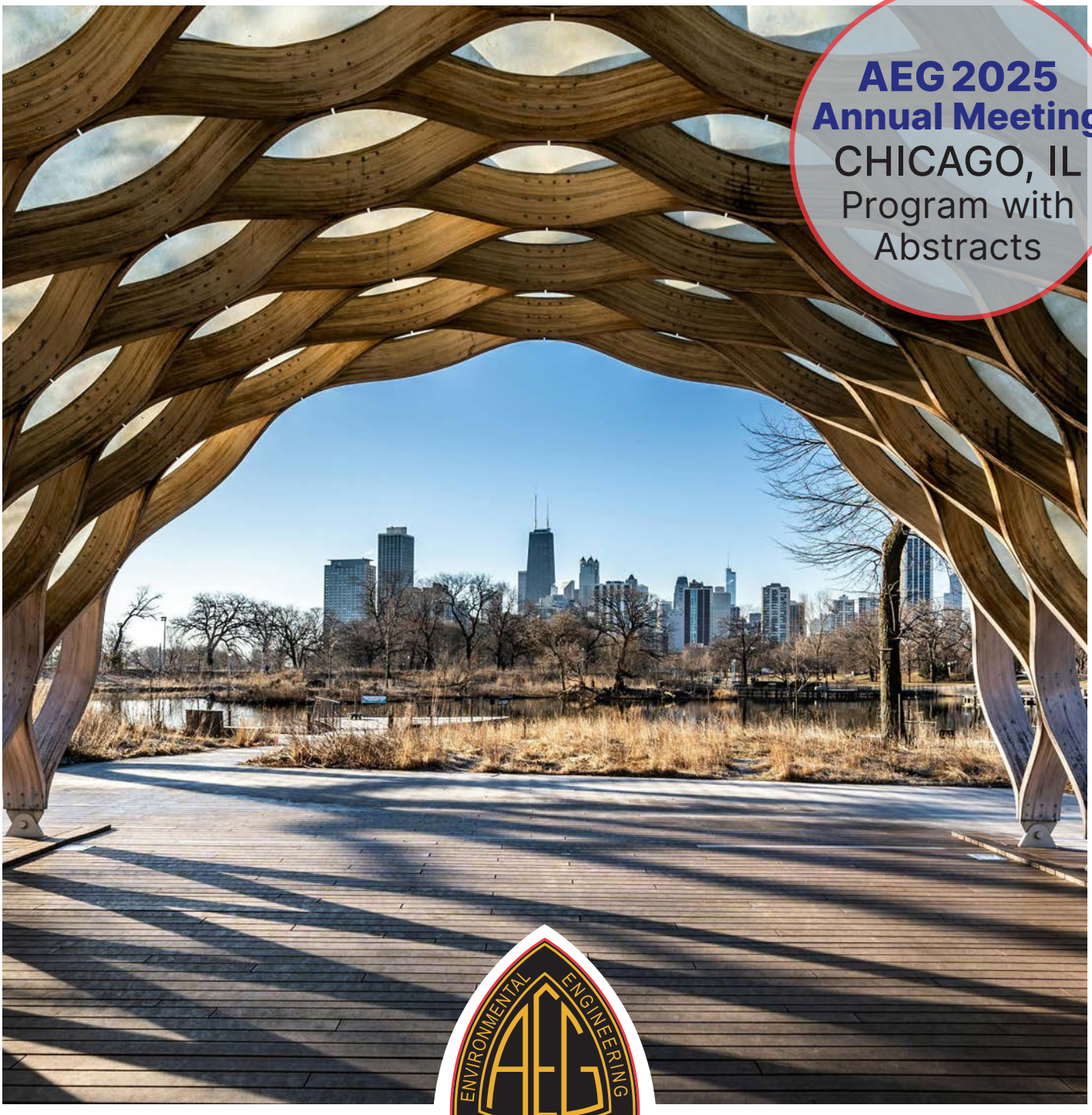
AEG NEWS

PROGRAM WITH ABSTRACTS 2025

Association of Environmental & Engineering Geologists



AEG 2025 Annual Meeting

CHICAGO, IL

Program with Abstracts

Mobile App Download & Login Instructions

Apple App Store

- Search for “AEG Annual Meeting” or scan the QR code
- You should see “AEG Annual Meeting” in the results
- Click on ‘GET’
- Download the app to your phone
- Open the app
- Click the profile icon located at the top right of the app home page to log in
- Follow the prompts on the screen to obtain an access code
- Make sure to use the email you registered with
- Enter the access code sent to your email
- You should now have access to the event
- Now that you’re logged in, you can make edits to your profile by clicking on the profile button at the top right of the home page

Google Play Store

- Search for “AEG Annual Meeting” or scan the QR Code
- You should see “AEG Annual Meeting” in the results. If the app does not appear in the search results, use quotes around the app name.
- Click on ‘Install’
- Download the app to your phone
- Click on ‘open’
- Click the profile icon located at the top right of the app home page to log in
- Follow the prompts on the screen to obtain an access code
- Make sure to use the email you registered with
- Enter the access code sent to your email
- You should now have access to the event
- Now that you’re logged in, you can make edits to your profile by clicking on the profile button at the top right of the home page

AEG News (ISSN 0899-5788; USPS 954-380) is published quarterly (March, April, July, and December) by the Association of Environmental & Engineering Geologists (AEG), 2840 West Bay Drive #141, Belleair Bluffs, FL, 33770-2620. Periodicals postage paid at Clearwater, FL and additional mailing offices.

POSTMASTER: Send address changes to *AEG News*, 2840 West Bay Drive #141, Belleair Bluffs, FL 33770-2620

The Annual Meeting Program with Abstracts is published only digitally, in September, and the digital copies are distributed at the AEG Annual Meeting.

Inquiries should be sent to **manager@aegweb.org.**

***AEG News* Editors**
Acquisitions Editor: Martha Whitney, Principal Engineering Geologist, Whitney Geologic, **international@aegweb.org**

Content Editor: Bill Roman, Woodsman, **bill.roman.bretz@gmail.com**

Managing Editor/Production: Allie Boman and Whitney Larson, Boman Commuications, 765-543-4191, **allie@bomancomms.com, www.bomancomms.com**

Submission Information
For detailed guidelines visit:
www.aegweb.org/assets/docs/Publications/News/AEG_News_StyleGuide_2025.pdf

Advertising in the News
Contact AEG at **manager@aegweb.org**.

Submission Deadlines
https://www.aegweb.org/aeg-news-2

Canada Agreement number: PM40063731; Return Undeliverable Canadian Addresses to: Station A, PO Box 54; Windsor, ON N9A 6J5; Email: returnsil@imex.pb.com

THE ASSOCIATION
2024-25 Officers

President: Renee Wawczak Hydrogeologist, president@aegweb.org

Vice President/President Elect: Paul Weaver Geotechnical Geologist–Retired, vp@aegweb.org

Treasurer: Mark Swank, Lead Engineering Geologist, Federal Highway Administration,, treasurer@aegweb.org

Secretary: Julia Frazier Senior Geologist, BGC Engineering, secretary@aegweb.org

Past President: Sarah Kalika Consulting Geologist, DiabloGeo Environmental, sarah@georx.net

Association Manager: Shannon Fitzpatrick-O'Shea manager@aegweb.org

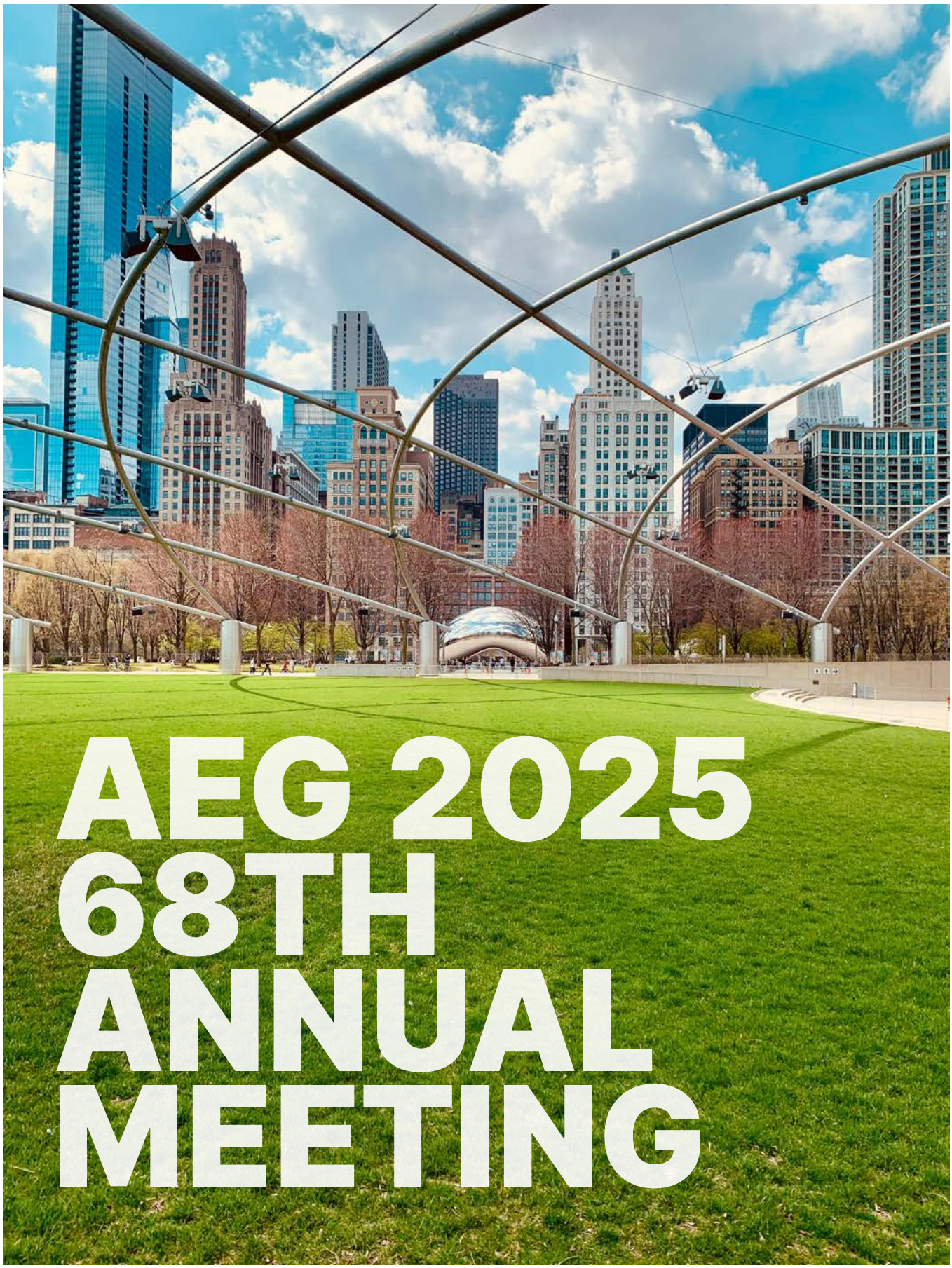
AEG Foundation: President, Matt Buche, Senior Engineering Geologist, California Department of Water Resources president@aegfoundation.org

---

ON THE COVER
Chicago, IL
Photo © Vishal Shah

TABLE OF CONTENTS

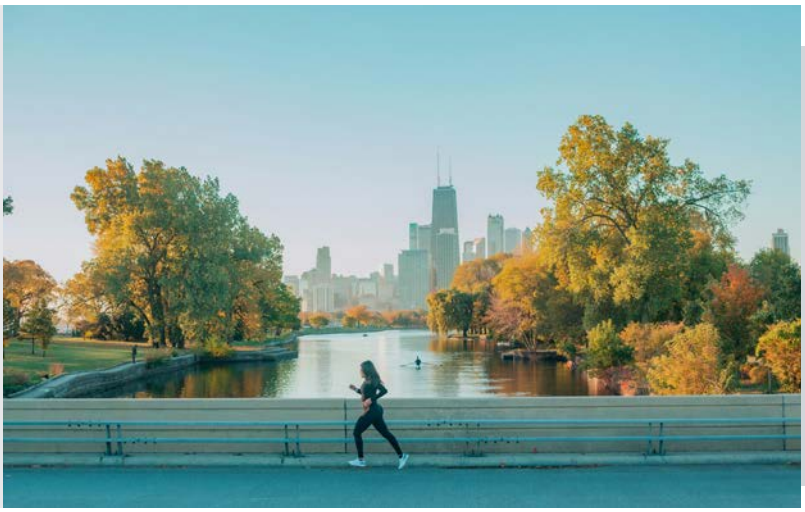
AEG 2025 68th Annual Meeting



AEG 2025 68TH ANNUAL MEETING

Welcome from AEG's President

By Renee Wawczak,
2024–25 AEG President



Join us for morning fitness and stretching classes and a "Run with the President." For details, see the Annual Meeting Mobile App.

Hello, and I hope you all are enjoying your summer! I have been enjoying the hospitality of the chapters during my presidential visits, and catching up with so many familiar faces and making new friends! If I have not visited your chapter yet, and you would like a talk from the president, please let me know as soon as possible! I would be honored to meet your chapter members and see what your fantastic meetings look like!

I am excited to see so many of you this year at our annual meeting in Chicago, Illinois. Not only do I have the privilege of serving as president of this Association for a few more months, but I am also an annual meeting co-chair. Chicago is a city near and dear to my heart, and I am so excited to share it with all of you. We have an excellent lineup of technical speakers, fantastic local field courses, exciting guest tours, and a short course entitled "Strategies for Solving Hydrogeologic Complexities from the Sedimentary Sequence in the Western Chicago Suburbs." Our special event this year will feature the architecture and geology of downtown Chicago during a tour on the Chicago River, where you'll also get to sample the city's famous deep-dish pizza for dinner. Also, don't forget to visit our Young at Heart event at the famous House of Blues, right across from our meeting hotel! As a healthy twist to our meeting this year, I will be hosting some fun-runs in the mornings before our technical sessions; for times check out the program for "Running with the President." All abilities and paces are welcome!

At our Opening Session, we will celebrate the AEG Foundation's student scholarship awardees and present awards to the Volunteers of the Year and the Outstanding Environmental & Engineering Project. The Annual Banquet will honor our outstanding award winners who serve AEG as mentors and technical experts. Don't forget to attend our Support Your Peers Luncheon on Thursday and the Closing Session on Friday afternoon, where we will present awards to our Outstanding Student Chapters, Chapters of the Year, and *Environmental & Engineering Geoscience (E&EG) Journal* Outstanding Paper & Reviewer Awards; we will also welcome our incoming Association President Paul Weaver. Our annual meetings are always strongly supported by our exhibitors and sponsors, so please help me welcome them by stopping by their booths during the Icebreaker Reception and Exhibitor-Hosted Luncheon, and during our morning and afternoon breaks!

In Association news, we say a fond farewell to our Association Manager Evelyn Neale. We are sad to see Evelyn go, but wish her well on her future endeavors. Please welcome Shannon Fitzpatrick-O'Shea, who will be our new association manager with Arden Solutions. Shannon comes from a strong background of representing non-profit organizations and is sure to be a strong asset to AEG. Please give her a warm AEG welcome when you meet her!

2025 Annual Meeting Schedule Of Events

(All times are Central Time. See the Mobile App for final schedule changes)

MONDAY, SEPTEMBER 22

AEG Virtual Day One	Online Only	9:00am-3:30pm
AEG / AGI Teacher's Workshop	Washington Park	1:00 p.m.-5:00 p.m

TUESDAY, SEPTEMBER 23

Event	Place	Time
Registration	Ballroom Foyer	7:00 a.m.–7:00 p.m.
Field Course #1: Geologic Trip down the Chicago Area Waterway	Meet in the Lobby	7:30 a.m.–5:00 p.m.
Field Course #2: Near Surface Geology and Urban Challenges in the Chicago Area	Meet in the Lobby	8:00 a.m.–4:00 p.m.
AEG Executive Council Meeting	Rogers Park	8:00 a.m.–5:00 p.m.
AEG Foundation Board Meeting	Washington Park	8:00 a.m.–5:00 p.m.
AEG Virtual Day Two	Online Only	9:00 a.m.–1:30 p.m.
Joint Luncheon – AEG EC and AEG Foundation Board (invitation only)	Rogers Park	12:00 p.m.–1:00 p.m.
Student/Professional Networking Reception	Riverfront	5:15 p.m.–6:15 p.m.
Welcome (Icebreaker)	Grand Ballroom	6:30 p.m.–8:00 p.m.
Young at Heart Student/Professional Event	House of Blues	8:00 p.m.–10:00 p.m.

WEDNESDAY, SEPTEMBER 24

Event	Place	Time
Speakers'/Moderators' Breakfast	Riverfront	6:30 a.m.–7:30 a.m.
Registration	Ballroom Foyer	7:00 a.m.–5:00 p.m.
Exhibitors (coffee & tea available all day in the exhibit hall)	Grand Ballroom	7:30 a.m.–5:00 p.m.
Poster Session Presentations	Ballroom Foyer	8:00 a.m.–4:00 p.m.
Guest Get Together (must have a Guest Registration)	Rogers Park	9:00 a.m.–10:00 a.m.
Committee Room	Rogers Park	10:00 a.m.–5:00 p.m.
Opening Session	Promenade ABC	8:00 a.m.–12:00 p.m.
Opening Session Welcome (AEG President Renee Wawczak)	Promenade ABC	8:00 a.m.–8:03 a.m.
Meeting Co-chairs' Welcome (Renee Wawczak and Sarah Kalika)	Promenade ABC	8:03-8:05 a.m.
AEG Volunteer Recognition Award – Bill Roman and Martha Whitney	Promenade ABC	8:05 a.m.–8:10 a.m.

AEG Advocacy Award – Dr. Kenneth Tramm	Promenade ABC	8:10 a.m.–8:15 a.m.
IAEG Honorary President Award - Dr. Scott Burns Presented by Dr. Vassilis Marinos, IAEG President	Promenade ABC	8:15 a.m.–8:30 a.m.
AEG Foundation Awards (AEG Foundation President Matt Buche)	Promenade ABC	8:30 a.m.–9:15 a.m.
Keynote Speaker - Dr. Timothy Stark	Promenade ABC	9:15 a.m.–9:45 a.m.
Keynote Speaker - Dr. Thomas Oommen	Promenade ABC	9:45 a.m.–10:15 a.m.
Morning Break	**Exhibit Hall**	**10:15 a.m.–10:35 a.m.**
AEG Outstanding Environmental & Engineering Geologic Project Award: TARP Project Kevin Fitzpatrick, MWRD of Greater Chicago	Promenade ABC	10:35 a.m.–11:15 a.m.
2024-25 AEG/GSA Richard H. Jahns Distinguished Lecturer: Dr. John Kemeny	Promenade ABC	11:15 a.m.–11:45 a.m.
2025-26 AEG/GSA Richard H. Jahns Distinguished Lecturer: Dr. Christopher Stohr	Promenade ABC	11:45 a.m.–12:00 p.m.
Exhibitor-Hosted Luncheon	Exhibit Hall	12:00 p.m.–1:30 p.m.
Dams and Levees TWG Meeting	Rogers Park	12:00 p.m.–1:00 p.m.
Technical Session #1: [Redacted] — A Symposium	Promenade A	2:00 p.m.–5:00 p.m.
Technical Session #2: Tunneling Symposium	Promenade B	2:00 p.m.–5:00 p.m.
Technical Session #3A: Current Status of Geology Programs at Universities	Promenade C	2:00 p.m.–3:00 p.m.
Technical Session #3B: Vapor Intrusion Symposium	Promenade C	3:20 p.m.–5:00 p.m.
AEG Foundation Town Hall	Rogers Park	3:00 p.m.–4:00 p.m.
Afternoon Break	**Exhibit Hall**	**3:00 p.m.–3:20 p.m.**
Special Event - Architectural Cruise with Chicago's *Emerald Lady*	Offsite	6:15 p.m.–8:30 p.m.
Student and Young Professional Event - Silent Disco	Jackson Park	7:00 p.m.–9:00 p.m.

THURSDAY, SEPTEMBER 25

Event	Place	Time
Speakers'/Moderators' Breakfast	Riverfront	6:30 a.m.–7:30 a.m.
Registration	Ballroom Foyer	7:00 a.m.–5:00 p.m.
Exhibitors	Exhibit Hall	7:30 a.m.–3:20 p.m.
Coffee & tea available until 3:20pm in the exhibit hall and after 3:30pm in the Ballroom Foyer		
Committee Room	Rogers Park	8:00 a.m.–5:00 p.m.
Poster Session Presentations	Ballroom Foyer	8:00 a.m.–4:00 p.m.
Technical Session #4: GASH Symposium - Advances in Studies of Intraplate Tectonics	Promenade A	8:00 a.m.–12:00 p.m.
Technical Session #5: Dams and Levees Symposium	Promenade B	8:00 a.m.–12:00 p.m.
Technical Session #6: Land Subsidence Symposium	Promenade C	8:00 a.m.–12:00 p.m.
Morning Break	**Exhibit Hall**	**10:00 a.m.–10:20 a.m.**

AEG Support Your Peers / Be Yourself Luncheon (ticketed event)	Riverfront	12:00 p.m.–1:30 p.m.
Lunch on your own for attendees		**12:00 p.m.–1:30 p.m.**
Technical Session #7: Geologic and Seismic Hazards Part I	Promenade A	1:40 p.m.–5:00 p.m.
Technical Session #8: Environmental Symposium	Promenade B	1:40 p.m.–5:00 p.m.
Technical Session #9A: Naturally Occurring Asbestos	Promenade C	1:40 p.m.–3:00 p.m.
Technical Session #9B: Geophysics and Climate Change: Impacts on Infrastructure and the Built Environment (In partnership with SEG)	Promenade C	3:20 p.m.–5:00 p.m.
AEG Foundation Town Hall	Rogers Park	3:00 p.m.–4:00 p.m.
Afternoon Break	**Exhibit Hall**	**3:00 p.m.–3:20 p.m.**
Landslide Technical Working Group Meeting	Rogers Park	4:00 p.m.–5:00 p.m.
Poster Reception and Happy Hour	Ballroom Foyer	5:00 p.m.–6:30 p.m.
Annual Banquet (ticketed event)	Riverfront	7:00 p.m.–9:30 p.m.

FRIDAY, SEPTEMBER 26

Event	Place	Time
Speakers'/Moderators' Breakfast	Riverfront	6:30 a.m.–7:30 a.m.
Registration	Ballroom Foyer	7:00 a.m.–1:30 p.m.
Coffee & Tea available all day in the Grand Ballroom Foyer		
Committee Room	Rogers Park	8:00 a.m.–3:00 p.m.
Technical Session #10: Landslides	Promenade A	8:00 a.m.–12:00 p.m.
Technical Session #11: Subsurface Urban Heat Islands / Geological Energy Harvesting and Storage Symposium	Promenade B	8:00 a.m.–12:00 p.m.
(Ticketed Event) Short Course - Strategies for Solving Hydrogeologic Complexities from the Sedimentary Sequence in the Western Chicago Suburbs	Promenade C	8:00 a.m.–12:00 p.m.
AEG Foundation Town Hall	Rogers Park	10:00 a.m.–11:00 a.m.
Morning Break	**Grand Ballroom Foyer**	**10:00 a.m.–10:20 a.m.**
Past Presidents' Luncheon (invitation only)	Riverfront	12:00 p.m.–1:00 p.m.
Lunch on your own for attendees		**12:00 p.m.–1:00 p.m.**
Technical Session #12: Geologic and Seismic Hazards Part II	Promenade A	1:00 p.m.–2:40 p.m.
Technical Session #13: AI/Machine Learning	Promenade B	1:00 p.m.–2:40 p.m.
Technical Session #14: Site Characterization	Promenade C	1:00 p.m.–2:40 p.m.
Afternoon Break	**Grand Ballroom Foyer**	**2:40 p.m.–3:00 p.m.**
AEG's Corporate Business Meeting and Closing Session	Riverfront	3:00 p.m.–5:00 p.m.
AEG President-hosted Closing Beer and Wine Reception (hosted bar, light appetizers)	Riverfront	5:00 p.m.–6:00 p.m.

SATURDAY, SEPTEMBER 27

Event	Place	Time
Field Course #3: Geology, Infrastructure, and Shoreline Morphodynamics of Illinois Beach State Park, Lake County, IL	Departs from Lobby	8:00 a.m.–4:00 p.m.
AEG Board of Directors' Meeting	Riverfront	8:00 a.m.–5:00 p.m.

SUNDAY, SEPTEMBER 28

AEG Board of Directors' Meeting	Riverfront	8:00 a.m.–12:00 p.m.

Wifi Information

Network Name: Westin Conference
Password: AEG2025

Events

Student/Professional Networking Reception

Tuesday, September 23, 2025, 5:15 p.m.–6:15 p.m.
Riverfront Room
Sponsored by Schnabel Engineering

Be sure to attend this reception prior to the Icebreaker Welcome. This fun and relaxed event is the perfect place for you to make new friends and meet future employers/employees! You don't want to miss it! Sign up on your registration form.

Icebreaker Welcome

Tuesday, September 23, 6:30 p.m.–8:00 p.m.
Exhibit Hall
Sponsored by Field Environmental Instruments

Join us to meet the exhibitors and socialize with your fellow attendees. We will have light appetizers and a cash bar. Each full and student registration gets a free drink ticket.

Young at Heart—Experience the Soul of Chicago at House of Blues

Tuesday, September 23, 2025, 8:00 p.m.–10:00 p.m.
Live music with Keithen Banks.
(Included with full and student registrations. $50 for all other attendees.)
Sponsored by AEG Foundation, AEG Student & Young Professional Support Committee, and IAEG

Experience the magic of House of Blues! Immerse yourself in the rich atmosphere of the legendary House of Blues, a space that seamlessly combines the grit of a Mississippi Delta juke joint with the grandeur of a 1920s opera house. Our event will be held in the famous Foundation Room. The House of Blues is more than just a venue; it's a cultural destination that celebrates Southern art, music, and community. This social event is a great way to start your week in Chicago. Mix or mingle with your friends in environmental and engineering geology while you enjoy free appetizers, live music, and a free drink ticket. Just a short walk from the hotel, this event is an excellent opportunity to build connections with peers, mentors, senior fellows, and potential employers. We encourage students and young professionals to join the event and welcome experienced professionals who are "young at heart!"

Guest Get Together

Wednesday, September 24, 2025, 9:00 a.m.–10:00 a.m.
Rogers Park Room

Get to know your fellow guest attendees! All guest registration attendees are invited to join us for an informal coffee/tea meet-and-greet to plan your week's fun excursions together.

Exhibitor-Hosted Luncheon

Wednesday, September 24, 2025, 12:00 p.m.–1:30 p.m.
Exhibit Hall
Sponsored by I.E.S Drilling Supplies

Join us for a chance to connect with colleagues, learn about industry innovations, and dine with old and new friends. Free for all full, Wednesday one-day, and student registrations!

Special Event—Architectural Cruise with Chicago's *Emerald Lady*

Wednesday, September 24, 2025, 6:15 p.m. - 8:30 p.m.
Meet at the Docking Location
$140/person
Sponsored by GEOVision Geophysical Services

Join us on a fabulous private yacht for a stunning evening along Chicago's beautiful riverwalk and spectacular lakefront. Take in epic views of Chicago's

On Wednesday night, our ticketed Special Event will take you on an unmatched Chicago experience, **an architectural cruise along the Chicago River.**

glittering skyline while you explore Chicago's iconic architecture. Highly trained and enthusiastic volunteer Chicago Architectural Center docents (guides) provide a compelling and detailed narrative of Chicago's numerous architectural styles and the stories of the legendary figures who designed and built the city. Includes hosted bar (soft drinks, iced tea, juices, summer wines, and draft beer) and catered dinner from Gino's East.

Silent Disco

Wednesday, September 24, 2025, 7:00 p.m.–9:00 p.m.
Jackson Park Room

Join us for Silent Disco! Not your normal nightclub: put on your headphones and rock out to the music of your choice. Refreshments provided. Fun to participate—or watch! This is a free event for students and young professionals!

Support Your Peers/Be Yourself Luncheon

Thursday, September 25, 2025, 12:00 p.m.–1:30 p.m.
Riverfront Room
$100/person

This networking event offers an open forum for discussion and mutual education, focused on encouraging everyone to develop their unique strengths and embrace their peers for everything that makes them themselves. Dr. Tara Haridy of the University of Chicago's Shubin Lab will present during the luncheon. Everyone is welcome!

Poster Reception

Thursday, September 25, 2025, 5:00 p.m.–6:30 p.m.
Grand Ballroom Foyer
Sponsored by Terracon Consultants, Inc.

Cash bar. Each full, Thursday one-day, and student registration receives one drink ticket.

Annual Banquet

Thursday, September 25, 2025, 7:00 p.m.–9:30 p.m.
Riverfront Room
$150/person
Sponsored by Susan Steele Weir

This is a well-attended, high-profile event at which the Association's major awards are given. Join us for a gourmet dinner, fine wine, and a chance to visit with friends—both old and new. Semi-formal attire is recommended, though not required.

Corporate Business Meeting and Closing Session

Friday, September 26, 2025, 3:00 p.m.–5:00 p.m.
Riverfront Room

Free with all registration types. The Awards Ceremony and Corporate Business Meeting is a time for association officers to report on the year's accomplishments and goals for the upcoming year; witness the installation of new officers; and present some of the association's awards. President-hosted reception to follow from 5:00 p.m.–6:00 p.m. Celebrate a successful meeting with a hosted beer and wine bar and light appetizers.

Schedule of Sessions

SESSION	LOCATION	TIME (CDT)
MONDAY, SEPTEMBER 22		
AEG Virtual Day One	Online Only	9:00 a.m.–3:30 p.m.
TUESDAY, SEPTEMBER 23		
AEG Virtual Day Two	Online Only	9:00 a.m.–1:30 p.m.
WEDNESDAY, SEPTEMBER 24		
Opening Session—*Sponsored by Geobrugg NA, LLC*	Promenade ABC	8:00 a.m.–12:00 p.m.
Opening Session Welcome AEG President and Meeting Co-chair Renee Wawczak and Meeting Co-chair Sarah Kalika		8:00 a.m.–8:05 a.m.
AEG Volunteer Recognition Award—Martha Whitney & Bill Roman		8:05 a.m.–8:10 a.m.
AEG Advocacy Award—Dr. Kenneth Tramm		8:10 a.m.–8:15 a.m.
IAEG Honorary President Award—Dr. Scott Burns		8:15 a.m.–8:30 a.m.
AEG Foundation Awards—AEG Foundation President Matt Buche		8:30 a.m.–9:15 a.m.
Keynote Speaker—Dr. Timothy Stark		9:15 a.m.–9:45 a.m.
Keynote Speaker—Dr. Thomas Oommen		9:45 a.m.–10:15 a.m.
Morning Break in the Exhibit Hall		10:15 a.m.–10:35 a.m.
AEG Outstanding Environmental & Engineering Geologic Project Award: The Tunnel and Reservoir Plan (TARP)—Kevin Fitzpatrick, MWRD of Greater Chicago		10:35 a.m.–11:15 a.m.
2024-25 AEG/GSA Richard H. Jahns Distinguished Lecturer Dr. John Kemeny		11:15 a.m.–11:45 a.m.
2025-26 AEG/GSA Richard H. Jahns Distinguished Lecturer Dr. Christopher Stohr		11:45 a.m.–12:00 p.m.
Technical Session #1: [Redacted] – A Symposium – *Sponsored by Arcadis*	Promenade A	2:00 p.m.–5:00 p.m.
Technical Session #2: Tunneling Symposium – *Sponsored by Aldea Services*	Promenade B	2:00 p.m.–5:00 p.m.
Technical Session #3A: Current Status of Geology Programs at Universities	Promenade C	2:00 p.m.–3:00 p.m.
Technical Session #3B: Vapor Intrusion Symposium	Promenade C	3:20 p.m.–5:00 p.m.

THURSDAY, SEPTEMBER 25

Technical Session #4: GASH Symposium – Advances in Studies of Intraplate Tectonics – *Sponsored by GFT*	Promenade A	8:00 a.m.–12:00 p.m.
Technical Session #5: Dams and Levees Symposium – *Sponsored by RJH Consultants*	Promenade B	8:00 a.m.–12:00 p.m.
Technical Session #6: Land Subsidence Symposium	Promenade C	8:00 a.m.–12:00 p.m.
Technical Session #7: Geologic and Seismic Hazards Part I – *Sponsored by Geosyntec Consultants*	Promenade A	1:40 p.m.–5:00 p.m.
Technical Session #8: Environmental Symposium – *Sponsored by GFT*	Promenade B	1:40 p.m.–5:00 p.m.
Technical Session #9A: Naturally Occurring Asbestos	Promenade C	1:40 p.m.–3:00 p.m.
Technical Session #9B: Geophysics and Climate Change: Impacts on Infrastructure and the Built Environment – *In partnership with Society of Exploration Geophysicists (SEG) – Sponsored by Geosyntec Consultants, Inc.*	Promenade C	3:20 p.m.–5:00 p.m.

