T. Macbeth, J. Bamer, C. Schaefer, and T. Burgesser.
Tamzen Macbeth (CDM Smith Inc./USA)

182. A Smoldering Solution to PFAS.
D. Major, A. Duchesne, J. Brown, L. Kinsman, G. Grant, J. Gerhard, B. Harrison, D. Patch, and K. Weber.
David Major (Savron/Canada)

183. Destruction of Per- and Polyfluoroalkyl Substances (PFAS) in a Continuous Supercritical Water Oxidation Reactor.
B.R. Pinkard, S.J. Moore, A.L. Purohit, and I.V. Novosselov.
Igor Novosselov (University of Washington/USA)

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184. Can You See Me Now? Evaluation of Field Instruments for On-Site Vapor Intrusion Investigations.
L. Beckley, C. Patterson, T. Lewis, and T. McHugh.
Lila Beckley (GSI Environmental Inc./USA)

185. Subslab Soil Gas Sampling Using Various Installation Methods, Sampling Durations, and Sample Volumes: A Case Study.
G. Buckley, J. Zimmerman, B. Schumacher, V. Boyd, C. Lutes, L. Levy, E. Ross, T. Walker, and R. Truesdale.
Gwendolyn Buckley (Jacobs/USA)

186. Training Field Staff to Observe and React to the Unexpected: Conducting Quality Vapor Intrusion Investigations.
G. Buckley, C. Lutes, L. Lund, B. Thompson, L. Levy, K. Hallberg, E. Ross, and T. Walker.
Gwendolyn Buckley (Jacobs/USA)

187. Using HAPSITE® to Protect Employee Health during Installation and Refinement of Remedial Measures.
S.F. Calkin, A.R. Quintin, J. Besse, A.B. Rosenstein, and D.A. Moore.
Scott Calkin (Wood/USA)

188. Evolution of Vapor Intrusion Assessment and Expected Future Trends.
C.A. Cox and L.A. Chilcote.
Craig Cox (Cox-Colvin & Associates, Inc./USA)

189. Using Real-Time Data to Evaluate the Sewer Gas to Indoor Air Pathway.
A. Friedrich and A. Wallace.
Aaron Friedrich (ERM/USA)

190. A Streamlined Approach to Evaluating Preferential Pathways: From Investigation to Mitigation.
A. Friedrich and N. Weinberg.
Aaron Friedrich (ERM/USA)

191. Use of Temporal-Spatial Continuous Monitoring Data to Isolate Vapor Intrusion Entry Points and Assess VOC Exposure Dynamics.
B. Kahl.
Brian Kahl (Farallon Consulting/USA)

192. Approximating Steady-State Conditions with the Results from Soil Gas Sampling May be Subject to Bias Depending on the Method Selected.
L. Kessel.
Lowell Kessel (Beacon Environmental Laboratory/USA)

193. Accounting for Dilution in Large Buildings during Building Pressure Cycling for Vapor Intrusion Testing.
K.E. Hallberg, B. Thompson, L. Levy, E. Keene, T. Lewis, E. Ross, R. MacLure, and T. Walker.
Loren Lund (Jacobs/USA)

194. Transport of Volatile Organic Compounds (VOCs) to and within Municipal Sewer Systems.
K. Rüegg, S. Pedersen, and P. Loll.
Anja Melvej Hermansen (Central Denmark Region/Denmark)

195. Evaluating the Potential for Mercury Vapor Intrusion.
N.S. Wanner.
Nate Wanner (Cox-Colvin & Associates, Inc./USA)

F8. Vapor Intrusion Mitigation and Effectiveness

196. Identifying Impacts to Vapor Intrusion Mitigation Performance Using Continuous Real-Time Monitoring.
C. Bonniwell, C. Ferguson, and K. Hoylman.
Chris Bonniwell (Vapor Products Group/USA)

197. Long-Term Results of VI Mitigation for Elevated Indoor Air VOCs and High Strength Sub-Slab VOCs at an Active Military Building at Naval Air Station North Island.
V. Hosangadi, P. Chang, R. Mennis, and M. Pound.
Pamela Chang (Battelle/USA)

198. Lessons Learned: Installing Vapor Intrusion Mitigation Systems in a Variety of Residential and Industrial Settings.
E. Dulle and E. Ahlemeyer.
Eric Dulle (Burns & McDonnell/USA)

199. Evolution and Evaluation of Composite Vapor Intrusion Barrier Systems.
P. Grant, A. Richards, and S. Weiterman.
Peter Grant (EPRO/USA)

200. Strategy to Overcome Sub-Slab Depressurization System Design and Operational Challenges in an Existing Building with Sensitive Tenant Use.
R. Henke, D. Kaiser, and R. Kovacs.
Rachel Henke (Roux/USA)

201. Remediation and Securing of the Sensitive Land Use on a Former Sedimentation Basin Regarding a Sugar Beet Processing Plant in Denmark.
J. Holm, H. Løjmand, S. Agger, and T.B. Nielsen.
Helle Løjmand (GEO/Denmark)

202. Soil Vapor Extraction beneath an Occupied Building at an Active Military Installation.
C. Martin, J.D. Spalding, J. Knight, T.N. Creamer, and P. Chang.
Chris Martin (Geosyntec Consultants/USA)

203. Innovative Sub-Slab Depressurization System Provides Advantages to the Future Use of a Former Manufactured Gas Plant Site Property.
R. Rago, D. Kerr, and T. Hatton.
Richard Rago (Haley & Aldrich, Inc./USA)

204. Implementation of a SVE Remediation System in a Functioning Shopping Mall in Sao Paulo State, Brazil.
G.D.C. de Mello, A.R. Cervelin, G.I. Correa, and J.R. Cury.
Matheus Roldan (Ramboll Brasil/Brazil)

205. The Value and Challenges of Post-Development Sampling Programs to Confirm Effective Installation of Vapor Intrusion Mitigation Systems.
P.J. Scaramella and J.P. Duffield.
Peter Scaramella (GSI Environmental Inc./USA)

206. Partial Building Mitigation for Vapor Intrusion at a Large Manufacturing Building Using Multiple Lines of Evidence and Lasers.
B. Schwie, J. Bankston, and E. Blodgett.
Brad Schwie (Barr Engineering Co./USA)

207. Lessons Learned from Continuous VOC Monitoring during Interim Vapor Intrusion Mitigation.
B. Thompson, K. Hallberg, L. Lund, E. Ross, and T. Walker.
Benjamin Thompson (Jacobs/USA)

208. Performance Testing of a New Vapor Barrier Comprising a Metalized Film Membrane.
K. Thoreson and H. Nguyen.
Kristen Thoreson (REGENESIS/USA)

F9. Vapor Intrusion Risk Assessment and Site Management

209. Vapor Intrusion Potential Control Combined with ISCR Pilot Test at an Industrial Site Impacted by Chlorinated Compounds (Rio Grande do Sul, Brazil).
S. Aluani, C. Spilborghs, E. Pujol, F. Tomiatti, N. Nascimento, and J. Mueller.
Sidney Aluani (SGW Services/Brazil)

210. An Evaluation of the Effects of Evolving Regulatory Framework on Vapor Intrusion Conceptual Site Model Development and Risk Identification.
M. Bono and G. Randall.
Matthew Bono (EnviroForensics, LLC/USA)

211. Stakeholder Lessons and Response Actions for Vapor Intrusion in a Large Active Military Manufacturing Building.
T.N. Creamer, J.D. Spalding, P. Chang, J. Knight, and R. Daprato.
Todd Creamer (Geosyntec Consultants/USA)

212. Review of State of Science on Potential Precluding Site Conditions for Application of Vertical Screening Distances for Petroleum Vapor Intrusion.
I. Hers, M. Lahvis, and P. Jourabchi.
Ian Hers (Hers Environmental Consulting, Inc./Canada)

213. An Empirical Study of Environmental Factors Affecting the Vapor Intrusion Attenuation Factor.
M.A. Lahvis and R.A. Ettinger.
Matthew Lahvis (Shell Global Solutions/USA)

214. Development of a Site-Specific Empirical Attenuation Factor for a Residential Neighborhood in California.
S.J. Luis, Y. Zhuang, C. Serlin, S. Dergham, and P. Vargas.
Steve Luis (Ramboll/USA)

215. I'm Stuck on You: Carryover Contamination and Other Quality Assurance Considerations for Passivated Canister Sample Results.
T.E. McHugh and L.M. Beckley.
Thomas McHugh (GSI Environmental Inc./USA)

216. Indoor Air Background Levels of Volatile Organic Compounds (VOCs) and Air-Phase Petroleum Hydrocarbons (APH) in Office Buildings and Schools.
R. Rago, A. Rezendes, J. Peters, K. Chatterton, and A. Kammari.
Richard Rago (Haley & Aldrich, Inc./USA)

217. The Benefits of a Comprehensive Vapor Intrusion Assessment.
M.V. Robinson and C. Stoker.
Melissa Robinson (Equipoise Corporation/USA)

218. Latest Developments in TCE Short-Term Indoor Air Standards.
L. Trozzolo.
Laura Trozzolo (TRC Companies, Inc./USA)

219. Mitigation of Vapor Intrusion Risks under Residential Buildings Using Inclined Vapor Extraction Wells and Inclined Soil Gas Monitoring Wells.
L.A. Araki, A. Yoshinari, R.L. Franklin, and L.A.G. Adensohn.
Victor Vanin Sewaybricker (EBP Brasil/Brazil)

220. Vapor Intrusion Visualizations and Mapping to Identify Sources of Contamination.
N.S. Wanner.
Nate Wanner (Cox-Colvin & Associates, Inc./USA)

G5. In Situ Remediation of Petroleum Hydrocarbons

221. Development of a Biogeochemical Conceptual Site Model Using Molecular Biological Tools at a Petroleum Terminal in Pasco, Washington.
K. Waldron, F. Barajas-Rodriguez, and B. Harding.
Francisco Barajas-Rodriguez (AECOM/USA)

222. Comparison of Bioeffect Screening Results for Hydrocarbons and Hydrocarbon Oxidation Products.
B.A. Bekins, J.K. Leet, J.C. Brennan, D.E. Tillitt, I.M. Cozzarelli, J.M. Illig, and D. Martinovic-Weigelt.
Barbara Bekins (U.S. Geological Survey/USA)

223. In Situ Remedial Design Characterization Using the Optical Image Profiler and Membrane Interface Probe with Hydraulic Profiling (OiHPT-UV and MiHPT).
J.V. Fontana.
John Fontana (Vista GeoScience/USA)

224. Steam It: Challenging Waste Oil NAPL Removal in Two Phases Using Steam Enhanced Extraction.
S. Griepke, J. Wattu, A. Fortune, S. Nienstedt, A. Bonarrigo, C. Rockwell, and S. Luczko.
Steffen Griepke (TerraTherm, Inc./USA)

225. Application of an All-in-One ISCO Technology for the Treatment of Hydrocarbons, BTEX and MTBE at a Former Retail Petrol Station in Italy.
A. Leombruni, M. Mueller, and B. Smith.
Alberto Leombruni (Evonik/Italy)

226. Combining Traditional and Advanced In Situ Remedial Methods to Address Source Petroleum Hydrocarbon Mass.
W. Moody, J. Mueller, E. Raes, A. DeGrandis, M. Huff, E. Duggan, and M. Scalzi.
Will Moody (Provectus Environmental Products, Inc./USA)

227. Using Tracer Gases (Sulfur Hexafluoride and Helium) to Assess Radius of Influence of Biosparge Pilot Systems.
W. Nolan and T. Andrews.
Wyatt Nolan (Jacobs/USA)

228. When It Comes to LNAPL, Activated Carbon May Replace NSZD as the Best Available Closing Technology.
S. Noland.
Scott Noland (Remediation Products, Inc./USA)

229. In Situ Bioremediation of N-methyl-2-pyrrolidone (NMP) and BTEX beneath an Active Oil Refining Facility.
C. Riis, J.B. Nielsen, A.K. Ludvigsen, S. Dworatzek, E. Cox, and A. Przepiora.
Charlotte Riis (NIRAS A/S/Denmark)

230. Bench-Scale Test for the Chemical Oxidation of Total Petroleum Hydrocarbons.
A.E. Fuse and R. Kumamoto.
Rubens Spina (EBP Brasil/Brazil)

G6. LNAPL Recovery/Remediation Technology Transitions

231. Use of Tiered Decision-Making Criteria to Assess LNAPL Recovery System Endpoints and Transition to NSZD at an Active Refinery.
N. Babu, D. Chheda, and D. Collins.
Naren Babu (Stantec/USA)

232. Innovative ISCO Solution with Nanobubbles of Ozone and Hydrogen Peroxide for a Large-Scale LNAPL Remediation in a Former Industrial Facility in Brazil.
R. Campos, M.Q. Omote, and G.D.C. Mello.
Rafael Campos (Ramboll Brasil/Brazil)

233. Super Hydrophobic Silane-Modified Carbon Nano Fibers/PDMS Sponge Fabrication for Oil/Water Separation.
Y.L. Choi, G.K.R. Angaru, P.C. Ashwinikumar, J.K. Yang, and Y.Y. Chang.
Yu-Lim Choi (Kwangwoon University/South Korea)

234. Using LNAPL Transmissivity to Define LNAPL Recovery to the Extent Practicable: But Why 0.1 to 0.8 ft²/day?
A. Kirkman, S. Gaito, B. Koons, and J. Smith.
Steven Gaito (AECOM/USA)

235. Automated NAPL Thickness Monitoring Using a Pressure Datalogger Deployed at a Variable Depth.
D. Buckley, S. Gaito, and B. Koons.
Steven Gaito (AECOM/USA)

236. Cleanup of a Daylighted Gasoline Release in a Sand-Filled Tank Hold Utilizing Total Fluid Recovery and a Targeted Surfactant Flood.
R.S. George and J.S. Poynor.
R. Steven George (Wright Environmental Services, LP/USA)

237. In Situ Bioremediation of Shallow Dispersed LNAPL Plume Travelling under a Major Highway.
D. Guilfoil, G. Simpson, N. Thacker, and N. Mau.
Duane Guilfoil (AST Environmental, Inc./USA)

238. Injection of High-Purity Oxygen into Groundwater to Enhance Bioremediation and Increase LNAPL Recovery at an Active Commercial Port in Southern California.
S.M. Hash, C.L. O'Neil, and M.P. Purchase.
Caryn Lee O'Neil (Orion Environmental, Inc/USA)

239. Modeling Approaches to Support Remedial Decisions at NAPL Sites.
L. Stewart, M. Widdowson, R. Deeb, M. Kavanaugh, and J. Nyman.
Lloyd Stewart (Praxis Environmental Technologies, Inc./USA)

240. Permeable Reactive Barrier Installation for Prevention of LNAPL Migration into an Adjacent Surface Water Body.
W. Wright, T. Uhler, C. Smith, D. Pizarro, and N. Thacker.
Tim Uhler (Groundwater & Environmental Services, Inc./USA)

241. In Situ Environmental Remediation of Oil (LNAPL) Using Foam as a Blocking Agent.
A. Vicard and O. Atteia.
Alexandre Vicard (INNOVASOL/France)

G7. LNAPL Sites: Understanding and Managing Risks

242. Unified Performance Assessment Metrics for LNAPL Management.
R. Muthu and A. Kirkman.
Ranga Muthu (Parsons/USA)

243. Optimization of Monitoring for Diesel-Range Organics in Groundwater.
W. Westervelt and T. Palaia.
Win Westervelt (Jacobs/USA)

G8. Environmental Forensics: Site Characterization and Source Determinations

244. Forensics for Assessing Commingled 1,4-Dioxane Plumes.
B. Bond, I. Wolfe, K. Kelly, and M. Morris.
Bob Bond (Langan/USA)

245. Forensic 1,1,1-TCA Ratio Age Dating as a Defensible Methodology: Insights from Multiple Case Studies.
B. Bond and I. Wolfe.
Bob Bond (Langan/USA)

246. PAH Forensics with Laser-Induced PAH Fluorescence to Differentiate Co-Located Fuel Oil Spills.
B. Bond.
Bob Bond (Langan/USA)

247. Using Forensic Analysis to Eliminate the Need for Remediation.
J.R. Gee.
John Gee (Weston Solutions, Inc./USA)

248. Use of Cross National Databases in the Pursuit of Sources to Groundwater Contamination with Pesticides.
T. Ljungberg, J.R. Pedersen, J. Pedersen, and S. Roost.
Thomas Ljungberg (Central Denmark Region/Denmark)

249. Application of Diagnostic Tools to Evaluate Remediation Performance at Two Petroleum Hydrocarbon-Contaminated Sites.
K. Sra, R. Kolhatkar, and E. Daniels.
Kammy Sra (Chevron/USA)

250. Identifying Origins of Chlorinated Organics During Land-Based and Sediment Investigation: Finding that Silver Bullet.
R. Vitale.
Rock Vitale (Environmental Standards, Inc./USA)

G9. Remote Sensing, Drones, and Other Unmanned Systems for Remote Monitoring and Site Assessments

251. Using Hyperspectral Sensors on Unmanned Aircraft Systems to Characterize Mine Tailings, Bauer Tailings Site, Tooele County, Utah.
S. Dent, H. Young, D. Reicks, T. Bragdon, and R. Olsen.
Stephen Dent (CDM Smith Inc./USA)

252. Conceptual Site Model Development Using an Airborne Geophysical Program to Evaluate Hydro-Stratigraphy, Laramie County, Wyoming.
P.G. Ivancie and J. Abraham.
Paul Ivancie (Wood/USA)

253. Using Remote Sensing, LiDAR, UAVs and Thermal Infrared Imagery to Efficiently Delineate Areas of Groundwater-Surface Water Exchange in a Large Forested Area in the Eastern United States.
L. Mastera, B. Shaver, C. Turner, and C. Jones.
Larry Mastera (ERM/USA)

254. Innovative Unmanned Aerial Survey to Assess Impacts to a Shoreline Landfill.
M. Meyer, D. Goddard, M. Jones, S. Rosansky, and J. Peach.
Michael Meyer (Battelle/USA)

255. Supplying Clean Drinking Water in a Rural Pennsylvania Village.
J.L. O'Reilly, D.V. Linahan, D.M. Lyon, and T. Uhler.
Jennifer O'Reilly (Groundwater & Environmental Services, Inc./USA)

256. Inventory of Waste, Using Drone Mapping, along 557.5 Miles of a Mining Company's Railway.
G. Setti, A. Ibiapino, A.P. Queiroz, and F. Lima.
Ana Paula Queiroz (Waterloo Brasil/Brazil)

G10. Using Omic Approaches and Advanced Molecular Tools to Optimize Site Remediation

257. Shifting Perception that "Omics" Is "Too Complicated": Biogeochemical Degradation of ~15+ mg/L of 1,2-DCA to Non-Detect.
J. Gamlin, S. De Long, S. Mahendra, and Y. Miao.
Jeff Gamlin (Jacobs/USA)

258. A Novel High-Throughput qPCR Tool for Bioremediation Monitoring.
F. Kara Murdoch, R. Murdoch, C. Swift, and F.E. Loeffler.
Fadime Kara Murdoch (Battelle/USA)

259. Microbial Indices for Monitoring and Evaluation of Groundwater and Soil Bioremediation Processes.
Y. Miao, M.B. Heintz, C.H. Bell, N.W. Johnson, A.L. Polasko, D. Favero, and S. Mahendra.
Shaily Mahendra (University of California, Los Angeles/USA)

260. Next Generation Sequencing Applications for Biodegradation Assessment.
C. Brown, K. Clark, S. Rosolina, and D. Taggart.
Sam Rosolina (Microbial Insights, Inc./USA)

261. Characterization and Quantification of Anaerobic Microbial Benzene, Toluene and *o*-Xylene Degraders in Three Bioaugmentation Cultures.
C.R.A. Toth, O. Molenda, F. Luo, C. Devine, S. Guo, E.A. Edwards, S. Dworatzek, J. Webb, and P. Dennis.
Courtney Toth (University of Toronto/Canada)

G11. International Remedy Applications: Regulatory and Logistical Challenges of Remediation Abroad

262. Applying Electrical Resistance Heating in Highly Occupied Areas.
T.L. Gomes and J. Seeman.
Thiago Gomes (TRS Doxor/Brazil)

263. Applying Electrical Resistance Heating in One Large-Scale, Low Permeable Site Contaminated by Chlorinated Compounds in China.
W. Sun, L. Wei, and A. Small.
Gorm Heron (TRS Group, Inc./USA)

264. In Situ Remediation of Source Chlorinated VOCs at an Industrial Site in Japan.
M.L. Lamar, C. Franzel, H. Kamemoto, R.L. Olsen, and G. Ebert.
Michael Lamar (CDM Smith Inc./USA)

265. Optimized Integrated Remediation of a Complex Plume with CHC/Vinyl Chloride Using a Treatment Train.
K. Menschner and T. Reichardt.
Karsten Menschner (CDM Smith Inc./Germany)

266. Sodium Persulfate with Integrated Activator Destroys >99% of Trichlorethylene in 5 Weeks at a Manufacturing Facility in Holland.
M. Mueller and H. Opdam.
Michael Mueller (Evonik/Austria)

267. Pilot Test of Bioaugmentation and Biostimulation on the Degradation of Persistent Chlorinated Ethenes in Groundwater in a Complex Site in Brazil.
M.Z. Osaki, B. Soares, and G.D.C. de Mello.
Monique Zorzim Osaki (SuperBAC Biotecnology Solutions/Brazil)

268. Bioaugmentation and Biostimulation under Different Redox Conditions on the Degradation of Chlorinated Solvents in Groundwater in a Site in Brazil.
M.Z. Osaki and J.D. de Jesus Filho.
Monique Zorzim Osaki (SuperBAC Biotecnology Solutions/Brazil)

269. Rats for Detection and Delineation of Hydrocarbon-Impacted Soil.
D.C. Segal, C. Fast, and C. Cox.
Daniel Segal (Chevron/USA)

270. International Collaboration to Execute a Combined SVE/ISCR Remedy in Brazil.
J.K. Sheldon, C. Bertolani, and T. Fernandes.
Jack Sheldon (Antea Group/USA)

271. Engineering Design and Removal of TPH-Impacted Soil at an Industrial Site under Deactivation.
T.F. Noccetti, A.A. Faria, and J.F.W. Castro.
Rubens Spina (EBP Brasil/Brazil)

272. Pilot Test at an Operational Industrial Site: SVE, Air Sparging, and Ozone Injection System.
D.D. Savio, D.S. Saunite, E. Freire, and T.F. Noccetti.
Rubens Spina (EBP Brasil/Brazil)

273. International Collaboration to Transfer Technology Best Practices: A Practitioner's Manual on Direct Push Technology Injection for In Situ Remediation.
J. Wang, N. Durant, D. Fan, A. Przepiora, N. Tuxen, and M. Hag.
James Wang (Geosyntec Consultants/USA)

274. NAPL: Does It Matter? What Can We Learn from the Last 15 Years of Remediation?
A.O. Thomas, K. Leahy, J. Baldock, and L. Wedge.
Christopher Wilson (ERM/USA)

H3. Advanced Geophysics and Remote/Direct Sensing Tools and Techniques

275. Subsurface Temperature Monitoring in In Situ Thermal Remediation Using Fiber Optic Sensing Technology.
H. Alemohammad, K. Joseph, and D. Alguire.
Doug Alguire (AOMS Technologies/Canada)

276. EPA Method ATP 16130 and GC-MS/MS Approaches for Chlorinated POP Analysis.
B. Chandramouli and M.C. Hamilton.
Bharat Chandramouli (SGS Canada/Canada)

277. Nuclear Magnetic Resonance Geophysics for Refined Hydrogeologic CSM Development.
E.M. Chapa.
Michael Chapa (Weston Solutions, Inc./USA)

278. Nuclear Magnetic Resonance Geophysics for High-Resolution Site Characterization, CSM Refinement, and Remedial Design Optimization.
B.D. Cross.
Bradley Cross (ERM/USA)

279. Hydrogeologic Mapping of Fluorescent Dye Transport Processes from TCE Source Area through Fractured Bedrock Aquifer.
J. Drummond, K. Fox, C. Vallone, R. Bower, and B. Rundell.
Jesse Drummond (EA Engineering, Science, and Technology, Inc., PBC/USA)