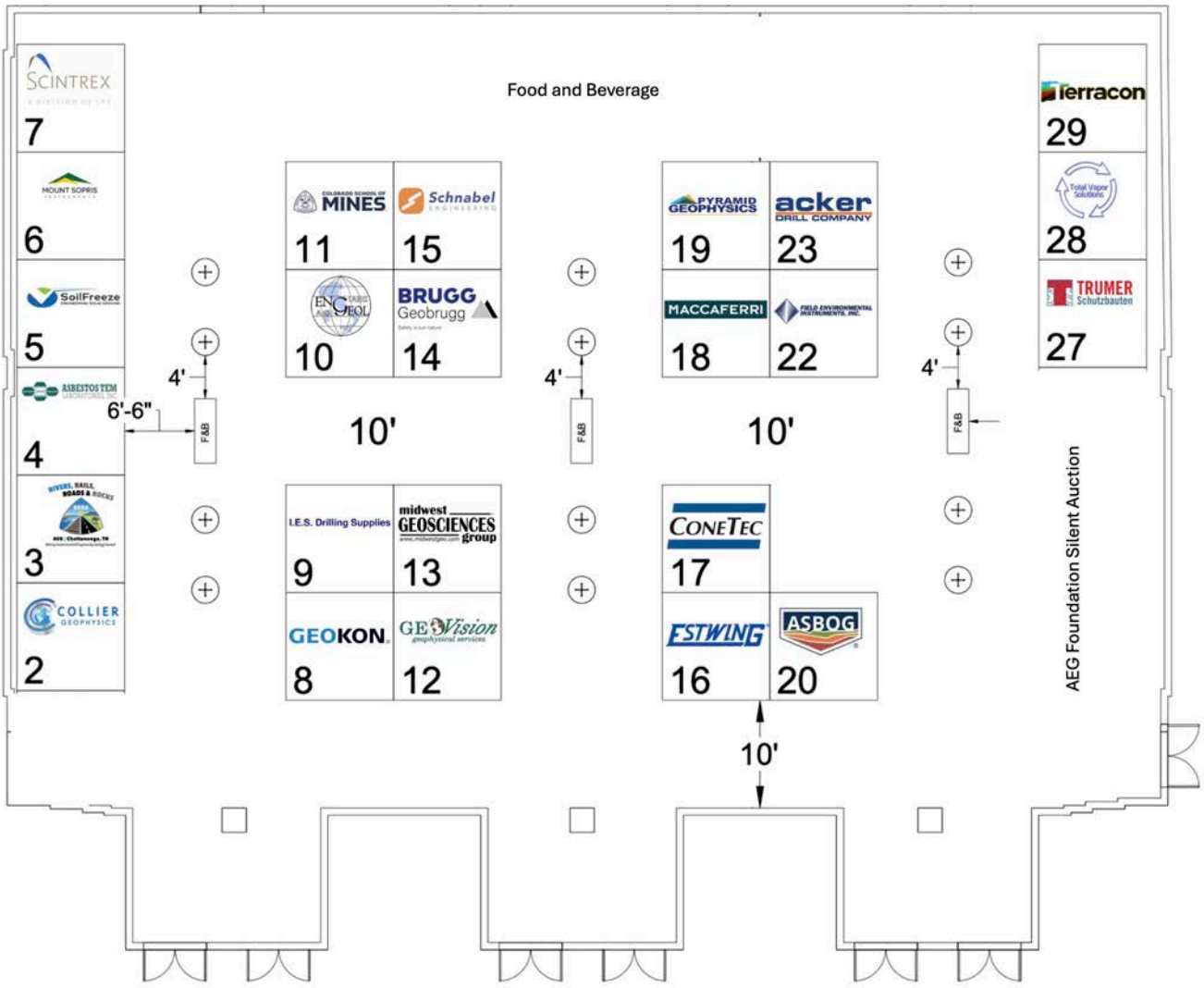
FRIDAY, SEPTEMBER 26

Technical Session #10: Landslides – *Sponsored by Geosyntec Consultants, Inc*	Promenade A	8:00 a.m.–12:00 p.m.
Technical Session #11: Subsurface Urban Heat Islands / Geological Energy Harvesting and Storage Symposium	Promenade B	8:00 a.m.–12:00 p.m.
Technical Session #12: Geologic and Seismic Hazards Part II	Promenade A	1:00 p.m.–2:40 p.m.
Technical Session #13: AI/Machine Learning – *Sponsored by GFT*	Promenade B	1:00 p.m.–2:40 p.m.
Technical Session #14: Site Characterization – *Sponsored by Geosyntec Consultants, Inc*	Promenade C	1:00 p.m.–2:40 p.m.


2025 ANNUAL MEETING @ Westin Hotel
CHICAGO
Must See Things in Chicago A-Z
Tripomatic.com
A John Hancock Observatory
B Yolk
C Water Tower
D Magnificent Mile
E State Street
F Ohio Street Beach
G Amazing Chicago's Funhouse Maze
H Navy Pier
I Wrigley Building
J Tribune Tower
K Lakepoint Tower
L James R. Thompson Center
M Chicago Theater
N Carbide and Carbon Building
O Jay Pritzker Pavillion
P Crown Fountain
Q Cloud Gate
R BP Bridge
S Sears Tower (Willis Tower)
T Art Institute of Chicago
U Grant Park
V Dearborn Station
W Buckingham Fountain
X Field Museum
Y Shedd Aquarium
Z Adler Planetarium and Astronomy Museum

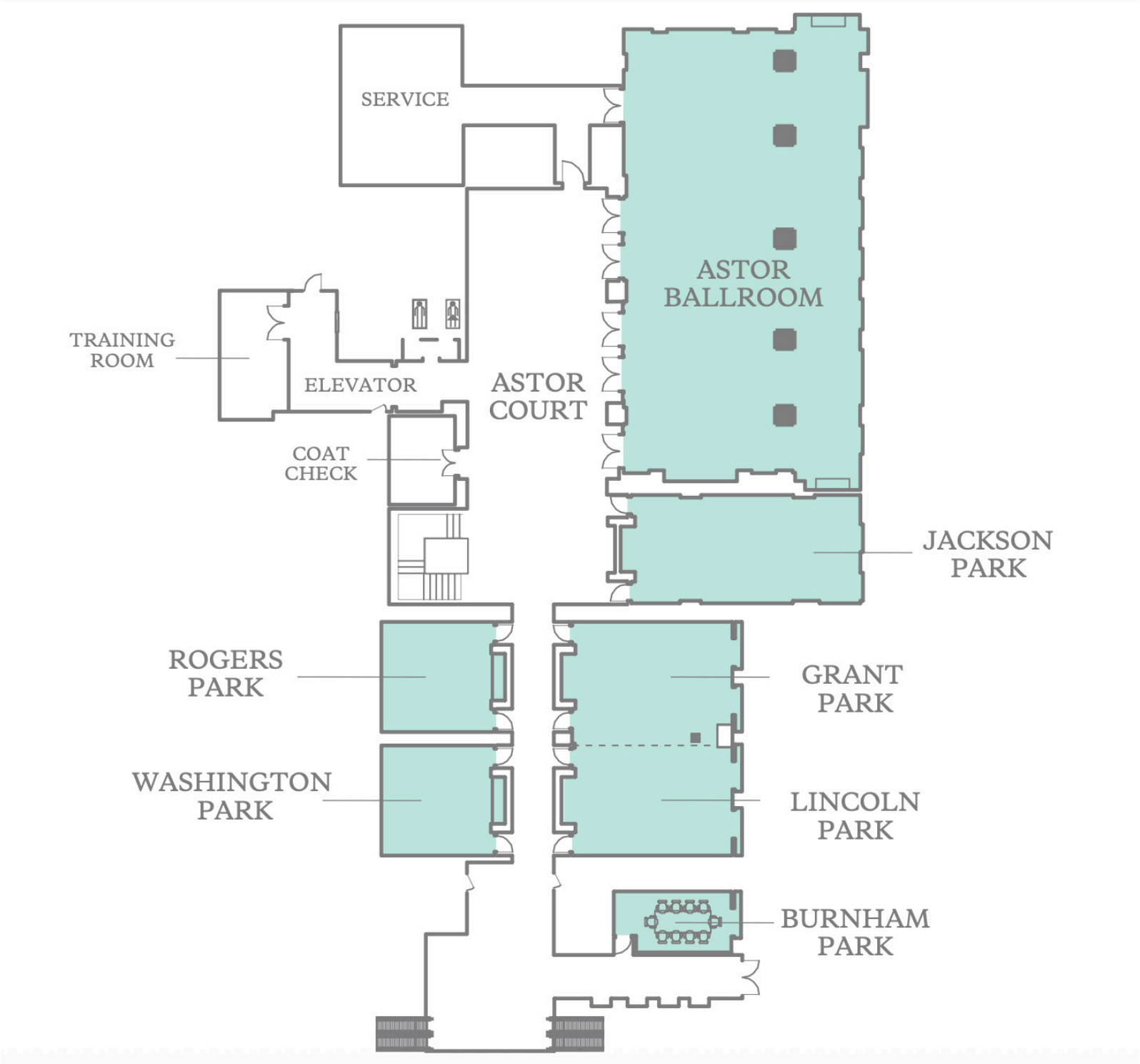
AEG 2025 Annual Meeting Exhibit Hall

September 23-25, 2025
Grand Ballroom



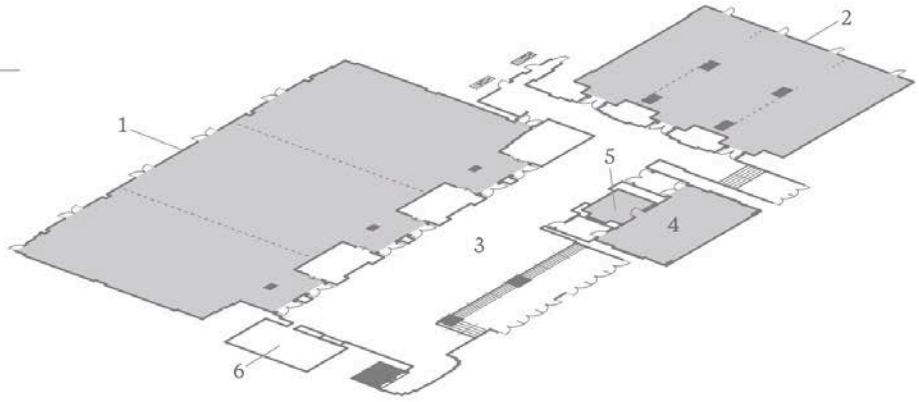
Get to know our exhibitors! Open throughout the conference. A great chance to network and learn about resources and developments in the field. **Flip to page 38 for more details!**

River Level One



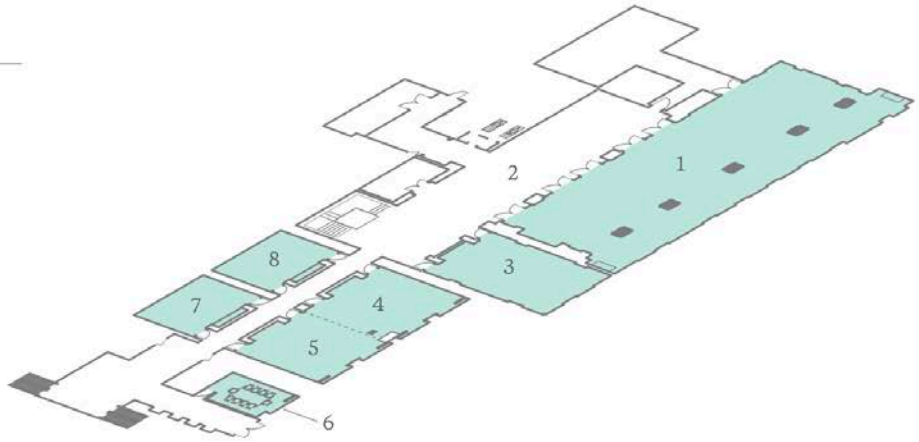
RIVER LEVEL TWO

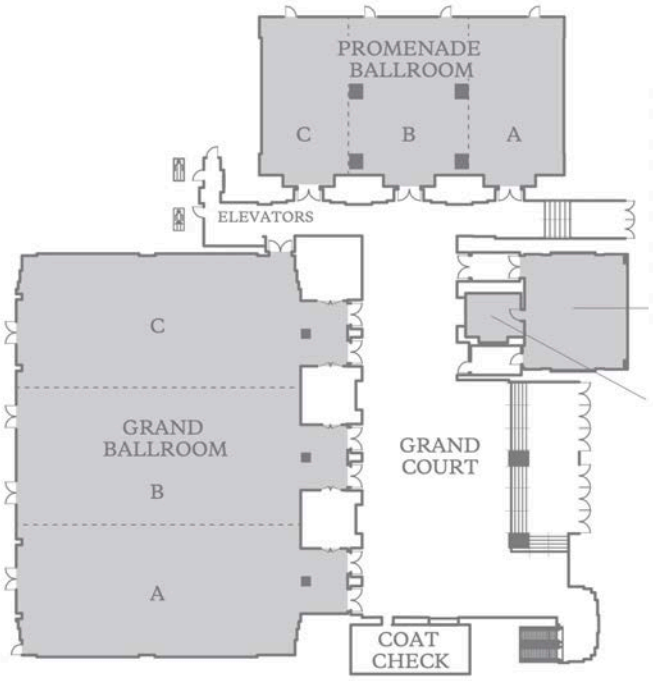
1. GRAND BALLROOM
2. PROMENADE BALLROOM
3. GRAND COURT
4. EXECUTIVE BOARDROOM
5. CAUCUS ROOM
6. COAT CHECK



RIVER LEVEL ONE

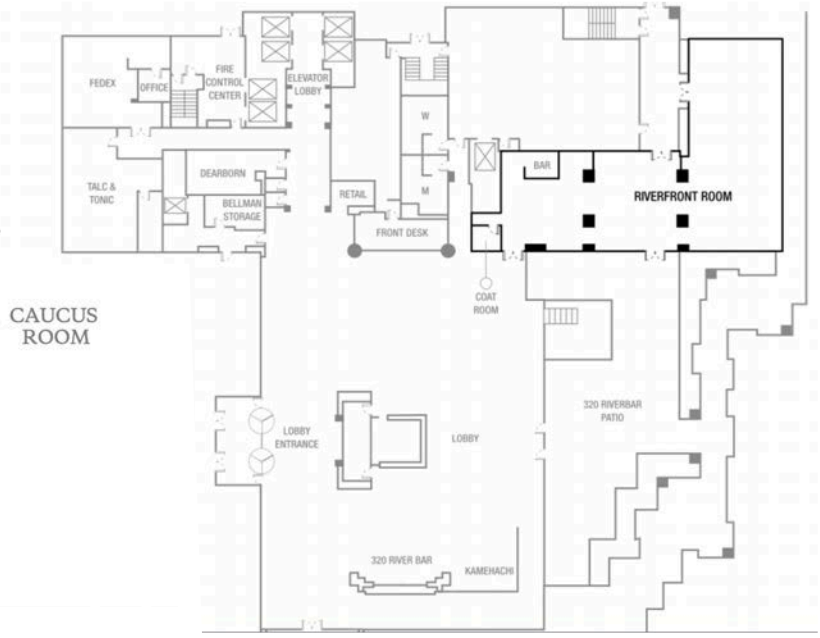
1. ASTOR BALLROOM
2. ASTOR COURT
3. JACKSON PARK
4. GRANT PARK
5. LINCOLN PARK
6. BURNHAM PARK
7. WASHINGTON PARK
8. ROGERS PARK

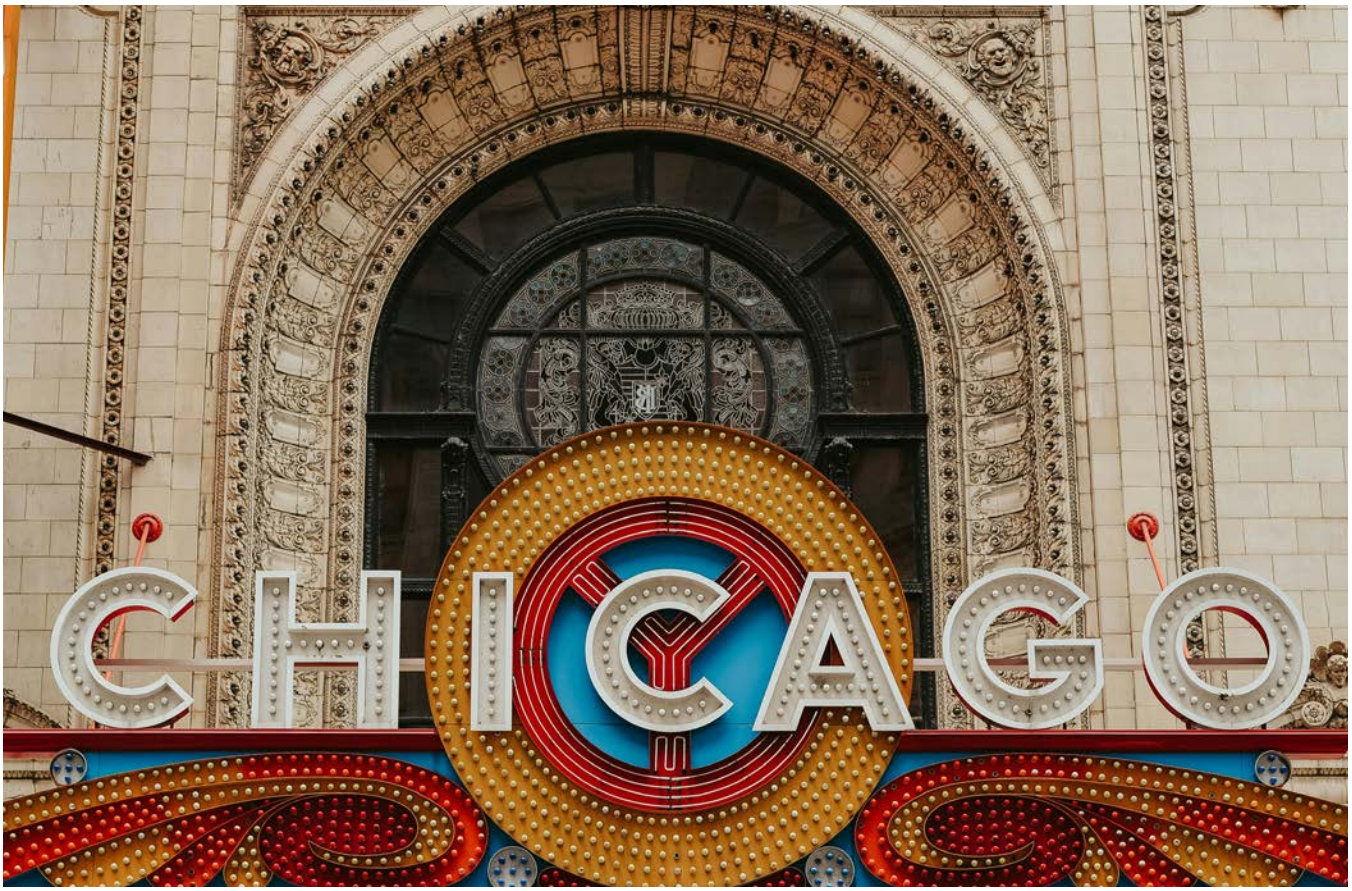




River Level Two

Hotel Lobby Level





By Renee Wawczak & Sarah Kalika, Meeting Co-chairs

Get ready for AEG's 2025 Annual Meeting!

While Chicago is known for its outstanding food and music scene, we hope you will get a chance to learn a bit about the fascinating geologic history of the area, as well as the role that geology continues to play in the continued growth of this beautiful city.

We are grateful for our outstanding team of 2025 Annual Meeting Planning Committee volunteers, particularly Chris Stohr, Kevin Richards, and Bill Rochford, who went above and beyond to get our field courses and keynote speakers arranged, as well as to the Chicago Chapter, which helped promote this meeting. AEG is truly grateful for the countless hours of work by the committee members to organize field courses, the special event, technical sessions, student events, and more!

Did you know that 2025 marks 100 years since pioneer in rock mechanics Ruth Terzaghi earned her master's degree in geology at the University of Chicago? Her thesis was on the origin of abnormally steep dips of the Silurian Niagaran reefs in the Chicago area, some of which were mined at Thornton and McCook quarries (visit these on two of our field courses)!

We have a fantastic assemblage of **Technical Sessions and Symposia** on a mix of environmental and engineering geology topics including PFAS, microplastics, site characterization, geological energy harvesting and storage, using artificial intelligence and machine learning in geoscience, land subsidence, intraplate seismic hazards, tunneling, dams & levees, challenges facing our profession and university education systems, and more—planned by AEG's technical working groups and expert members.

For the first time ever, we have expanded our virtual sessions into two days! Join us on Monday and Tuesday from your home or office for presentations from outstanding speakers and interactive break activities. This is a perfect way to participate in the annual meeting and get some PDHs if you're unable to join us in person.

Looking for more learning opportunities? We're hosting an outstanding short course on Friday of the meeting. Join Dan Kelleher and Susan Grover while they discuss field strategies used to decipher depositional environments and stratigraphy of a sedimentary sequence drilled in 2022 through Wisconsinan-age deposits. The course **Strategies for Solving**

Hydrogeologic Complexities in the Western Chicago Suburbs will explore how they made history by age dating the buried A-horizon that was confirmed within the Pre-Wisconsinan-age portion of the sequence!

Want to get outside? Don't miss our field courses exploring the geology of the Chicago area including a **Geologic Trip down the Chicago Area Waterway** with visits to McCook Quarry, Lockport Lock & Dam, and the Fish Barrier; an overview of **Near Surface Geology and Urban Challenges in the Chicago Area** featuring visits to Sandy Ridge Nature Preserve, Indiana Harbor, and Northerly Island; an overview of **Geology, Infrastructure, and Shoreline Morphodynamics of Illinois Beach State Park** on the shores of Lake Michigan; and **Reefs to Roads: The Role of Ancient Reefs in the Development of Chicago's Infrastructure and its Stone Industry** with a visit to Stearns and Thornton quarries, sources of aggregate that helped build the area and an opportunity to learn about the re-purposing of former quarries as storage facilities for combined stormwater and sewage as part of Chicago's huge Tunnel and Reservoir Plan.

Learn more about why officials embarked on a daring design to reshape part of the natural world – and reverse the flow of the Chicago River in the documentary Reverse the River.

Northerly Island

AEG will award the Outstanding Environmental & Engineering Geology Project Award to the Metropolitan Water Reclamation and TARP project at this year's Opening Session.

Tuesday after the Icebreaker Reception in the exhibit hall, don't forget to join us at the Young at Heart event at the **House of Blues**! The venue is across the street from the hotel, and this event will feature drinks, appetizers, and live blues music for all participants.

To begin Wednesday morning, join us for our Opening Session, which will feature AEG Foundation awards and scholarships presented to deserving students, keynote speakers including **Dr. Thomas Oommen, Dr. Timothy Stark**, current Richard H. Jahns Distinguished Lecturer **Dr. John Kemeny,** introduction to our incoming Jahns Lecturer **Dr. Chris Stohr**, and presentation of the Outstanding Environmental & Engineering Geology Project Award to the **Metropolitan Water Reclamation District of Greater Chicago's Tunnel and Reservoir Plan (TARP).**

On Wednesday night, our ticketed Special Event will take you on an

On Wednesday night, our ticketed Special Event will take you on an unmatched Chicago experience, **an architectural cruise along the Chicago River.**

unmatched Chicago experience, an **architectural cruise along the Chicago River**. We'll feast on deep-dish pizza and beverages while we enjoy a narrated tour of Chicago's eclectic buildings.

Don't forget to **vote for your favorite student poster** in the Meeting App and celebrate our student poster authors during the Thursday afternoon reception.

On Thursday night, don't miss our Annual Banquet, where we'll honor AEG's outstanding new honorary members and winners of the Floyd T. Johnston Service Award, Douglas R. Piteau Outstanding Young Member Award, Claire P. Holdredge Publication Award, Karl and Ruth Terzaghi Mentor Award, and the Schuster Medal. IAEG President Vassilis Marinos will be presenting a very special Honorary President Award to **Dr. Scott Burns**. Our final presentation of the evening will be from our incoming President **Paul Weaver** who will introduce himself and his plans for the upcoming year!

You can find us at our **Support Your Peers/Be Yourself Luncheon** on Thursday and the **Closing Session** on Friday afternoon, where AEG will present the **AEG Publication Award**, and recognize winners of the **Outstanding Chapter Award, Outstanding Student Chapter Award**, and the **Outstanding Reviewer for *Environmental & Engineering Geoscience* Journal Award**. We will officially welcome our incoming **AEG president** and invite you to join us afterward for a president-hosted happy hour and toast to a great year!

Our annual meetings are always strongly supported by our exhibitors and sponsors, so please help us welcome our **exhibitors** by stopping by their booths during the Icebreaker Reception, Exhibitor-Hosted Luncheon, and morning and afternoon breaks! Thank you to our **generous sponsors** who helped make this meeting successful including bringing us all day coffee. There are still opportunities to sponsor and a few exhibit booths available, so don't miss an opportunity to showcase your company!

Tuesday, September 23
8:00-10:00 p.m.
Live Music with Keithen Banks

The House of Blues is more than just a venue; it's a cultural destination that celebrates Southern art, music, and community. This social event is a great way to start your week in Chicago.

OFFICE OF THE GOVERNOR
207 STATE HOUSE
SPRINGFIELD, ILLINOIS 62706

JB PRITZKER
GOVERNOR

Association of Environmental and Engineering Geologists
2480 W Bay Dr, #141
Belleair Bluff, FL 33770

Greetings!

As Governor of the State of Illinois, I am pleased to welcome everyone gathered for the 68th Annual Meeting of the Association of Environmental and Engineering Geologists (AEG). This occasion offers an exciting opportunity for everyone in attendance to join fellow members of AEG and generate ideas that implement solutions. I commend the work you have done to help make Illinois a stronger and more enjoyable state.

With its origins dating to 1958, the AEG has grown into one of the preeminent organizations tasked with incorporating geology and environmental considerations in civil engineering decisions. Helping city, state, and federal governments build stable buildings and craft eco-friendly projects, AEG has created a footprint aimed at making our buildings more secure, our environment protected, and people safe.

Illinois is proud to have enjoyed your service to our state. As you reflect on your accomplishments, I urge you to make plans for the future of AEG that will build on your past successes. I am grateful for all the ways your environmental and engineering geologists have supported a strong future for Illinois.

On behalf of the people of Illinois, I offer my best wishes for an enjoyable and memorable occasion.

Sincerely,

Governor JB Pritzker

September 2025

Hello AEG Members,
On behalf of the Illinois State Geological Survey and the Prairie Research Institute at the University of Illinois at Urbana-Champaign, I am honored to welcome you to the Windy City of Chicago for the 68th Annual Meeting of the Association of Environmental & Engineering Geologists.

North to south and west to east, Illinois' landscape and geological diversity are dominated by the legacy left behind by repeated advances and retreats of glaciers, and all underlain by mineral-rich bedrock, both of which are directly responsible for the State's rich agriculture, the overall 200+ years of successful economic development, and a sincere emphasis on environmental protection of all of our resources. Glaciation has resulted in deposits that host often hidden groundwater and aggregate resources, and it had a profound influence on the formation of Lake Michigan and all of the Great Lakes. Our underlying bedrock now reveals newly discovered potential resources of critical minerals. The 70% of Illinois underlain by the Illinois Basin not only contains an archive of geological history and the natural resources that helped power our past, it also has become increasingly valuable as a resource for addressing various energy storage and use scenarios such as for carbon sequestration, hydrogen storage, and geothermal potential. All of our State's geology are constantly providing true "gifts that keep on giving".

An outstanding program has been planned by AEG with Session Topics from A to V (AI-Machine Learning to Volcanic Hazards) and Field Courses focusing on issues in the Greater Chicago area. Please trust me when I state this, you all are going to get a "full dose" of the Chicago Experience.

Richard C. Berg, Ph.D.
Director and State Geologist
Illinois State Geological Survey
Prairie Research Institute
University of Illinois at Urbana-Champaign

STATE OF ILLINOIS

EXECUTIVE DEPARTMENT

Proclamation

WHEREAS, *professional engineering, environmental geology, geophysics, and geoscience professionals investigate, test, and design foundations, clean contaminated sites, and provide technical consultation for significant structures in North America and around the world; and,*

WHEREAS, *the Association of Environmental and Engineering Geologists is a leading professional organization dedicated to promoting public health, safety, and welfare through leadership, advocacy, and applied research in the fields of environmental and engineering geology; and,*

WHEREAS, *members of the Association of Environmental and Engineering Geologists adhere to sound scientific principles in the study and evaluation of geological processes, their impact on humans, and the effects of human activities on the Earth; and,*

WHEREAS, *local chapters, such as the Chicago Chapter of the Association of Environmental and Engineering Geologists, hold regular meetings for geoscientists, geophysicists, and engineers to facilitate ongoing education and training while supporting members in their commitment to maintaining the highest standards of professional practice; and,*

WHEREAS, *the Chicago Chapter of the Association of Environmental and Engineering Geologists promotes public appreciation for the roles that environmental and engineering geologists, geophysicists, and engineers play in enabling economic development, ensuring public safety, and protecting property; and,*

WHEREAS, *the Chicago Chapter of the Association of Environmental and Engineering Geologists welcomes members from diverse backgrounds, cultures, and genders, and actively implements initiatives to increase representation, participation, and leadership opportunities within a culture of mutual respect, tolerance, and inclusivity;*

THEREFORE, *I, JB Pritzker, Governor of the State of Illinois, do hereby proclaim September 22-26, 2025, as* ***Environmental and Engineering Geologists Recognition Week*** *in Illinois.*

In Witness Whereof, *I have hereunto set my hand and caused the Great Seal of the State of Illinois to be affixed.*

Done at the Capitol in the City of Springfield, this SIXTEENTH *day of* JULY*, in the Year of Our Lord, two thousand and* TWENTY-FIVE*, and of the State of Illinois, two hundred and* SIXTH*.*

SECRETARY OF STATE

GOVERNOR

Special Issue

Environmental & Engineering Geoscience

Modeling Mass Movements Across Varied Geological Terrains: Processes, Hazards, and Mitigation

Mass movements, such as landslides, debris flows, rock falls, and earthflows, present significant risks in various terrains. This Special Issue focuses on advanced modeling approaches for understanding, predicting, and mitigating such hazards in different geological environments.

Topics of interest include:

- Modeling shallow and deep-seated landslides in heterogeneous lithology
- Influence of geological setting and soil/rock properties on landslide dynamics
- Coupled hydrological and slope stability models for rainfall- and snowmelt-induced landslides
- Simulation of rainfall infiltration and pore pressure evolution preceding slope failure and debris flows
- Modeling landslides in volcanic, glacial, and permafrost terrains
- Regional-scale susceptibility mapping using machine learning and GIS
- Case studies of mass movement modeling in tectonically active zones
- Early warning systems and real-time modeling using sensor networks and IoT
- High-performance computing applications in landslide modeling
- Modeling cascading hazards: landslides triggering floods, tsunamis, or debris flows
- Sediment transport and deposition after mass movement events
- Time-dependent modeling of creep and progressive slope deformation

Submission Timeline:

Last Date for Manuscript Submission: December 31, 2025

Special Issue Publication: May 2026

Guest Editors:

Dr. Sajinkumar K.S.
Department of Geology, University of Kerala, India
sajinks@keralauniversity.ac.in

Dr. Yunus Ali Pulpadan
Department of Earth Sciences, IISER Mohali, India
yunusp@iisermohali.ac.in

Dr. Srikrishnan Siva Subramanian
Centre of Excellence in Disaster Mitigation and Management, IIT Roorkee, India
srikrishnan@dm.iitr.ac.in

Dr. Nikhil Nedumpallile Vasu
British Geological Survey, Nottingham, UK
nikned@bgs.ac.uk

ENVIRONMENTAL ENGINEERING AEG GEOLOGISTS

THE GEOLOGICAL SOCIETY OF AMERICA®

2025 Planning Committee

AEG's 68th Annual Meeting would not be possible without the hard work and dedication of the following committee chairs and the many more volunteers that serve on these committees.