280. Application of an Iterative Source Localization Strategy at a Chlorinated Solvent Site.
E. Essouayed, O. Atteia, and N. Guiserix.
Elyess Essouayed (Groupe Renault/France)

281. Technology Post Audit of High-Resolution Site Characterization Data for Successful Remediation.
S. Frandsen, T. Halihan, and S.W. McDonald.
Samantha Frandsen (Aestus, LLC/USA)

282. High-Resolution Site Characterization at Vertically Fractured Bedrock Sites.
T. Halihan, S.W. McDonald, and K. Spears.
Todd Halihan (Oklahoma State University/USA)

283. Fluorescence Tracing Techniques Successfully Applied for Wellhead Protection and DNAPL Sources Identification.
M.H. Otz, I. Otz, T. Gubler, and T.M. Hurd.
Todd Hurd (TMH Tracing/USA)

284. Review of Conceptual Site Model (CSM) and Remediation Approach after High-Resolution Site Characterization Using Combined OIP and HPT Technologies.
M. Evald, S. Souto, C. Malta-Oliveira, M. Saturnino, and F. Carvalho.
Mateus Knabach Evald (FINKLER Ambiental/Brazil)

285. Designing a Treatment Solution Using High Density Site Characterization.
A.R. Taylor and J.R. Lanier.
Jeffrey Lanier (SME/USA)

286. A Novel Approach to Characterize a Chlorinated Solvents Plume beneath an Extensive Wetland System.
P.L. Lepczyk and C.A. Weber.
Peter Lepczyk (Fishbeck/USA)

287. High-Resolution Contaminant Profiling to Support a Reduced Scope of Remediation at the Cristex Drum Superfund Site, Oxford, North Carolina.
W.N. O'Steen, J.T. Ferreira, and N. Atashi.
William O'Steen (U.S. Environmental Protection Agency/USA)

H4. Advanced Sampling and Analysis Tools and Techniques

288. Push-Ahead Groundwater Sampling and Near Real-Time Field Screening of PCE Concentrations during Deep Drilling.
Q.G. Bingham, R. Adams, G. Colgan, D. Waite, and J. Cox.
Quinten Bingam (Haley & Aldrich/USA)

289. Advances in Bio-Trap Samplers for Environmental Site Diagnostics.
K. Clark, D. Taggart, and K. Sublette.
Kate Clark (Microbial Insights, Inc./USA)

290. Experimental and Modelling Investigations of ^{222}Rn Profiles in Chemically Heterogeneous LNAPL-Contaminated Vadose Zone.
G. Cohen, O. Atteia, D. Su, K.U. Mayer, and P. Höhener.
Grégory Cohen (G&E/France)

291. A New Passive Contaminant Flux Measurement Device: Development and Testing.
P. Erickson, S. Nguyen, C. Sandefur, K. Thoreson, and R. Hardenburger.
Paul Erickson (REGENESIS/USA)

292. Low-Cost, High-Resolution Investigation to Improve CSM and Remediation Approach in an Industrial Area in Brazil.
C.D. Maluf, C.V. Witier, and A.R. Cataldo.
Cristina Deperon Maluf (Ambscience Engenharia Ltda/Brazil)

293. Use of Passive Soil Gas Tools for Fuel Spill Delineation.
C.J. Mulry and P.A. Reichardt.
Christopher Mulry (Groundwater & Environmental Services, Inc./USA)

294. Smart Head: Remote Well Monitoring System for Contaminated Area Evaluation and Full-Scale Remediation Project Design.
L.A.M. Santos and G.Q. Ferreira.
Lucas Santos (Reconditec Sistemas/Brazil)

295. Real-Time Data through Horizontal Soil Sampling for Optimal Horizontal Vapor Extraction Well Construction and Placement.
T. Will and M. Sequino.
Tomas Will (Directional Technologies, Inc./USA)

296. Relative Transmissivity within Layered Fractured Rock Aquifer Informed by Hydraulic Head in a Moveable Four-Packer String.
J.D. Zettl, J.R. Kennel, P. Quinn, and B.L. Parker.
Julie Zettl (University of Guelph/Canada)

H5. Groundwater Modeling: Advancements and Applications

297. Strategies for Simulating the Complete Transport Pathways of Regional-Scale, Atmospherically-Dispersed Contaminants from Emissions Sources to Groundwater Receptors.
E. Christianson, D. Dahlstrom, A. Janzen, J. Carter, and R. Wuolo.
Evan Christianson (Barr Engineering Company/USA)

298. Use of Visual ModFlow for Risk Management at a Former Industrial Landfill.
L.T. Kimura, F. Gimenes, R. Coelho, and V. Vanin.
Rodrigo Coelho (EBP Brasil/Brazil)

299. Evaluating Field Measurements for Characterizing Properties and Predicting Dissolution Rates of DNAPL Source Zones.
A. Prieto, M. Widdowson, and B. Stewart.
Andres Prieto Estrada (Virginia Polytechnic Institute and State University/USA)

300. Combining Traditional Site Characterization with Modern Uncertainty Analyses to Assess Elevated Arsenic Concentrations in an Access-Constrained Site.
P. Khambhammettu, M.W. Killingstad, L. Goldstein, J. Wahlberg, and C. Spill.
Prashanth Khambhammettu (Arcadis/USA)

301. Building a Better Mousetrap: The Evolution of MODALL.
M.W. Killingstad, M.P. Kladias, J. Wang, and S.T. Potter.
Marc Killingstad (Arcadis/USA)

302. Impact of Matrix Diffusion on the Migration of Groundwater Plumes for Non-Degradable Compounds such as Perfluoroalkyl Acids (PFAAs).
S.A. Lee, S.K. Farhat, C.J. Newell, B. Looney, and R.W. Falta.
Sophia Lee (U.S. Navy/USA)

303. Application of Reactive Transport Modeling for In Situ Perchlorate Treatability Design.
P. Rasouli and C.J. Ritchie.
Pejman Rasouli (Ramboll/USA)

304. An Effective and Efficient Numerical Modeling Approach to Support the Horizontal Reactive Treatment Well (HRX Well®) Design.
J. Wang, M.P. Kladias, C. Divine, and J. Wright.
Jack Wang (Arcadis/USA)

H6. MIP/HPT/LIF/UVOST—Realtime HRSC Tools and Techniques

305. NAPL Investigation Approach Applying Geophysical Methods and LIF/UVOST at a Lubricant Plant in Brazil.
K. Campos and V. Limeira.
Kamilo Campos (Arcadis Brazil/Brazil)

306. Redefinition of Remediation Strategy Based on High-Resolution Site Characterization Results.
S. Souto, C. Malta-Oliveira, M. Evald, M. Saturnino, and F.C.C. de Carvalho.
Mateus Knabach Evald (FINKLER Ambiental/Brazil)

307. Complete Redefinition of Conceptual Site Model Based on a High-Resolution Site Characterization Approach: A Case Study of a High-Risk Site Contaminated by Chlorinated Compounds.
S. Souto, C. Malta-Oliveria, M. Evald, M. Saturnino, and F.C.C. de Carvalho.
Mateus Knabach Evald (FINKLER Ambiental/Brazil)

308. Using Direct Sensing Tools to Evaluate Remediation Effort on the Site Contaminated by Strongly Mineralized Acidic Groundwater.
V. Knytl, O. Lhotsky, and T. Cajthaml.
Vladislav Knytl (DEKONTA, a.s./Czech Republic)

309. Real-Time Investigation to Support Treatability Studies: A Pioneer Field-Campaign in Argentina.
A. Kuriss, S. Prince, L. Spaccarotella, L. Ribeiro, J. Arthur, P. Barreto, J. Sohl, H. O'Neill, and J. Henderson.
Laura Spaccarotella (Worley/Argentina)

310. Conceptual Site Model Refinement to Support the Change of Use of a Former Industrial Site Impacted with Chlorinated Solvents.
R. Mori, F. Gimenes, M. Scarance, L. Kimura, M. Nunes, and V. Vanin.
Victor Vanin Sewaybricker (EBP Brasil/Brazil)

H7. HRSC Suites of Tools to Improve CSMs

311. Comparison of High-Resolution Site Characterization Tools for Evaluating Aquifer Characteristics and Extent of Contamination in Groundwater.
S. Blanchard, D. Kekacs, and J. Peeples.
Scott Blanchard (T&M Associates/USA)

312. High Resolution Design Optimization (HRDO) for In Situ Remediation through MiHPT "Expert Rules" and 3-D Imaged Targeted Injection Logs.
E. Cooper and B. Carlson.
Eliot Cooper (Cascade Environmental/USA)

313. Whodunnit, Matrix Diffusion or Reductive Dechlorination? The Case of the Disappearing PCE.
J. Finegan and G.E. Johnson.
James Finegan (Kleinfelder/USA)

314. Shifting from Traditional to Advanced Investigative Techniques during a Multi-Media Site Characterization.
M.D. Flanik, H.P. Corley, and B. Glisson.
Michael Flanik (Wood/USA)

315. High-Resolution Site Characterization of a Trichloroethene (TCE) DNAPL Source Zone with a Mobile Laboratory.
D.J. Kekacs, S.M. Blanchard, and J.A. Peeples.
Daniel Kekacs (T&M Associates/USA)

316. High-Resolution Characterization of a Source Area and Its Downgradient Plume to Optimize Full-Scale ERD Design.
P.L. Lepczyk, C.A. Weber, and M.D. Colvin.
Peter Lepczyk (Fishbeck/USA)

317. Remedial Design Investigation Using Geoprobe® Groundwater Profiler (GWP).
S. Pitts, K. Knapp, and F. Stolfi.
Steven Pitts (Equipoise Corporation/USA)

I4. Microplastics, Pharmaceuticals, and Other Emerging Contaminants

318. Transport and Fate of "New" Pesticide/Biocide Metabolite in Groundwater (Denmark).
M. Frederiksen, M. Christophersen, N. Tuxen, L. Clausen, P.L. Tüchsen, G.A.S. Janniche, C.N. Albers, and P.L. Bjerg.
Majken Frederiksen (Ramboll/Denmark)

319. Microplastics: California and Beyond—A Survey of State Approaches to Microplastic Research and Regulation.
R. Henke, S. Edmonds, R. Maxwell, and J. Rohrer.
Rachel Henke (Roux/USA)

320. Effect of Micro- and Nano-Plastics on the Microbial Reductive Dechlorination Process.
F. Kara Murdoch, Y. Sun, F. Loeffler, and K.H. Kucharzyk.
Fadime Kara Murdoch (Battelle/USA)

321. Discovery of a Novel Sulfolane-Degrading Bacterium through Lab- and Field-Scale Studies.
T.A. Key, A. Thavendrarasa, L. Eastcott, P. Dennis, X. Druar, M. Vachon, J. Webb, S. Dworatzek, J. Harder, S. Hains, and A. Madison.
Trent Key (Exxon Mobil Corporation/USA)

322. Assessment of Treatment Technologies for Removing Microplastics from Water: Current Perspectives and Future Directions.
Y. Kunukcu.
Yasemin Kunukcu (TRC Companies/USA)

323. Microplastics as Hubs Enriching Antibiotic-Resistant Bacteria and Pathogens in Municipal Activated Sludge.
D. Pham and M. Li.
Mengyan Li (New Jersey Institute of Technology/USA)

324. Pentachlorophenol, Polychlorinated Dibenzo-*p*-Dioxin, and Polychlorinated Dibenzofuran Concentrations in Soil Surrounding Treated Utility Poles.
A. Lutey and J. Sampson.
Amber Lutey (Integral Consulting, Inc./USA)

325. How Clean is Clean for Plastic Pellet Remediation?
S.S. Patil, K. Maroo, J. Powell, S. Dunn, D. Gerber, J. Burdick, and J. Henson.
Sonal Patil (Arcadis U.S., Inc./USA)

326. Bench-Scale Biodegradation of 1,2,3-Trichloropropane from a Dilute Aquifer Using *Dehalogenimonas*-Containing Bioaugmentation Culture.
M. Pompliano and S. Dworatzek.
Michael Pompliano (Matrix Design Group/USA)

327. Detection and Genotyping of Rotavirus Present in Samples of Wastewater and Superficial Water of the City of Sao Paulo.
A.P. Queiroz and D. Mehnert.
Ana Paula Queiroz (Waterloo Brasil/Brazil)

I5. Technical Impracticability: Challenges and Considerations for Evaluation of Fractured Rock Sites

328. Understanding the Hydrogeological Conceptual Model to Define Remediation Approach: Bedrock Mapping in a Site with Hydrocarbon and Chlorinated Compounds Contamination.
S. Aluani, F. Tomiatti, R. Moura, G. Siqueira, and N. Moura.
Sidney Aluani (SGW Services/Brazil)

329. Assessment of Impact with Xylenes in the Crystalline Aquifer at an Industrial Site in Sao Paulo, Brazil, Using Geophysics and Mathematical Modeling.
D. Saunite, L.T. Kimura, and N.D. Brandsch.
Rodrigo Coelho (EBP Brasil/Brazil)

330. DNAPL in Shallow Fractured Rock: Geotechnical Studies for Environmental Management Strategy.
C. Shibata, J. Teixeira, K. Farris, D. Szuch, R. Royer, M. Sousa, M. Alarsa, G. Nishikawa, F. Oliveira, and R. Passos.
Kathryn Farris (Arcadis/USA)

331. Heat and Treat Bedrock: Can ERH be Effective in Sandstone?
M. Kluger, G. Heron, M. Nanista, E. Crownover, A. Morgan, E. Marnette, and J. Pustjens.
Mark Kluger (TRS Group, Inc./USA)

332. Site Characterization for Remediation in Fractured Rock Settings.
K.S. Novakowski.
Kent Novakowski (Queen's University/Canada)

333. Characterizing Chlorinated Ethene Sources and Transport in a Complex Fractured Rock Aquifer Impacting Twin Cities Area Municipal Supply.
D.A. Scheer.
David Scheer (Minnesota Pollution Control Agency/USA)

334. Understanding Radius of Influence of Bedrock Fractures.
W. Slack.
William Slack (FRx, Inc./USA)

335. Evaluating Feasible Methods to Remediate 1,4-Dioxane and Uranium in Fractured Rock at the Nuclear Metals, Inc. Superfund Site.
B. Thompson, T. Majer, R. Harding, D. Adilman, C. Elder, D. Chlebica, and M. Kelley.
Bruce Thompson (de maximis, inc./USA)

336. Multiphase Hydrogeological Characterization of a Fractured Bedrock Aquifer to Optimize Amendment Injection.
T. Tomaselli, J. Button, J.N. Dougherty, A. Brown, A.S. King, and S. Rahman.
Travis Tomaselli (CDM Smith Inc./USA)

I6. Depositional Environments and Stratigraphic Considerations for Remediation

337. Correlation of Water-Bearing Fracture Zones with Stratigraphic Horizons in Sedimentary Rock.
J.M. Marolda, R.L. O'Neill, and S. Stucker.
James Marolda (Brown and Caldwell/USA)

338. Using Facies Models and Depositional Systems to Understand and Predict Continuity of Aquitards.
C. Plank, R. Cramer, and M.R. Shultz.
Colin Plank (Burns & McDonnell/USA)

339. Role of Sequence Stratigraphy in Remediation Geology: An Example from the Puchack Well Field Superfund Site, New Jersey.
J. Sadeque and J. Rice.
Junaid Sadeque (AECOM/USA)

340. Using Sequence Stratigraphy to Inform RI Activities at a Superfund Site Located within a Complex Fluvial Setting.
R.C. Samuels, L.J. Alexander, M. Kieling, and D. Flores.
Ryan Samuels (AECOM/USA)

341. Predicting the Feasibility of Groundwater Remediation Strategies from Depositional Systems Analysis.
M.R. Shultz, C.P. Plank, and R. Cramer.
Mike Shultz (Burns & McDonnell/USA)

342. Case Study on Amendment Delivery Methodology for Permeable Reactive Barrier (PRB) Installation in a Challenging Lithology at Shaw AFB, Sumter, South Carolina.
G. Simpson, D. Christensen, J. Chytil, S. Palakur, and D. Pizarro.
Gary Simpson (AST Environmental, Inc./USA)

343. Applied Environmental Sequence Stratigraphy.
B.D. Smith.
Brian D. Smith (Trihydro Corp./USA)

I7. Process-Based Conceptual Site Models (CSMs) for Informing Remediation

344. Successful CSM Development at Bedrock Chlorinated Solvent Site with Historic Mines and Channels.
T. Halihan, J. Ewert, S.W. McDonald, and K. Spears.
Todd Halihan (Oklahoma State University/USA)

345. A "Multiple Lines of Evidence Approach" for High-Resolution 3-D Geological Modelling/Risk Assessment of a Former Landfill Site in Denmark.
K.E.S. Klint.
Knud Erik Klint (GEO/Denmark)

346. Streamlining Lifecycles with High-Resolution Site Characterization (HRSC) and Three-Dimensional Conceptual Site Models.
J. Orris and J. Ruf.
Joshua Orris (Antea Group/USA)

347. Leveraging PRISM® to Assess Contaminant Migration Pathways at a Complex Geologic Site, Washington, DC.
R.C. Samuels, J. Sadeque, K. VanGelder, and D.G. Collins.
Ryan Samuels (AECOM/USA)

I8. Advances in the Application of Geologic Interpretation to Remediation

348. Connecting the Dots: Advanced Geologic and Geochemical Analysis Key to Identifying an Upgradient Source of Gasoline Impacting an Industrial Site in Southern California.
M. Einarson, C. Payne, D. Bernier, and P. Fontaine.
Murray Einarson (Haley & Aldrich, Inc./USA)

349. Improved Remedial Approaches at Complex Sites Using Health Risk Assessments Informed by Environmental Sequence Stratigraphy and Groundwater Modeling.
K. Patel-Coleman, G. Kenoyer, M. Shultz, and G. McLinn.
Kanan Patel-Coleman (Burns & McDonnell/USA)

350. Correlating the Permeability of Specific Fracture Sets to Regional Tectonic Stresses: A Case Study from Sao Paulo, Brazil.
C.W. Payne, M.D. Einarson, and M. Singer.
Charles Payne (Haley & Aldrich, Inc./USA)

351. Application of Sequence Stratigraphy in Developing Remediation Strategy in LNAPL-Impacted Sites.
J. Sadeque, R. Samuels, K. Carr, and J. Garcia-Rincon.
Junaid Sadeque (AECOM/USA)

352. Use of a Conceptual Site Model to Evaluate Contaminant Migration Pathways in Complex Igneous and Metamorphic Rock Terrains.
M.L. Schmidt, J. Breza, and J. Hershberger.
Martin Schmidt (EHS Support/USA)

I9. Remediation Approaches in Fractured Rock and Karst Aquifers

353. Extended Zone of Influence and Enhanced Mass Removal Achieved in Fractured Bedrock with Air Sparging.
M. Berman, J. Dishon, and H. Hays.
Michael Berman (SRS/USA)

354. In Situ Remediation of a Fractured Metamorphic Bedrock Aquifer Impacted with TCE and 1,1,1-TCA through ERD Techniques: Pilot-Scale Results.
M. Chaturgan and D. Smith.
Mindy Chaturgan (EWMA/USA)

355. Optimizing Remediation in Bedrock: Lessons from Successful Remediation at Two Sites following Past Failures.
P.M. Dombrowski, T. Musser, P. Kakarla, M. Temple, C. Weeden, M. Colon, and D. Bytautas.
Paul Dombrowski (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)

356. Case Study of Karst Site in Kentucky: Bedrock Remediation of PCE (10-Year Review).
D. Guilfoil and K. Thompson.
Duane Guilfoil (AST Environmental, Inc./USA)

357. Field Performance of Novel Amendments to Support the Biodegradation of TCE in a High Sulfate Fractured Bedrock Environment.
M.R. Harkness, P. Hare, P. Freyer, and L. Scheuing.
Mark Harkness (Ramboll/USA)

358. Site Closure Ramifications of Karstic Terrain Hydrogeology.
D.T. Heidlauf, B. Kennington, S. Popelar, A. DeDolph, and S. Tarmann.
David Heidlauf (Ramboll/USA)

359. A Synergistic Approach to Fractured Bedrock Remediation Using Combined Remediation Strategies and Delivery Methods.
B.S. Langan and J. Bennett.
Bonani Langan (Wood/USA)

360. The First Implementation of a Combined ERH and MPE Remedy at a Fractured Bedrock Site in Scotland, UK.
A. Morgan and G. Wealthall.
Andrew Morgan (Geosyntec Consultants/United Kingdom)

361. Remediation of Persistent Arsenic in Groundwater Using Groundwater Circulation Wells as an Effective Source Removal Approach in a Fractured Rock Aquifer.
M. Petrangeli Papini, P. Ciampi, G. Rehner, E.J. Alesi, E. Bartsch, M. Pellegrini, S. Olivieri, F. Bonfanti, and G. Liali.
Marco Petrangeli Papini (University of Rome "La Sapienza"/Italy)

362. BiRD Overcomes Rising Source Concentrations and Back Diffusion: Exceptional In Situ Contaminant Plume Treatment Performance.
J. Studer and N. Glenn.
James Studer (InfraSUR, LLC/USA)

363. Discovery of Submerged Springs: A Step Forward to Effectively Remediate and Manage Contaminated Groundwater in a Karst Aquifer.
H. Rafiee, W. Zhou, J. Zoeckler, and C. Jettie.
Wanfang Zhou (Hana Engineers and Consultants, LLC/USA)