Meeting Co-chairs
Sarah Kalika, DiabloGeo
Renee Wawczak, AEG President

Field Course Planners
Brandon Curry
C. Robin Mattheus, Illinois State Geological Survey
Donald Mikulic
Kevin Richards
William Rochford, USACE
Chris Stohr

Planning Committee
Dan Kelleher, Midwest GeoSciences Group
Ana Vargo
Cornelia Marin, Wang Engineering
Alessandro Rotta-Loria, Northwestern University
Andrew Stumpf, University of Illinois
Mariam Saini
Tim Drexler
Paco Gomez

Technical Program
Marty Goff
Chris Stohr
Rick Kolb

Short Course
Dan Kelleher, Midwest GeoSciences Group
Susan Grover

Teachers Workshop
Lauren Brase, American Geosciences Institute

AEG Headquarters
Jennifer Breitenbach, Member Services Manager
Heather Clark, Meetings Manager
Shannon Fitzpatrick O'Shea, Association Manager

Enhanced Protection

New Debris flow barriers to mitigate risks and safeguard communities

Maccaferri's debris flow barriers offer reliable protection against destructive debris flows. Designed to contain and slow debris, they help mitigate shallow landslides and protect critical infrastructure. With advanced energy-absorbing systems and certified performance, our barriers ensure long-lasting resilience and effective risk mitigation in high-risk areas.

FIND OUT MORE

maccaferri.com/us/rockfall

MACCAFERRI

Special Thanks

AEG wishes to acknowledge the following companies for their support by allowing their employees to assist with the planning of the 2025 Annual Meeting:

DiabloGeo Environmental Consulting

Illinois State Geological Survey

Midwest GeoSciences Group

USACE

USDA-NRCS

AEG wishes to thank the following individuals for their assistance with the planning of the 2025 Annual Meeting:

Renee Wawczak, AEG President

Paul Weaver, AEG Vice President/President-Elect

Mark Swank, AEG Treasurer

Julia Frazier, AEG Secretary

Sarah Kalika, AEG Past President

Field Course Leaders

Mitchell Barklage, ISGS

Brandon Curry, University of Illinois Urbana-Champaign

Dan Ferris, MWRD

Yuki Galisanao, MWRD

C. Robin Mattheus, ISGS

Jan Merl, USACE

Don Mikulic, Weis Earth Science Museum

William Rochford, USACE

Joe Schulenberg, MWRD - Lockport Powerhouse

Robbie Sliwinski, Christopher B. Burke Engineering, Ltd.

Chris Stohr, ISGS retired

Justine Stumpf, Ramboll Environmental

Symposium Conveners and Technical Session Moderators

James Borchers

Kerry Cato, California State University San Bernardino

Jim Fineis, Total Vapor Solutions

Judith Gauriau, Exponent

Maddie German

Marty Goff, Retired USACE

Kristen Hasbrouck, ERM

Paul Headland, Aldea Services

Matt Huebner, TVA

Ike Isaacson, Brierley Associates

Erik James, USACE

Courtney Johnson, Slate Geotechnical Consultants

Sarah Kalika, DiabloGeo Environmental Consulting

Rick Kolb

Kathryn Murdock, Exponent

Mike Piepenburg, Mott MacDonald

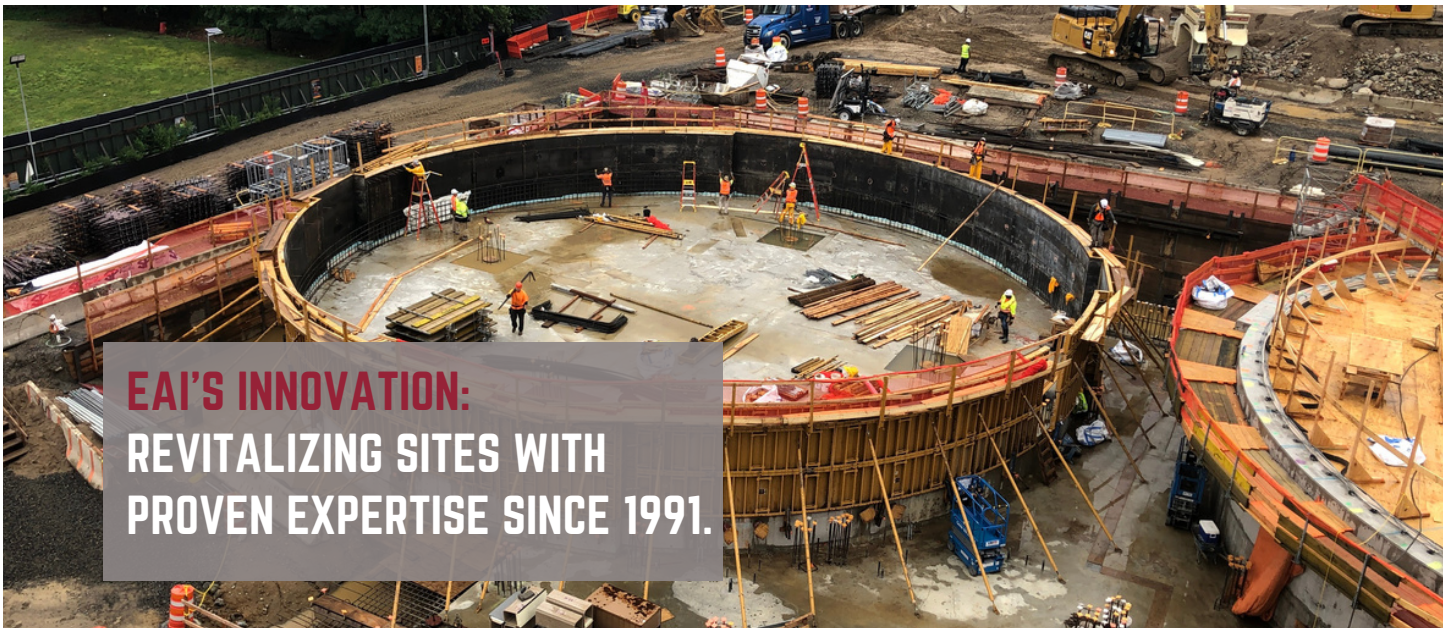
Cole Rosenbaum, BGC Engineering

Alessandro Rotta Loria, Northwestern University

Anna Saindon, UES/Geotechnology

Nate Saraceno, GFT

Gerry Stirewalt, U.S. Nuclear Regulatory Commission



EAI'S INNOVATION:
REVITALIZING SITES WITH PROVEN EXPERTISE SINCE 1991.

TRANSFORMING CHALLENGES INTO OPPORTUNITIES.

EAI INC
ENVIRONMENTAL MANAGEMENT SERVICES
SPECIALTY CONTRACTING

Transform contaminated sites with EAI's expertise. Since 1991, we've installed millions of square feet of vapor barriers, vapor intrusion mitigation systems, and transformed hazardous lands into thriving communities. Partner with us for innovative, sustainable site solutions.

Contact us to discuss your project:

201-395-0010 eaienviro.com

Jewish Holidays During the Annual Meeting

We recognize that Rosh Hashanah and the Fast of Gedaliah fall during the Annual Meeting and would like to assist with locations to celebrate these holidays.

Here are some synagogues located near the Westin Chicago River North:

- Chicago Sinai Congregation: Located at 15 W Delaware Pl, this Reform synagogue is highly-rated (4.6 stars) and described as distinguished, with excellent music and a storied history. Reviews mention a welcoming atmosphere and engaging community. The address is close to the Westin, around 0.7 miles away.

- Central Synagogue of Chicago: Located at 122 S Michigan Ave, Suite 1449, this synagogue is described as a traditional, egalitarian Conservative congregation in downtown Chicago. It's conveniently located within walking distance of several neighborhoods, including River North, and accessible by public transit.

- Lake Shore Drive Synagogue: This traditional synagogue, located at 70 E Elm St, is described as a small and significant Jewish House of Worship serving the Gold Coast, Streeterville, and River North areas. It is rated 5 stars based on user reviews. It's about 1.0 mile from the Westin.

- Chicago Loop Synagogue: Situated in the heart of downtown Chicago at 16 S Clark St, this traditional synagogue is known for its iconic stained-glass window. It offers daily services, High Holiday observances, and programming that blends tradition with modern life. It is rated 4.8 stars. It's about 0.8 miles away.

AEG Risk Workshop

SCAN ME

Back by popular demand - Join us for AEG's Risk Assessment for Dam and Levee Foundations Workshop!

The Association of Environmental & Engineering Geologists (AEG), Dams and Levees Technical Working Group, is proud to present a workshop that focuses on the role and contribution of engineering geologists and geotechnical engineers in the Risk Informed Decision Making (RIDM) process in managing dam and levee safety programs. Risks associated with geological potential failure modes and communicating these conditions to the Risk Assessment (RA) team will be emphasized including the methodology, and implementation of RA for dam and levee foundations.

For complete details and to register visit, www.aeg2025riskworkshop.org

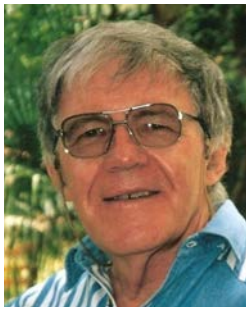
(Limited to 80 attendees)

AEG 2025 Association Awards

Advocacy Award

Kenneth Tramm

The AEG Advocacy Committee hosted the first AEG Advocacy Award in 2018. This annual award is to recognize and showcase the accomplishments of one or more effective advocates for geological practice.



Claire P. Holdredge Award

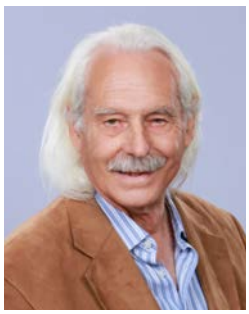
Frank Netterberg

The Association's highest publication award, the Claire P. Holdredge Award, is presented to an AEG Member who has produced a publication within the past five years that is adjudged to be an outstanding contribution to the environmental and engineering geology profession.

Douglas Piteau Outstanding Young Member Award

Isaac Pope

This award, established in 1985, is presented to a Member who is age 35 or under and has excelled in technical accomplishment, service to the Association, and service to the engineering geology profession.



Richard H. Jahns Distinguished Lecturer in Engineering Geology

Dr. Christopher Stohr

A joint committee of AEG and the Engineering Geology Division of GSA selects the Jahns Lecturer, who presents an annual series of lectures at academic institutions to increase students' awareness about careers in engineering geology.

Floyd T. Johnston Service Award

Anna Saindon

This award is presented to a member for outstanding active and faithful service to AEG over a minimum period of nine years to coincide with Floyd T. Johnston's tenure as Executive Director.

Schuster Medal

Mike Porter

A joint award from AEG and the Canadian Geotechnical Society recognizing excellence in geohazards research in North America (NA). Nominees must be residents of NA and meet at least two of these criteria: professional excellence in geohazards research relevant to NA, significant contribution to public education on geohazards, international recognition for a career in geohazards, influential geohazards research or development of methods or techniques, teacher of geohazards students.

(awarded at the Canadian Geotechnical Society Annual Conference in Winnipeg on September 22, 2025)

Honorary Member

AEG confers an honor of such high esteem that the distinction is recognized as a membership class: Honorary Member. This recognition is given to those whose careers have exemplified the ideals of AEG.

J. David Rogers and Oliver Barker

Karl and Ruth Terzaghi Mentor Award

Dr. Andrew Stumpf

Established in 2008, this award recognizes outstanding individuals for their achievements as mentors throughout their career. The recipient has made lifelong efforts in providing professional, ethical, and technical mentoring for environmental and engineering geologists.

AEG Publication Award

This award was established by the Association in 1968 and is presented to the author(s) of the most outstanding paper published in any AEG publication during the fiscal year. Winning papers can be viewed online through the journal's archives. For access instructions, visit: https://aeg.memberclicks.net/assets/docs/Publications/EEG-Access.pdf.

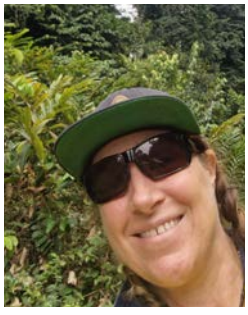
William C. Haneberg

Haneberg, William C., 2024, Precipitation patterns, mountaintop removal mining, and the July 2022 North Fork Kentucky River Flood: *Environmental & Engineering Geoscience*, v. 30, no. 3, p. 131–145.

Volunteer Recognition Award

We recognize those volunteers within AEG that have worked hard to move AEG forward over the past year. These awards will be given during the Opening Session on Wednesday morning.

Martha Whitney and Bill Roman

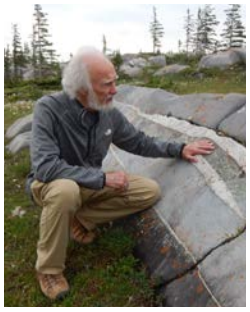


Student Professional Paper Award

Okiemute Commander, Illinois State University

Commander, Okiemute, Peterson, Eric W., and Perry, William L., Agricultural contribution of chloride to a saturated riparian buffer system: a case study in central Illinois: *Environmental & Engineering Geoscience*, v. 31, no. 2, p. 119–130.

Outstanding Reviewer for *Environmental & Engineering Geoscience* Journal Award



Gerry L. Stirewalt, US Nuclear Regulatory Commission

Outstanding Student Chapter Award

Portland State

(Runners-up – The University of Alaska Fairbanks and Fresno State)

Portland State UNIVERSITY

Outstanding Chapter Award

This award was established by the Board of Directors in 2001 to honor a Chapter of the Association judged to excel in a number of areas including professional activities, communications, membership, and networking.

TBA (will be awarded during the corporate business meeting at the 2025 AEG Annual Meeting)

AEG Foundation 2025 Scholars

Christopher C. Mathewson Scholarship

Anna Soleil Heikes
Trinity University

Established in 2007 as the Texas Section Scholarship, the scholarship was renamed in 2011 to honor Dr. Christopher C. Mathewson. Recipients of the scholarship are undergraduate or graduate students enrolled in an accredited Texas college or university, or graduate students conducting field studies in Texas.

Martin L. Stout Scholarship

Elise Chan
Colorado School of Mines

Abigail Manderano
Binghamton University

Cristal Stephanie Patino
California State University-San Bernardino

Dr. Martin L. Stout was professor of geology at California State University, Los Angeles from 1960 to 1990. He is remembered by his students for his passionate and insightful instruction in engineering geology. Dr. Stout was known for his expertise on landslides, his travels, his good humor, and his gracious manner. This scholarship supports his legacy.

Carolinas Scholarship

Kyleih Sky Martens
Appalachian State University

Established in 2015 with a gift from the Carolinas Chapter, this scholarship supports geologic studies by undergraduate students enrolled in a geology or geoscience program at an accredited university in North Carolina or South Carolina.

West-Gray Scholarship

Lauren Elizabeth Johnson
Purdue University

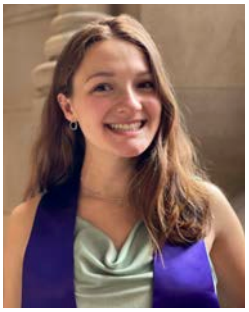
Chandler Deese
University of North Carolina at Chapel Hill

Established in 2014 with initial funding provided as a gift from AEG Past Presidents Terry R. West and Richard E. Gray, this fund supports undergraduate and graduate geology students studying in the eastern half of the United States.

Susan Steele Weir (Women of "Steele") Scholarship

Francesca Skene
Colorado School of Mines

The Susan Steele Weir Scholarship Fund was established by the AEG Foundation in 2017 to create a scholarship fund that promotes and supports the continued development and advancement of women in the profession of engineering geology.



Shlemon Quaternary Engineering Geology Scholarship

Margi Smith
University of Missouri-Columbia

The Shlemon Quaternary Engineering Geology Scholarship supports graduate geology students conducting quaternary engineering geology research. Initial funding for the scholarship was provided by a gift from Roy J. Shlemon, honorary member of AEG.

Marliave Scholarship

Lauren Guido
Colorado School of Mines

The Marliave Scholarship Fund was established in 1968 to honor the late Chester E. Marliave, Burton H. Marliave, and Elmer C. Marliave, outstanding engineering geologists and supporters of AEG. The funds are distributed as grants, which are intended to support academic activity and reward outstanding scholarship in engineering geology and geological engineering.

Robert J. Watters Great Basin Chapter Scholarship

Cody Russo
University of Nevada, Reno

The Robert J. Watters Great Basin Chapter Scholarship Fund supports geoscience studies by students at the undergraduate and graduate levels.

Beardsley-Kuper Field Camp Scholarship

Michael Heebner
Idaho State University

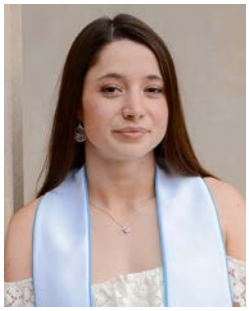
Huston Oliver Spellman
University of Missouri-Columbia

Michael Poon
Commonwealth University of Pennsylvania, Bloomsburg

The Beardsley-Kuper Field Camp Scholarship Fund supports expenses for geology field camps with applied environmental and engineering geology components that will be useful to the students' future profession as an environmental or engineering geologist. The scholarship was established in 2009 by Cathryne Beardsley with her daughter Dorian Kuper and son-in-law Tom Kuper.

Norman R. Tilford Field Study Scholarship

Meaghan Dutton
St. Norbert College



Daphne Charlot
University of North Carolina at Chapel Hill

Marco Rodriguez
California State University, Fresno

The Tilford Scholarships are awarded to both undergraduate and graduate students for the summer field season and were established in memory of Norman R. Tilford, who was a leader in engineering geology and a professor at Texas A&M University. Norm died in 1997 while flying his small aircraft to meet a student field trip. Norm was dedicated to teaching geology in the field and these scholarships support his legacy.

Diversity Scholarship

Abigail Perez Villanueva
Sonoma State University

Established by AEG's Workforce Development Committee in 2021, this $5,000 scholarship is awarded annually to one student who is a geoscience major in their sophomore, junior, or senior year at an accredited college or university. The successful applicant will have a GPA of 2.9 or better.

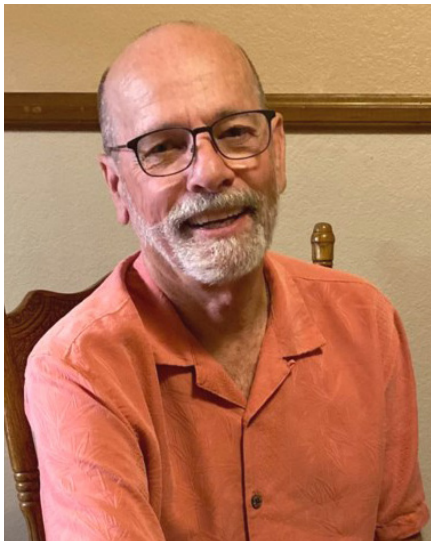
The Race to Reverse the River — A Chicago Stories Documentary

This 55-minute documentary film covers some of the environmental and engineering challenges confronted by Chicago in its effort to overcome water-borne diseases by improving sanitation and protecting its source of public drinking water.

In Memoriam

(For full obituaries, please see links)

2024



Michael Otis Cook, 73, of San Bernardino, California, passed away on November 2, 2024, in San Bernardino, California, doing one of the things he loved most, running. He married Jean Marie (Jeannie) Schweitzer on October 7, 1978, in Long Beach, California. He then graduated from California State University, Los Angeles. He worked as a geologist for 42 years, with the last 24 years at Kleinfelder. Michael was heavily involved in the San Bernardino Pacers running club and the Association of Engineering Geologists, both of which he also served as president. His proud accomplishments include completing over 20 half-marathons and 2 full marathons and winning the World Champion Dart Tournament in 2010. Michael was given recognition from many associations and local schools for his community service, and he volunteered over the years as a foster father, boy scout leader, baseball coach, and mentor. Michael was an incredible person and a great friend to all. His vibrant spirit touched the lives of many, and his presence and that ever-present smile and enthusiasm will be sincerely missed.

▶ Michael's full obituary can be found here.

Allen Vaughan Shaw passed away suddenly on October 16, 2024, in Rockville, Maryland. He grew up at the family homestead, Number 12 King Street in Groveland, and as a teenager worked on a local dairy farm, which he reminisced about frequently. An animal lover from an early age, he raised a Holstein cow named Bobolink, after which his adventures in dairy farming came to a close. Allen went on to study geology at Tufts University and received his master's degree from Michigan State. He continued his formal education at the University of Arizona, University of Oklahoma, and University of Texas at Dallas. His career began in oil exploration, working for Conoco in the Western United States. He lived in the Rocky Mountain region for many years before moving to Arizona and then to Texas to work for Sun Exploration. In the early 90s, he moved back to the East Coast and transitioned to environmental geology, working for URS Corporation and Bechtel. Allen stayed active in his field and served as past editor of *AEG News*, the newsletter for the Association of Environmental & Engineering Geologists. He lived a life of service and spent countless hours volunteering for many organizations, big and small. Allen regularly donated blood earning his 25-gallon pin and beyond. When he wasn't out and about enjoying this beautiful world and its flora and fauna, many other hobbies and passions occupied his time. Allen was an accomplished baker (his focaccia bread had an informal fan club), chef extraordinaire (his butternut squash soup is a holiday favorite), and singer (his rich baritone voice was a joy to hear, just like his dad's). He was also an amateur photographer and an avid birdwatcher.

▶ Allen's full obituary can be found here.

2025

Richard "Dick" E. Gray, 90, passed away on Wednesday, June 25, 2025. He received an undergraduate degree in 1956 from Carnegie Mellon University in Pittsburgh. In April 1957, Dick began a six-month assignment as a lieutenant in the U.S. Army Corps of Engineers. He then went on to take courses at MIT in Boston during the summers of 1958 and 1959. While at MIT, Dick was fortunate to be exposed to the world's leading practitioners in soil mechanics and foundation engineering (Professors Terzaghi, Casagrande, and Peck, among others). Dick, with his classmate, CMU lab partner, and friend Dr. Anthony DiGioia, Jr., went on to cofound the firm of General Analytics, which later became GAI Consultants. Dick retired from GAI at the age of 70, after the firm had grown to over 600 employees, where he and Tony earned a reputation as brilliant engineers, excellent leaders, and generous employers. Dick and Tony felt they still had so much to contribute to the engineering world. They decided to "consult," joining together once again to establish DiGioia Gray and Associates, an engineering firm that grew to more than 125 employees before recently becoming part of the larger firm, Gannett Fleming (now GFT). Dick and Tony firmly believed in encouraging and supporting the next generation of engineers, so they established the DiGioia Gray Scholarship at Carnegie Mellon University. Dick was predeceased by his beloved wife and best friend, Audrey Gray, and they shared a wonderful life together for 47 years. Dick was the recipient of countless awards, too numerous to list. Two awards that were close to his heart were receiving the Alumni Achievement Award (2010) from Carnegie Mellon University and the Distinguished Alumnus Award from the Carnegie Mellon University Civil and Environmental Engineering Department (2016). Dick was a prolific and distinguished writer, contributing over 95 publications in print. His efforts included leading the writing team in producing "The Geology of Pittsburgh" for AEG's *Geology of the Cities of the World* series. Dick was an AEG past president and member for over 50 years. Dick never met a rock he didn't like. In collaboration with his close friend and colleague Terry R. West, the two established the West-Gray Scholarship, which provides funding for students in the environmental and engineering geology fields in the eastern portion of the United States to further their studies. Both Terry West and Dick Gray have sustained this important AEG Foundation Scholarship for many years, and numerous college and university students have benefitted from it.

Dr. Anthony DiGioala, Jr. (left) and Dick Gray (right)

▶ Richard's full obituary can be found here.

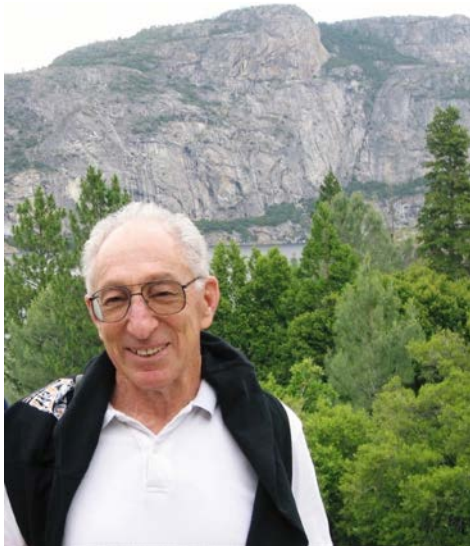
Terry Ronald West, 88, past president of AEG, passed away on Tuesday, March 4, 2025. He received two undergraduate degrees and a master's degree from Washington University in St. Louis and another master's and a Ph.D. (1966) from Purdue University in Civil Engineering & Engineering Geology, respectively—all by age 30. On August 10, 1957, he married Shirley Mueller in St. Louis, Missouri. They were married 67 years. Terry was a full professor at Purdue University in the Earth, Atmospheric & Planetary Sciences Department before retiring at age 85, after 61 years at Purdue. At the time of his retirement, he was the oldest full-time professor. Some of his proudest professional moments were authoring a key engineering geology textbook and serving as the major professor to 88 graduate students during his tenure. He was a long-standing member and tireless advocate for the Association of Environmental & Engineering Geologists. He held the president post, sponsored scholarships, and even convinced Shirley to travel to meetings. Terry was a Purdue multi-sport season ticket holder and enjoyed everything about his beloved Boilermakers. He was known as an avid reader and enthusiastic traveler. He came alive seeing new places and having opportunities to teach and mentor students in his field. Terry leaves an extensive legacy in the students he inspired.

▶ Terry's full obituary can be found here.

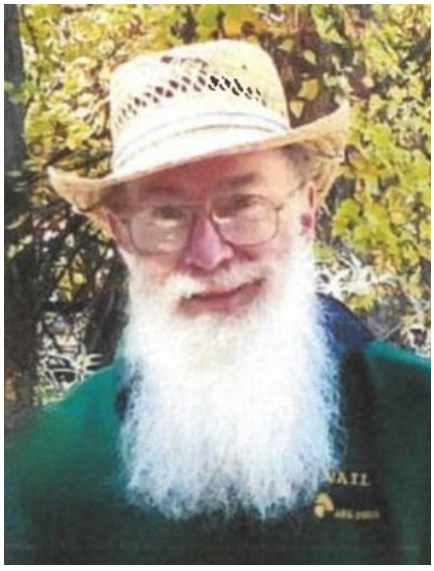
Richard "Dick" E. Goodman, a University of California (UC), Berkeley professor of geological engineering who founded the Berkeley Opera Company, passed away peacefully surrounded by family on March 10. He was 89. He received a bachelor's degree in geology and a master's degree in civil engineering and economic geology from Cornell, and a Ph.D. in geological engineering from UC Berkeley in 1964. Dick became a UC Berkeley professor in 1964, and over the course of his academic career wrote and published five books and over 200 articles in journals and conference proceedings. He retired as professor emeritus in 1994. Dick's exciting life included spending six months in 1957 on Baffin Island, based out of Cape Dorsett, where he worked for Belcher conducting mineral prospecting. He camped among the polar bears in sub-zero temperatures, learned to communicate with the local Inuit people in their language, traveled around the area by dog sled, and survived many harrowing adventures. His many other adventures included consulting projects in every state of the union and throughout South America, Asia, South Africa, and Europe. He traveled to South America countless times for consulting projects. Goodman was a passionate and brilliant musician. In 1979, he founded the Berkeley Opera Company and directed it for 13 years. He put on over 30 full stage productions and performed over 70 major roles in operas for several companies. He was a beloved mentor to 39 Ph.D. students, most of whom were welcomed as family during their doctoral studies and maintained enduring relationships for decades.

▶ Richard's full obituary can be found here.

Ernest "Ernie" Solomon, 89, of Los Altos Hills, California, passed away peacefully in the early morning hours of June 12, 2025, with the music of the Modern Jazz Quartet playing softly beside him. Ernie studied geology at University of California (UC), Berkeley, where he also earned a varsity letter as a member of UC Berkeley's vaunted wrestling team. After graduation, he met the love of his life, Gail, then still a student at UC Berkeley. Ernie and Gail married in 1962 and moved to Palmdale, California, where Ernie worked as an engineering geologist for the California Department of Water Resources on the California Aqueduct. Together, they raised two children, Debra and Aaron, who grew up learning about soil, rocks, and faults at every family outing. Ernie enjoyed a long and successful career as an engineering geologist. He joined Waller Associates and was instrumental in designing the foundations of numerous earth-filled dams and other critical infrastructure throughout California, as well as dam projects in Costa Rica and the Dominican Republic. He was a 50-year member of the Association of Environmental & Engineering Geologists and a testament to his commitment to the field. Ernie was preceded in death by just ten days by his beloved wife of 62 years, Gail Solomon.



▶ Ernest's full obituary can be found here.



Alexander "Sandy" Kunzer, passed away March 27, 2025. He is survived by his wife, Elizabeth "Betsy" Kunzer. He completed a Bachelor of Science degree in chemistry at C.W. Post (now Long Island University). After college, he volunteered in the Army and went to Officer Candidate School (OCS) at Fort Sill, Oklahoma. After OCS (where he earned the nickname "Dead Man" from the number of times he ended up in hospital from the heat), he was detailed to teach missile ordinance at Fort Sill. In his off time, he took a few geology courses, raced cars and, when he was released from the Army, enrolled at the University of Oklahoma, where he got a master's degree in geology. He went to work for Shell Oil at their Denver office in September 1969 as a developmental geologist. However, in 1970 the oil business took one of its downturns, and he ended up working for the Army Corps of Engineers in Buffalo, New York. He worked on de-watering and evaluating the American side of Niagara Falls. In 1973, he transferred to the New Orleans office and worked, among other things, on Lock and Dam 1 on the Red River in the effort to make Tuscaloosa, Texas, a seaport. It was here he became an expert in soils because there was so little rock in southern Louisiana. In 1979, he returned to Denver where he became a dam doctor for the Bureau of Reclamation, Department of Geology. He worked mostly in the Pacific Northwest checking older dams for problems and possible solutions, but he also spent a fair amount of time working on the Senator Wash Dam near Yuma, Arizona. Sandy discovered Sierra Vista on the internet in 1996 and, after visiting in three different seasons, he and Betsy bought land there and started designing their retirement home. In 2001, they retired to Sierra Vista. They traveled, birded, and photographed all over, taking at least one big trip (Alaska, New Zealand, Iceland, Mexico, Belize, Jamaica, Galapagos, Svalbard, Norway, Ireland, Great Britain, Panama, USA) each year but otherwise spent most of their time in Sierra Vista.

▶ Alexander's full obituary can be found here.

Ruth Doggett Terzaghi

October 14, 1903 – March 3, 1992

Honoring 100 Years Since She Earned her Master's Degree at the University of Chicago

Sarah Kalika, AEG Past President

Ruth Terzaghi (née Doggett) was born on October 14, 1903, in Chicago, Illinois. She developed a passion for earth sciences early on, leading her to pursue an undergraduate degree in geology and earth sciences and a Master of Science degree at the University of Chicago.. University of Chicago geology Professor J. Harlen Bretz served as advisor on her master's thesis. She received her Ph.D. in geology from Harvard in 1930. Her first role as a professor was at Goucher College from 1925 to 1926, and the second at Wellesley College from 1926 to 1928.

The beginning of Terzaghi's first mark on geological history was with her master's thesis on the abnormal dips in the Niagaran reefs near Chicago. She completed this thesis in 1925 but would continue to work on it throughout her academic career. It was through this continued research that she met her husband and lifelong scientific partner, Karl von Terzaghi, who she married after receiving her Ph.D. in 1930. Karl von Terzaghi is known as the "father of soil mechanics and geotechnical engineering," so it is no surprise that his pursuits regarding the civil engineering applications of geological research would rub off on his new partner and wife. Her husband had just taken on a role at the Technische Hochschule in Vienna, which sparked an eight-year worldwide geological expedition for the couple. From 1930 to 1938 both Terzaghi and her husband investigated the conditions for several projects worldwide. Ruth traveled with Karl to investigate geological conditions for projects including a 600-foot arch dam in Sulak Canyon in Dagestan, Soviet Russia; a main irrigation canal through loess and broken limestone in central Asia; a rockfill dam in Bou Hanifia, Algeria; a concrete dam on clay sediments to great depth on the Svir River near Leningrad; and numerous foundations and landslides in Europe.

On September 5, 1936, Terzaghi gave birth to her first child, a boy whom they named Eric. Due to tensions regarding her husband's work and the brewing war in Europe, Terzaghi returned to the United States without her husband in 1938, so she could raise her son safely. Following their return to the U.S., Terzaghi assumed her role as a professor, then eventually as a research fellow at Harvard. After Terzaghi agreed to look into the causes of deterioration on one of her husband's older projects, specifically concrete placed on a shipyard, she was published in two technical journals. She equated the deterioration to weathering, findings which impressed the publishers at The Proceedings of the American Concrete Institute and The Journal of the Boston Society of Civil Engineers. Terzaghi's research led to several more opportunities, including an investigation of deteriorating concrete by the Association of American Railroads, research into subsidence after being hired by a chemical plant, and investigating dams (including Hogback Dam in Connecticut and Necaxa Dam in Mexico) with her husband.

In 1931, Terzaghi also published her findings on syngenite in the Mineralogical Society of America's journal, comparing those findings with similar ones on hematite and gypsum. She published the final version in the Journal of Sedimentary Petrology in 1940. In May 1941, they had their second child whom they named Margaret. Terzaghi's publication in The Journal of the Boston Society of Civil Engineers led her to receive their Clemens Herschel Prize in 1950. Her paper titled "Sources of Error in Joint Surveys," published in Géotechnique, paired with her outstanding scientific portfolio, earned her an honorary membership in the Association of Engineering Geologists as the first women ever to be recognized. Terzaghi was elected to Fellowship in the Geological Society of America in 1948. She was a member of the American Concrete Institute and the Boston Society of Civil Engineers, of which she served as chairman of the Structural Section in 1954–1955.

In 1957, she took on another professorship at the Graduate School of Engineering at Harvard. Terzaghi was then hired as a research fellow from 1963 to 1970, all while pursuing her own research and interests in the field of geology. Terzaghi's final contribution to geological research was published in 1965. A culmination of all her experiences and knowledge led to her paper titled "Sources of Error in Joint Surveys," which appeared in Géotechnique.

Her paper titled "Sources of Error in Joint Surveys," published in Géotechnique, paired with her outstanding scientific portfolio, **earned her an honorary membership in the Association of Engineering Geologists—the first women ever to be recognized.**

The Association of Environmental & Engineering Geologist's KARL AND RUTH TERZAGHI OUTSTANDING MENTOR AWARD

This award, established in 2008, recognizes outstanding individuals for their achievements as mentors throughout their career. The recipients have made lifelong efforts in providing professional, ethical, and technical mentoring for environmental and engineering geologists. This special recognition is intended for both our members in academia, where mentoring is a natural part of their job, and our members who have made extraordinary efforts in the workforce, where it is less expected but equally important. Karl Terzaghi, civil engineer, geologist, and professor, and Ruth Terzaghi, geologist, were a renaissance man and woman who profoundly influenced the mode of thought of their contemporaries, consequently initiating new eras in the geologic and engineering practices. They worked as geologists in the field of civil engineering, providing mentoring through wit, wisdom, and labor in advancing both geotechnical engineering education and practice as well as generating the interest of young students, while developing a loyal following.

References

Goodman, Richard E., 1999, Karl Terzaghi: The Engineer as Artist: American Society of Civil Engineers, 352 p.

Ogilvie, Marilyn, and Harvey, Joy, editors, 2000, The Biographical Dictionary of Women in Science, Pioneering Lives from Ancient Times to the Mid-20th Century, Vol. 2, L-Z: Routledge, New York. http://bit.ly/4maT15p

Peck, Ralph B., 1993, Memorial to Ruth Doggett Terzaghi 1903-1992:- Geological Society of America. https://bit.ly/3US3kyW

Rogers, J. David, 2013, Ralph Peck's Circuitous Path to Professor of Foundation Engineering (1930–48): Seventh International Conference on Case Histories in Geotechnical Engineering, Chicago, Illinois, April 29–May 4, 2013. https://bit.ly/4ouVkI6

Additional Resources

Video (no sound) of Ruth and Karl Terzaghi, Arthur Casagrande, Friedrich (Fritz) Schaffernak, and Philipp Forchheimer in 1930. https://bit.ly/4lhZf1R

AEG 2025 Exhibitors

Our exhibitors offer an excellent platform to interact one-on-one with you and your company. Your active interest and participation during the exhibit hours will help to ensure that vendor support will remain strong during the years to come. Remember, without these exhibitors, the AEG 68th Annual Meeting would not be successful!

Exhibit Hall Hours
Tuesday, September 23
6:30 p.m.–8:00 p.m.

Wednesday, September 24
7:30 a.m.–5:00 p.m.

Thursday, September 25
7:30 a.m.–3:20 p.m.

Icebreaker Welcome

Tuesday, September 23, 6:30–8:00 p.m.

Exhibit Hall

Join us in the Exhibit Hall to meet the exhibitors and socialize with your fellow attendees. We will have light appetizers and a cash bar (one drink ticket included for full, guest, and student registrations).

Exhibitor-Hosted Luncheon

Wednesday, September 24, 12:00–1:30 p.m.

Exhibit Hall

The Exhibitor-Hosted Luncheon is a great way to connect with colleagues, gather information about innovations in the industry, and relax with friends old and new over a delicious meal. Free for all full, Wednesday one-day, and student registrations.

Association of Environmental & Engineering Geologists Registration Area

www.aegweb.org

AEG welcomes you to Chicago! We hope your stay is filled with informative technical sessions, great meals, and of course lots of networking. Stop by our booth to see some of the latest publications and merchandise available. We will also have information on the various committees and what each has been working on to advance AEG and the profession.

AEG 2026 Annual Meeting Chattanooga, Tennessee – Booth #3

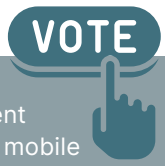
Hawkins Gagnon, Schnabel Engineering, jgagnon@schnabel-eng.com
Scott Walker, TVA, srwalker3@tva.gov

Mark your calendar to join us for the 69th AEG Annual Meeting at the Westin Chattanooga, September 14–20, 2026. Stop by our booth to get all the details.

AEG Foundation – Silent Auction in the Exhibit Hall

Alex Vazquez, staff@aegfoundation.org
www.aegfoundation.org

Established in 1992 by three AEG past presidents, the AEG Foundation plays a key role in the success of our profession. The AEG Foundation's vision is to create a culture of giving back to the profession, and to instill complete confidence in donors that their money is well-invested and well-spent. Our core programs emphasize scholarship, research, and professional development to improve professional practice. We support outreach to increase the public's appreciation of environmental and engineering geology in geohazard evaluation and risk reduction.



Vote for Your Favorite Poster! We will once again be holding a university student poster competition. Voting will be conducted exclusively through the Mobile App, so bring your mobile device to vote for your favorite.
Winners will be awarded at the Poster Reception on Thursday, September 25, 2025, 5:00-6:30pm
All poster presenters will be at their posters during the poster reception.

Acker Drill Company – Booth #23

Robert Stephen Lepre Jr., rlepre@ackerdrill.com
www.ackerdrill.com

Founded in 1916, Acker Drill Company is a leading U.S. manufacturer of drill rigs and tooling for geotechnical, environmental, mineral exploration, mining, and civil engineering industries. Renowned for versatile, high-quality equipment and custom-engineered solutions, Acker has been exporting worldwide since 1960.

Asbestos TEM Labs – Booth #4

Mark Bailey, mark@asbestostemlabs.com
www.asbestostemlabs.com

Asbestos TEM Laboratories was founded in 1989 with the goal of providing the highest quality asbestos testing services. Originally, the company focused on testing samples of building materials for asbestos. Over the years, we have expanded our range of testing services, while shifting the major emphasis of our business towards analysis of hazardous geology-based materials including naturally occurring asbestos (NOA), silica dust, and identification of asbestos in talc products. Conveniently located in Oakland, California (San Francisco Bay Area), Asbestos TEM Labs is the largest provider of NOA testing services on the West Coast and has been involved with virtually all of the largest NOA projects in California and Nevada. We are fully accredited for asbestos, environmental lead, and silica analysis in bulk, soil/rock, air, and water. Our NOA analysts are highly trained in the identification of asbestiform minerals by PLM, PCM, TEM, EDS, and XRD. Our staff includes scientists with backgrounds in geology, crystal physics, biology, chemistry and environmental science.

ASBOG – Booth #20

Deana S. Sneyd, dsneyd@asbog.org
www.asbog.org

ASBOG's mission is to advance licensure examinations for geologists and geoscientists to safeguard the health, safety, and welfare of the public.

Collier Geophysics – Booth #2

Roy Bowling, roy@colliergeophysics.com
www.colliergeophysics.com

Collier Geophysics (Collier) is a world-class provider of near surface geophysics. Collier supports many industries across the nation with subsurface characterization for both federal and commercial clients. Collier has numerous geophysical leaders with a depth of experience in each of the industries that we support.

Colorado School of Mines – Booth #11

Rachel McDonald, rmcdonald@mines.edu
www.mines.edu

Colorado School of Mines is a public R1 research university focused on applied science and engineering. The interdisciplinary program in Geographic Information Systems (GIS) and GeoInformatics focuses on applications of GIS technology, geospatial training, multi-criteria decision-making and quantitative analysis aspects of GIS and remote sensing. The focus is on earth, energy and environmental aspects of GIS. Our program enhances quantitative geospatial data analysis skills, helps the student get ahead of the technology curve and enables professionals to advance their careers.

ConeTec, Inc. – Booth #17

Bruce Miller, bmiller@conetec.com
www.conetec.com

Our teams are positioned throughout our regions to deliver superior site characterization services to the mining, renewable energy, infrastructure, power, construction, and environmental sectors worldwide. We operate a full-service fleet of site investigation equipment for in-situ testing, drilling, sampling, and geophysical profiling. Our truck, track, amphibious, over water, and limited access rigs are deployed from over 20 locations around the world. With an unrelenting focus on safety and innovation, our goal is to assist our clients to build and develop sustainably by using high-quality, trusted site characterization data. That is the ConeTec difference: Better Information, Better Decisions.

Estwing Mfg. Co. – Booth #16

Alicia Magee, amagee@estwing.com
www.estwing.com

U.S. manufacturer of hand tools including rock pick and chisels. Estwing has been in business since 1923.

Field Environmental Instruments – Booth #22

Kelsey Waltman, kwaltman@fieldenvironmental.com
www.fieldenvironmental.com

Established in 1995, Field Environmental Instruments, Inc. (FEI) specializes in the rental, sales, and service of portable monitoring instruments, field equipment and sampling supplies utilized in environmental assessment, investigations, remedial actions, incident response, safety, and compliance services. Thirteen full-service facilities throughout the U.S. offer local delivery, customer pickup, overnight, and ground shipping. FEI's corporate culture fosters integrity, reliability, and responsiveness. These qualities, enhanced through technical expertise, customer service, and advanced systems create value and increase efficiency for FEI's customers. FEI offers an extensive multimillion-dollar inventory of the industry's most technologically current and well-known instruments and equipment.

Geobrugg NA, LLC – Booth #14

Tim D. Shevlin, tim.shevlin@geobrugg.com
www.geobrugg.com

Safety is our nature! True to this guiding principle, Geobrugg has been developing and manufacturing protection solutions since 1951. High-tensile steel wire nets and matching services monitor and protect against natural hazards such as rockfall, landslides, debris flows, avalanches, and coastal erosion. They ensure safety in mining, tunneling, motorsports tracks, industry, and test facilities. With experience, a spirit of research, continuous training, and close cooperation with research institutes, we drive innovation and industry standards.

GEOKON – Booth #8

Shawn Dedeker, sdedeker@geokon.com
www.geokon.com

GEOKON, a 100-percent employee-owned company located in Lebanon, New Hampshire, USA, operates on a worldwide basis through a network of agencies. GEOKON was founded in 1979 by Barrie Sellers and currently has more than 160 employees. GEOKON is a recognized world leader in the manufacture of geotechnical and structural instrumentation due to our quality, responsive customer service and industry-leading designs. Our broad range of geotechnical instrumentation is manufactured at our factory in the USA, by a staff of trained, qualified, and experienced machinists and assemblers.

GEOVision Geophysical Services – Booth #12

Darin Pendergraft, dpendergraft@geovision.com
www.geovision.com

Since 1995, GEOVision has offered services and consulting specialized in the application of geophysics to engineering, groundwater, and environmental investigations. We offer state-of-the-art geophysical services using the most modern techniques and instrumentation to provide cost-effective solutions to solve our clients' problems worldwide. GEOVision services include near surface and borehole geophysical measurement, analysis, and monitoring to provide a better understanding of subsurface geologic and hydrologic conditions; subsurface infrastructure; engineering properties of soil and rock; earthquake hazards and the source, location, and migration of subsurface contaminants.

I.E.S Drilling Supplies – Booth #9

Conrad Iandola, 20slot@gmail.com
www.iesdrillingsupplies.com

I.E.S. Drilling Supplies is a family-owned business, not part of a vast corporation. Our company is very much like the companies we serve: family oriented, responsible, and caring. In 1990, I entered the industry on the drilling side. I was shocked by the lack of inventory, product knowledge, and care that ran

through the supply side of this business. From day one, we have provided a large inventory, quick customer response, and product knowledge to all customers. I wish to extend an invitation to you and your colleagues to put us on your team. We deliver top quality supplies at the right time in the right amounts.

International Association for Engineering Geology and the Environment (IAEG) – Booth #10

Julien Waeber, jwaeber@exponent.com
https://iaeg.info

The International Association for Engineering Geology and the Environment (IAEG) was founded in 1964 and is affiliated to the International Union of Geological Sciences (IUGS). IAEG is a worldwide scientific society with more than 4,857 members and 68 national groups. The aims of IAEG are:

- to promote and encourage the advancement of engineering geology through technological activities and research,
- to improve teaching and training in engineering geology, and
- to collect, evaluate and disseminate the results of engineering geological activities on a worldwide basis.

Maccaferri, Inc. – Booth #18

Michael Koutsourais, m.koutsourais@maccaferri.com
www.maccaferri.com

Maccaferri is a worldwide leader in rockfall protection and geohazard mitigation systems. With over 60 years experience, Maccaferri offers a wide range of rockfall protection and natural hazard mitigation systems for stabilizing rock faces, soil slopes, and snow masses, reducing risks to people and infrastructure. Maccaferri's wide variety of engineered systems provide the highest level of performance in the industry. Product offerings include SteelGrid and RockMesh drapery systems, High Energy Absorption (HEA) cable nets, rockfall barriers, embankments and attenuators, debris flow barriers, and avalanche protection.

Midwest GeoSciences Group – Booth #13

Dan Kelleher, dan@midwestgeo.com
www.midwestgeo.com

Midwest GeoSciences Group serves geologists, engineers, and environmental scientists through training, shared insight, and field tools. We are motivated by serving you with hope that our collaborative efforts help all of us become successful professionals who strive to always improve our God-given talents while achieving effective global stewardship.

Mount Sopris Instruments Company – Booth #6

Kyle Dawson, kyle.dawson@mountsopris.com
www.mountsopris.com

Mount Sopris Instruments is a leading manufacturer of geophysical slimhole borehole logging systems for groundwater, mining, research, geotechnical, and other applications—featuring a complete range of stackable wireline probes, rugged logging winches, versatile data loggers, and best-in-class WellCAD software. Mount Sopris Instruments manufactures, distributes, and rents geophysical equipment and software for subsurface investigations.

Pyramid Geophysics – Booth #19

Eric Cross, eric@pyramidenvironmental.com
www.pyramidenvironmental.com

Pyramid Geophysics is a consulting firm based in Greensboro, North Carolina, offering a full range of near-surface geophysical services. Our instrumentation includes ground penetrating radar (GPR), electromagnetics, electrical resistivity/IP, and seismic methods (refraction and MASW). Specific applications include geotechnical site characterization, geologic mapping (bedrock, stratigraphy, karst, voids), environmental and hydrogeologic surveys, underground storage tank management, landfill delineations, and a variety of other subsurface characterization techniques. Our services are available throughout the United States.

Schnabel Engineering – Booth #15

Hawkins Gagnon, jgagnon@schnabel-eng.com
www.schnabel-eng.com

Schnabel is a trusted partner in building the foundation for project success. We provide specialized expertise and design for geotechnical, tunnel, and dam engineering projects across the United States and worldwide. As an entrepreneurial, employee-owned company of over 600 diverse professionals, we have a passion for client service and tough technical challenges. An ENR Top 250 engineering firm, Schnabel serves both public and private sector clients.

Scintrex – Booth #7

Bill Male, bmale@scintrexltd.com
www.scintrexltd.com

Scintrex is the gravity specialist, meeting all your gravity requirements. With gravity meters like the CG-6 Autograv™ gravity meter, data quality and repeatability are unsurpassed by other meters, whether you will be using it for sinkhole detection or finding a karst hazard or many other applications. We have other gravimeter models as well to meet your other applications such as aquifer monitoring. Contact us to learn more.

SoilFreeze, Inc. – Booth #5

Michael McMillan, mmcmillan@soilfreeze.com
www.soilfreeze.com

SoilFreeze, Inc. is the largest U.S. construction and engineering company specializing exclusively in ground freezing technologies. SoilFreeze has built on that technology over the past two decades playing a major role in “mainstreaming” the benefits of ground freezing for the civil construction industry. SoilFreeze has successfully completed complex and technically challenging excavation support projects throughout the U.S. We provide temporary frozen soil shoring systems to support excavations and provide groundwater cut-off. Our technology can be used for contaminated site remediation, groundwater cut-off and in situ-isolation barriers, foundation excavation shoring, ground stabilization and more.

Terracon Consultants, Inc. – Booth #29

Vicki Zak, vicki.zak@terracon.com
www.terracon.com

Terracon has grown and evolved to become a thriving, employee-owned, multidiscipline engineering consulting firm over the past 60 years. Our more than 7,000 curious minds include engineers, scientists, architects, facilities experts, and field professionals focused on solving engineering and technical challenges from more than 180 locations nationwide. On-time and real-time data driven insights, provided by our talented employee owners, create an unmatched client experience that spans the lifecycle of any project from earth-to-sky.

Total Vapor Solutions – Booth #28

Jim Fineis, jim@totalvaporsolutions.com
www.totalvaporsolutions.com

Total Vapor Solutions (TVS) provides a full range of services dealing with vapor intrusion sites. Services include work plan development, sample collection, risk analysis, and mitigation consulting services. TVS has collected over 50,000 vapor intrusion samples and has conducted work in the majority of the 50 U.S. states and internationally.

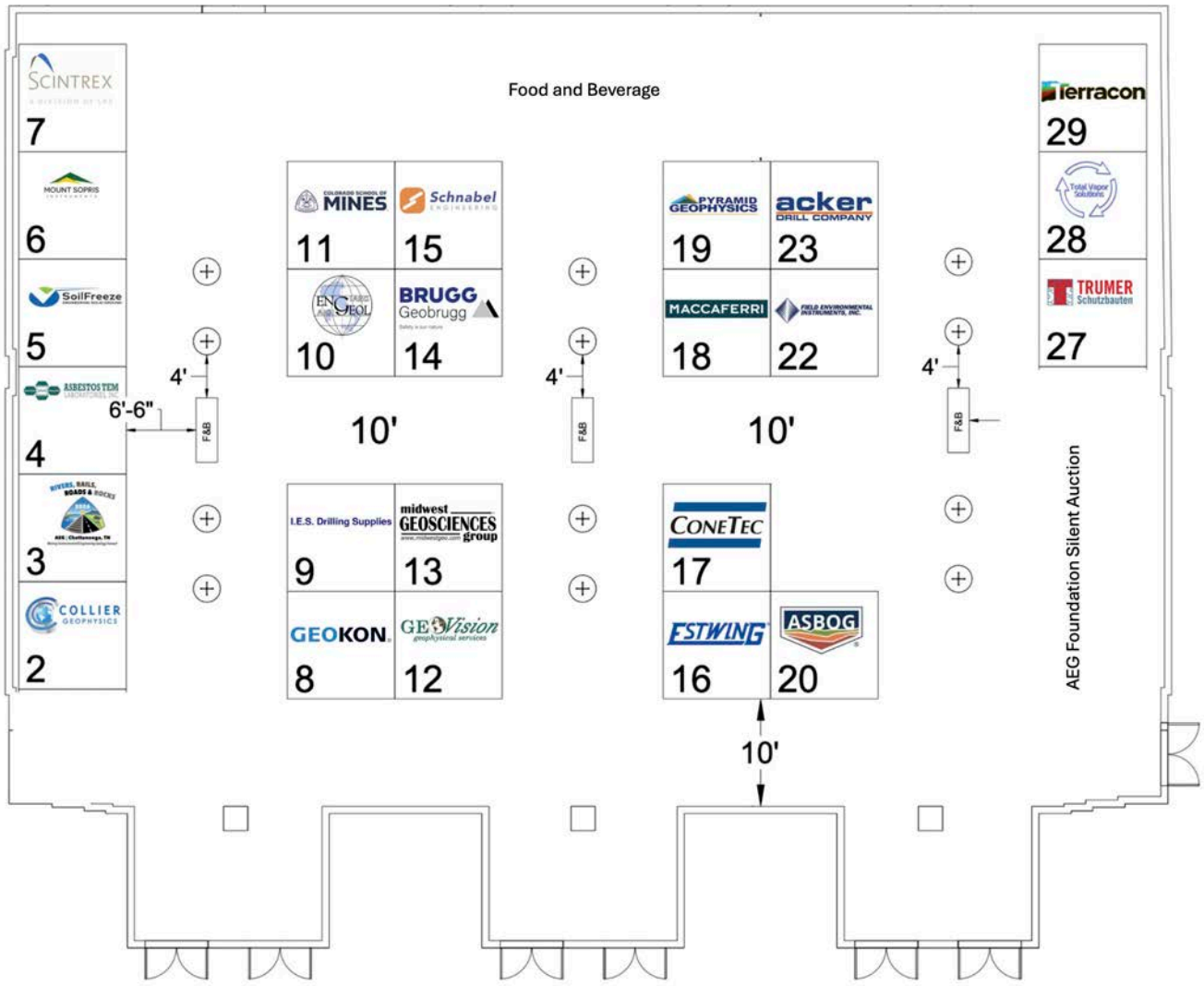
Trumer Schutzabauten Americas Ltd.- Booth #27

Ahren Bichler, a.bichler@trumer.cc
www.trumer.cc

Trumer Schutzbauten is known around the world as a provider of robust and innovative geohazard mitigation solutions for rockfall, debris flow, avalanche, and slope stabilization. From slope mesh to massive barriers, we protect life, buildings, and infrastructure where failure is not an option. Developed at some of the most modern test facilities in the world, there is no better test than nature itself. Our systems prove time and time again that they withstand the most extreme events.

AEG 2025 Annual Meeting Exhibit Hall

September 23-25, 2025
Grand Ballroom



AEG 2025 Annual Meeting Sponsors

Without the help and financial support of the following individuals and companies, it would be impossible to plan the high-quality meeting to which AEG members have become accustomed.

PREMIUM SPONSORS

Opening Session

Geobrugg NA, LLC

Tim D. Shevlin, tim.shevlin@geobrugg.com
www.geobrugg.com

Safety is our nature! True to this guiding principle, Geobrugg has been developing and manufacturing protection solutions since 1951. High-tensile steel wire nets and matching services monitor and protect against natural hazards such as rockfall, landslides, debris flows, avalanches, and coastal erosion. They ensure safety in mining, tunneling, motorsports tracks, industry, and test facilities. With experience, a spirit of research, continuous training, and close cooperation with research institutes, we drive innovation and industry standards.

Technical Sessions
Technical Session #4: GASH Symposium - Advances in Studies of Intraplate Tectonics
Technical Session #8: Environmental Symposium
Technical Session #13: AI/Machine Learning

GFT

Nate Saraceno, nsaraceno@gftinc.com
www.gftinc.com

GFT is a recognized leader in geotechnical and geological engineering. We provide consultation for dams, deep foundations, ground improvement, geohazard mitigation, and risk management, offering innovative solutions to safeguard infrastructure and communities. Our team of geoprofessionals specializes in landslide stabilization, rockfall mitigation, debris flow management, and seismic hazard evaluation. Using cutting-edge technology, including LiDAR, remote sensing, and predictive modeling, we assess and address complex geotechnical challenges for transportation, water, energy, and public sector clients. With decades of experience, we develop customized, cost-effective strategies to enhance resilience and protect critical assets from natural hazards, ensuring safety, sustainability, and long-term performance in diverse and challenging environments.

Lanyard

Maccaferri, Inc.

Michael Koutsourais, m.koutsourais@maccaferri.com
www.maccaferri.com

Maccaferri is a worldwide leader in the supply of rockfall protection and geohazard mitigation systems. We offer a wide range of solutions to stabilize rock faces, soil slopes and snow masses, reducing risks to people and infrastructure. Maccaferri's wide variety of engineered systems provide the highest level of performance in the industry. Product offerings include SteelGrid and RockMesh drapery systems, High Energy Absorption (HEA) cable nets, Rockfall barriers, embankments and attenuators, debris flow barriers, and avalanche protection. Maccaferri's design software suite includes MacRO software for simple and pinned draperies and Mac S-Design for surface strengthening in soil nailing applications.

Giveaway

Scintrex

Bill Male, bmale@scintrexltd.com
www.scintrexltd.com

Scintrex is the gravity specialist, meeting all your gravity requirements. With gravity meters like the CG-6 Autograv™ gravity meter, data quality and repeatability are unsurpassed by other meters, whether you will be using it for sinkhole detection or finding a Karst Hazard or many other applications. We have other gravimeter models as well to meet your other applications such as aquifer monitoring. Contact us to learn more.

GOLD SPONSORS

Icebreaker

Field Environmental Instruments

Kelsey Waltman, kwaltman@fieldenvironmental.com
www.fieldenvironmental.com

Established in 1995, Field Environmental Instruments, Inc. (FEI) specializes in the rental, sales and service of portable monitoring instruments, field equipment and sampling supplies utilized in environmental assessment, investigations, remedial actions, incident response, safety and compliance services. Thirteen full-service facilities throughout the U.S. offer local delivery, customer pickup, overnight and ground shipping. FEI's corporate culture fosters integrity, reliability, and responsiveness. These qualities, enhanced through technical expertise, customer service, and advanced systems, create value and increase efficiency for FEI's customers. FEI offers an extensive multimillion-dollar inventory of the industry's most technologically current and well-known instruments and equipment.

Exhibitor-Hosted Luncheon

I.E.S Drilling Supplies

Conrad Iandola, 20slot@gmail.com
www.iesdrillingsupplies.com

I.E.S. Drilling Supplies is a family-owned business, not part of a vast corporation. Our company is very much like the companies we serve: family-oriented, responsible, and caring. In 1990, I entered the industry on the drilling side. I was shocked by the lack of inventory, product knowledge, and care that ran through the supply side of this business. From day one, we have provided a large inventory, quick customer response, and product knowledge to all customers. I wish to extend an invitation to you and your colleagues to put us on your team. We deliver top quality supplies at the right time in the right amounts!

Poster Presentations and Reception

Terracon Consultants, Inc.

Vicki Zak, vicki.zak@terracon.com
www.terracon.com

Terracon has grown and evolved to become a thriving, employee-owned, multidiscipline engineering consulting firm over the past 60 years. Our more than 7,000 curious minds include engineers, scientists, architects, facilities experts, and field professionals focused on solving engineering and technical challenges from more than 180 locations nationwide. On-time and real-time data-driven insights, provided by our talented employee owners, create an unmatched client experience that spans the lifecycle of any project from earth-to-sky.

SILVER SPONSORS

Special Event

GEOVision Geophysical Services

Darin Pendergraft, dpendergraft@geovision.com
www.geovision.com

Since 1995, GEOVision has offered services and consulting specialized in the application of geophysics to engineering, groundwater, and environmental investigations. We offer state-of-the-art geophysical services using the most modern techniques and instrumentation to provide cost-effective solutions to solve our clients' problems worldwide. GEOVision services include near surface and borehole geophysical measurement, analysis, and monitoring to provide a better understanding of subsurface geologic and hydrologic conditions; subsurface infrastructure; engineering properties of soil and rock; earthquake hazards, and the source, location, and migration of subsurface contaminants.

Student/Professional Networking Reception

Schnabel Engineering

Hawkins Gagnon, jgagnon@schnabel-eng.com
www.schnabel-eng.com

Schnabel is a trusted partner in building the foundation for project success. We provide specialized expertise and design for geotechnical, tunnel, and dam engineering projects across the United States and worldwide. As an entrepreneurial, employee-owned company of over 600 diverse professionals, we have a passion for client service and tough technical challenges. An ENR Top 250 engineering firm, Schnabel serves both public and private sector clients.

Annual Banquet

Susan Steele Weir

Young at Heart

AEG Foundation

Alex Vazquez, staff@aegfoundation.org
www.aegfoundation.org

Established in 1992 by three AEG past presidents, the AEG Foundation plays a key role in the success of our profession. The AEG Foundation's vision is to create a culture of giving back to the profession, and to instill complete confidence in donors that their money is well-invested and well-spent. Our core programs emphasize scholarship, research, and professional development to improve professional practice. We support outreach to increase the public's appreciation of environmental and engineering geology in geohazard evaluation and risk reduction.

International Association for Engineering Geology and the Environment (IAEG)

Julien F Cohen-Waeber, jwaeber@exponent.com
https://iaeg.info

The International Association for Engineering Geology and the Environment (IAEG) was founded in 1964 and is affiliated to the International Union of Geological Sciences (IUGS). IAEG is a worldwide scientific society with more than 4,857 members and 68 national groups.

The aims of IAEG are:
To promote and encourage the advancement of engineering geology through technological activities and research,
To improve teaching and training in engineering geology, and
To collect, evaluate, and disseminate the results of engineering geological activities on a worldwide basis.

AEG Student & Young Professional Support Committee

contact@aegweb.org
www.aegweb.org

The Student & Young Professional Support Committee is responsible for the development and implementation of strategies related to attracting and supporting student and young professional members and related goals in the association's strategic plan. AEG's Student & Young Professional Support Committee accepts applications for travel grants for student members, early career members, and teacher members who attend AEG's annual meetings. These grants are for $500 each and are awarded to current members based on meeting involvement and need. Grants are intended to support association members who might not otherwise be able to attend the annual meeting. Email contact@aegweb.org if you are interested in volunteering on this committee.

Wednesday All Day Coffee

PanGEO, Inc.

Stephen H. Evans, sevans@pangeoinc.com
www.pangeoinc.com

PanGEO is a full-service geotechnical consulting firm based in Seattle, servicing the northwest.

Tuesday and Friday All Day Coffee
Thursday Morning Technical Session Break

AEG Chicago Chapter

https://www.aegweb.org/chicago

Technical Session Breaks
Wednesday Afternoon

AEG Sacramento Chapter

https://aegsacto.wordpress.com/
The Sacramento Chapter of AEG was the original and founding section of AEG in 1957 and proudly supports the 2025 AEG Annual Meeting and the many dedicated members of AEG across the nation.

Friday Afternoon

AEG Carolinas Chapter

http://aegcarolinas.org/
Join AEG and get involved.

TECHNICAL SESSIONS

Technical Session #2 – Tunneling Symposium

Aldea Services, Inc.

Paul Headland, pheadland@aldeaservices.com
www.aldeaservices.com

Aldea specializes in the design and construction of underground structures and has worked on some of the most challenging and important underground infrastructure projects in North America. Aldea's vast experience in managing large tunneling and heavy civil engineering projects enables us to provide unrivaled support to our clients and confidence in our work. Our work spans the United States and extends around the world. We are equipped with the best minds in the industry providing leadership and direction in all facets of heavy civil engineering project management.

Technical Session #5 – Dams and Levees Symposium

RJH Consultants, Inc.

Kevin Mininger, kmininger@rjh-consultants.com
www.rjh-consultants.com

RJH is a design firm providing our clients with dam and levee engineering expertise typically associated with a large firm, but with a philosophy of client service more commonly associated with a small firm. Dam and levee engineering is the core practice of our firm, not just a subset of other service lines, comprising over 90 percent of our work. Whether we are designing a new dam, rehabilitating an existing dam, or inspecting a levee system, we leverage this specialized experience to guide our clients through the design and regulatory processes needed to deliver exceptional results.

Technical Session #7 - Geologic and Seismic Hazards; Technical Session #9B - Geophysics and Climate Change: Impacts on Infrastructure and the Built Environment; Technical Session #10 - Landslides; and Technical Session #14 - Site Characterization

Thursday All Day Coffee and Wednesday Morning Technical Session Break

Geosyntec Consultants, Inc.