Thursday Platform Sessions—8:00–10:05 a.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
8:00	A5. Permeable Reactive Barriers: Best Practices and Lessons Learned **Permeable Reactive Barrier Approaches to Reduce the Flux of Metals and CVOCs into Sediments and Surface Water.** *L. Hellerich, N. Hastings, J. Markey, Z. Smith, K. Lauer, and D. MacDonald.* Lucas Hellerich (Woodard & Curran/USA)	B7. Innovative and Optimized Amendment Delivery and Monitoring Methods **Utilizing Permeability Enhancements for In Situ Remediation of 1,4-Dioxane with Propane Biosparging.** *J. Saling and D. Favero.* Jacelyn Saling (Arcadis/USA)	C8. Setting Cleanup Goal End Points: When Are We Done? **Past Performance Does Not Guarantee Future Results: Evaluation of Remedy Performance Using Long Monitoring Records.** *T.E. McHugh, C.J. Newell, L.M. Beckley, S.R. Rauch, G. DeVaull, and M. Lahvis.* Thomas McHugh (GSI Environmental Inc./USA)	D7. Precipitation and Stabilization of Metals **Treatment of Soil and Groundwater Contaminated with Mercury and Numerous Heavy Metals Using a Mackinawite-Structured Iron Sulfide-Based Reagent.** *D.P. Cassidy, T.P. McCullough, J.A. Adams, and L. Kinsman.* Daniel Cassidy (Western Michigan University/USA)	E7. PFAS Site Characterization **Innovative Approach to Assessing Vadose Zone Transport of PFAS Using Lysimeters.** *J.B. Feild, S. Gormley, R.H. Anderson, R. Krebs, M. Helton, and H. Albertus-Benham.* James Feild (Wood/USA)
8:25	**Evaluating Permeability and Treatment Enhancements to a Zero-Valent Iron Permeable Reactive Barrier.** *J. Peeples, D. Freedman, H. Wang, and L. Lehmicke.* James Peeples (T&M Associates/USA)	**Cross-Borehole Resistivity Tomography: Can It Be Used to Plan and Monitor In Situ Remediation?** *R. Thalund-Hansen, P.L. Bjerg, L. Levy, T. Bording, A.V. Christiansen, K. Rügge, M. Dreyer, L. Brabaek, M.T. Hag, and N. Tuxen.* Rasmus Thalund-Hansen (Technical University of Denmark/Denmark)	**Using Multiple Lines of Evidence to Determine Success of In Situ Thermal Remediation.** *L. Soos, J. van Rossum, M. van den Brand, L. Stauch, and H. Boden.* Lauren Soos (TRS Group, Inc./USA)	**Feasibility of a Biobarrier to Treat a Molybdenum and Vanadium Plume Core in Highly Permeable Fractured Basalt.** *M.-Y. Chu, N. Tucci, M. Einarson, L. Peterson, and T. Lewis.* Min-Ying Jacob Chu (Haley & Aldrich, Inc./USA)	E7. PFAS Site Characterization **A Data Scientist's Look into PFAS Sites.** *A. Harrington, J. Dalton, and R. Velazquez.* Anna Harrington (Daybreak/USA)
8:50	**Application of Integrated Remedial Approaches to Address an Off-Site 4,000-foot 1,2-DCA Plume under Developed Properties.** *B. Vanderglas, D.R. Griffiths, R.J. Stuetzle, and B. Wilkinson.* Brian Vanderglas (Parsons/USA)	**Direct-Push Jet Injection for Enhanced Treatment of Chloropicrin in Low-Permeability Soils.** *C.S. Martin, R.E. Scott, C.M. Greene, and C.M. Ross.* Chris Martin (Geosyntec Consultants/USA)	**Application of a Tool and Process to Determine SVE Endstate.** *C.D. Johnson, K.A. Muller, M.J. Truex, D.J. Becker, C.M. Harms, J. Popovic, and G. Tartakovsky.* Christian Johnson (Pacific Northwest National Laboratory/USA)	**Assessment of In Situ Chemical Fixation Technologies for Addressing High Arsenic Concentrations in Groundwater.** *D.S. Finney and D. Williamson.* David Finney (Jacobs/USA)	**Evaluating PFAS Sample Bias in High Turbidity Environments Using Passive Sampling Methods: Pilot Studies.** *K. Shields and E. Palko.* Katelynn Shields (Integral Consulting, Inc./USA)
9:15	**Use of a Horizontal Colloidal Activated Carbon Permeable Reactive Barrier to Control Vertical Mass Loading into a Sandstone Aquifer.** *K. Gaskill, D. Davis, J. Birnstingl, and B. Kappen.* Keith Gaskill (REGENESIS/USA)	**Practical Approaches to ISCO Delivery Promote Informed Dosing Calculations across Multiple Sites.** *B.R. Hoye and J.R. Hesemann.* Brian Hoye (Burns & McDonnell/USA)	**The Impact of Adding Chemicals of Emerging Concern to CERCLA Site Cleanup Requirements.** *G.L. Kirkpatrick.* Gerry Kirkpatrick (Environmental Standards, Inc./USA)	**A Novel Formulation of Reagents for In Situ Remediation of a Commingled Plume of Metals and Chlorinated Solvents in Saprolite and Bedrock Aquifers.** *S. Golaski, J. Foster, B. Hardin, P. Hicks, D. Leigh, and A. Seech.* Stan Golaski (Rogers & Callcott Environmental/USA)	SESSION BREAK
9:40	SESSION BREAK	SESSION BREAK	SESSION BREAK	**Laboratory and Pilot Testing for Removal of Chromium and Nickel from Groundwater.** *S. Dore, C. Meincke, D. Pope, R. Thomas, and J. Wasielewski.* Sophia Dore (GHD/USA)	E7. PFAS Site Characterization **A Novel Real-Time PFAS Sensor with High Selectivity and Sensitivity Meeting Federal and State Regulatory Limits.** *L. Zhenglong, Y.H. Cheng, C. Chande, J.M. Torgeson, J. Schmid, C. Divine, J. McDonough, E. Houtz, R.K. Motkuri, and S. Basuray.* Sagnik Basuray (New Jersey Institute of Technology/USA)
10:05	A6. **Thermally-Enhanced Soil Vapor Extraction and Enhanced Aerobic Bioremediation.** *S. Crawford, L. Crawford, and M.C. Marley.* Scott Crawford (XDD Environmental/USA)	B8. **Biodegradation of Vinyl Chloride and *cis*-Dichloroethene in Aerobic and Suboxic Microcosms Using Environmental Samples from Naval Air Station North Island, IR Site 9.** *P.M. Richards, J.M. Ewald, W. Zhao, T.E. Mattes, H.V. Rectanus, D. Fan, N.D. Durant, and M. Pound.* Timothy Mattes (University of Iowa/USA)	C9. **Challenges with Green Remediation Planning.** *S.A. Sheldrake and M.A. Harclerode.* Sean Sheldrake (CDM Smith Inc./USA)	SESSION BREAK	E7. PFAS Site Characterization **Stratigraphic Flux-Based Approach during Adaptive Characterization at Multiple Large PFAS Plumes in Variably Complex Geologic Settings.** *M. Spurlin, J. Quinnan, P. Curry, T. Darby, J. Nail, C. Shepherd, and M. Rossi.* Matt Spurlin (Arcadis/USA)

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Thursday Platform Sessions—8:00–10:05 a.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
8:00	**Older Residential Homes: Sub-Slab Depressurization Lessons Learned for Successful Mitigation.** *C.E. Regan.* Catherine Regan (ERM/USA)	**Application of LNAPL Forensic Interpretations for Source Identification and Assessment of a New Release.** *D. Chheda, D. Collins, and W. Xiong.* David Collins (Stantec/USA)	**PFOA Plume Development and Remediation: Numerical Model Simulations with and without Precursor Impacts.** *M.J. Gefell, K. Gustafson, M. Carey, D. Opdyke, H. Huang, D. Vlassopoulos, S. Best, and J. McCray.* Michael Gefell (Anchor QEA, LLC/USA)	**PANEL DISCUSSION** **Remediation Geology, Remediation Hydrogeology, and Process-Based CSMs to Support Complex Site Remediation** **Moderators** Rick Cramer (Burns & McDonnell) Robert Stuetzle (Dow Chemical) **Panelists** Frederick Day-Lewis (PNNL) Sophia Lee (NAVFAC EXWC) Herb Levine (U.S. EPA, Region IX) Jim Strunk (Dow Chemical) John Wilson (Scissortail Environmental Solutions, LLC)	
8:25	**Spray-Applied Membranes: Practical Considerations for Use in Vapor Mitigation Systems.** *J. Nemesh.* Joseph Nemesh (Tetra Tech, Inc./USA)	**Field Applications of Compound Specific Isotope Analysis (CSIA) at Sites Contaminated with Chlorinated Solvents.** *L. Brabæk, K. Rügge, B. Grosen, K.S. Grunnet, and K. Sørensen.* Laerke Brabaek Ildvedsen (Capital Region of Denmark/Denmark)	**Unraveling Complexity through Fate and Transport Numerical Simulations in a Tidally-Influenced Heterogenous, Multi-System, Density Driven Regime.** *J.W. Schuetz, R.J. Stuetzle, and R.R. Wenzel.* James Schuetz (Parsons/USA)		
8:50	**Freedom! Open Source Vapor Mitigation System Monitoring.** *B. Schwie, A. Janzen, and K. Eisen.* Brad Schwie (Barr Engineering Co./USA)	**The Importance of CSM Verification: Implications for Source Identification, Monitoring, and Remediation.** *D. Livermore and A. Frankel.* David Livermore (Integral Consulting, Inc./USA)	**New Targets for Improving Contaminant Transport Model Calibration.** *A. Laase, R. Kent, and J. Rumbaugh.* Al Laase (RSI Entech/USA)		**HET-TRANS: A New Practical Software Tool for Examining Plume Remediation and Back-Diffusion at Sites with Highly Heterogeneous Subsurface Geology**
9:15	**Sensors, the Internet, and Automated Data Collection and Response Triggering for Vapor Control and Remedial Optimization.** *M.L. Kram, B. Hartman, and C. Frescura.* Mark Kram (Groundswell Technologies, LLC/USA)	**Development of a Molecular Biological Tools Framework to Support Contaminated Site Management.** *T.A. Key and A. Madison.* Trent Key (Exxon Mobil Corporation/USA)	SESSION BREAK		
9:40	**Time Critical Investigation, Performance Assessment, and Retrofit of a Passive Vapor Mitigation System.** *J. Gal and M. O'Hearn.* Justin Gal (Wood/USA)	SESSION BREAK	**Analytical Model for 3-D Solute Transport of Sequentially Decaying Species with Dual Porosity, Sorption, and Time-Varying Source.** *T. Perina, D. Rojas-Mickelson, and H. Levine.* Tomas Perina (APTIM/USA)	SESSION BREAK	**Furthering Hydraulic Characterization by Visual Mapping of Injection Data**
10:05	SESSION BREAK	**G9. Large-Scale Photogrammetry and Gamma Survey via Unmanned Aerial Vehicle at a Former Uranium Mine, New Mexico.** *K. Silver.* Kirk Silver (Woodard & Curran/USA)	**H5. Reactive Transport Capabilities in MT3D-USGS for Simulating Subsurface Contaminant Transport.** *V.S. Bedekar, G. Ou, and M.J. Tonkin.* Vivek Bedekar (S.S. Papadopulos and Associates, Inc./USA)	**I8. Using Sequence Stratigraphy to Inform a PFAS RI: Cannon AFB, New Mexico.** *R.C. Samuels and J. Gillespie.* Ryan Samuels (AECOM/USA)	

F8. Vapor Intrusion Mitigation and Effectiveness

G8. Environmental Forensics: Site Characterization and Source Determinations

H5. Groundwater Modeling: Advancements and Applications

Panel Discussion

Learning Lab

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Thursday Platform Sessions—10:30 a.m.–12:35 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
10:30	A6. Thermally Enhanced In Situ Degradation Processes at Sub-Boiling Temperatures **Microbes and Heat: How Hot Is too Hot? A Retrospective Look at Thermal Sites.** *D. Nelson, J. Byrd, and J. Baldock.* Jennifer Byrd (ERM/USA)	B8. Monitored Natural Attenuation: Innovative Monitoring Approaches/Lines of Evidence and Lessons Learned **Quantifying Natural Attenuation Capacity of Groundwater Systems: Comparison of Methods and Lessons Learned.** *M.A. Widdowson.* Mark Widdowson (Virginia Polytechnic Institute and State University/USA)	C9. GSR Best Practices and Nature-Based Remediation Case Studie **Accelerating Cleanup, Reducing Costs, and Increasing Sustainability at Travis Air Force Base.** *J. Gamlin and L. Duke.* Jeff Gamlin (Jacobs/USA)	D8. Mining and Uranium Site Restoration **Treatability Study for Sequestration of Uranium Using Fish Bone-Derived Hydroxyapatite at the Nuclear Metals, Inc. Superfund Site.** *K.M. Belli, D. Adilman, C. Martin, J. Gillow, L. Nielsen Lammers, B. Thompson, N. Hunt, and A. Hoffmann.* Keaton Belli (Geosyntec Consultants/USA)	E7. PFAS Site Characterization **3M Settlement: Project 1007 PFAS Source Assessment, Fate and Transport in Interconnected Surface Water and Groundwater.** *R.A. Higgins, A. Tarara, and A. Gorski.* Al Gorski (AECOM/USA)
10:55	**Heat Speeds Up Hydrolysis of Munitions Constituents: Low Temperature ERH Pilot Study.** *L. Soos, E. Crownover, C. Thomas, B. Morris, M. Maxwell, K. Cottrell, C. Crane, L. Kessler, and C. Williams.* Lauren Soos (TRS Group, Inc./USA)	**Monitored Natural Attenuation for Phthalates in a Former Industrial Site.** *L.T. Kimura and E.V. Freire.* Rodrigo Coelho (EBP Brasil/Brazil)	**In Search of PFAS Hyperaccumulation in Plants.** *B.J. Harding, M. Zenker, and F. Barajas.* Barry Harding (AECOM/USA)	**Biogeochemical Evaluation Strategies to Achieve Sustainable Long-Term Reclamation of Uranium Mines.** *M. Hay, K. Ashfaque, and J. Spitzinger.* Khandaker Ashfaque (Arcadis/USA)	**Traditional versus Incremental Sampling Methodology for Characterization of a Historical AFFF Release Area.** *J. Bamer, D. Wintle, H. Lanza, R. Merrick, and D.D. Nguyen.* Jeff Bamer (CDM Smith Inc./USA)
11:20	**Heated Water Recirculation to Enhance In Situ Abiotic and Biotic Degradation.** *F.J. Krembs, C. Carlson, S. Quint, R. Hefner, M. Mercier, A. Sansom, Q. Le, N. Geibel, and M.C. Maxwell.* Fritz Krembs (Trihydro Corporation/USA)	**Transition to Monitored Natural Attenuation for a CVOC Plume after 28 Years of Pump and Treat: Lessons Learned.** *J.A. Ricker and D.C. Winchell.* Joseph Ricker (WSP/USA)	**Seven Years of Using Endophyte-Assisted Phytoremediation Systems for Contaminated Groundwater Removal and In Situ Degradation.** *J.L. Freeman, C.M. Cohu, G. O'Toole, J.G. Burken, S.L. Doty, S. Rock, J.E. Landmeyer, D. Rowe, E. Pearson, D. Oram, R. Haughy, and B. Searcy.* John Freeman (Intrinsyx Environmental/USA)	**Evaluating Ongoing Contaminant Sources at a Former Uranium Mill Site: Is a 100-Year Natural Flushing Timeframe Reasonable?** *R.H. Johnson, R.D. Kent, and A.D. Tigar.* Raymond Johnson (RSI EnTech, LLC/USA)	**A Screening Tool to Measure Total Extractable Organofluorine in Per- and Polyfluoroalkylated Substances (PFAS)-Contaminated Media.** *K. Dasu, C. Cucksey, D. Siriwardena, P. Denen, and S. Allen.* Kavitha Dasu (Battelle/USA)
11:45	SESSION BREAK	SESSION BREAK	SESSION BREAK	**Field Hydrology and Ecology of an Engineered Cover for Uranium Mill Tailings Managed to Enhance Evapotranspiration.** *W.J. Waugh, C.H. Benson, W.H. Albright, M.M. Williams, A.D. Tigar, D.L. Holbrook, C.J. Jarchow, and M. Fuhrmann.* David Holbrook (RSI EnTech/USA)	SESSION BREAK
12:10				SESSION BREAK	
12:35	A7. **Horizontal Groundwater Control Wells for Large-Scale Remediation beneath CCR Ponds and Impoundments.** *K. Carlton and D. Richardson.* Kyle Carlton (Geosyntec Consultants/USA)	B9. **Exploring the Frontier of Bioremediation with High-Throughput Synthetic Biology.** *K. Sorenson and D. Saran.* Kent Sorenson (Allonnia/USA)	C10. **The Evolution of GSR: Comparing ITRC and ASTM 2021 Resilient Remediation Guides.** *R.I. Thun.* Roy Thun (GHD/USA)		E8. **Results from Six In Situ Pilot-Scale Tests for the Treatment of PFAS-Impacted Groundwater.** *R. McGregor.* Rick McGregor (InSitu Remediation Services Ltd./Canada)