Elson "Chip" Barnett, Chip.Barnett@Geosyntec.com
www.geosyntec.com

Since 1983, Geosyntec has served municipalities and government agencies providing services in water resources, civil engineering and design, environmental consulting, geotechnical engineering, and construction management. Geosyntec provides specialized geotechnical and geological services for public and private sector clients nationwide. We are a practice-centered business with a strong desire for continuous self-improvement and ongoing reinvention to meet the evolving needs of our current clients and to productively engage with new ones.

Field Course #1: Geologic Trip down the Chicago Area Waterway

Kevin Richards, kevinsrichards1@gmail.com
AEG Emeritus Member

Student Mini Grant

Bryan Environmental Consultants, Inc.

Patricia Bryan, pbryan@bryanenv.com
www.bryanenv.com

Founded in 2014, Bryan Environmental Consultants, Inc. (BEC) provides full-service environmental consulting services to the greater Chicagoland area and the Midwest. Our clients are municipalities, industries, DOTs, and the financial, real estate, and healthcare sectors. We specialize in due diligence projects, site investigations, and remediation. With its deep industry and technical expertise, BEC consistently delivers quality, cost-effective environmental consulting services to advance your project.

Past Presidents' Luncheon

DiabloGeo Environmental Consulting

Sarah Kalika, skalika@diablogeo.com
www.diablogeo.com

DiabloGeo Environmental Consulting is a California-based woman-owned independent consultancy who provides over 20 years of expertise in naturally occurring asbestos, Phase I ESAs, asbestos & lead prerenovation/demolition surveys, and health & safety training (on-site or remote). Contact us for teaming opportunities and small projects. Licensed as a PG, CAC, and CDPH lead paint inspector/assessor/supervisor in California.

Earth Consultants International

Eldon Gath
gath@earthconsultants.com
www.earthconsultants.com

Jeffrey Keaton, jeff.keaton@wsp.com

CORPORATE SPONSORS **2024-25**

EVEREST

EAI, Inc.
Robert Carvalho / robc@eaienviro.com
www.eaienviro.com

DENALI

Scintrex Ltd.
Bill Male / bmale@scintrexltd.com
https://scintrexltd.com

Maccaferri
Mike Koutsourais / m.koutsourais@maccaferri.com
www.maccaferri.com/us

Geobrugg
Tim Shevlin / Tim.Shevlin@geobrugg.com
www.geobrugg.com

U of Penn
lps@sas.upenn.edu
https://www.lps.upenn.edu/hs/msgo

GLACIER PEAK

BGC Engineering, Inc
Tony Monasterio / tmonasterio@bgcengineering.ca
www.bgcengineering.com

KILAUEA

Earth Consultants International
Eldon Gath / gath@earthconsultants.com
www.earthconsultants.com

ConeTec
Kelly Cabal / kelly.cabal@conetec.com
www.conetec.com

2025 Technical Program

Opening Session

Wednesday, September 24,
8:00 a.m. – 12:00 p.m.

KEYNOTE SPEAKERS

Dr. Timothy Stark
Professor of Civil & Environmental Engineering
University of Illinois Urbana–Champaign

Elevated Temperatures in Landfills—Recent Cases and Best Practices

Understanding Subsurface Elevated Temperature (SET) events is critical for properly operating a municipal solid waste (MSW) facility. Once a SET event initiates in a MSW landfill, it is difficult to isolate and/or contain the event. Usually, operators take a "wait and see" approach, which delays implementation of techniques to isolate and contain the SET event. This presentation will provide recommendations and suggested best management practices to reduce the impacts of a SET event and allow the landfill to properly collect landfill gas without initiating and/or expanding the SET event. This presentation will also discuss proposed changes to the U.S. Environmental Protection Agency (EPA) New Source Performance Standards (NSPS) and National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations for landfills under sections 111 and 112, respectively, of the Federal Clean Air Act to reduce the potential for a SET event to occur.

Timothy D. Stark is a professor of civil and environmental engineering at the University of Illinois Urbana–Champaign with an expertise in geotechnical engineering. In particular, Dr. Stark has been conducting research and teaching on the static and seismic stability of natural and manmade slopes, dams, embankments, and earth structures for over 30 years. He has received a number of awards for his research, teaching, and service activities including the 2024 Distinguished Member, American Society of Civil Engineers (ASCE); the 2023 J.E. Jennings Award, South African Institution of Civil Engineers; the 2023 Martin S. Kapp Lectureship, Geo-Institute Met Section; 2022–2023 Cross-USA Lectureship from ASCE; 2022 T.H. Wu Lectureship at The Ohio State University; 2019 George H. Norman Medal, ASCE; Best Paper in *Geosynthetics International* Journal, 2016; 2015 James M. Hoover Lectureship at Iowa State University; Thomas A. Middlebrooks Award, ASCE, 2013 and 1998; and Associate Editor Award, *Journal of Geotechnical and Geoenvironmental Engineering*, ASCE, 2012.

Dr. Thomas Oommen
Professor & Chair, Department of Geology and Geological Engineering
University of Mississippi

Environmental and Engineering Geology in a Data-Driven World

Environmental and engineering geology integrate geologic principles with engineering concepts to meet growing demands in infrastructure development, resource management, and disaster resilience. With the global population projected to reach 9.8 billion by 2050, mounting environmental pressures and climate variability emphasize the need for innovative, data-driven solutions. The field has traditionally focused on constructing critical facilities, such as dams, tunnels, and other subsurface structures, and mitigating hazards like floods, landslides, and earthquakes. It has now expanded its scope to promote sustainable development and environmental stewardship.

In this new era, high-resolution remote sensing, advanced numerical simulations, and artificial intelligence enable more robust interpretation of vast geoscience datasets, from mapping flood extents using synthetic aperture radar to classifying complex soil textures for engineering geology. These technologies significantly enhance hazard prediction, resilience-building, and resource planning when integrated with open-access data and global

repositories. Incidents like the Edenville Dam failure emphasize the critical need for proactive data analysis and decision support systems. By embracing emerging technologies and forging collaborations across academia, government, and industry, environmental and engineering geologists can play a pivotal role in ensuring that critical infrastructure and natural systems remain resilient and sustainable.

Thomas Oommen is professor and chair of geology and geological engineering at the University of Mississippi. He began his academic career at Michigan Technological University, serving 13 years in geological engineering and progressing from assistant to associate to professor. He has contributed significantly to understanding earth materials, geologic processes, and geohazards, applying those insights to engineering and hazard mitigation. Oommen's research leverages remote sensing and machine learning to address critical issues in site characterization, infrastructure monitoring, and geohazards. Recognized for developing collaborations across academia, government, and industry, he has secured over $12 million in research funding from various agencies and industry partners, authored over 100 peer-reviewed journal publications, and advanced transformative approaches to engineering geology. An active leader, Oommen has served as past chair of the Geological Society of America's Environmental and Engineering Geology Division. He currently chairs the American Society of Civil Engineers–Geo-Institute's Engineering Geology and Site Characterization Committee, is chair of the Awards Committee of the American Geophysical Union Natural Hazards Section, and is AEG's co-editor for the *Environmental & Engineering Geoscience* journal. With a strong commitment to mentorship, he guides students and cultivates a supportive, research-focused environment.

AEG/GSA RICHARD H. JAHNS DISTINGUISHED LECTURERS

2024-25 Lecturer – Dr. John Kemeny

Professor (retired), University of Arizona; cofounder, Split Engineering (acquired by Hexagon Mining)

Combining the New with the Old to Solve Rock Engineering Problems in the 21st Century

Rock engineering involves the design and ongoing safety assessment of important rock structures such as slopes, underground excavations, and dam and bridge foundations. Many advancements have been made in this field in the past 100 years, starting with rock and fracture mechanics and most recently the developments in advanced numerical modeling, AI, and modern geospatial techniques. Rock engineering is faced with two major obstacles at the present time, the rising world population and the effects of climate change. Climate change is causing an increase in rock failure events, and an increased population makes it more likely that humans will encounter a rock failure event. Addressing these obstacles involves the creative and innovative combination of established techniques (rock mechanics, rock fracture mechanics) along with some of the newest developments (AI and modern geospatial).

Combining the old with the new to solve rock engineering problems in the 21st century has been the overriding theme of my 2024–2025 Jahns lectureship. In this AEG presentation, I will give an overview of the five talks that were developed for my 2024–2025 Jahns lectureship. Two of these talks discuss established techniques in rock engineering:

- Rock Mechanics, Geomechanics, Rock Engineering: What's It All About (and What Are the Career Opportunities)?
- Why is that Unstable-Looking Rock Slope Still Standing, and When Can We Expect It to Fail: An Introduction to Rock Fracturing, Time-Dependent Fracturing, and Rock Bridges

Another two of the talks discuss the use of very new technologies and ideas in rock engineering:

- Innovative Monitoring and Characterization Technologies (with the Help of AI) for Combatting Geologic/ Hydrologic Hazards Associated with Climate Change
- Everyday Geospatial: New Technologies Anyone Can Afford for 3D Field Scanning, Point Cloud Processing, Rock Mass Characterization, and Slope Stability

A final talk discusses the benefits of considering entrepreneurship in rock engineering:

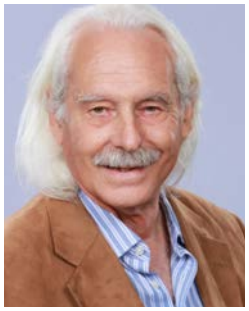
- Entrepreneurship in Applied Geology: Why Your Next Career Move Could Be an Innovative Small Business Startup

These five talks are meant to stress the importance of this topic in applied geology, as well as the satisfaction of a career in this field, which is both challenging and utilizing some of the latest technologies and innovations. Students and young professionals will no doubt be continuing to incorporate the new with the old to solve ever-more complicated applied geology problems in the years to come, and this points to the importance of a diverse educational background that includes geologic and environmental foundations along with engineering and other scientific fields.

Dr. John Kemeny has over 40 years of experience in the applied geoscience fields during a career that has included work at a geomechanics consulting company, a postdoc at the Lawrence Berkeley National Lab, 33 years as professor at the University of Arizona, and cofounding a successful startup company that became a world leader in vision-based rock fragmentation measurement software and point cloud-based rock mass characterization software. He earned B.S. degrees in geology and math from the University of California, Santa Barbara, in 1977, and he earned M.E. and Ph.D. degrees focusing on rock mechanics from the University of California, Berkeley, in 1982 and 1986. He began his career in the Department of Mining and Geological Engineering at the University of Arizona in 1989, retiring as emeritus professor in 2022. At the University of Arizona, Dr. Kemeny published over 170 papers, gave over 80 invited technical talks and workshops, and graduated 15 Ph.D.s and more than 50 master's students with research and teaching focused on rock mechanics, slope stability, rock fracture mechanics, numerical simulation in rock mechanics, and developing 3D imaging and sensing technologies for geotechnical applications. In 1998, he co-founded Split Engineering with three students, a spinoff company focused on new technologies for measuring rock fragmentation and point cloud processing software for slope and underground stability. The company had offices in the U.S., Chile, Peru, South Africa, and Australia and was acquired by Hexagon Mining in 2019. Since retiring from the University of Arizona, Dr. Kemeny has recently started another company involved with integrating AI into the applied geology fields to help combat the increasing hazards due to climate change.

2025-26 Lecturer – Dr. Chris Stohr

Founder & president, Applied Geo-Imaging Solutions, Inc.; engineering geologist, Illinois State Geological Survey



Chris Stohr continues professional and community work after more than 40 years of applied geology, research, and humanitarian work in the midwestern U.S., Africa, and South America. Obtaining a B.S. in geology at Saint Joseph's College in Rensselaer, Indiana, with a minor in philosophy/theology, and a M.S. in engineering geology at Purdue University developing applications for innovative digital image processing of remotely sensed imagery at the Laboratory for Applications of Remote Sensing, Dr. Stohr began work at the Missouri Geology and Land Survey performing investigations for dams, sewage lagoons, hazardous and nuclear waste sites, dye tracing, dumps and landfills in the Ozarks and throughout that state; directed an inventory of 3,600 dams; and

conducted a site selection study for hazardous waste disposal facilities in Missouri. He worked as part of a Shannon and Wilson team conducting special fault studies, reconnaissance mapping, trench mapping and paleomagnetic studies for a nuclear power plant in central Iran using U.S. Nuclear Regulatory Commission (NRC) procedures.

At the Illinois State Geological Survey (ISGS), Prairie Research Institute, University of Illinois Urbana-Champaign, he participated in or led research on landslides, trench covers, groundwater, agronomic analysis of lake sediments, downhole geophysics, precision agriculture, remote sensing, coastal erosion, close range photogrammetry and terrestrial and aerial laser scanning, archeology, glacial geology, Height Modernization (geodetic surveying), and geologic sequestration of carbon dioxide.

ISGS investigations at the Earthline Industrial Chemical Waste Landfill identified failure mechanisms and the observed different drainage characteristics of depressions in earthen covers of landfills using post-sunset thermal infrared imagery (Autometric Award), which became the focus of a Ph.D. dissertation. Dr. Stohr has investigated dumps and legacy landfills in the midwestern U.S., Egypt, Malawi, and Patagonia, Argentina.

Dr. Stohr was a Fulbright Senior Specialist at Beni Suef University, Egypt, and participated in and led international humanitarian development projects in Malawi, Africa. He is a Professional Geologist and Certified Engineering Geologist in Illinois and Oregon and sits on the Illinois Board of Licensing for Professional Geologists. He served as thrice-elected member of the Champaign County Board and twice appointed to serve on the Mahomet Aquifer Council and is an active member of American Society for Photogrammetry and Remote Sensing (ASPRS), AEG, and the Geological Society of America (GSA).

Synopses of Planned Jahns Lectures

Christopher Stohr, Ph.D., PG
chair.aeg.chicago@gmail.com

Retrospective of the Earthline Hazardous Waste Landfill Failure, a Case Study of Legacy Landfills and Dumps

Subject of a landmark, legal precedent-setting trial, an unlined, hazardous waste landfill was said by experts “not to leak in 100 years”; however, contaminants were detected in monitoring wells 3 meters from the burial trenches only 3 years after closure. Field and lab tests and remote sensing measurements showed causes for the faster-than-predicted contaminant migration from a hazardous waste landfill, but why? Numerous landfills are similarly constructed throughout the world.

Protecting Groundwater Quality Through Improved Landfill Field Inspections and Records for Maintenance Using Freely Available Imagery

Legacy dump and sanitary landfills are cemeteries of wastes including some that are no longer permitted to be generated or buried. Unfortunately, infiltration from precipitation through deformed, thin earthen covers contributes to leachate generation that escapes through the unlined bottom and sides, continuing surface and groundwater contamination. The Earthline Hazardous Waste Landfill is a well-studied example of landfill operations, design, and contamination.

Regulatory landfill inspections mostly rely upon institutional memory and traditional “walk over” inspections to identify flaws and deficiencies for written reports. However, most of these defects can be identified and mapped by Geographic Information Systems (GIS) and image processing of freely available airborne lidar, historical black and white photography and modern color infrared orthoimagery to direct low-cost, spot repairs for maintenance and custodial care to reduce undesired contamination from legacy waste structures.

Navigating a Career in Environmental and Engineering Geology—*Make a Living and a Difference to Heal a Hurting Planet*

Planning and preparing for a career is difficult. A geoscientist might have many careers in environmental, engineering, mining, and related disciplines requiring both a breadth and depth of

knowledge of geoscience including multiple technologies.

So much applied geology work affects public health and safety that professional licensing is required just as other professions such as engineers, physicians, and architects. A working professional should become licensed and keep abreast of developing technology and best practices through continuing education in an increasingly sophisticated profession. Professional organizations can help not only with technical skills, but also informal practical help with "buried knowledge," listening, leadership, organization, and physical and mental wellness.

Participation in activities outside of professional work offers diversion and respite that offset the intense pressures of client-driven obligations with family and community concerns. Examples of international humanitarian development projects, volunteer, appointed and elected offices in working and post-work careers are illustrated.

Outcrop Measurements in Glacial Materials Which Became a Focus for Groundwater Protection

Close range photogrammetry, terrestrial laser scanning and geodetic surveying methods were employed for mapping and measuring subsurface clast pavements and glacial meltwater channel phenomena along a remote stream in east-central Illinois. The buried channels consistent with deltaic distributary systems formed in front of retreating ice margins, provide an important source of groundwater in east-central Illinois for areas not underlain by the regional Mahomet Aquifer.

This is an example of an academic study with no apparent immediate use. However, health and safety concerns following the accidental escape of natural gas stored in a subsurface saline reservoir and the development of an ordinance for Carbon Capture and Storage (CCS) (or carbon dioxide sequestration in deep saline reservoirs) raised the academic study to the nexus of science and public policy with lively public interest. This talk provides an insight into geoscience in politics.

Detailed Image Interpretation of Thermal Infrared, Orthophotography, and Lidar Imagery for Geographic Information System-based Tracking of Features of Interest on Legacy Landfill Covers

Infiltration of precipitation through earthen landfill covers contributes to leachate generation that can leak through the unlined bottom and sides of closed dumps and sanitary landfills. Several technologies (multi-date and multi-band aerial photography, airborne lidar, post-sunset thermal infrared imagery) were tested for identifying defects in landfill covers including depressions, erosion, landslides, and areas of interest. Features of interest for field examination were identified by enhancing and comparing multiple dates of imagery using conventional photointerpretation cues and mapping/tracking the features with GIS and a relational database. This is a more technically focused discussion of lecture #2.

Short talks on

- Interpretation of Oblique Aerial Photography and Remote Sensing for Landslide Identification, Classification, and Inventory
- Detecting Carbon Dioxide Emissions in Soybeans by Aerial Thermal Infrared Imagery
- Downhole, Natural Gamma Logging for Engineering & Environmental Applications of Quaternary Geology Mapping
- Rio Gallegos Legacy Dump and Rising Sea Level in Southern Patagonia
- Some Engineering/Environmental Geology Problems of Beni Suef, Lower Egypt
- Quarry Wall Relaxation, Block Sliding, and Seismic Events Occurring in Chicago Metropolitan Area
- Describing Earthen Landfill Cover Soil Cores
- What Influence Does a Geoscientist–County Elected Official Have on State and National Politics? More Than You Would Think.

AEG 2025 Outstanding Environmental and Engineering Geology (OEEG) Project Award The Tunnel and Reservoir Plan (TARP)

By the Metropolitan Water Reclamation District of Greater Chicago

A tunnel boring machine, used in the construction of the MWRD's TARP deep tunnels, can be lowered through a drop shaft in separate pieces and assembled underground. Technological advances now allow boring machines to tunnel up to 200 feet in length per day.

Introduction

The Tunnel and Reservoir Plan (TARP) was adopted in 1972 as the Metropolitan Water Reclamation District of Greater Chicago's (MWRD) innovative and cost-effective plan to protect the region's prized water resources and mitigate area flooding. Now over 50 years in the making, TARP has made a resounding impact on the quality of life for the Chicago region and its water, thanks to an ambitious vision and irrepressible implementation through the bedrock of 400-million-year-old limestone. The ambitious TARP system helped the MWRD comply with federal and state water quality standards with respect to the region's combined sewer area consisting of the City of Chicago and 51 suburban municipalities, and today, TARP stands as a benchmark against which other cities around the world have attempted to measure.

General Overview

TARP's main goals are to protect Lake Michigan's drinking water supply from raw sewage, improve the water quality of area waterways, and provide an outlet for area floodwaters to reduce street and basement sewage backup. The TARP tunnels consist of four separate large diameter, deep underground tunnel systems designed to reduce pollution and flooding in the Chicago area caused by combined sewer overflows (CSOs), which are mixtures of stormwater and sewage. Before the tunnels were built, CSOs would discharge to area waterways,

A tunnel boring machine is “daylighting” as it completes one of the initial TARP deep tunnel bores.

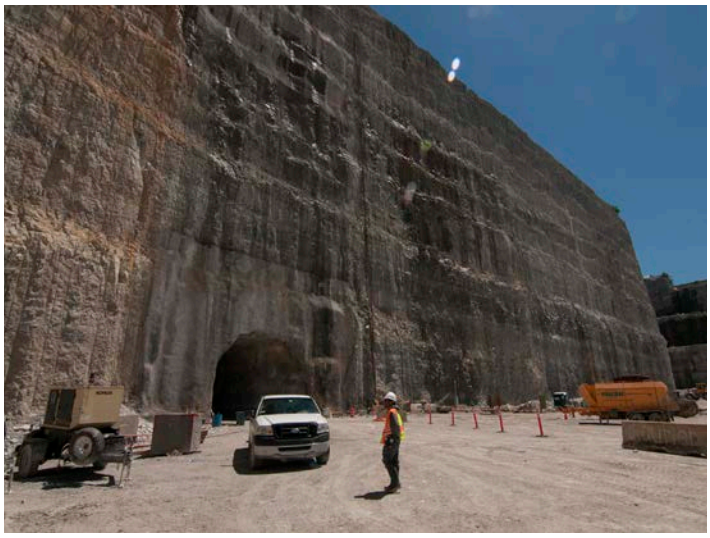
A segment of deep tunnel is lined with concrete, while the process of placing the forms for the next tunnel segment awaits a concrete pour and liner.

including Lake Michigan on occasion, and caused flooding due to basement sewer backups. The combined sewage is now intercepted by drop shafts and redirected to the TARP tunnels. The TARP tunnels convey this polluted water to large reservoirs for storage following heavy rainfall events. After storm events subside, this stored combined sewage is pumped to water reclamation plants on the surface to be treated, and the clean water is then discharged back to area waterways. The framework for TARP began in 1965 as an interagency effort between the MWRD, the City of Chicago, and the State of Illinois. Technical advisory committees reviewed and evaluated more than 50 alternative plans, and the final TARP plan was adopted on October 26, 1972, by the MWRD Board of Commissioners, eight days after the federal Clean Water Act was passed. The final TARP plan was a composite of the best eight alternatives based on the technical advisory committee evaluations. After designs were completed and contracts advertised and awarded, the construction of the tunnels began in 1975. The system began partial operation in the 1980s, and the tunnels were fully completed in 2006.

TARP Infrastructure

The TARP system consists of 110 miles of deep, concrete-lined tunnels with diameters up to 33 feet and located at depths of up to 300 feet below the surface. TARP comprises four separate tunnel systems with a total tunnel capacity of 2.3 billion gallons. The system includes 264 drop shafts, some as wide as 25 feet in diameter, 19 construction shafts, three major pumping stations, and over 600 near-surface connecting and regulating structures.

The completed Thornton Connection Tunnel links the Calumet Tunnel System to the newly completed Thornton Composite Reservoir. In the background, the tunnel plug would be removed to create a live connection to the new reservoir.



Looking east from the floor of the Thornton Composite Reservoir 300 feet below the surface, the highwall is present along with a 30-foot diameter portal opening to the Calumet Tunnel System.

The Majewski Reservoir contains up to 350 million gallons of combined sewer overflow water and serves the TARP Upper Des Plaines Tunnel System. The downtown Chicago skyline to the southeast is visible in the background.

Innovation

The design of TARP demonstrated a high level of creativity and vision, as it was the first project to use deep tunnels to store combined sewer overflows. While the goals of improving water quality in area waterways and protecting Lake Michigan's drinking water supply could have been achieved through more traditional methods—such as replacing the existing combined sewer infrastructure with new, separate storm and sanitary sewer systems—this approach would have been impractical for a metropolitan area as large as Chicago. In addition, undertaking such a project would have been cost prohibitive and caused significant disruptions, requiring the excavation of old sewers, managing conflicts with existing utilities, establishing new service connections for every residential and commercial property, and repaving thousands of miles of roads. TARP was an innovative hybrid solution that delivered maximum environmental and public health benefits while minimizing disruption to the community.

Tunnels

The deep tunnels were constructed at depths of 150 to 300 feet underground to convey the captured polluted waters by gravity to reservoirs that would be mined at the termination of the tunnels. Resourceful techniques were required to create construction access shafts to reach the required tunnel depths, with a combination of vertical overburden removal, controlled rock blasting, and vertical boring at more sensitive locations. At the base of the shafts, additional rock blasting was utilized to create large chambers used to launch tunnel boring machines (TBMs). Once the access shafts and chambers were constructed, TBMs were lowered in pieces by cranes down to the chambers and then assembled underground for mobilization. The TBMs extended up to 300 feet in length. The use of TBMs was a relatively new and unproven technology at the start of TARP. When tunnel boring began in the mid-1970s, the machines could tunnel up to 50 feet per day. As technology improved into the 1990s and 2000s, new machines could tunnel up to 200 feet per day. Another example of the innovation associated with TARP is the substantial pump stations necessary to dewater the tunnels, pumping flows up to the surface to water reclamation plants for treatment. The largest pump station, for example, was designed to operate with redundant pumps capable of pumping 700 million gallons per day at 330 feet of head.

Reservoirs

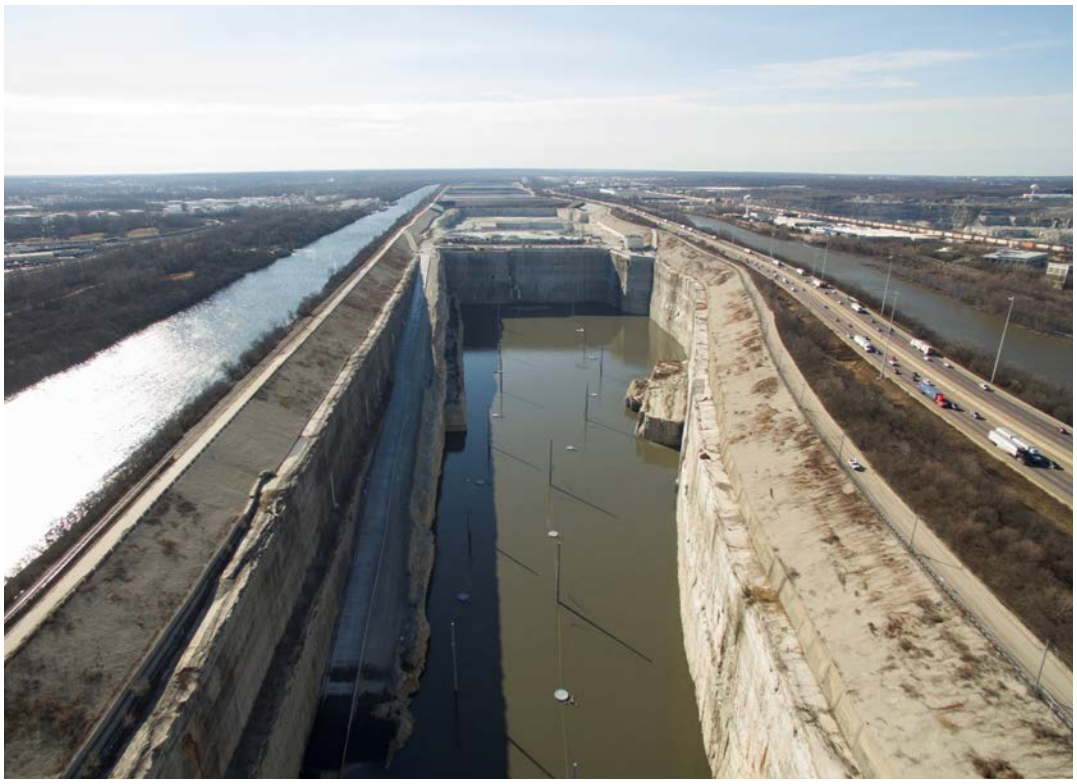
The TARP system is comprised of three separate reservoirs that are connected to the tunnel systems.

The Upper Des Plaines Tunnel System is tributary to the Gloria Alitto Majewski Reservoir and was originally named the O'Hare Chicagoland Underflow Plan (CUP) Reservoir due to its proximity to Chicago's

Viewed to the east, Thornton Composite Reservoir measures 300 feet deep, one half mile long, and approximately one third of a mile wide, with a capacity of 7.9 billion gallons of combined sewer overflow and floodwater storage.

O'Hare International Airport. It was commissioned in 1998 as the first operational TARP reservoir. The Majewski Reservoir is the smallest of the three TARP reservoirs, with a capacity of 350 million gallons, and is sealed with a high-density polyethylene liner to prevent exfiltration into the surrounding earth. After storm events, CSO water captured and held by the Majewski Reservoir is treated at the MWRD Kirie Water Reclamation Plant in Schaumburg, Illinois. Once the pollutants have been removed and flooding is no longer a risk, water is then discharged to Higgins Creek.The Calumet Tunnel System is tributary to the Thornton Reservoir, which was commissioned in 2015 as the Thornton Composite Reservoir (TCR). The TCR is located in the expanded north lobe of Thornton Quarry, one of the largest active aggregate quarries in the world. In existence since the 1860s and owned by Heidelberg Materials, the quarry was chosen as an ideal site for the reservoir due to its highly impermeable dolomite bedrock and its proximity to the Calumet Tunnel System. The MWRD reached an agreement in 1998 to allow the former quarry owner, Hanson Material Service, to expand and mine the quarry's north lobe, after which the MWRD would take ownership and complete the necessary construction improvements to convert the expanded north lobe into an operational CSO reservoir. As a primary defense against CSO seepage into the aquifer, an approximately 9,800-foot continuous double-row grout curtain was constructed around the reservoir perimeter. From the surface, four-inch holes were drilled at 5-foot intervals at a 15-degree angle to a depth of up to 500 feet and were subsequently filled in stages with pressurized grout. State of the art drilling and grouting techniques and equipment were used on the project. The TCR is currently the largest CSO facility in the world, covering an area of approximately 83 acres. It measures 2,480 feet long, 1,580 feet wide, and 300 feet deep, and the design included an allotment for 4.8 billion gallons of CSO storage and 3.1 billion gallons of overbank floodwater from Thorn Creek for a total capacity of 7.9 billion gallons. After heavy rainfall events have ended, CSO water is pumped to the Calumet Water Reclamation Plant for treatment prior to discharge to the Little Calumet River.

The Mainstream and Des Plaines Tunnel Systems are tributary to the McCook Reservoir, which is located within the MWRD Lawndale Avenue Solids Management Area (LASMA) in Bedford Park, Illinois. The McCook Reservoir is being constructed in two stages. The first stage, with a capacity of 3.5 billion gallons for CSO floodwaters, became operational in 2017. The second



McCook Reservoir Stage 1 takes on water to protect 37 communities while surrounded by the Chicago Sanitary and Ship Canal (left), Interstate 55 (Stevenson Expressway), the Des Plaines River (right), and the McCook Reservoir Stage 2 to the southwest, which is under construction.

stage will add another 6.5 billion gallons of capacity, bringing the total volume of the McCook Reservoir to 10 billion gallons. Water will transfer from Stage 1 to Stage 2 through two connecting tunnels bored through a rock dividing wall. The completed reservoir will measure approximately 6,400 feet in length, 1,000 feet in width, and 300 feet in depth. It protects residents of Chicago and 37 surrounding suburban communities from flooding by capturing CSO water that would have previously overflowed into local waterways during periods of heavy rainfall. Once storms have passed, the stored CSO water is pumped from the reservoir to the MWRD Stickney Water Reclamation Plant, where it is treated before being discharged into the Chicago Sanitary and Ship Canal.

Water Quality Benefits

Chicago is located along the shores of Lake Michigan, one of the five Great Lakes on the North American continent. The Great Lakes encompass one of the largest freshwater surface ecosystems on planet Earth and are the primary drinking water source for more than 40 million people, including 5 million people within 120 communities in the metropolitan Chicago area. The implementation of the TARP system helps protect Lake Michigan by capturing and storing CSOs during heavy rainfall events that would otherwise discharge into the local waterways and, during severe storms, often backed up into Lake Michigan, polluting the water supply. When completed, the reservoirs will cumulatively provide 18.2 billion gallons of additional CSO storage volume, which is nearly eight times the amount that can be captured in the tunnels alone. With 11.8 billion gallons of reservoir volume already in service, CSOs, sewer backups, and flooding in the service area have been greatly reduced. Other improvements have also been realized regionally, including an increase in the number of fish species in the Chicago Area Waterway System—from only 10 in the 1970s to 77 today. Additionally, tremendous improvements in water quality parameters have been measured in area waterways, including increased levels of dissolved oxygen and lower levels of suspended solids, ammonium as nitrogen, and fecal coliform. The improved water quality has also led to increased recreation, development, and property values along the Chicago area rivers, which have now become a much larger public amenity and tourist attraction.

Lessons Learned

Hydraulic modeling capabilities have improved significantly since the early computer models of the 1970s that ran simulations of

Water surfaces inside the Thornton Composite Reservoir, while the 300-foot-tall reservoir highwall and portal to the Calumet Tunnel System appear in the background.

various rainfall events during the initial tunnel design. Due to the large tributary area of the TARP system and increased rainfall intensities, there is potential for segments of the tunnel system to fill very rapidly during certain storms, producing hydraulic transients and sending pressure waves throughout some of the tunnels. These pressure waves can eventually escape up drop shafts, causing geysers, with the potential of injury and property damage. To address this, enhanced computer modeling technology has been utilized to run updated hydraulic models with current rainfall intensities to identify potential tunnel segments where pressure transients can occur, allowing staff to remotely open and close regulating gates to throttle flows over time and reduce transient potential. With the challenges of climate change and improvements in hydraulic modeling, engineers and staff have adapted to optimize the performance of the tunnels.

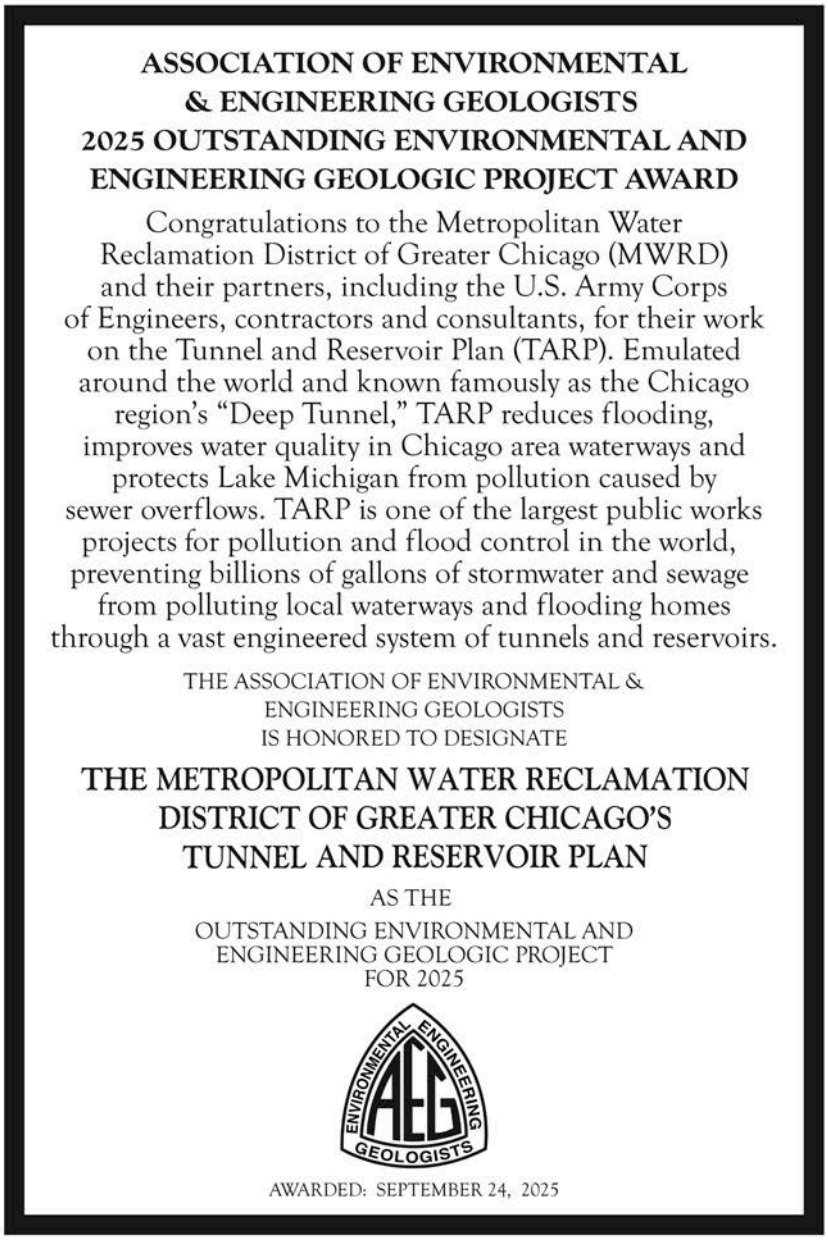
Legacy

After more than 50 years since it was first adopted, TARP remains one of the largest public works projects for pollution and flood control in North American history. Unmatched in scale globally, TARP was the first project to use deep tunnels to store combined sewer overflows, setting a precedent for similar infrastructure projects worldwide. As a pioneering effort, TARP effectively created the blueprint for addressing CSOs using underground storage systems.

Together with its associated reservoirs, the TARP tunnels have eliminated an estimated 95 percent of the pollution that previously entered local waterways. This has led to significantly cleaner and healthier rivers and canals across the region, including in downtown Chicago. Property values have risen and both residential and commercial development have flourished along the revitalized waterways. Tourism has also increased with the waterways now embraced as valuable aesthetic and recreational assets. Environmental improvements also include growing fish populations and dramatic gains in water quality metrics. In addition to these ecological and economic benefits, TARP has substantially reduced basement sewer backups and flooding during heavy rainfall.

Due to its unprecedented scale and measurable success, TARP has become a model for urban infrastructure projects across the United States and around the world, influencing major initiatives in cities such as London, Singapore, and Vienna.

The Association Of Environmental & Engineering Geologists Is Honored To Designate The **Metropolitan Water Reclamation District Of Greater Chicago's Tunnel And Reservoir Plan** As An Outstanding Environmental And Engineering Geologic Project.



ASSOCIATION OF ENVIRONMENTAL
& ENGINEERING GEOLOGISTS
2025 OUTSTANDING ENVIRONMENTAL AND
ENGINEERING GEOLOGIC PROJECT AWARD

Congratulations to the Metropolitan Water Reclamation District of Greater Chicago (MWRD) and their partners, including the U.S. Army Corps of Engineers, contractors and consultants, for their work on the Tunnel and Reservoir Plan (TARP). Emulated around the world and known famously as the Chicago region's "Deep Tunnel," TARP reduces flooding, improves water quality in Chicago area waterways and protects Lake Michigan from pollution caused by sewer overflows. TARP is one of the largest public works projects for pollution and flood control in the world, preventing billions of gallons of stormwater and sewage from polluting local waterways and flooding homes through a vast engineered system of tunnels and reservoirs.

THE ASSOCIATION OF ENVIRONMENTAL &
ENGINEERING GEOLOGISTS
IS HONORED TO DESIGNATE

THE METROPOLITAN WATER RECLAMATION
DISTRICT OF GREATER CHICAGO'S
TUNNEL AND RESERVOIR PLAN

AS THE
OUTSTANDING ENVIRONMENTAL AND
ENGINEERING GEOLOGIC PROJECT
FOR 2025

ENVIRONMENTAL ENGINEERING AEG GEOLOGISTS

AWARDED: SEPTEMBER 24, 2025

Presenter of the Tunnel and Reservoir Plan

Kevin Fitzpatrick has been a Professional Engineer working in the water resources field for 25 years. Mr. Fitzpatrick is the assistant director of engineering at the Metropolitan Water Reclamation District of Greater Chicago, overseeing the work of approximately 100 engineers, including the $3.8 billion Tunnel and Reservoir Plan, other stormwater management projects, collection system improvement projects, and administering the Watershed Management Ordinance to regulate development and local sewer construction.

AEG 2025 Virtual Days

Monday, September 22, 2025, 10:00 a.m. – 4:30 p.m. (Eastern)
Tuesday, September 23, 2025, 10:00 a.m. – 2:30 p.m. (Eastern)

$100 members / $150 non-members / $20 students (email heather@aegweb.org for discount code)

(Registration for this event will be included with all annual meeting full and student registrations)
Nine PDHs will be available for these sessions

REGISTER NOW

Join us for AEG's Annual Meeting Virtual Days! This will be two online-only days of technical presentations for those that would like to participate in the annual meeting but are unable to attend in person. All presentations will be recorded for later viewing.
We are excited to announce that the AEG Geologic and Seismic Hazards (GASH) Technical Working Group is hosting a second virtual day on **Tuesday, September 23, from 10 a.m. to 2:30 p.m. (Eastern Time).** There is no additional cost for this extra day.

Supplementary Virtual Presentations on Advances in Studies of Intraplate Tectonics (Virtual Day Two)

Symposium Convenor: Gerry L. Stirewalt, PhD, PG, CEG

This exciting virtual 4-hour session, planned and convened by Dr. Gerry L. Stirewalt, co-chair of AEG's Geologic and Seismic Hazards Technical Working Group showcases four speakers with information to share that expands the number of intraplate tectonic sources being discussed during the Thursday, September 25 in-person symposium on "Advances in Studies of Intraplate Tectonics." This virtual session was organized to allow inclusion of these sterling speakers who were unable to attend the annual meeting but have fascinating data to present that is sure to be of keen interest to attendees. The session will include the following topics:

- Geology of the Reelfoot Rift and Its Earthquakes Beneath the Mississippi River Valley – Roy Van Arsdale, University of Memphis
- Methods for Studying Earthquake Hazards in the New Madrid Seismic Zone in West Tennessee – Valerie J. Harrison, Tennessee Geological Survey
- Looking High and Low for Active Intraplate Faults in the Charleston Seismic Zone in South Carolina by Combining Geophysical Datasets – Anjana K. Shah, U.S. Geological Survey
- The Mw 5.1 Sparta, North Carolina, Surface-Rupturing Earthquake and Evidence for Recurrent Quaternary Deformation – Paula M. Figueiredo, North Carolina State University and Institute Dom Luis, Lisbon, Portugal

This virtual session provides attendees with the opportunity to learn more about how data emerging from investigations conducted in the specified intraplate tectonic areas are enhancing understanding of intraplate geologic hazards from faulting and associated seismicity. Your enthusiastic convenor, G. Stirewalt, believes this opportunity to listen, learn, and exchange ideas with these four expert geoscientists is absolutely too good to miss! DON'T MISS THIS GREAT SUPPLEMENTARY VIRTUAL SESSION!

Monday, September 22, 2025
10:00 a.m.–4:30 p.m. (Eastern)

Time	Presenter	Title
10:00 a.m.–10:30 a.m.		Welcome from AEG Executive Council, Meeting Co-chairs, and Marty Goff
10:30 a.m.–11:00 a.m.	Richard Berg	The Economic Value of Geological Mapping in the United States from 1994 to 2019
11:00 a.m.–11:30 a.m.	Joel Hirales-Rochin	Microzoning Seismotectonic Hazards: Site Effects on the Seismic-Structural Response in the Urban Area of La Paz, Baja California Sur, Mexico
11:30 a.m.–12:00 p.m.	Abdolreza Osouli	Subsidence Initiated from Collapse of Room and Pillar Limestone Mines versus Coal Mines
12:00 p.m.–12:30 p.m.	Lunch Break	
12:30 p.m.–1:00 p.m.	Edgar Angeles-Moreno	Geological Features of Rock Quarries (Loseros) Around the City of Guanajuato Relationship with Some Geological Hazards
1:00 p.m.–1:30 p.m.	Noble Nniaoko	Phytoremediation and Land Reclamation of Oil Polluted Areas in Bayelsa State, Nigeria
1:30 p.m.–2:00 p.m.	Shahid Shahriar Bin	Hydrologic Controls on Nitrate Mobility in a New England Coastal Setting: A Groundwater Modeling Perspective
2:00 p.m.–2:30 p.m.	Ahmad Hakouk	Seismically-Induced Geohazards (Rockfalls-Landslides) Along the East Anatolian Fault: Insights from the February 6, 2023, Earthquakes
2:30 p.m.–3:00 p.m.	David Ross	Dealing with Stakeholder Outrage—How to Navigate Conflict, Rebuild Trust, and Protect What Matters Most
3:00 p.m.–3:30 p.m.	Tarun Singh	Kashmir on the Brink: Confronting the Rising Landslide Crisis and Charting a Path to Resilience
3:30 p.m.–4:00 p.m.	Laura Trozzolo	PFAS Practical Guide to Vapor Intrusion
4:00 p.m.–4:30 p.m.	Jenise Thompson	Developing a Graded Approach to Site Characterization for Nuclear Power Reactors in Response to the ADVANCE Act of 2024

Tuesday, September 23, 2025
10:00 a.m.–2:30 p.m. (Eastern)

10:00 a.m.–11:00 a.m.	Roy Van Arsdale	Geology of the Reelfoot Rift and Its Earthquakes Beneath the Mississippi River Valley
11:00 a.m.–12:00 p.m.	Valerie Harrison	Methods for Studying Earthquake Hazards in the New Madrid Seismic Zone in West Tennessee
12:00 p.m.–12:30 p.m.	Lunch Break	
12:00 p.m.–1:30 p.m.	Anjana Shah	Looking High and Low for Active Intraplate Faults in the Charleston, South Carolina Seismic Zone by Combining Geophysical Datasets
1:30 p.m.–2:30 p.m.	Paula Figueiredo	The Mw 5.1 Sparta, North Carolina Surface Rupturing Earthquake and Evidence for Recurrent Quaternary Deformation

Abstracts: Virtual Day 1

Geological Features of Rock Quarries (Loseros) Around the City of Guanajuato Relationship with Some Geological Hazards

Angeles-Moreno, Edgar, University of Guanajuato, e.angeles@ugto.mx; Andrew Felix Boni-Noguez, andrew.boni@ugto.mx; Isidro Loza-Aguirre, loza.aguirre@ugto.mx; Patricia Flores-Olvera, patyflores2002@yahoo.com.mx; Miguel Ángel Herrera-Bermúdez, ma.herrerabermudez@ugto.mx; Diana Gabriela Martínez-Romero, dg.martinezromero@ugto.mx

The city of Guanajuato in Mexico, is a UNESCO World Heritage Site that is part of a historical worldclass mining district. Like many cities around the world, it is experiencing lateral growth, which is causing an encroachment into surrounding natural spaces. The construction of historic heritage buildings has used green and reddish-brown rock of the Loseros geological formation due to their lithological and physical characteristics, making it suitable for handling by quarry workers known as loseros. The Loseros Formation rock quarries are located between the Guanajuato Conglomerate and the Bufa Formation. The objective of this study was to analyze the geological characteristics of the quarry rock (stratigraphy, lithology, fabric, texture, structural attitude of layers, geological faults, and other types of fractures) and to learn how these determine the appropriate conditions for the cultural and economic exploitation of the quarries, as well as the generation of derived geological hazards. Methodologies such as engineering geological mapping, field geology, and some elements of environmental geology were used to achieve this objective. The results show that relationships between stratification, with fractures and geological faults, as well as the mechanical strength of the Loseros rock, provided suitable conditions for rock extraction and handling. However, this rock handling activity and geological setting may interact by generating geological hazards such as fracturing, rockfalls, and landslides. These geological hazards affect the suburbs of Guanajuato city, and these hazards will probably become more frequent in the future. Therefore, these results could support better urban planning of Guanajuato city and contribute to the 11-goal named sustainable cities and communities in the 2030 Agenda for Sustainable Development of the United Nations. Thanks to FAPEMIG (Process APQ-01613-22) and CNPq for supporting the development of the project.

The Economic Value of Geological Mapping in the United States from 1994 to 2019

Berg, Richard, Illinois State Geological Survey, rberg@illinois.edu; James Faulds, jfaulds@unr.edu; Subhash Bhagwat, subhash.bhagwat@gmail.com

Geological maps have a wide spectrum of applications ranging from mitigating the effects of natural hazards, enhancing public safety, and facilitating environmentally sound economic development of resources. This study provides the first economic evaluation of geological mapping conducted for the entire U.S., and it covers the period from 1994 to 2019. Globally, this is the largest and most comprehensive jurisdictional economic assessment for geological mapping ever conducted. Approaches were employed to analyze the costs, benefits, and economic impacts of geological mapping. Total spending on geological mapping by state geological surveys (SGS) and the U.S. Geological Survey (USGS) from 1994 to 2019 was $1.991B USD in 2020. The number of maps downloaded and sold during that period was estimated at 7.1M. The value and returns on investments were obtained from a questionnaire distributed to >81,000 likely users of geological maps. Responses were received from 4,779 individuals and all 50 states. Information was obtained on the willingness to pay for a map, estimates of the long-term value of geological maps, and expected payment for one map if unavailable. Median project time and cost savings were 20 percent and 15 percent, respectively. The median value per map use ranged from ~$11,000 to $18,000, with a long-term median of ~$10,000. Median amounts for willingness to pay and expected payment were similar at $3,000 and $2,883, respectively. Using the most conservative median for the expected amount to pay per map ($2,883), the cumulative value of the actual maps downloaded and sold ranges from $13.9B to $20.6B. Based on these results and the $1.991B cost of producing the geological maps from 1994 to 2019, the most conservative cumulative monetary value of maps ranges from ~7 to 10 times higher than the production cost, with maximum value estimates ranging between ~23 to 35 times the expenditure.

Seismically-Induced Geohazards (Rockfalls-Landslides) Along the East Anatolian Fault: Insights from the February 6, 2023, Earthquakes

Hakouk, Ahmad, Istanbul Technical University, ahmadhakouk@gmail.com

On February 6, 2023, a devastating sequence of earthquakes struck southeastern Turkey and northern Syria. The initial 7.7 Mw earthquake (AFAD) at 04:17 local time, with an epicenter in Pazarcık, Kahramanmaraşm, and a focal depth of 8.6 km, was followed by a 7.6 Mw event in Elbistan-Kahramanmaraş at 13:24, with a depth of 7 km. Over 30,000 aftershocks occurred in the following months, leading to extensive destruction, including more than 63,000 fatalities and severe impacts on 14 million people. These earthquakes triggered widespread slope failures, catastrophic landslides, and significant infrastructure damage, presenting major geohazard challenges. This study integrates geotechnical engineering, seismology, and remote sensing to analyze earthquake-induced slope instability failures (rockfalls-landslides) along the East Anatolian Fault Zone. Advanced techniques, including unmanned aerial photogrammetry, lidar mapping, and neural network-based data processing, were employed to assess the interplay between strong ground motion characteristics and slope failure mechanisms. The findings provide critical insights into the geotechnical and seismic factors influencing mass movements in active fault zones, contributing to improved hazard assessment and mitigation strategies.

Microzoning Seismotectonic Hazards: Site Effects on the Seismic-Structural Response in the Urban Area of La Paz, Baja California Sur, Mexico

Hirales-Rochin, Joel, Instituto Tecnológico de La Paz, Joel.hr@lapaz.tecnm.mx / Joelhirales@itlp.edu.mx

Mexico is one of the most seismically active regions in the world, due to the interaction of various tectonic plates, especially in the western states and the Baja California Peninsula. To assess seismic risk, the probabilistic seismic hazard assessment (PSHA) methodology is used (Cornell, 1968; McGuire, 2004, 2008), which allows understanding the threat of ground acceleration during earthquakes. Seismic zoning maps have been developed, and seismic databases have been improved through the installation of new stations, which has facilitated more detailed studies (e.g., Bustillos, 2005; Iglesias et al., 1995, 2002). In the Baja California Peninsula, aspects such as seismic structure and the socioeconomic impact of earthquakes have been investigated (González-Durán, 2016). Additionally, seismic activity related to regional tectonics has been studied (Munguía et al., 2006; Orbis, 2013; Ortega-Quintanar, 2007, 2010; Busch et al., 2011; Ortega-Quintanar, 2011; Ortega-Rivera, 2014; Ortega-Quintanar, 2015; Ortega et al., 2019), which has allowed for a better understanding of seismic activity and the estimation of seismic hazard in the southern and northern portions of the peninsula. The highest accelerations in Baja California Sur have been recorded in the last 15 years, focusing on the transform and active faults, which present short recurrence periods of less than 1,000 years. On the other hand, the peninsular faults control the hazard in return periods greater than 1,000 years. Due to these geo-seismic conditions, a microzonation was carried out that analyzes threats, vulnerability, and exposure, generating a ground-motion prediction equation (GMPE) modeling of seismic-structural response in the city of La Paz, Baja California Sur. This analysis was carried out by linking the litho-structural conditions of the local-regional fault system, recent seismicity, the mechanical properties of the soils, and the geo-mechanical conditions of the dominant lithology.

Phytoremediation and Land Reclamation of Oil Polluted Areas in Bayelsa State, Nigeria

Nniaoko, Noble, The Granites Avenue, nniaokonoble@gmail.com; Noble Oko, noblenniaoko@gmail.com

Nigeria is the seventh largest supplier of crude oil according to the Organization of the Petroleum Exporting Countries (OPEC), and Bayelsa state produces 40 percent of this crude. As a result of poor land use and little land reclamation schemes, most flora, fauna and aquatic organisms have been left in a dire state. Increased heavy and trace metal contamination in streams and rivers poses a threat to lives, property, and the ecosystem at large. This prompted the Granites Avenue to perform a series of tests on contaminated water, x-ray Florescence, and atomic absorption

spectroscopy to determine the degree of contamination. Bio accumulators and plants that accumulate heavy metals were planted, thus reducing the level of contamination in a less costly and ecofriendly way.

Subsidence Initiated from Collapse of Room and Pillar Limestone Mines versus Coal Mines

Osouli, Abdolreza, Marino Engineering Associates, aosouli@meacorporation.com; Gennaro Marino, gmarino@meacorporation.com

Subsidence resulting from underground mines that are developed using room and pillar mines manifest at the ground surface ranges from sinkhole (pit) to bowl-shape depressions. For bowl-shaped depression the maximum subsidence will be at the center of the sag and will reduce toward the subsidence limit. The horizontal movement of the ground surface is also experienced in these types of sags. The magnitude of the maximum subsidence is related to depth and thickness of the bed being extracted among other parameters. The extraction thickness of seams in limestone mines is 3 to 5 times larger than typical coal seams. Therefore, the subsidence from limestone underground mines will result in a lot more vertical depression and many times will result in expressions that are sinkhole-like or sag with a faulted perimeter type at the ground surface particularly between stable and collapsed zones of such mines. This presentation will go through the general subsidence mechanism initiated from underground limestone versus coal mines and provide magnitude and characteristics comparison of such subsidence events.

Dealing With Outrage—How to Successfully Navigate Stakeholder Conflict

Ross, David, Phoenix Strategic Management, David. Ross@phoenixstrategic.com.au

In today's hyperconnected world, engineering and environmental geologists, unfortunately, can no longer rely solely on technical expertise. The job has become significantly harder—not because of the geoscience, but through the need to often

interact with their stakeholders. Geologists, hydrogeologists, and related professionals now operate in an era where stakeholders are more informed, more organized, and more vocal than ever. Whether it's mining, energy, utilities, construction, or river management, community outrage and stakeholder conflict are now routine—and rising. Over the past decade, trust in organizations has declined. As I see time and time again, geoscience professionals and their public or private sector employers, who once worked with little public attention, now find themselves facing ongoing community anger, social and mainstream media scrutiny, political pressure, and in many cases, mental and emotional burnout. Understandably, geologists and hydrogeologists have rarely been trained for such situations. Hence, costly project delays, protests, reputational damage, and staff turnover (due to personal stress or disengagement) are now common consequences when outrage is mishandled—or ignored.

Hydrologic Controls on Nitrate Mobility in a New England Coastal Setting: A Groundwater Modeling Perspective

Shahid, Shahriar Bin, University of Rhode Island, sb.shahid@uri.edu; Christopher J. Russoniello, chris.russoniello@uri.edu

Nutrient contamination from onsite wastewater treatment systems remains a pressing concern in coastal aquifers with limited topographic relief and shallow groundwater tables. In this study, a conceptual groundwater model was developed to explore how hydrologic factors influence nitrate movement from septic sources toward coastal discharge zones in a low-lying New England setting. Emphasis was placed on assessing how recharge rates and aquifer properties shape the flow field and, in turn, affect the timing and extent of nitrate plume migration. Rather than relying on detailed spatial heterogeneity, the model adopted a uniform framework to isolate the effects of key parameters under controlled conditions. The simulations revealed consistent inland-to-coast flow patterns, while nitrate behavior varied depending on hydrologic forcing. Higher recharge conditions notably enhanced plume mobility and dilution. These findings offer practical insight into how future changes in recharge—whether from climate variability or land use—may alter contaminant dynamics in vulnerable coastal zones. This work also highlights the utility of simplified models for identifying dominant transport mechanisms in data-limited regions, offering a foundation for scenario-based planning and risk assessment.

Kashmir on the Brink: Confronting the Rising Landslide Crisis and Charting a Path to Resilience

Singh, Tarun, Earthworks, dr.tarunsingh@outlook.com

The Kashmir Valley, renowned for its picturesque landscapes, is increasingly facing the threat of landslides, posing significant risks to human life, infrastructure, and the environment. This paper examines the growing landslide problem in the region, driven by factors such as intense rainfall, seismic activity, deforestation, and unplanned urbanization. The study highlights the vulnerability of specific areas within the valley, emphasizing the need for a comprehensive understanding of the geological and climatic conditions contributing to landslide occurrences. Furthermore, the paper explores innovative and sustainable strategies to mitigate these risks, including the implementation of early warning systems, slope stabilization techniques, afforestation programs, and community-based disaster management initiatives. By integrating scientific research with local knowledge, this study proposes a multifaceted approach to reduce landslide susceptibility and enhance resilience in the Kashmir Valley, ensuring the safety and sustainability of its communities and ecosystems.

Developing a Graded Approach to Site Characterization for Nuclear Power Reactors in Response to the ADVANCE Act of 2024

Thompson, Jenise, U.S. Nuclear Regulatory Commission, Jenise.Thompson@nrc.gov

The Accelerating Deployment of Versatile, Advanced Nuclear for Clean Energy (ADVANCE) Act of 2024 requires the Nuclear Regulatory Commission (NRC) to take numerous actions to enhance the regulatory framework and increase efficiency in licensing nuclear reactors in the United States. Several sections of the Act relate directly to site characterization activities performed in support of new reactor applications, including Section 206 related to brownfields sites, Section 207 related to expedited Combined License reviews, and Section 208 related to microreactors. The NRC staff identified cross-cutting site characterization issues between these sections, including the availability and use of existing site characterization information, the applicability of site characterization methods not previously used at nuclear reactor sites, and the development of a graded approach to site characterization. Additionally, they are developing guidance on a graded approach to site characterization for nuclear reactors informed by site, hazard, and design-specific considerations that could be used by any new reactor applicant. The NRC staff is determining how existing site characterization information such as age, distance from the site, and methods or models may be used to obtain the data. They are also determining how alternate methods of analysis may be used to obtain site-specific information in addition to the subsurface methods used in the past. The NRC staff is reviewing existing site characterization guidance to determine what can be incorporated in a graded approach to site characterization that will result in a more efficient and risk-informed approach to site characterization. The guidance on a graded approach to site characterization will focus on all natural and human induced external hazards that must be considered when siting a nuclear reactor, including hazards associated with the meteorological, hydrological, geologic, seismic, geotechnical engineering conditions of a site as well as nearby pipelines, transport routes, and structures.

PFAS Practical Guide to Vapor Intrusion

Trozzolo, Laura J., TRC, LTrozzolo@trccompanies.com

Per- and polyfluoroalkyl substances (PFAS) are ubiquitous in ambient air, with elevated concentrations observed in urbanized areas nearest emission sources (e.g., manufacturing facilities). Long-range transport (LRT) processes are responsible for global distribution of PFAS, as evidenced by their occurrence in surface snow, ice cores, seawater, and other environmental media in remote regions as far as the Arctic and Antarctic. This presentation will discuss the factors influencing atmospheric fate and transport of PFAS, routes of exposure, current PFAS inhalation toxicity, PFAS in indoor environments, and risk assessment challenges associated with the vapor intrusion (VI) pathway from subsurface sources. PFAS exposure associated with VI is difficult to quantify from a risk perspective. However, the U.S. Environmental Protection Agency's (EPA's) traditional risk assessment process can still be utilized to understand PFAS exposure related to ambient air exposure, as well as deposition of

airborne PFAS within the airshed of the emission source. Therefore, the focus of this presentation includes three components: (1) fate and transport of PFAS, including routes of human exposure; (2) potential PFAS toxicity from the VI pathway, and (3) understanding challenge of quantifying VI risks from subsurface source versus indoor air sources from consumer products.

Abstracts: Virtual Day 2

The Mw 5.1 Sparta, North Carolina, Surface Rupturing Earthquake and Evidence for Recurrent Quaternary Deformation

Figueiredo, Paula M., North Carolina State University, USA and Institute Dom Luiz (Lisbon, Portugal), paula_figueiredo@ncsu.edu / pmfigueiredo@fc.ul.pt; DelWayne R. Bohnenstiehl, drbohnen@ncsu.edu; Arthur Merschat, amerschat@usgs.gov; Mark Carter, mcarter@usgs.gov; Miguel Neves, migueljgneves@gmail.com; Eric Szymanski, szymanskied@ornl.gov; Karl W. Wegmann, kwwegman@ncsu.edu; Matthew C. Ricker, mcricker@ncsu.edu; Zhigang Peng, zpeng@gatech.edu; Lewis A. Owen, lewis.owen@ncsu.edu

On 9 August 2020, a Mw 5.1 earthquake occurred along the previously unknown Little River fault zone, generating co-seismic surface ruptures near Sparta, North Carolina. The earthquake damaged ~600 houses and infrastructures, causing a ~$24M economic impact. The earthquake was a complex one, with an <2km deep shallow hypocenter and localized between two fault strands that merged at a small angle, causing them to rupture together. One strand was a reverse fault that reached the ground surface and produced the co-seismic surface rupture and scarp, while the second corresponded to a buried sinistral strike-slip fault, both causing subtle and permanent surface deformation. The earthquake location was outside known seismic zones within an area where little seismicity has been recorded. Following the earthquake, a holistic research effort combining geological field surveys, InSAR, lidar, unmade aerial vehicle (UAV) imagery, geophysical surveys, geodesy, and seismology, documented the fault zone, anomalously crossing the regional tectonic fabric. The aftershock sequence detailed analysis and relocation identified clusters of seismicity, which allowed to characterize the two fault strands and to infer a subsurface rupture with a ~7km length. Post-earthquake lidar data combined with pre-earthquake lidar and geologic surveys corroborated a ~4-km-long co-seismic reverse faulting surface rupture and a subtle and wider surface deformation zone (<7km) that impacted Sparta's infrastructures. Furthermore, paleoseismic excavations and detailed characterization of deformed Quaternary features revealed a recurrence of surface ruptures during the past 100ka, indicating that 2020 was not a one-time event. This earthquake is an example of Quaternary reactivation of pre-existing structures, in a low-strain tectonic setting, raising questions regarding recognition of recent activity in faults, especially if located outside known seismic zones. The combination of several datasets enhances the recognition of subtle co-seismic deformation, suggesting that similar earthquakes may be more common than expected, but poorly characterized.

Methods for Studying Earthquake Hazards in the New Madrid Seismic Zone in West Tennessee

Harrison, Valarie Joyner, Tennessee Department of Environment and Conservation, Tennessee Geological Survey, Valarie.harrison@tn.gov; Roy B. Van Arsdale, rvanrsdl@memphis.edu; William T. Jackson, Will.jackson@tn.gov; Chris H. Cramer, ccramer@memphis.edu; Hamed Tohidi, tohidihamed@yahoo.com

The New Madrid seismic zone (NMSZ) is an intraplate seismic zone within the northern Mississippi embayment that produces hundreds of earthquakes with magnitudes <4 each year. There is the potential for large-magnitude earthquakes in the region, such as the M 6 earthquakes that occurred in 1895 at Charleston, Missouri, and in 1843 at Marked Tree, Arkansas, as well as the M 7 New Madrid earthquakes of 1811–12. Studying the geology and earthquake hazards of West Tennessee, which lies along the southeastern flank of the NMSZ, presents a set of challenges due to limited field exposures of strata and erosion of earthquake features and fault traces by the Mississippi River and its tributaries. Methods used to study earthquake hazards in West Tennessee through recent collaborative efforts of the Center for Earthquake Research and Information (CERI), the Department of Earth Sciences, and the Department of Civil, Construction and Environmental Engineering at the University of Memphis as well as ongoing efforts of the Tennessee Geological Survey

are presented. These methods include making county-scale 3D geological models, geophysical measurements of shear-wave velocity, derivative seismic hazard and liquefaction hazard maps to refine existing hazard assessments, drilling boreholes to a depth of 300 feet to map strata in the area near Dyersburg, Tennessee, continued quadrangle mapping , and the use of lidar and multi-spectral imagery to identify and map geomorphological features such as landslides, sackungen, liquefaction features, and terraces. All of this additional geological, geophysical, and geotechnical information improves the detail and resolution of seismic and liquefaction hazard in West Tennessee and indicate high earthquake shaking hazard and high to low liquefaction hazard depending on whether one is located on saturated sandy river deposits or not.