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Thursday Platform Sessions—10:30 a.m.–12:35 p.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
10:30	F8. Vapor Intrusion Mitigation and Effectiveness **Exposing the Cracks: Challenges Encountered When Installing a Vapor Intrusion Mitigation System.** *G.J. Graening.* Guy Graening (GHD/USA)	G9. Remote Sensing, Drones, and Other Unmanned Systems for Remote Monitoring and Site Assessments **Innovation in Environmental Monitoring with Remote Sensing Techniques.** *M. Rawitch.* Brittni Engels (Ramboll/USA)	H5. **MODALL-U: An Unstructured Grid Tool for Facilitating Remedial Design (Two Case Studies).** *P. Khambhammettu, S.T. Potter, M.P. Kladias, M.W. Killingstad, J. Wang, and J. Wahlberg.* Prashanth Khambhammettu (Arcadis/USA)	I8. Advances in the Application of Geologic Interpretation to Remediation **Accelerated Remedial Approaches Using Environmental Sequence Stratigraphy.** *J.M. Stapleton, J. Gillespie, K. Glover, R. Cramer, and C.P. Plank.* J. Mark Stapleton (Noblis/USA)	Learning Lab
10:55	**Effectiveness of Passive Vapor Intrusion Mitigation Systems: An Examination of Key Parameters for Success.** *S. Reinis, J. Schaettle, and J.F. Ludlow.* Sigrida Reinis (Langan/USA)	**In Situ ORP, Pressure, and Temperature Sensors to Better Monitor and Optimize Remedial Actions.** *T.J. Simpkin and C. Mowder.* Sarah Brubaker (Jacobs/USA)	SESSION BREAK	**Leveraging Geologic Controls to Focus Your Remedial Strategy.** *T.H. Darby, R. Stuetzle, J.F. Strunk, Jr., M. Petersen, and C. Bertz.* Robert Stuetzle(Dow/USA)	
11:20	**Innovative Sub-Slab Depressurization System Provides Advantages to the Future Use of a Former Manufactured Gas Plant Site Property.** *R. Rago, D. Kerr, and T. Hatton.* Richard Rago (Haley & Aldrich, Inc./USA)	**An Interdisciplinary Approach to Understanding and Predicting Earth Movements at Steep Pipeline Rights of Way.** *F.J. DiGnazio.* Frank DiGnazio (Groundwater & Environmental Services, Inc./USA)		**A Guide to Performing Remediation Applying Remediation Geology: Two Case Studies.** *S. Pittenger, P.M. Dombrowski, S. du Pont, and T.L. Blazicek.* Scott Pittenger (ISOTEC/USA)	**In Situ Remediation Optimization Calculators and Technology Matrix: Manifolding, Radius of Influence, Dosing, and Chlorinated Solvent and Petroleum Technology**
11:45	SESSION BREAK	SESSION BREAK	H6. MIP/HPT/LIF/UVOST—Realtime HRSC Tools and Techniques **Improvement of the Optical Imaging Profiler (OIP) for the Detection of UV Range Fluorescing Compounds.** *T.M. Christy, B. Jaster, and W. McCall.* Ben Jaster (Geoprobe Systems/USA)	SESSION BREAK	
12:10			**High-Resolution Site Characterization of a Complex Bedrock Setting with DNAPL.** *T.A. Harp.* Thomas Harp (Remediation Risk Reduction, LLC/USA)		**Automated Remote Continuous Vapor Intrusion Monitoring and Response: Streamlining Deployment Logistics**
12:35	F9. **Incorporating Vapor Intrusion into Human Health Risk Assessments.** *L. Lund, M. Bedan, and D. Caldwell.* Loren Lund (Jacobs/USA)	G10. **Identification of Genetic Markers for Anaerobic Dichloromethane Metabolism.** *R.W. Murdoch, F. Kara Murdoch, E.E. Mack, G. Chen, M.I. Villalobos Solis, R.L. Hettich, and F.E. Loeffler.* Robert Murdoch (Battelle/USA)	**The Significance of Filling Data Gaps and Developing Good Conceptual Site Models Prior to Remedy Implementation under Fixed-Price, Performance-Based Remediation Contracts.** *P. Srivastav, W. Foss, S. Suryanarayanan, and R.E. Mayer, Jr.* Praveen Srivastav (APTIM/USA)	I9. **Technical and Regulatory Approaches for Cleanup of Contaminated Groundwater at Test Area North at the INL.** *P.K. Johansen, M. Roddy, and N. Badrov.* Pete Johansen (Idaho Department of Environmental Quality/USA)	

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Thursday Platform Sessions—1:00–3:05 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
1:00	**The Horizontal Reactive Treatment Well (HRX Well®) for Effective Long-Term In Situ cVOC and PFAS Mass Discharge Control at Two Sites.** *C.D. Divine, J. Wright, J. McDonough, J. Wang, M. Kladias, C. Griggs, M. Lubrech, D. Ombalski, K. Gerber, M. Crimi, and M. Riggle.* Craig Divine (Arcadis/USA)	**Vinyl Chloride Detoxification by a Novel Anaerobic Bacterium.** *G. Chen, F. Kara Murdoch, Y. Yang, J. Yan, and F.E. Loeffler.* Gao Chen (University of Tennessee/USA)	**Robust Groundwater Risk Assessment of Chlorinated Ethenes Using Solute Transport Modelling and Climate Change Scenarios.** *M. Christophersen, G.L. Søndergaard, L. Bennedsen, B.B. Thrane, B. Neuman, A.T. Bentzen, and J.F. Christensen.* Mette Christophersen (Ramboll Denmark/Denmark)	**Remediation of Hexavalent Chromium in Groundwater Using In Situ and Monitored Natural Attenuation Techniques in Five Countries.** *R.L. Olsen.* Roger Olsen (CDM Smith Inc./USA)	**In Situ Stabilization and Solidification (ISS) to Reduce PFAS Leaching from Contaminated Soils.** *D.P. Cassidy, D.M. Reeves, and M. Jury.* Daniel Cassidy (Western Michigan University/USA)
1:25	**Horizontal SVE and Steam Injection for Aerobic/Anaerobic Source Zone Depletion in Mixed LNAPL with JP5/TCE/TCA under an Active Building at Naval Air Station North Island.** *V. Hosangadi, P. Chang, R. Mennis, K. Asam, and M. Pound.* Vitthal Hosangadi (NOREAS, Inc./USA)	**Vinyl Chloride and 1,4-Dioxane Metabolism by *Pseudonocardia dioxanivorans* CB1190.** *I. Kwok, A.L. Polasko, Y. Miao, S. Mahendra, K. Park, and J.O. Park.* Ivy Kwok (University of California/USA)	**Integrating Resilience into Massachusetts Remediation Sites.** *C. Rockwell, M. Wade, and K. Marra.* Cathy Rockwell (Woodard & Curran/USA)	**Natural Attenuation of Hexavalent Chromium at Groundwater-Impacted Sites.** *L. Hellerich, R. Hogdahl, M. Pietrucha, and D. Waite.* Lucas Hellerich (Woodard & Curran/USA)	**A Greenhouse-Scale Remediation Study of PFAS and Metals in Stormwater by 10 Oregon Native Plants.** *R. Hilliard, B. Parker, J. Field, S. Simonich, and T. Radniecki.* Richard F. Hilliard (Oregon State University/USA)
1:50	**Application of Horizontal Injection Wells to Enhance In Situ Reductive Dechlorination of a Source Zone.** *A. Madison, J. Gutsche, B. Phillips, C. Elofson, and M. Kozar.* Andrew Madison (WSP Golder/USA)	**Stimulating and Sustaining Reductive Dechlorination Using In Situ Bioreactors.** *K. Clark, D. Taggart, S. Rosolina, K. Sublette, and E. Raes.* Kate Clark (Microbial Insights, Inc./USA)	**Implementing Greener Cleanup Best Management Practices at a Complex, Dynamic Groundwater Remediation Site.** *C.J. Ritchie and M. Sosa.* Mia Sosa (Ramboll/USA)	**Historical Evaluation of In Situ Hexavalent Chromium Remediation.** *J.V. Rouse and R.H. Christensen.* Jim Rouse (Acuity Environmental Solutions, LLC/USA)	**PFAS Reductions in Groundwater Maintained below EGLE's Proposed MCLs for 2.5 Years by Colloidal Activated Carbon Barrier at a Michigan National Guard Site.** *R. Moore and P. Lyman.* Ryan Moore (REGENESIS/USA)
2:15	SESSION BREAK	SESSION BREAK	SESSION BREAK	**EVO and Other Amendments for Hexavalent Chromium Treatment.** *M.D. Lee and R.L. Raymond.* Michael Lee (Terra Systems, Inc./USA)	**In Situ PFAS Extraction by Foam Fractionation Utilizing Multi-Azimuth High Permeability Propped Vertical Planes.** *D.L. Schnell, G. Hocking, and G. Filbey.* Deborah Schnell Shaffer (Cascade Environmental/USA)
2:40	**Modified Emulsified Vegetable Oil Formulations for Site-Specific Challenges.** *P.M. Dombrowski, F. Hostrop, M. Lee, and R. Raymond, Jr.* Paul Dombrowski (In-Situ Oxidative Technologies, Inc. [ISOTEC]/USA)	**How Good are Thermal Models?** *J. Baldock, J. Dinham, R. Meinke, O. Kohnen, and F. Coelho.* James Baldock (ERM/United Kingdom)	**Contaminant Bioavailability: Toward a Sustainable and a More Science-Based Remediation Approach.** *F. Abo.* Fouad Abo (GHD/Australia)	SESSION BREAK	SESSION BREAK
3:05	**The Enhanced Reductive Dechlorination of Dissolved Phase Trichloroethene in Methanogenic Groundwater Downgradient of a Former Industrial Facility.** *M. Scalzi, W. Meese, and I. Connor.* Michael Scalzi (Innovative Environmental Technologies, Inc./USA)	**From Concept to Post-Performance: Lessons Learned from Three Thermal Projects in New Jersey.** *S. Gupta, J. Kingston, A.K. Murphy, and J.P. Yoder.* Amy Murphy (Haley & Aldrich, Inc./USA)	**Sustainable Remedial Approach: Construction of a Recreational Park in an Off-Site Area to Mitigate Risk.** *M. Naves, L. Buve, A. Chaves, and V. Martins.* Matheus Naves (ERM/Brazil)	**In Situ Groundwater Treatment to Address Electroplating Facility Waste Discharging to the Surface.** *D. Beck, L. Kozel, A. Cuellar, and P. McCall.* David Beck (Tetra Tech, Inc./USA)	**Anion Exchange Permeable Adsorptive Barrier (PAB) for In Situ PFAS Immobilization and Removal.** *D. Lippincott, P. Hatzinger, G. Lavorgna, C. Schaefer, Z. Nguyen, F. Boodoo, and A. Danko.* David Lippincott (APTIM/USA)

A7. Horizontal Wells: Applications and Lessons Learned in Site Characterization and Remediation

B9. Advanced and Synthetic Biological Treatment Applications

C10. Climate Resilience and Site Remediation

D9. Managing Chromium-Contaminated Sites

E8. In Situ PFAS Treatment Approaches

A8. Electron Donors: Innovations for Biodegradation

B10. Elec. Resistance Heating: Best Practices/Lessons Learned

C11. Aligning Remediation Goals with Env, Social, and Gov. (ESG) Consid.

D9.

E8.

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Thursday Platform Sessions—1:00–3:05 p.m.

	F SESSIONS - Sierra/Ventura	G SESSIONS - Pasadena	H SESSIONS - Madera	I SESSIONS - Catalina	LEARNING LAB - Exhibit Hall
1:00	F9. Vapor Intrusion Risk Assessment and Site Management **Vapor Intrusion Risk Evaluation Using Automated Continuous Chemical and Physical Parameter Monitoring.** *M. Kram, B. Hartman, C. Frescura, P. Negrao, and D. Egelton.* Mark Kram (Groundswell Technologies, LLC/USA)	G10. Using Omic Approaches and Advanced Molecular Tools to Optimize Site Remediation **Assessment of Methyl Tert-Butyl Ether (MTBE) Degradation Using Metagenomics and Metaproteomics.** *S. Fiorenza, K.H. Kucharzyk, J. Nyvall, and S. Lummus.* Stephanie Fiorenza (Arcadis/USA)	H6. MIP/HPT/LIF/UVOST—Realtime HRSC Tools and Techniques **High-Resolution Source Area Delineation and Targeted Enhanced Bioremediation at a 1,2-DCA Site.** *D.R. Griffiths, B. Vanderglas, R.J. Stuetzle, and B. Wilkinson.* Dan Griffiths (Parsons/USA)	I9. Remediation Approaches in Fractured Rock and Karst Aquifers **Thermal Conductive Heating for Remediation of Bedrock: State of the Art.** *D. Phelan, S. Griepke, J. LaChance, S. LaRoche, and N. Ploug.* Steffen Griepke (TerraTherm, Inc./USA)	Learning Lab
1:25	F9. Vapor Intrusion Risk Assessment and Site Management **Tracing Radon to Evaluate VI Potential.** *J.M. Buel, J.L. Parra, Jr., T.J. Brent, R. Kotun, and A. Bernhardt.* Jennifer Buel (Tetra Tech, Inc./USA)	G10. Using Omic Approaches and Advanced Molecular Tools to Optimize Site Remediation **Comparison of Whole Metagenome Sequencing and 16S Amplicons to Monitor Tetracholoroethene Remediation Efforts.** *R.A. Reiss and P. Guerra.* Peter Guerra (Wood PLC/USA)	H6. MIP/HPT/LIF/UVOST—Realtime HRSC Tools and Techniques **LIF/UVOST Application for Conceptual Site Model Refinement at a NAPL-Impacted Site in Brazil.** *K. Campos and J. Vasconcellos.* Kamilo Campos (Arcadis Brazil/Brazil)	I9. Remediation Approaches in Fractured Rock and Karst Aquifers **GWQS Achieved in Fractured Bedrock at a TCE Release Site in New Jersey.** *B. Brab.* Bill Brab (AST Environmental, Inc./USA)	
1:50	SESSION BREAK	G10. Using Omic Approaches and Advanced Molecular Tools to Optimize Site Remediation **Quantitative Proteomics Approach for Assessing MNA in cVOC-Contaminated Aquifers.** *K.H. Kucharzyk, F.K. Murdoch, F.E. Loeffler, J. Wilson, P.B. Hatzinger, J.D. Istok, L. Mullins, A. Hill, R.W. Murdoch, and M.M. Michalsen.* Fadime Kara Murdoch (Battelle/USA)	SESSION BREAK	SESSION BREAK	
2:15	F9. Vapor Intrusion Risk Assessment and Site Management **Fate and Transport of Vinyl Chloride at VI Sites.** *B. Eklund and R. Rago.* Bart Eklund (Haley & Aldrich/USA)	SESSION BREAK	H7. HRSC Suites of Tools to Improve CSMs **High-Resolution Site Characterization Using New Groundwater Profiler.** *G. Lilbaek, A. Christensen, C. Riis, V. Ronde, N. Tuxen, H. Kerrn-Jespersen, W. McCall, and D. Pipp.* Gro Lilbæk (NIRAS A/S/Denmark)	I9. Remediation Approaches in Fractured Rock and Karst Aquifers **Strategy to Transition a Dilute TCE Plume at a Bedrock Site from Active In Situ Biotreatment Mode to Monitored Natural Attenuation.** *K. Ramanand, C. Milone, and P. Randazzo.* Karnam Ramanand (Brown and Caldwell/USA)	
2:40	F9. Vapor Intrusion Risk Assessment and Site Management **Using a Phased Approach and Multiple Lines of Evidence to Evaluate Vapor Intrusion at Industrial Buildings with Background Sources.** *M. Meyer, L. Goode, D. DeYoung, H. Dawson, and C. Cellucci.* Lisa Goode (Geosyntec Consultants/USA)	G11. Int. Remedy App.: Regulatory/Logistical Challenges Abroad **Urban Regeneration: Managing Complex Social and Regulatory Challenges in Chile.** *J. Henriquez, R. Victor, and J.P. Davit.* Raul Victor (WSP Golder/Chile)	H7. HRSC Suites of Tools to Improve CSMs **High-Resolution Fractured Bedrock Characterization Using Advanced Technology Tools for TCE Source Area.** *J. Drummond, K. Fox, C. Vallone, R. Bower, and B. Rundell.* Jesse Drummond (EA Engineering, Science, and Technology, Inc., PBC/USA)	I9. Remediation Approaches in Fractured Rock and Karst Aquifers **Naturally and Biologically-Mediated Abiotic Transformation of TCE in Low-Permeability Formations.** *D.L. Freedman, H. Wang, R. Yu, L. Slater, S. Falzone, M. Glamoclija, and R. Iery.* David Freedman (Clemson University/USA)	
3:05	F9. Vapor Intrusion Risk Assessment and Site Management **Use of Volatile Organic Compound (VOC) Screening Analysis and Ventilation Assessments to Identify and Address Potential Preferential Pathways in a Large Manufacturing Building Basement.** *R. Rago, B. Geissler, M. Zlotoff, D. Denyer, and S. Crowell.* Richard Rago (Haley & Aldrich, Inc./USA)	G11. Int. Remedy App.: Regulatory/Logistical Challenges Abroad **Not Even Coronavirus Could Thwart Australia's First In Situ Thermal Desorption Cleanup.** *B. Schultz, J. Fairweather, R. D'Anjou, I. Cowie, and C. Winell.* Ben Schultz (Orica Ltd./Australia)	H7. HRSC Suites of Tools to Improve CSMs **Guidance on Building Robust CSMs Using High-Resolution Site Characterization at Complex Air Force Sites.** *T.W. Macbeth, K.L. Leslie, T.J. Cook, K. Glover, J. Davis, and G. Rose.* Tamzen Macbeth (CDM Smith Inc./USA)	I9. Remediation Approaches in Fractured Rock and Karst Aquifers **Investigation and Remediation of a Chlorinated Solvent Release: A Case Study.** *S. Manley.* Stuart Manley (GHD/USA)	

Room Locations: **Palm Springs Convention Center** or **Renaissance Hotel**

Thursday Platform Sessions—3:30–3:55 p.m.

	A SESSIONS - Primrose A	B SESSIONS - Primrose B	C SESSIONS - Primrose C	D SESSIONS - Primrose D	E SESSIONS - Smoketree
3:30	A8. Electron Donors: Innovations for Biodegradation **Application of Novel Amendment via Forced Advection Delivery for Rapid Anaerobic Dechlorination of TCE-Impacted Groundwater.** *M.M. Mejac, S.W. Tarmann, M.W. Hahn, and D.A. Schlott.* Mark Mejac (Ramboll/USA)	B10. Electrical Resistance Heating: Best Practices and Lessons Learned **Power Density: Why It Rules and How to Maximize It.** *E. Crownover and G. Heron.* Emily Crownover (TRS Group, Inc./USA)	C11. Aligning Remediation Goals with Env., Social, and Gov. (ESG) Consid. **Sustainable Remediation of Contaminated Sites While Minimizing Project Expenditures.** *F. Achour and A. Amarandos.* Farid Achour (GSI Environmental Inc./USA)	D9. Managing Chromium-Contaminated Sites **Evolution of In Situ Biological, In Situ Biogeochemical and Abiotic Pilot Studies for Treatment of a Hexavalent Chromium Source Area.** *S. Brubaker, G. Ng, T. Simpkin, R. Barber, A. Darpinian, E. Hauber, C. Bonney, S. Nelson, and K. Flynn.* Sarah Brubaker (Jacobs/USA)	E8. In Situ PFAS Treatment Approaches **In Situ Remediation of PFAS-Contaminated Groundwater Using Sorptive Media in a Constructed Treatment Lagoon.** *D.G. Greene.* Daniel G. Greene (Fishbeck/USA)
3:55	A8. Electron Donors: Innovations for Biodegradation **Formulating and Comparing Carbon Substrates with Bioaugmentation for Full-Scale In Situ Bioremediation of Chlorinated Solvents.** *L. LaPat-Polasko, R. Britton, T. Silverman, and L. Gross.* Richard Britton (Matrix New World Engineering/USA)	B10. Electrical Resistance Heating: Best Practices and Lessons Learned **Experimental Study of Mass Transfer from Contaminant-Water Vapor Bubbles to Groundwater during Thermal Remediation.** *D.A. Rountree, T. Lombardo, and A. Doxtator.* David Rountree (McMillan-McGee Corporation/Canada)	C11. Aligning Remediation Goals with Env., Social, and Gov. (ESG) Consid. **Combating International Brain Drain: The Social Benefits of Sustainable Remediation.** *M. Lemes, M. Harclerode, and J. Henderson.* Maria Cristina Lemes (CDM Smith Inc./USA)	D9. Managing Chromium-Contaminated Sites **A 20-Year Evaluation of Hexavalent Chromium Reduction following Sodium Dithionite Injections.** *J.M. Tillotson and E. Carter.* Jason Tillotson (Arcadis/USA)	E8. In Situ PFAS Treatment Approaches **Potential Enhanced Retention Processes to Manage PFAS Plumes in Groundwater.** *C.J. Newell, D.T. Adamson, P.R. Kulkarni, and S.D. Richardson.* Charles Newell (GSI Environmental Inc./USA)