Looking High and Low for Active Intraplate Faults in the Charleston, South Carolina, Seismic Zone by Combining Geophysical Datasets

Shah, Anjana K., U.S. Geological Survey, ashah@usgs.gov; Tom L. Pratt, tpratt@usgs.gov; Jessica Thompson Jobe, jjobe@usgs.gov; J. Wright Horton, Jr., whorton@usgs.gov

The Charleston, SC, intraplate seismic zone (CSZ), as the site of the M ~7.0 Summerville earthquake in 1886 and ongoing M <4 seismicity, poses risk for major earthquake damage due to its proximity to a major population center. Knowledge of active faults in the region is important for evaluating earthquake hazard and better understanding factors that drive intraplate seismicity, but previous studies have produced conflicting interpretations. Differences between results may be linked to methodologies that image only specific parts of the layered geology. Here we combine multiple geophysical datasets to locate basement faults that are long and deep enough to create significant earthquakes but also show slip in younger, shallower sediments, indicating reactivation in the passive margin setting. The CSZ lies within the South Georgia rift basin, where Paleozoic and Neoproterozoic crystalline basement rocks underlie early Mesozoic sedimentary strata plus Jurassic intrusive and volcanic rocks, all overlain by Cretaceous and Cenozoic sediments. We use 2019 high-resolution aeromagnetic data to image the basin basement and igneous infill, legacy seismic reflection data to image Mesozoic and Cenozoic strata, and 1-m lidar to locate surface ruptures in Quaternary sediments. The reflection data show numerous areas with disturbances in Cenozoic sediments, but only a subset correspond to faults visible in Mesozoic strata and magnetic lineaments; conversely only a subset of magnetic lineaments align with Cenozoic disturbances. Near Summerville, a >20 km-long, ENE-trending magnetic lineament (interpreted as a rift basin fault aligns with a plan-view offset in seismicity) can be extended to a fault mapped with lidar and is favorably oriented in the modern stress regime. This lineament terminates at the >60-km-long, NE-trending Gants fault, interpreted as a Paleozoic structure long enough to generate an M7 earthquake.

Geology of the Reelfoot Rift and Its Earthquakes Beneath the Mississippi River Valley

Van Arsdale, Roy, University of Memphis, rvanrsdl@memphis.edu

The Reelfoot rift extends from southern Arkansas into southwestern Kentucky. The NE-trending Reelfoot rift cuts across preexisting NW-trending faults, which resulted in the formation of sub-basins. Most if not all of these faults have been reactivated through time. The end of Paleozoic Appalachian-Ouachita compression resulted in the uplift of the Axial fault system (Blytheville arch) down the middle of the Reelfoot rift and the Pascola arch. The entire rift was part of a larger late Cretaceous thermal uplift caused by the passage of the United States over the Bermuda hotspot. Erosion of the uplift and subsequent thermal subsidence upon passing of the Reelfoot rift region off the hotspot resulted in the formation of the Mississippi embayment. Eocene compression reactivated some Reelfoot rift faults. Quaternary displacement has occurred on numerous Reelfoot rift faults with the great New Madrid earthquakes of 1811–12 occurring on a portion of the Reelfoot rift. The question remains as to the possible repeat of these great earthquakes and/or the possibility of activity on additional Reelfoot rift faults. Quaternary erosion above Reelfoot rift faults in the Mississippi River valley has been proposed to be the triggering mechanism for fault activation. If true, this erosion would reduce the risk of future major earthquakes on many of the Reelfoot rift faults.

AEG 2025 Annual Meeting Technical Program Schedule

WEDNESDAY, SEPTEMBER 24 – MORNING OPENING SESSION

Moderator: AEG President Renee Wawczak
Room: Promenade Ballroom
Sponsored by Geobrugg NA, LLC

Time	Speaker
8:00 a.m.–8:05 a.m.	Welcome (AEG President and Meeting Co-Chair Renee Wawczak and Meeting Co-Chair Sarah Kalika)
8:05 a.m. -8:10 a.m.	AEG Volunteer Recognition Award (Renee Wawczak) *AEG News* Editors - Bill Roman and Martha Whitney
8:10 a.m.–8:15 a.m.	AEG Advocacy Award Dr. Kenneth Tramm
8:15 a.m.–8:30 a.m.	IAEG Honorary President Award (Dr. Vassilis Marinos) Dr. Scott Burns
8:30 a.m.–9:15 a.m.	AEG Foundation Awards (Matt Buche)
9:15 a.m.–9:45 a.m.	Keynote Speaker: Elevated Temperatures in Landfills – Recent Cases (Dr. Timothy Stark)
9:45 a.m.–10:15 a.m.	Keynote Speaker: Environmental and Engineering Geology in a Data-Driven World (Dr. Thomas Oommen)
10:15 a.m.–10:35 a.m.	**Morning Break in the Exhibit Hall**
10:35 a.m.–11:15 a.m.	AEG Outstanding Environmental & Engineering Geologic Project Award: The Tunnel and Reservoir Plan (TARP) (Kevin Fitzpatrick, MWRD of Greater Chicago)
11:15 a.m.–11:45 a.m.	2024-25 AEG/GSA Richard H. Jahns Distinguished Lecturer: Dr. John Kemeny
11:45 a.m.–12:00 p.m.	2025-26 AEG/GSA Richard H. Jahns Distinguished Lecturer: Dr. Christopher Stohr

WEDNESDAY, SEPTEMBER 24 – AFTERNOON

Technical Session #1: [Redacted] – A Symposium

Sponsored by Sponsored by Arcadis

This is AEG's Fifth Annual [Redacted] Symposium, and it comes at a time when these issues, and more importantly people, are under attack. Sometimes literally. Sometimes in more subtle but still damaging ways—both personally and professionally for individuals, and for our profession. The issues we will discuss in AEG's [Redacted] Symposium are more important than ever.

Convener: Anna Saindon
Room: Promenade A

Time	Speaker	Title
2:00 p.m.–2:20 p.m.	Masai Lawson	Professional Development: An Overlooked Inclusion Strategy
2:20 p.m.–2:40 p.m.	Ashley Aguilar	Whiplash: Journey through a Shifting Landscape
2:40 p.m.–3:00 p.m.	Earl White	Building a Strong Foundation – Bringing Geoscience to Underrepresented Students (Presented by Earl White, Jill Carlson, Casey Dowling, and Madison Bowen)
3:00 p.m.–3:20 p.m.		**Break**
3:20 p.m.–3:40 p.m.	Chris Stohr	Promoting Nontraditional Paths to Careers in Earth Science
3:40 p.m.–4:00 p.m.	Lauren Guido	Exploring the Value, Challenges, and Future of Geoscience Field Education from Field Camp to Early-Career Job Sites
4:00 p.m.–4:20 p.m.	Lee Mullin	Unfriendly Skies, Unsafe Waters: (T)raveling for Work in 2025
4:20 p.m.–5:00 p.m.		Panel Discussion

Technical Session #2: Tunneling Symposium

Sponsored by Aldea Services

This year's tunneling symposium will feature a keynote presentation by Dave Jurich regarding his experiences rehabilitating older tunnels—a task fraught with uncertainties that cannot always be answered and require all the experience and judgement that an engineering geologist can muster. Subsequent presentations feature site characterizations for underground projects in Louisiana and Pennsylvania and a follow-up presentation about how this information is used and presented in a Geotechnical Baseline Report. Additional presentations showcase issues related to underground construction including a ground movement monitoring program from Ontario and the practical application of maneuvering 500-ton pieces of tunneling equipment across the world to the project site. There should be something for all with an interest in underground works, and we hope you will join us for this year's tunneling symposium.

Conveners: Paul Headland, Ike Isaacson, and Mike Piepenburg
Room: Promenade B

Time	Speaker	Title
2:00 p.m.–2:40 p.m.	David M. Jurich	Keynote: Engineering Geologists in Tunnel Repair and Rehabilitation
2:40 p.m.–3:00 p.m.	Aaron McCain	Soil Freezing in Tunnel Applications and Beyond
3:00 p.m.–3:20 p.m.		**Break**
3:20 p.m.–3:40 p.m.	Anna Crockford	Response to Movement within an Open-Cut Rock Face: Case Study from Ottawa Light Rail Project, Ontario, Canada
3:40 p.m.–4:00 p.m.	Emma O'Hara	Subsurface Characterization for Deep Tunnels in Delta Soils, Lessons Learned from an Early Career California-Based Professional
4:00 p.m.–4:20 p.m.	Erin Sibley	Advances in Digital Solutions for Site Characterization: Insights from ALCOSAN's Ohio River Tunnel Project (ORT)
4:20 p.m.–4:40 p.m.	Paul Headland	An Overview of Geotechnical Baseline Reports (GBRs), Ground Characterization, & Risk for Underground Projects
4:40 p.m.–5:00 p.m.	Mike Piepenburg	Moving the Big Iron: How to get your Tunnel Boring Machine (TBM) to your Site

Technical Session #3A: Current Status of Geology Programs at Universities

Geology departments nationwide are under stress due to drops in enrollments, university budget cuts, and other reasons. This stress is causing additional pressure on engineering geology programs. Speakers in the Engineering Geology Academic Status Symposium will provide details to this problem and describe how programs are shifting to maintain their program's relevance.

Convener: Kerry Cato
Room: Promenade C

Time	Speaker	Title
2:00 p.m.–2:20 p.m.	Kerry Cato	Maintaining the Academic Supply Chain for Engineering Geology Practitioners
2:20 p.m.–2:40 p.m.	Chris Keane	How Geoscience Programs Can Face the Ongoing External Pressures
2:40 p.m.–3:00 p.m.	Randy Kath	The Changing Undergraduate Curriculum

Technical Session #3B: Vapor Intrusion Symposium

This seminar is designed to equip professionals with the latest knowledge and techniques in addressing vapor intrusion issues. This seminar is suitable for environmental scientists, geologists, engineers, and regulatory professionals. Major areas of focus include advances in vapor intrusion assessment and mitigation, case studies and practical applications, and emerging technologies and methodologies. This session is a must-attend for anyone looking to enhance their expertise in environmental remediation and risk management.

Conveners: Maddie German and Jim Fineis
Room: Promenade C

Time	Speaker	Title
3:20 p.m.–3:40 p.m.	Jim Fineis	Vapor Intrusion, Conceptual Site Model (CSM), Hidden and Unexpected Sources
3:40 p.m.–4:00 p.m.	Harry O'Neill	The Best Method to Measure Indoor Air Concentrations to Assess Vapor Intrusion Risks – The Preference for Passive Samplers
4:00 p.m.–4:20 p.m.	Thomas R. Szocinski	Methane & Vapor Intrusion – Ongoing and Long-Term Affects
4:20 p.m.–4:40 p.m.	Tom Hatton	Evaluation of Airflow and Pressure Differential as Visual and Infrared Mapping Spectrometer (VIMS) Performance Metrics
4:40 p.m.–5:00 p.m.	Jordan Knight	Vapor Intrusion Barrier Technologies and Installation

THURSDAY, SEPTEMBER 25 – MORNING

Technical Session #4: GASH Symposium - Advances in Studies of Intraplate Tectonics

Sponsored by GFT

This exciting, information-filled symposium, organized and convened by AEG's Geologic and Seismic Hazards Technical Working Group (GASH TWG), showcases six invited speakers who are either from academia and engineering firms or are independent consultants. The sterling presentations focus on investigations of tectonic deformation and associated geologic and seismic hazards conducted in intraplate settings located away from active plate margins. The presentations include practical discussions related to collecting and evaluating field evidence for Quaternary faulting based on paleoseismic and tectonic geomorphic evidence; constraining deformation in tectonically active intraplate regions for hazard preparedness and mitigation; evaluating field evidence for distributed faulting at a nuclear waste repository outside the United States; stochastic modeling of intraplate faults; analyzing information collected for seismic hazard assessment and evaluation of the resilience of infrastructure that could be affected by tectonic deformation in intraplate settings; and analyzing information useful for earthquake hazard mitigation, response, and recovery. The information discussed is based on extensive studies of deformation in intraplate study locations that include the New Madrid Seismic Zone in the central United States, the East Tennessee Seismic Zone, the Meers Fault area in Oklahoma, the Cheraw Fault area in Colorado, the 2010 earthquake on the South Island of New Zealand, the Western Australian Shear Zone, and the Fennoscandian Shield area of Sweden. Each speaker has a 40-minute block of time to allow detailed discussion of the techniques applied during field investigations to identify and characterize deformation occurring within intraplate tectonic settings and evaluate potential geologic and seismic hazards associated with that deformation. The symposium provides attendees with the unique opportunity to learn how data emerging from field studies are being used to enhance understanding of intraplate geologic hazards from faulting and resultant seismic hazards. Your enthusiastic symposium conveners, G. Stirewalt and C. Johnson, also co-chairs of the GASH TWG, believe this opportunity to exchange ideas with expert geoscientists who have studied deformation in intraplate tectonic settings is simply too good to miss! GREAT PRESENTATIONS ARE ASSURED!!

Conveners: Gerry L. Stirewalt and Courtney Johnson
Room: Promenade A

Time	Speaker	Title
8:00 a.m.–8:40 a.m.	Randel Tom Cox	Field Evidence of Late Quaternary Faulting in the Eastern Tennessee Seismic Zone near Knoxville and Implications of Seismic Hazard
8:40 a.m.–9:20 a.m.	Mark Zellman	Late Quaternary Reactivation of the Cheraw Fault on the Western North American Craton
9:20 a.m.–10:00 a.m.	Beau Whitney	Intraplate Neotectonics of Northwestern Australia
10:00 a.m.–10:20 a.m.		Break
10:20 a.m.–11:00 a.m.	Kevin Furlong	Constraints on Deformation in Tectonically Active Intraplate Regions: Hidden Hazards in Plain Sight
11:00 a.m.–11:40 a.m.	James McCalpin	Predicting Distributed Fault Displacements at Forsmark Nuclear Waste Repository, Sweden
11:40 a.m.–12:00 a.m.	Kris Hornsby	Paleoseismic and Tectonic Geomorphic Study of the Meers Fault, Oklahoma, Reveals a Longer Fault Length, Variable Rupture Lengths, and Multiple Holocene Surface-Deforming Earthquakes

Technical Session #5: Dams and Levees Symposium

Sponsored by RJH Consultants, Inc

The Dams & Levees Technical Working Group is pleased to host this year's Dams and Levees Symposium on Thursday of the meeting! We have a great lineup of wide-ranging talks, including case histories, discussions on erodibility rock scour and spillway evaluations, and presentations on current projects. Our symposium will kick off with a keynote presentation by Visty Dalal (Maryland Dam Safety Program) on embankment dam inspections in Maryland. We hope you will join us!

Conveners: Matt Huebner and Erik James
Room: Promenade B

Time	Speaker	Title
8:00 a.m.–8:40 a.m.	Visty Dalal	Intricacies of External Inspection of Earthen Dams in Maryland
8:40 a.m.–9:00 a.m.	Hawkins Gagnon	Hydraulics Considerations for Erodibility Analyses for Concrete Dams
9:00 a.m.–9:20 a.m.	Matt Huebner	Geologic and Geotechnical Investigations at Nolichucky Dam, Tennessee, following Record Inflows from Hurricane Helene
9:20 a.m.–9:40 a.m.	Luke Weidner	Modeling Three-Dimensional Rock Scour of Unlined Spillways Using a New Analytical Numerical Method
9:40 a.m.–10:00 a.m.	Eric Cross	Multi-Method Geophysical Investigation of a Dam Spillway to Evaluate Failure Zones and Flow Conditions
10:00 a.m.–10:20 a.m.		**Break**
10:20 a.m.–10:40 a.m.	Tomoki Tanaka	Geological Survey and Geotechnical Analysis of Trapezoidal Cemented Sand and Gravel (CSG) Dam
10:40 a.m.–11:00 a.m.	Greg Martin	Infrastructure Upgrades and Ecological Uplift: Environmental and Engineering Geology of the Kellogg Creek Restoration and Community Enhancement Project
11:00 a.m.–11:20 a.m.	Erinn Johnson	Building the Deepest Slurry Wall in Colorado
11:20 a.m.–11:40 a.m.	Joshua Shinpaugh	"Not permeable, but will hold water": A Discussion of Rim Leakage Issues at Tennessee Valley Authority Reservoirs
11:40 a.m.–12:00 p.m.	Scott Walker	Tennessee Valley Authority's (TVA's) Hiwassee Basin Dams: Hydropower, Flood Control, Tunnels, and… Torpedoes?

Technical Session #6: Land Subsidence Symposium

The AEG Subsidence Working Group convenes AEG's seventh and fifth annual Symposium on Land Subsidence, which explores the diverse causes, impacts, and monitoring of land subsidence, including the relationship with sea-level rise, to advance subsidence understanding and mitigation strategies. Land subsidence is a widespread geologic hazard driven by diverse natural and anthropogenic processes, with significant implications for infrastructure, water resources, and coastal resilience. With increasing urbanization, growing groundwater demand, and climate change intensifying subsidence-related risks, there is a need for interdisciplinary collaboration and discussion to address subsidence challenges in a changing world. This session will offer presentations describing subsidence from numerous causes, such as the extraction of underground fluids (groundwater, brine, or hydrocarbons), collapse of underground openings (mines and tunneling), thawing of permafrost and melting of ground ice, and others. The session includes case studies, monitoring techniques, modeling approaches, mitigation strategies, and interdisciplinary perspectives on understanding and managing land subsidence at the local to global scale.

Conveners: James Borchers
Room: Promenade C

Time	Speaker	Title
8:00 a.m.–8:20 a.m.	James Borchers	Subsidence Around the World 2024–2025
8:20 a.m.–9:00 a.m.	Brian Conway	Keynote: Arizona Department of Water Resources Hydrological and Land Subsidence Monitoring Using Satellite and Terrestrial Data
9:00 a.m.–9:20 a.m.	John Ellis	Sinking Ground, Rising Concerns—A Century of Land Subsidence in California
9:20 a.m.–9:40 a.m.	Leila Saberi	From Data to Decision: Predicting Future Subsidence Under Varying Management Strategies
9:40 a.m.–10:00 a.m.	Jeffrey Unruh	Probabilistic Subsidence Forecast Model for Engineering Evaluation of the California Aqueduct
10:00 a.m.–10:20 a.m.		**Break**
10:20 a.m.–10:40 a.m.	Dmitry Streletskiy	Subsidence Rates in Thawing Permafrost Regions of the Arctic
10:40 a.m.–11:00 a.m.	Wendy Zhou	Monitoring Ground Subsidence Induced by Underground Excavation or Tunneling in Urban Environments Using InSAR Techniques
11:00 a.m.–11:20 a.m.	Robert Bauer	History of Coal Mine Subsidence and Research in Illinois
11:20 a.m.–11:40 a.m.	David Hibbard	Subsidence Induced Collapse Triggers Intensification of Kenilworth Coal Mine Fire
11:40 a.m.–12:00a.m.	Robert Millar	Methods for Site Characterization of Inaccessible Highwall Slopes

THURSDAY, SEPTEMBER 25 – AFTERNOON

Technical Session #7: Geologic and Seismic Hazards Part I

Sponsored by Geosyntec Consultants, Inc.

This exciting information-filled technical session along with Technical Session #12 (on Friday afternoon), organized and convened by AEG's Geologic and Seismic Hazards Technical Working Group (GASH TWG), showcase speakers who are from academia, a state geological survey, and engineering firms or are independent consultants. The presentations cover a broad range of topics related to evaluation of geologic and seismic hazards in multiple geographic locations and different geologic settings. The topics this afternoon include modeling spatial variability of ground motion site resonance in the New Madrid Seismic Zone, potential effects of excavation-induced stress changes for the 2013 M3.2 Chicago-area earthquake, block sliding and seismic events in the Chicago area, neotectonic deformation and seismic hazard in Southern California, historical seismicity and source zone activity comparison in the Canadian Shield, and evaluation of usability and accuracy of flood maps in rural Vermont. Your symposium convenors, C. Johnson and G. Stirewalt, who are also co-chairs of the GASH TWG, enthusiastically suggest this opportunity to exchange ideas with expert geoscientists who have investigated geologic and seismic hazards in a variety of geologic settings should not be missed! GREAT FOOD FOR THOUGHT IS GUARANTEED!!

Conveners: Gerry Stirewalt and Courtney Johnson
Room: Promenade A

Time	Speaker	Title
1:40 p.m.–2:20 p.m.	James Neely	Advances in Stochastic Modeling for Large Intraplate Faults
2:20 p.m.–2:40 p.m.	Greg Hempen	Noted Impacts of the New Madrid Earthquake Series
2:40 p.m.–3:00 p.m.	Greg Hempen	New Madrid Earthquake Scenarios' (NMES') Recognition for Central U.S. (CUS) Earthquakes' Mitigation, Response and Recovery
3:00 p.m.–3:20 p.m.		**Break**
3:20 p.m.–3:40 p.m.	Noah Bezanson	Mapping Where Rivers Meet People: Usability and Accuracy of Flood Maps in Rural Vermont
3:40 p.m.–4:00 p.m.	Ann Mariam Thomas	Stress Changes from Industrial Excavation and their Potential Role in the 2013 M3.2 Chicago-Area Earthquake
4:00 p.m.–4:20 p.m.	Chris Stohr	Block Sliding and Seismic Events Occurring in Chicago Metropolitan Area
4:20 p.m.–4:40 p.m.	Eldon Gath	Neotectonic Development and Seismic Hazard of the Puente Hills in Orange County, Southern California
4:40 p.m.–5:00 p.m.	Jeffrey Keaton	Historical Seismicity and Source Zone Activity Comparison: Canadian Shield Example

Technical Session #8: Environmental Symposium

Sponsored by GFT

This technical session targeted to environmental geologists covers a range of environmental topics that include contaminants of emerging concern (CEC), a topic about which the Interstate Technology & Regulatory Council has played a significant role in advancing solutions; PFAS substances, formerly a CEC but research has found these compounds are present throughout our ecosystem; analytical methods; and insight into naturally occurring metals.

Convener: Rick Kolb
Room: Promenade B

Time	Speaker	Title
1:40 p.m.–2:00 p.m.	Anne Tavalire	Michigan's Regulatory Approach for Addressing PFAS in Wastewater, Stormwater, Groundwater, and Biosolids
2:00 p.m.–2:20 p.m.	Olajide Oladipo	Stabilization of Boron in Coal Combustion Wastewaters Using Industrial Byproducts: Insights from FTIR and XRD Analyses
2:20 p.m.–2:40 p.m.	Meaghan Cibarich	Contaminants of Emerging Concern Identification Framework (Interstate Technology and Regulatory Council [ITRC], 2023)
2:40 p.m.–3:00 p.m.	Mitchell Brourman	True Real-Time Environmental Remediation Monitoring: Its Attributes and Lessons Learned from Multiple Deployments
3:00 p.m.–3:20 p.m.		**Break**
3:20 p.m.–4:20 p.m.	JP Verheul	PFAS Regulatory Updates and Analytical Methods and Rapid PFAS Testing with No Compromises: Direct Inject Analysis
4:20 p.m.–4:40 p.m.	Louis Tisinger	Automated Analysis of Microplastics Using a Quantum Cascade-based Infrared Analyzer
4:40 p.m.–5:00 p.m.	George Freitag	Naturally Occurring Metals as Drivers for Ocean Disposal of Dredged Rock, and Comparison to Modern Sediments, Newport and Coos Bay, Oregon

Technical Session #9A: Naturally Occurring Asbestos (NOA)

Convener: Sarah Kalika
Room: Promenade C

Time	Speaker	Title
1:40 p.m.–2:00 p.m.	Sarah Kalika	The State of NOA Regulations—A Call for Unity and Harmonization
2:00 p.m.–2:20 p.m.	Paige Bauer	Emerging and Non-Standard Technologies in the Identification of Naturally Occurring Asbestos and other Minerals during Geological Evaluation of Rocks
2:20 p.m.–2:40 p.m.	Mark Bailey	Further Examination of Unground to Lightly Disaggregated Samples of Coarsely Crystalline Actinolite Amphibolite from Franciscan Rocks in Cazadero and Fremont, California
2:40 p.m.–3:00 p.m.	Mark Bailey	Holmquistite: Characterization of an Asbestiform Amphibole of Concern in the Mining of Lithium Ores with Properties Similar to Amphiboles in the Glaucophane-Riebeckite Solid-Solution Series

Technical Session #9B: Geophysics and Climate Change: Impacts on Infrastructure and the Built Environment

In partnership with Society of Exploration Geophysicists (SEG)

Sponsored by Geosyntec Consultants, Inc.

The impact of climate change on infrastructure from roads, bridges, tunnels, rail lines as well as building foundations and stability cannot be underestimated. Consequences of climate change from flooding, differential compaction, erosion, slope failure, storm-surge and rising sea level to premature deterioration of materials caused by increased freeze–thaw cycles, increased moisture, and extreme temperatures can be observed worldwide. In areas characterized by clay soils like those encountered in Chicago, where expansion and contraction of the overburden materials modify the competency of the bearing surfaces, degrading foundations and impacting infrastructure that over time can contribute to damage and failure on the urban environment. This special session/ panel discussion will focus on identifying and addressing impacts to the subsurface caused by climate related issues especially the role of clay soils.

Moderator: Judith Gauriau
Room: Promenade C

Time	Speaker	Title
3:20 p.m.–3:40 p.m.	David Carpenter	A Fast-Paced Multichannel Analysis of Surface Waves (MASW) Survey to Inform Reconstruction of I-40 after Hurricane Helene in North Carolina
3:40 p.m.–4:00 p.m.	Roy Bowling	Climate-Driven Geohazards: Applications of Geophysics to the Characterization and Remediation of Geohazards for Civil Structures
4:00 p.m.–4:20 p.m.	Ryan Korth	Electrical Resistivity Imaging on the Missouri River Levee System
4:20 p.m.–5:00 p.m.		Panel Discussion (David Carpenter, Roy Bowling, and Ryan Korth)

FRIDAY, SEPTEMBER 26 – MORNING

Technical Session #10: Landslides

Sponsored by Geosyntec Consultants, Inc.

The Landslide Technical Working Group is pleased to present this technical session with a variety of talks on landslides, rock fall, and debris flows, ranging from new applications of remote sensing to practical discussions of risk reduction and mitigation.

Moderators: Lauren Guido and Paul Santi
Room: Promenade A

Time	Speaker	Title
8:00 a.m.–8:20 a.m.	Yonathan Admassu	The Use of High-Resolution Digital Elevation Models and the Mapillary Street Level Imagery for Rock Cut Slope Inventory and Rockfall Hazard Characterization
8:20 a.m.–8:40 a.m.	Christopher Kalev	Analysis of Sand Flow Slides in Haines, Alaska (Presented by Margaret Darrow)

8:40 a.m.–9:00 a.m.	Victoria Leffel	Ground-Truthing Landslide Inventories to Support Hazard Mitigation in Indiana State Parks
9:00 a.m.–9:20 a.m.	William McCormick	Awakening of the Ancient Altamira/Portuguese Bend Landslide
9:20 a.m.–9:40 a.m.	Paul Santi	Prediction and Case Studies of Debris-Flow Avulsion
9:40 a.m.–10:00 a.m.	Francesca Skene	Using Storm Direction and Runoff Thresholds to Distinguish Between Post-Fire Debris Flows and Flash Floods
10:00 a.m.–10:20 a.m.		**Break**
10:20 a.m.–10:40 a.m.	Asher Staubach	Multi-Scale Remote Sensing and RocScience Slide 3 Integration for Assessing Slope Instability and Displacement along Transportation Corridors: A Study of Paonia Reservoir, Colorado
10:40 a.m.–11:00 a.m.	Lauren Guido	Mechanisms of Postfire Debris Flow Sediment Recruitment in the Grizzly Creek Burn Area and Implications for Mitigation
11:00 a.m.–11:20 a.m.	Nate Saraceno	Seeing the Big Picture: Constructability in Landslide Remediation
11:20 a.m.–11:40 a.m.	Todd Bown	When Did the Slope Start Moving…Varved Clays, Pipelines, and Landslides
11:40 a.m.–12:00 p.m.	Luke Weidner	Automatic, Distributed Rock Slope Monitoring Using Low-Cost, Daily Photo Monitoring

Technical Session #11: Subsurface Urban Heat Islands / Geological Energy Harvesting and Storage Symposium

This mini symposium invites contributions that address the challenges and opportunities associated with energy flows beneath urban areas, including those arising from subsurface urban heat islands, geothermal energy harvesting, and underground thermal energy storage. Contributions are encouraged across a broad spectrum, from studies examining the threats posed by subsurface urban heat islands—such as their impacts on civil infrastructure, groundwater systems, and subsurface ecosystems—to investigations exploring the opportunities these phenomena present, along with emerging applications of geological energy harvesting and storage in urban areas worldwide. The symposium welcomes theoretical, computational, and experimental studies spanning scales from soil particles to entire cities.

Convener: Alessandro Rotta Loria
Room: Promenade B

Time	Speaker	Title
8:00 a.m.–8:40 a.m.	Zhonghao Chu	Harnessing Machine Learning for Simulating Underground Climate Change
8:40 a.m.–9:20 a.m.	Jack Nulisch	Performance of Plane Energy Geostructures Serving as Thermal Batteries
9:20 a.m.–10:00 a.m.	Anjali Thota	Updating the Subsurface Characterization across the Chicago Loop: Bridging Geological and Geotechnical Insights
10:00 a.m.–10:20 a.m.		**Break**
10:20 a.m.–11:00 a.m.	Naghmeh Mehraeen	Plastic Shakedown in Thermo-Mechanically Loaded Granular Media
11:00 a.m.–11:40 a.m.	Alessandro Rotta Loria	The Urban Underground: A Mine of Heat
11:40 a.m.–12:00 p.m.		All Speaker Q & A

FRIDAY, SEPTEMBER 26 – AFTERNOON

Technical Session #12: Geologic and Seismic Hazards Part II

This technical session is organized and convened by AEG's Geologic and Seismic Hazards Technical Working Group (GASH TWG). This session will showcase speakers who are from academia, a state geological survey, and engineering firms or are independent consultants and continues some of the superb conversation from Technical Session #7 (which was on Thursday afternoon). The topics today include deep geophysical surveying for investigating earthquake hazards, complexly faulted mining prospects, and subsurface aquifer geometry; evaluating how glacial drift and lava flows control debris flow pathways at Mount Adams in Washington; lidar-based mapping of alluvial fans for post-wildfire hazard assessment in Colorado; enhancing resiliency of coastal levees against strong earthquakes and tsunami using pressed-in piles in Japan; and probabilistic seismic hazard and assessment of site effects at a gas plant in Oman. The two technical sessions provide attendees with the unique opportunity to learn about a variety of projects for evaluation of potential geologic and seismic hazards in multiple geographic locations with different geologic settings.

Moderators: Courtney Johnson and Gerry Stirewalt
Room: Promenade A

Time	Speaker	Title
1:00 p.m.–1:20 p.m.	John Louie	Deep ReMi Surveying to 1-km Depths for Earthquake Hazards, Mining, and Water Resources
1:20 p.m.–1:40 p.m.	Isaac Pope	Crossroads of Fire and Ice: How Glacial Drift and Lava Flows Control Debris Flow Paths at Mount Adams, Washington, USA
1:40 p.m.–2:00 p.m.	Jonathan Lovekin	Lidar-Based Mapping of Alluvial Fans and High-Angle Fans for Post-Wildfire Geohazard Assessment in Colorado
2:00 p.m.–2:20 p.m.	Takuma Takefumi	Enhancing Resiliency of Coastal Levees with Pressed-in Piles Against Strong Earthquake and Tsunami
2:20 p.m.–2:40 p.m.	Issa El-Hussain	Probabilistic Seismic Hazard and Site Effect Assessment at Musandam Gas Plant, Oman

Technical Session #13: AI/Machine Learning

Sponsored by GFT

Moderator: Nate Saraceno
Room: Promenade B

Time	Speaker	Title
1:00 p.m.–1:20 p.m.	John Kemeny	Innovative AI-Based Monitoring for Predicting Unstable Rock Events: EdgeAI, Vision Language Models, and Gaussian Splats
1:20 p.m.–1:40 p.m.	Declan Vanderhor	Logging Core Defects Using Computer Vision: Enhancing Speed and Accuracy in Geotechnical Investigations
1:40 p.m.–2:00 p.m.	Gary Zarrelli	Coding for Geotechnical Engineers: Necessity or Niche?
2:00 p.m.–2:20 p.m.	Tyler Kamp	Using Machine Learning and Iterative Ensemble Smoothing to Evaluate Groundwater Model Parameter Sensitivity
2:20 p.m.–2:40 p.m.	Nate Saraceno	Practical AI for Professionals: How Custom GPTs Can Empower Your Team, Your Workflows, and Your Mission

Technical Session #14: Site Characterization

Sponsored by Geosyntec Consultants, Inc.