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	F SESSIONS - Sierra/Ventura		G SESSIONS - Pasadena		H SESSIONS - Madera		I SESSIONS - Catalina		LEARNING LAB - Exhibit Hall	
3:30	F9. Vapor Intrusion Risk Assessment and Site Management	**Seeing through the Fog: Making VI Risk Decisions in the Presence of Indoor Air Sources.** *C.E. Regan, R.J. Fiacco, J. Hancock, and K. Warner.* Catherine Regan (ERM/USA)	G11. Int. Remedy App.: Regulatory/Logistical Challenges Abroad	**ISCR for Chlorinated Compound Remediation in the Tropics: What to Expect, How to Adjust, Results.** *S. Aluani, C. Spilborghs, E. Pujol, F. Tomiatti, J. Mueller, W. Meese, and M. Scalzi.* Sidney Aluani (SGW Services/Brazil)	H7. HRSC Suites of Tools to Improve CSMs	**Smart Characterization®: An Adaptive Strategy for High-Resolution Investigation to Develop Relative Mass-Flux Based Conceptual Site Models.** *L. Santetti, K. Campos, V. Limeira, and V. Souza.* Kamilo Campos (Arcadis Brazil/Brazil)	I9. Remediation Approaches in Fractured Rock and Karst Aquifers	**Remediation of Chlorinated Solvent Plume in Fractured Bedrock via Pneumatically-Enhanced Injections of Zero-Valent Iron and Carbon Substrate.** *H. Rodack, P. Downham, and P. Armstrong.* Haley Rodack (Roux/USA)	Learning Lab	
3:55		**cVOCs in Indoor Air Due to Slab Breach with Elevated Impacted Soil Gas What to Expect? Naval Air Station North Island.** *V. Hosangadi, P. Chang, R. Mennis, R. Robitaille, and M. Pound.* Vitthal Hosangadi (NOREAS, Inc./USA)		**Applying Electrical Resistance Heating in Highly Occupied Areas.** *T.L. Gomes and J. Seeman.* Thiago Gomes (TRS Doxor/Brazil)		**3-D Visualization and Analysis of High-Resolution Site Characterization Data to Support Remedial Selection and Design.** *E.B. Dieck, L. Zeng, J. Horner, and J. Musco.* Eric Dieck (Langan/USA)		**Cutting Off the Hand that Feeds the Plume: Remediation of a Fractured Rock Aquifer.** *W. Plasket, M. Cobb, A. Horneman, and S. Potter.* Whitney Plasket (Arcadis/USA)		

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A leading provider of interdisciplinary environmental services, **EA** excels at developing and implementing realistic and cost-effective remediation strategies. Throughout the remediation process - from the creation of site conceptual models to the application of today's most innovative technologies – we advise our clients steadily along the way so that their goals are achieved, and expectations exceeded. A 100% employee-owned public benefit corporation, EA employs more than 550 professionals through a nationwide network of offices. In business for more than 47 years, EA has earned an outstanding reputation for technical expertise, responsive service, and judicious use of client resources. Visit us at **eaest.com**.

GHD recognizes and understands the world is constantly changing. We are committed to solving the world's biggest challenges in the areas of water, energy and urbanization. We are a global professional services company that leads through engineering, construction and architectural expertise. Our forward-looking, innovative approaches connect and sustain communities around the world. Delivering extraordinary social and economic outcomes, we are focused on building lasting relationships with our partners and clients. Established in 1928, we remain wholly owned by our people. We are 10,000+ diverse and skilled individuals connected by over 200 offices, across five continents – Asia, Australia, Europe, North and South America, and the Pacific region. Visit us at **ghd.com**.

Haley & Aldrich, Inc., is committed to delivering the value our clients need from their capital, operations, and environmental projects. Our one-team approach allows us to draw from our 700 engineers, scientists, and constructors in 30 offices for creative collaboration and expert perspectives. Since our founding in 1957, we have one goal in all we do: deliver long-term value efficiently, no matter how straightforward or complex the challenge. In 2020, Haley & Aldrich acquired Hart Crowser, an engineering and environmental consultancy with extensive expertise in the Pacific Northwest and recognized for its cutting-edge performance-based seismic design methods. Visit us at **haleyaldrich.com**.

Tetra Tech is a leading, global provider of consulting and engineering services. We are differentiated by "Leading with Science®" to provide innovative technical solutions to our clients. We support global commercial and government clients focused on water, environment, sustainable infrastructure, renewable energy, and international development. With 21,000 associates worldwide, Tetra Tech provides clear solutions to complex problems. Visit us at **tetratech.com**.

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Program at a Glance

MONDAY, May 23	TUESDAY, May 24	WEDNESDAY, May 25	THURSDAY, May 26
7:00 a.m.–9:00 p.m. Registration, Exhibits, Poster Group 1 Display 7:00–8:00 a.m. Continental Breakfast 8:30-10:00 a.m. Plenary Session 10:30 a.m.–12:00 p.m. General Lunch 2:00–3:00 p.m. Afternoon Beverage Break	7:00 a.m.–1:50 p.m. Registration, Exhibits, Poster Group 1 Display 7:00–8:00 a.m. Continental Breakfast 9:00–10:00 a.m. Morning Beverage Break 11:45 a.m.–12:45 p.m. Afternoon Beverage Break	7:00 a.m.–7:00 p.m. Registration, Exhibits, Poster Group 2 Display 7:00–8:00 a.m. Continental Breakfast 9:30–10:30 a.m. Morning Beverage Break 11:30 a.m.–1:00 p.m. General Lunch 2:00–3:00 p.m. Afternoon Beverage Break	7:00 a.m.–1:00 p.m. Registration, Exhibits, Poster Group 2 Display 7:00–8:00 a.m. Continental Breakfast 9:30-10:30 a.m. Morning BeverageBreak 11:30 a.m.–1:00 p.m. General Lunch 2:00–3:00 p.m. Afternoon BeverageBreak
12:10–4:20 p.m. Platform Sessions & Learning Lab Demonstrations	**8:00 a.m.–1:50 p.m. Platform Sessions & Learning Lab Demonstrations**	**8:00 a.m.–4:20 p.m. Platform Sessions & Learning Lab Demonstrations**	**8:00 a.m.–4:20 p.m. Platform Sessions 8:00 a.m.–1:00 p.m. Learning Lab Demonstrations**
A1. Emerging Remediation Technologies	A2. Abiotic and In Situ Biogeochemical Processes: Applications and Lessons Learned A3. ZVI: 25 Years of Groundwater Remediation Applications	**Panel:** Thermal Remediation Technology Updates: Eight Experts Discuss Four Years of Innovations in 100 Minutes A4. Combined Remedies and Treatment Trains	A5. Permeable Reactive Barriers: Best Practices and Lessons Learned A6. Thermally Enhanced In Situ Degradation Processes at Sub-Boiling Temperatures A7. Horizontal Wells: Applications and Lessons Learned in Site Characterization and Remediation A8. Electron Donors: Innovations for Biodegradation
B1. In Situ Technologies: Lessons Learned	B2. Thermal Conductive Heating: Best Practices and Lessons Learned B3. Thermal Conductive Heating: Case Studies	B4. In Situ Chemical Oxidation: Optimized Design Approaches and Lessons Learned B5. Injectable Activated Carbon Amendments: Lessons Learned and Best Practices B6. Innovations in ZVI Amendment Formulations and Applications	B7. Innovative and Optimized Amendment Delivery and Monitoring Methods B8. Monitored Natural Attenuation: Innovative Monitoring Approaches/Lines of Evidence and Lessons Learned B9. Advanced and Synthetic Biological Treatment Applications B10. Electrical Resistance Heating: Best Practices and Lessons Learned
C1. Remedial Design/Optimization: Applications of Mass Flux and Mass Discharge	C2. Remedy Implementation: Assessing Performance and Costs C3. In Situ Activated Carbon-Based Amendments: Assessing Effectiveness and Performance C4. Compound-Specific Isotope Analysis: Case Studies in Evaluating Remedy Performance	C5. Site Closure: Models Used to Estimate Cleanup Timeframes C6. Data Analytics: Use of Advanced Decision Analysis Tools, Including AI and Machine Learning for Improved Analysis, Optimization and Decision Making C7. Optimizing Remedial Systems	C8. Setting Cleanup Goal End Points: When Are We Done? C9. GSR Best Practices and Nature-Based Remediation Case Studies C10. Climate Resilience and Site Remediation C11. Aligning Remediation Goals with Environmental, Social, and Governance (ESG) Considerations
D1. Large, Dilute and Commingled Plume Case Studies **Panel:** Investigating and Remediating a Major Chlorinated Solvent DNAPL Site	D2. Landfill Assessment and Remediation D3. Adaptive Site Management: Lessons Learned for Site Characterization and Remedy Implementation	D4. Evaluating Surface Water/Groundwater Interactions: Innovative Monitoring Approaches and Modeling Applications D5. DNAPL Source Zone Remediation: Lessons Learned D6. Low-Permeability Zone Challenges, Permeability Enhancements, and Case Studies	D7. Precipitation and Stabilization of Metals D8. Mining and Uranium Site Restoration D9. Managing Chromium-Contaminated Sites

MONDAY, May 23	TUESDAY, May 24	WEDNESDAY, May 25	THURSDAY, May 26
E1. Advances in the Analysis of Non-Target Per- and Polyfluorinated Alkyl Substances (PFAS) E2. PFAS and Bugs: The Search Continues	E3. Ex Situ PFAS Treatment: Soils/Solids and Other Waste Streams **Panel:** Should We Develop PFAS Ambient Levels: Why and How?	E4. PFAS Human Health and Ecological Risk Assessment and Toxicity E5. Managing PFAS at Publically-Owned Treatment Works (POTWs) E6. Ex Situ PFAS Water Treatment Technologies	E7. PFAS Site Characterization E8. In Situ PFAS Treatment Approaches
F1. PFAS Fate and Transport Properties	F2. PFAS Conceptual Site Model Approaches F3. PFAS Program Management in a Rapidly Changing Regulatory Environment F4. PFAS Source and Forensic Considerations	F5. PFAS: Groundwater Treatment Case Studies F6. Ex Situ PFAS Destruction Technologies F7. Advances in Vapor Intrusion Investigations	F8. Vapor Intrusion Mitigation and Effectiveness F9. Vapor Intrusion Risk Assessment and Site Management
G1. Expedite Site Closure: Innovative Strategies and Approaches G2. Practice of Risk Communication and Stakeholder Engagement	**Panel:** Monitored Natural Source Zone Depletion G3. Heavy Hydrocarbons: Characterization and Remediation G4. Natural Source Zone Depletion	G5. In Situ Remediation of Petroleum Hydrocarbons G6. LNAPL Recovery/Remediation Technology Transitions G7. LNAPL Sites: Understanding and Managing Risks	G8. Environmental Forensics: Site Characterization and Source Determinations G9. Remote Sensing, Drones, and Other Unmanned Systems for Remote Monitoring and Site Assessments G10. Using Omic Approaches and Advanced Molecular Tools to Optimize Site Remediation G11. International Remedy Applications: Regulatory and Logistical Challenges of Remediation Abroad
H1. Improvements in Site Data Collection, Data Management, and Data Visualization	H2. Conceptual Site Models: Improvements in Development and Application	H3. Advanced Geophysics and Remote/Direct Sensing Tools and Techniques H4. Advanced Sampling and Analysis Tools and Techniques	H5. Groundwater Modeling: Advancements and Applications H5. Groundwater Modeling: Advancements and Applications H6. MIP/HPT/LIF/UVOST–Realtime HRSC Tools and Techniques H7. HRSC Suites of Tools to Improve CSMs
Panel: How Can Genetically-Modified Organisms Safely Solve Environmental Challenges? I1. Explosives, Perchlorate	I2. Advances in 1,4-Dioxane Biological Treatment Technologies I3. 1,4-Dioxane Remediation Challenges	I4. Microplastics, Pharmaceuticals, and Other Emerging Contaminants I5. Technical Impracticability: Challenges and Considerations for Evaluation of Fractured Rock Sites I6. Depositional Environments and Stratigraphic Considerations for Remediation I7. Process-Based Conceptual Site Models (CSMs) for Informing Remediation	**Panel:** Remediation Geology, Remediation Hydrogeology, and Process-Based CSMs to Support Complex Site Remediation I8. Advances in the Application of Geologic Interpretation to Remediation I9. Remediation Approaches in Fractured Rock and Karst Aquifers
4:00–6:30 p.m. Poster Group 1 Presentations and Refreshments See page 20 for presentations in Poster Group 1.	2:00–4:00 p.m. Career KickStarter 2:00–6:00 p.m. Short Courses 3:00 p.m. Film Screening with Craig Leeson	4:30–6:30 p.m. Poster Group 2 Presentations and Refreshments See page 52 for presentations in Poster Group 2.	4:30 p.m. Closing Reception

The Conference 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 and cost-effective solutions to complex problems in site restoration, risk assessment, hydrogeologic assessment and monitoring and sustainable remediation. 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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