Moderator: Kristen Hasbrouck

Room: Promenade C

Time	Speaker	Title
1:00 p.m.–1:20 p.m.	Rob Kramer	Integrating Geophysical Testing in "Smart Exploration Plan" for Site Exploration and Characterization
1:20 p.m.–1:40 p.m.	Kristen Hasbrouck	VertebraeTM Segmented Horizontal Wells for Monitoring Groundwater Flux and PFAS Contaminant Mass Discharge
1:40 p.m.–2:00 p.m.	Claire Thomassen	2025 Interstate Technology & Regulatory Council (ITRC) PFAS Team Update
2:00 p.m.–2:20 p.m.	Daniel Costamagna	Engineering Geology Limits Pipeline Scour Mitigation Alternatives, Mississippi River near Dubuque, Iowa
2:20 p.m.–2:40 p.m.	Kenneth Tramm	Trouble with Metals: Importance of Background Threshold Values in Risk Assessment

AEG 2025 Annual Meeting Poster Sessions

(Each poster author will post their schedule on their poster for when they will be available for questions.)

Vote for Your Favorite Poster!

We will once again be holding a university student poster competition. Three cash prizes ($200, $100, and $50) will be awarded for the top three vote recipients of the student poster sessions. Voting will be conducted exclusively through the mobile app, so bring your mobile device to vote for your favorite. Winners will be awarded at the Poster Reception.

Poster Reception
Thursday, September 25, 2025
5:00 p.m.–6:30 p.m.
Most poster presenters will be at their posters during the poster reception.

Wednesday, September 24, 2025, 8:00 a.m.–4:00 p.m.

Geologic and Seismic Hazards – Student Poster Presenters (Eligible for the Student Poster Competition)

Speaker	Title
Julia Bruno	Interactions Between Basaltic Melt and Xenoliths in Volcanic Ejecta at Dotsero Maar, Colorado
Elise Chan	Alluvial or Debris Flow Fan? Classifying Process from Fan and Catchment Geomorphometry
Cassidy Davis	Predicting Missing Volcanic Vents for Ground-Truth Analysis: Case Study of Coyote Hills, Black Rock Desert (Utah)
Aidan Howe	Identifying Habitable Extraterrestrial Lava Tubes Using Electrical Resistivity Tomography (ERT) & Lidar Detection
Ipsita Mitra	Using 3D Electrical Resistivity (ER) to Image an Active Fault at Porter Gap, New Madrid Seismic Zone
Ipsita Mitra	Characterization of Faulting Style along the Eastern Reelfoot Rift Margin at Union City, Tennessee
Isaac Pope	Morphometrics of Modern Lava Flows: What Physicochemical Properties Control Surface Roughness and its Evolution through Time?
Huston Spellman	Seismic vs. Climatic Triggers: Evaluating Landslide Evolution near the Motagua Fault, Guatemala
Taylor Trudell	Advancing Baroque-Era Earthquake-Resistant Building Research in Antigua, Guatemala, Using A Scanning Electron Microscope (SEM) and Schmidt Hammer Analyses

Landslides Student Presenter (Eligible for the Student Poster Competition)

Marco Rodriquez	Landslides Timing and Trigger Mechanisms of the Buckeye Canyon Rockslide, North of Yosemite National Park, California

Professional Poster Presenters

Leyla Namazie	High Spatial Resolution Ground Motions in the Eel River Basin, California: Site Response Implications of Nodal Data Following the 2024 Mw 7.0 Mendocino Earthquake
Luis Bacellar	Creep-Type Mass Movements on Slopes Composed of Soft Rocks in Historic Cities of Southeastern Brazil
Luis Bacellar	Evaluation of Fractured Rock Masses in Areas Susceptible to Mass Movements Using Thermal Infrared Surveys

Thursday, September 25, 2025, 8:00 a.m.–4:00 p.m.

Environmental Student Presenters (Eligible for the Student Poster Competition)

Speaker	Title
Megan Brown	Analyzing Microplastics Using Laser Direct Infrared Spectroscopy: Midwest Center for Microplastic Research
Andrew Custis	Microplastics in the Little Blue River
Madison Mitchell	A 5,000-Year Paleoenvironmental Record Based on Macro- and Microfossil Analysis of Cores from Clear Pond, San Salvador Island, the Bahamas
Banuchandra Nagaraja	Development of Novel Chitosan-Biochar-Bentonite Composite (CBBC) for Contaminant Barriers
Oyindamola Oseni	Enhanced Phytoremediation of Perchlorate and Nitrate in Sand-Biochar Bioreactors
Margi Smith	Integrating Remote Sensing Techniques to Analyze Rock Glacier Movement and Morphology

AI/Machine Learning Student Presenter (Eligible for Student Poster Competition)

Jagadeesh Kumar Janga	Machine Learning for Predicting Electrokinetic Remediation Performance: Initial Study and Challenges

Landslides Student Presenter (Eligible for the Student Poster Competition)

Jessica Hiatt	Surface Deformation Monitoring using Terrestrial Lidar and Unmanned Aerial Vehicle (UAV)-Multispectral Orthomosaics of the Axial Coal Mine

Professional Poster Presenters

Elson T. “Chip” Barnett	Stormwater Infrastructure Improvements in Recessional Outwash, AKA Infiltration Gold, Renton, Washington
Monica Hill	Shoreline Roadway Hazard Assessment of Bainbridge Island, Washington

High School Student Poster Presenters - Environmental

Collin Lo	From Legacy to Innovation: Reshaping Perceptions of Nuclear Power
Avishai Ramnauth	The Extent and Effects of Nuclear Proliferation (Presented by Andrew Singh)

High School Student Poster Presenter - Student / Professional Perspectives

Sophie Walters	Academic Burnout in STEM Students: Causes and Effects

Abstracts

The Use of High-Resolution Digital Elevation Models and the Mapillary Street Level Imagery for Rock Cut Slope Inventory and Rockfall Hazard Characterization
Admassu, Yonathan, James Madison University, admassyx@jmu.edu *(TS #10)*

Rock cut slopes adjacent to roadways are common geotechnical assets especially in mountainous regions. Performing inventory of existing rock cut slopes and rating their risk of rockfall hazard are the main components of managing geotechnical assets along roadways. Slope inventory involves identifying locations and collecting preliminary geometric/geologic attributes, whereas rockfall hazard rating provides a detailed analysis of the presence of rockfall hazard risk factors. Both efforts are aimed at helping agencies to proactively monitor and maintain problematic slopes. Determination of geologic and geometric attributes for the rock slope hazard rating requires extensive time to drive to individual rock slope sites and take onsite measurements. An alternative method is the use of remote sensing data such as the use of lidar and photogrammetry to measure geologic parameters. This research project is a pilot test to investigate the use of high-resolution lidar-derived digital elevation models (DEMs) and street level imagery from Mapillary.com to build slope inventory and characterize rockfall hazard. Three major roadways in western Virginia were used for the study to collect geometric and geologic data on the desktop as well as make field verifications. The accuracy of automated soil/rock slope detection was found to be 86 percent. Identifying rock cut slopes was successful at 94 percent. Measurements of rockfall hazard parameters were also in close agreement to those measured in the field. The proposed method will save time and money required for both rock slope inventory and rockfall hazard rating. It will not completely discard field visits but attempts to put forward a streamlined desktop process to help infrastructure agencies to become more efficient in managing their rock slope assets.

Journey through a Shifting Landscape
Aguilar, Ashley, University of Texas at San Antonio, ashleyvaguilar@gmail.com *(TS #1)*

This talk summarizes a personal and historical reflection of an evolving landscape within the U.S. from the perspective of a 34-year-old woman on the cusp of finishing a PhD and joining the applied geology workforce. Beginning with a childhood in a military culture of Don't Ask Don't Tell, witnessing the advancement of progressive policies, to the current political climate—the twists, turns, hills, and valley that we find ourselves traveling can prove difficult to navigate without an unwavering support system. Drawing on lived experiences during sociopolitical trends, we'll explore how systematic changes have altered students' and young professionals' sense of stability over the past three decades. Examination of these transitions will allow attendees to consider how the future workforce in our profession might be encumbered and the importance of advocating for the next generation in a time of uncertainty and scrutiny.

Creep-Type Mass Movements on Slopes Composed of Soft Rocks in Historic Cities of Southeastern Brazil
Bacellar, Luis, Federal University of Ouro Preto. Brazil. bacellar@ufop.edu.br*; Dalila dos Santos Matta,* dalila.dias@aluno.ufop.edu.br*; Hugo Souza, hugo.* alvarenga@aluno.ufop.edu.br*; Thayanne Teixeira,* thayanne.teixeira@aluno.ufop.edu.br *(Poster)*

The Iron Quadrangle (IQ) is one of the largest mineral provinces in the world, rich in ore deposits, particularly iron and gold. Among the numerous municipalities in the region, some hold significant relevance due to their rich historical heritage dating back to the 18th century, recognized by UNESCO. The IQ is naturally highly susceptible to various types of mass movements, with landslides being particularly prominent due to its mountainous terrain and high rainfall indices. In some slopes within the urban zones of these municipalities, creep movements occur. Although these movements

receive little media attention due to their slow and seasonal nature, they have the potential to trigger catastrophic landslides. These creep processes mobilize an unconsolidated mantle several meters thick, especially on long, gentle slopes composed of soft and low-permeability rocks such as phyllites and steatites. The geotechnical characterization of these areas involved the interpretation of multi-temporal satellite imagery, auger and percussion (SPT) drilling, geophysical surveys (electrical resistivity), and instrumentation (piezometers and surface benchmarks). The unconsolidated mantle consists of residual soils that are partially mobilized, forming colluvial deposits with low shear strength. Movement is triggered when a perched water table develops within the unconsolidated mantle over the bedrock during and shortly after the rainy season, which typically occurs from October to March. Surcharges at the slope crest or toe excavations further favor the development of creep. Numerical simulations have shown that common retaining structures in the area, such as concrete or gabion walls, are not suitable for stabilizing these slopes. Instead, the installation of horizontal drains or drainage trenches would be significantly more effective. Thanks to FAPEMIG (Process APQ-01613-22) and CNPq for supporting the development of the project.

Evaluation of Fractured Rock Masses in Areas Susceptible to Mass Movements Using Thermal Infrared Surveys

Bacellar, Luis, Federal University of Ouro Preto, Brazil. bacellar@ufop.edu.br*; Dalila dos Santos Matta,* dalila.dias@aluno.ufop.edu.br *(Poster)*

Landslides are one of the main geological risks in urban areas of Brazil, such as in the city of Ouro Preto, in the State of Minas Gerais. In this city, a UNESCO World Heritage Site, hundreds of high-risk areas have been mapped, many of them involving landslides and rock falls on slopes with discontinuous rock mass. Landslide risk assessment methods involve the use of the Markland method or specific geomechanical classifications (e.g., slope mass rating [SMR], Qslope). In all of these methods, it is necessary to recognize the parameters that influence the mechanical behavior along discontinuities (orientation, spacing, opening and filling material, roughness, and presence of water). These parameters are normally assessed along scanlines in the field, which can be replaced on large or difficult-to-access slopes by remote methods, such as 3D aerial photogrammetric surveys with drones. However, such surveys fail to allow easy recognition of some parameters of these discontinuities, such as opening, filling material and presence of water. This paper presents the geomechanical characterization of a remarkably high slope, with the aid of a multitemporal survey with a thermal infrared camera. The results show that thermal imaging can be useful for preliminary geomechanical zoning of slopes and for better characterization of these parameters. The investigated slope showed high susceptibility to landslides and rock falls due to a set of open discontinuities with presence of water. Thanks to FAPEMIG (Process APQ-01613-22) and CNPq for supporting the development of the project.

Further Examination of Unground to Lightly Disaggregated Samples of Coarsely Crystalline Actinolite Amphibolite from Franciscan Rocks in Cazadero and Fremont, California

Bailey, R. Mark, Asbestos TEM Labs, mark@asbestostemlabs.com *(TS #9A)*

Shear stress during metamorphism of amphiboles can cause a reduction in grain size through the formation of subgrains by a common metamorphic process called dislocation creep. During dislocation creep, slip-systems are activated in amphiboles, which are observed to be parallel to crystallographic planes of the type (*hk*0) and with dislocation slip on the system (hk0)[001]. As dislocation creep proceeds, subgrains develop, which are elongate in the c-axis direction and bounded by the coalescence of dislocations parallel to the c-axis which form crystal subgrain boundaries. For some amphibole minerals, this process can lead to intracrystalline formation of fibers that meet regulatory definitions of asbestos completely within a larger parent amphibole grain. Coarsely crystalline actinolitic amphiboles from the Franciscan formation in Fremont, California, and Cazadero, California, have been studied, which demonstrate such subgrain fiber formation processes.

Holmquistite: Characterization of an Asbestiform Amphibole of Concern in the Mining of Lithium Ores with Properties Similar to Amphiboles in the Glaucophane-Riebeckite Solid-Solution Series

Bailey, R. Mark, Asbestos TEM Labs, mark@asbestostemlabs.com (TS #9A)

Holmquistite is a lithium amphibole commonly found in association with the lithium ore minerals spodumene, lepidolite, and petalite in or near lithium-rich pegmatites. It is known to occur in an asbestiform habit and is a potentially serious health risk to drillers, miners, millers, and battery production workers who are exposed to dust that contain it. Holmquistite is both a general name for the solid solution series, as well as a specific member of the solid-solution series of amphiboles with chemical formula of $Li_2[(Mg,Fe^{2+})_3(Al, Fe^{3+})_2]Si_8O^{22}(OH)^2$ that are the lithium analog of the sodic glaucophane-riebeckite solid solution series $Na_2[(Mg,Fe^{2+})_3(Al, Fe^{3+})_2]Si_8O_{22}(OH)_2$, with whom the lithium amphiboles are in solid-solution. Notably, holmquistite occurs in both orthorhombic and monoclinic crystal systems. The IMA recognized end members are: 1) Orthorhombic (Holmquistite (HQST), ferro-HQST, ferri-HQST, ferro-ferri-HQST) & 2) Monoclinic (clino-HQST, clino-ferro-HQST, clino-ferri-HQST, clino-ferro-ferri-HQST). Holmquistite is blue in color, has blue/yellow pleochroism and has optical properties similar to its sodic analogs. As with all amphiboles that may occur in an asbestiform morphology, its crystal habit ranges from blocky to asbestiform. A study of holmquistite from various sources has been conducted following standard methods used for asbestos analysis (X-ray Diffraction [XRD], Polarized Light Microscopy [PLM] & Transmission Electron Microscopy [TEM]), with particular focus on the range of morphologies it exhibits, and its energy dispersive elemental signature, the latter of which is particularly challenging as lithium x-rays are weak and are commonly absorbed by Energy-Dispersive X-ray [EDX] window materials.

Stormwater Quality Improvements in Recessional Outwash, AKA Infiltration Gold, Renton, Washington

Barnett, Elson T. "Chip", Geosyntec Consultants, Inc., Chip.Barnett@Geosyntec.com; Alec Melone, Alec.Melone@Geosyntec.com; Erik Andersen, Erik.Andersen@Geosyntec.com; Russ Gaston, russ.gaston@otak.com; Kevin Evans, KRevans@Rentonwa.gov; Joe Farah, JFarah@Rentonwa.gov; Jared McDonald, JMcDonald@Rentonwa.gov (Poster)

A developed residential and commercial 244-acre subbasin within the city of Renton, Washington, needed to better manage stormwater. A team of geologists, civil, and stormwater engineers were asked to consider a new facility for treatment and infiltration of stormwater in an area with underlying glacial deposits of silt, sand, and gravel. Subsurface data from geotechnical studies across the subbasin were used to develop GIS maps characterizing groundwater depth and feasibility for stormwater infiltration based on the type of deposits that ranged from low permeability dense glacial till to medium dense granular recessional outwash deposits. A former sand and gravel pit in recessional outwash was selected as a potential candidate for an approximate 1.7-acre stormwater facility. Explorations at the site including several Pilot Infiltration Tests and a Borehole Infiltration Test indicated an estimated infiltration rate of more than 20 inches/hour across the former pit. The pit had been reclaimed with various uncontrolled fill materials including a gray sandy silt to silty clay with thicknesses of up to 28–58 feet in depth across the site as evaluated through several borings. Excavation and removal of the fine-grained fill soils exposing receptor soil was completed in summer of 2023. Slope stability analysis was completed to verify temporary stability of the excavated slopes. Facility construction used supplemental receptor soils that were tested and verified to be similar to recessional outwash deposits. A design was developed to reduce the risk of fines migration into the receptor soils using an overlying 30 feet of facility gravel (AASHTO #3) with geotextile fabric layering at distinct intervals. The design for this stormwater retrofit showed an innovative approach that was acceptable for Department of Ecology funding in partnership with private and public entities.

Emerging and Non-Standard Technologies in the Identification of Naturally Occurring Asbestos and other Minerals during Geological Evaluation of Rocks

Bauer, Paige, Bailey Geological Consulting, paige.bauer@baileygeoconsulting.com; R. Mark Bailey, mark@asbestostemlabs.com (TS #9A)

Evaluation of potential naturally occurring asbestos (NOA) in rocks (in situ) such as an exposed rock face or in drill core has commonly required extensive time spent by a highly trained geologist, often requiring additional lab analysis, to evaluate and identify various minerals. New techniques such as hyperspectral imaging, handheld Raman spectroscopy, or handheld X-ray fluorescence spectroscopy of bulk rocks are changing and improving the manner in which rocks are evaluated and identified. For instance, mining companies are exploring the use of hyperspectral imaging to identify minerals within drill core in a non-destructive manner providing spatial resolution down to 0.2 mm in grain size and extremely high spectral resolution (encompassing over 1,000 narrow bands). For comparison, satellites performing remote sensing of the earth typically utilize less than 10 spectral bands. Standard RGB cameras sense wavelengths in the range of ~435–700 nm (blue from 435.8–465 nm; green from 520–546 nm; and red from 630–700 nm). This example is an extremely broad range of wavelengths encompassing only 3 spectral bands. Hyperspectral, on the other hand, allows for data collection over a wider range of the electromagnetic spectrum (250–14,000 nm) with the bands having a much narrower range, which allows for greater specificity of mineral species. In addition to red-green-blue other non-visible portions of the electromagnetic spectrum (EMS) are also useful. The infrared portion has been found helpful to identify both hydrous minerals and alteration. In addition to absorption, transmission, and reflectance, the incoming light may also get scattered. In Raman spectroscopy, the scattered light provides additional insight on the chemical molecular species and structural properties. This allows a graph to be created that gives a unique "mineral fingerprint" and ultimately aids in identification and quantification. With advances in technology, asbestos identification could be less subjective and quantified through use of these techniques.

History of Coal Mine Subsidence and Research in Illinois

Bauer, Robert A., Illinois State Geological Survey, Prairie Research Institute, University of Illinois Urbana-Champaign, rabauer@illinois.edu (TS #6)

Subsidence occurred over underground room-and-pillar coal mines, which started in the very early 1800s. Subsidence occurred in areas of floor instability, high extract, and robbing of pillars while pits developed over shallow mines where roof falls reached the top of bedrock. No time dependence has been found. Longwall mining with planned subsidence started in Illinois shortly after 1856 in the town of LaSalle and was used in over 167 mines in Illinois. Subsidence of the surface was part of this mining method with the lowering of the roof several hundred feet behind the extraction face. From 1903 to1911, there were 430 coal mine fatalities, which may have contributed to the first subsidence research starting with the Illinois General Assembly authorizing an investigation of coal resources and mining practices to conserve the lives of mine workers and mineral resources. In 1914, a study was started on surface subsidence in counties representing 94 percent of coal extracted in Illinois, which led to the 1916 *Subsidence Due to Coal Mining in Illinois* publication and four detailed case studies published by the U.S. Bureau of Mines in 1927. In the early 1930s, a large-scale investigation was performed for appraisal of land for loans by the Federal Land Bank of St. Louis. Reports and county-based maps showed subsidence events over mines, mine outlines and severance rights based on county and mine records, landowner interviews, and visual inspection. In the 1970s, a study on roof stability in underground coal mines led to subsidence research on room-and-pillar coal mines. In the late 1970s to early 1980s, successful mechanized longwall mining in Illinois produced various concerns that led to the multidisciplinary Illinois Mine Subsidence Research Program, whose unique findings in the world for impacts on agriculture were used in legislation in several countries.

Mapping Where Rivers Meet People: Usability and Accuracy of Flood Maps in Rural Vermont

Bezanson, Noah, Colorado School of Mines, noah_bezanson@mines.edu; Paul Santi, psanti@mines.edu; Elizabeth Reddy, reddy@mines.edu (TS #7)

In July 2023, severe flooding impacted the northeastern United States. Ludlow, Vermont, on the Black River, was already experiencing wet conditions, but received an additional 6 inches of rain in less than 48 hours. While flood hazard maps are commonly used by community members to predict the risk at specific areas, there remain questions about accuracy and usability. To explore these issues, this study used a mixed methods approach including interviews, community mapping, and on-site inventories. Results indicate that flood hazard map accuracy and usability are significant issues of concern for all interviewed groups, including impacted residents, community organizers, and local and state officials. They note that their experience of flooding is quite different from what they understand hazard maps to suggest. They ascribe differences to lack of consideration of plugging of culverts, changes due to erosion and channel migration, and infrequent map updates. They also reported difficulty in distinguishing among and navigating through various map products and layers and difficulty in getting answers to basic questions. In particular, community members noted challenges distinguishing between the uses of the Federal Emergency Management Agency's (FEMA's) National Flood Hazard Layer and the River Corridor maps developed by the State of Vermont. Our community and field mapping of flooded areas showed that FEMA maps were more accurate close to the active Black River channel but failed to capture points farther away from the river where smaller streams and drainages flooded. On the other hand, the River Corridor maps are better at identifying flood areas on smaller drainages, but not as good along the main river channel, where they map a narrower floodplain than FEMA. Based on these results, we present possible corrective measures that could be done at the community, state, and federal levels to increase accuracy, usability, and confidence in flood hazard maps.

Subsidence Around the World 2024–25

Borchers, James, Hydrologist, jborcher@outlook.com (TS #6)

This presentation, which introduces AEG's 2025 Land Subsidence Symposium, summarizes land subsidence as reported in the news media worldwide. Subsidence during the past year occurred from groundwater extraction, hydrocarbon production, hydrocompaction, tunneling, loading of squishy sediment, drought-induced soil shrink-age, thawing permafrost, karst, mining, and other causes. News reports described the magnitude and areal extent and damage from subsidence and its effects on infrastructure at various locations in the U.S., England, India, Iran, China, Indonesia, Vietnam, Korea, Russia, Taiwan, and elsewhere. Threats from land subsidence have spurred, in some cases, unusual public policy decisions and spawned a market for subsidence insurance.

Climate-driven Geohazards: Applications of Geophysics to the Characterization and Remediation of Geohazards for Civil Structures

Bowling, Roy, Collier Geophysics, roy@colliergeophysics.com (TS #9B)

Geohazards present challenges to existing and future civil structures. Geohazards can be known prior to design and construction or may occur after these structures have been planned, designed, and built. Climate change causes an increase in weather severity and intensity, which can induce and accelerate the occurrence of geohazards impacting civil structures. Resilient construction and predicting and mitigating the effects of geohazards are important aspects of engineering and living in a world with climate change. Remote sensing and geophysical site investigations are tools in the engineering geologist's toolkit to characterize geohazard risk. Multi-method geophysical and geotechnical investigations have been proven to help create holistic and actionable site models. These models allow for robust and resilient design of systems to protect and mitigate the effects of geohazards in the built environment. Landslides, sinkholes, foundation undermining, land subsidence, etc., are all examples of geohazards that can increase in frequency due to climate change and are geohazards where geophysical investigations have the ability to provide information

to aid in remediation and resilient design. This presentation will share examples of various geophysical methods applied as tools to characterize geohazard risk as related to impacts from climate change.

When Did the Slope Start Moving…Varved Clays, Pipelines, and Landslides

Bown, Todd, GZA, todd.bown@gza.com; Nick LaPlant, Nick.LaPlant@nationalgrid.com (TS #10)

Following a week of heavy rain, on May 16, 2000, a landslide occurred in the village of Delmar, New York, just outside of the city of Albany. During the landslide, a portion of the slope between Delaware Avenue (Route 443) and Normans Kill failed and moved northwards to Normans Kill creating a 300-ft-long and 70-ft-deep scarp. The landslide flow carried soil into the Normans Kill, damming it, which prompted the City of Albany to relocate that section of the river. In May of 2024, a regional natural gas utility operator, whose right-of-way is located adjacent to the properties affected by the 2000 landslide, reached out for assistance in identifying the current stability state of their property. At this time, a landslide scarp (tension crack), approximately 140 feet wide with measured displacement between 2 to 6 inches was present within an asphalt parking lot situated above their property. Initially, the project started with a desktop analysis, involving the review geotechnical data memorandums from the subsurface investigation completed response to the 2000 landslide event. Using the historic borings, material index and strength data (peak and residual), and stability of the right-of-way slope was assessed under several case conditions for global and localized stability. Model case conditions reported factors of safety below unity for a circular failure along various critical slip surfaces. Slope instrumentation was installed along the right-of-way, and an operations and management plan was put in place by the utility operator. This presentation will discuss the progression from desktop analysis to slope instrumentation program, development of an instrumentation monitoring plan to safely operate their subsurface assets with real-time data, and how the project team responded to the geohazard following the framework the American Petroleum Institute's (API) Recommended Practice 1187 "Pipeline Integrity Management of Landslide."

True Real-Time Environmental Remediation Monitoring: Its Attributes and Lessons Learned from Multiple Deployments

Brourman, Mitchell, Field Environmental Instruments, Inc., mbrourman@fieldenvironmental.com (TS #8)

True real-time environmental remediation monitoring can be an extremely effective tool to 1) present a real-time comparison to dynamic ambient conditions, 2) demonstrate the efficacy of various engineering controls and operational strategies, and 3) as leverage to demonstrate implementation confidence to various stakeholders. Case studies and a live data feed will be used to demonstrate these attributes and highlight lessons learned.

Analyzing Microplastics Using Laser Direct Infrared Spectroscopy: Midwest Center for Microplastic Research

Brown, Megan R.M., Northern Illinois University, mbrown18@niu.edu; Chit W. Oo, coo@niu.edu; Melissa E. Lenczewski, lenczewski@niu.edu (Poster)

Microplastics (MPs) are ubiquitous in the environment. At Northern Illinois University, we have created the Midwest Center for Microplastics Research (MCMR) where we can analyze samples from a wide variety of media for MP concentration, size, and chemical composition. We utilize an Agilent Laser Direct Infrared (LDIR) Chemical Imaging Spectroscopy System to analyze MP in water, soil, air, and tissue samples. Protocols for each type of sample have been developed and rigorously tested. In addition, experiments were conducted to determine the best way to ship samples to the laboratory. Many samples can be processed onto metal filters, which are easier and more cost effective to ship. We investigated the recovery rate of samples after shipping using envelopes, boxes, and hard sided coolers. The highest recover rate (91–92 percent) was in samples shipped in hard-sided coolers with material to reduce movement of the samples. Cardboard boxes with material to reduce movement of the samples provided moderate protection, with a recovery rate of approximately 70 percent. Beyond the protocols and shipping experiments, large amounts of information such as multiple size measurements (like height, width, area, and perimeter), aspect ratio, and circularity of each particle are automatically reported in the LDIR

results. We have systematically tested MPs with known shapes to determine how to use the shape/size parameter results to automatically determine the sample particle shape. Further, we have added spectra to our library that can identify an estimate of tire rubber age and can add specific spectra based on provided control samples. This presentation will introduce the Midwest Center for Microplastic Research, describe our analysis processes and capabilities, and share lessons learned.

Interactions Between Basaltic Melt and Xenoliths in Volcanic Ejecta at Dotsero Maar, Colorado

Bruno, Julia, University of Missouri-Kansas City, jbch4@umkc.edu*; Alison Graettinger,* graettingera@umkc.edu
(Poster)

Phreatomagmatic eruptions occur when magma explosively interacts with subsurface water, forming craters and displacing crustal rocks, some of which are incorporated into volcanic ejecta as xenoliths. This study focuses on Dotsero Maar in Colorado, investigating the boundaries between volcanic ejecta and sedimentary xenoliths to better understand magma–sediment interactions. Dotsero Maar is characterized by three main pyroclastic deposits: welded spatter, red vesicular tuff breccia, and lithic-rich lapilli tuff. Quartz, sandstone, and siltstone xenoliths are found within all eruptive units, while evaporite xenoliths are restricted to the unwelded deposits. Fieldwork was conducted to collect samples and document the site's geological characteristics, including xenolith types, abundance, spatial distribution, and relative sizes. Laboratory analyses utilized Scanning Electron Microscopy (SEM) to study mineral compositions across xenolith-host boundaries, such as the boundary between evaporites and vesicular deposits, and how the boundaries differ between both xenolith and pyroclastic deposit types. Petrographic thin section analysis was also used to assess textural relationships, evidence of melting, and chemical alteration at the boundary zones. These analyses identify differences in boundary textures between welded and unwelded deposits, helping to infer the degree of thermal and chemical interaction between magma and sediment. Petrographic analysis has revealed several features indicative of magma–sediment interactions, such as anhydrite rims surrounding xenoliths, the presence of closely compacted aligned crystals around xenoliths, and signs of crystallization under disequilibrium conditions. The variance of these textures between welded and unwelded deposits and xenolith type can be used to interpret the extent of magma–sediment mixing and xenolith alteration. These findings will be compared to Cerro Overo Maar and contribute to a broader understanding of phreatomagmatic eruption processes and eruption dynamics.

A Fast-Paced MASW Survey to Inform Reconstruction of I-40 after Hurricane Helene in North Carolina

Carpenter, David, Schnabel Engineering, dcarpenter@schnabel-eng.com*; Jacob Sheehan (TS #9B)*

The devastation that Hurricane Helene brought to North Carolina and the surrounding areas is extensive and will take years for recovery. This project consists of geophysical and geotechnical investigations to inform the rebuild of a 5-mile stretch of Interstate 40 (I-40) extending from the Tennessee state line southeast into western North Carolina. I-40 was constructed on heterogenous embankment fill approximately 60 to 80 ft above the Pigeon River. Conditions within the project limits include geologic hazards such as steeply dipping bedrock with a documented history of instability. Moreover, embankment fill placed for the construction of I-40 is subject to high-velocity flows from the river. The Pigeon River had an estimated flow rate of 62,000 cubic feet per second (cfs) through the project corridor during the Hurricane Helene event. The flow rate corresponds to about a 500-year storm. Due to high-velocity flows and curvatures of the gorge, the water ramped up the embankments in some areas, particularly around sharp bends, and scoured miles of the embankment to such a degree that significant portions of the eastbound (EB) lanes and shoulder are completely washed away. Soil beneath and behind existing retaining walls supporting EB lanes was also scoured away. Scour exposed the top of bedrock in some areas of the channel bed. The initial geophysical program consisted of about 9.6 miles of seismic data for Multi-Channel Analysis of Surface Wave (MASW) processing. This data was collected in only 12 days by utilizing three concurrent crews from three different companies to meet the urgent timeline, commensurate

with the emergency nature of the project. The program included review of historical MASW data and a feasibility kick-off study. Data collection was concurrent with ongoing onsite construction of temporary repairs, which necessitated an extra level of field coordination and an almost continuous 24-hour per day data collection program. Data processing was conducted concurrently with data collection to minimize the timeframe from project award to final geophysical deliverable. The results of the MASW survey are compared to 130 available boreholes within the survey area to both evaluate the effectiveness of the MASW survey and to aid with interpretation. We would like to thank S&ME and F&ME for their work collecting data alongside Schnabel Engineering field crews. Without the efforts of the combined dedicated field team from three firms, the aggressive timeline set for this project would not have been achieved. We would like to thank the North Carolina Department of Transportation (NCDOT), and RK&K, the design team.

Maintaining the Academic Supply Chain for Engineering Geology Practitioners

Cato, Kerry, California State University San Bernardino, Kerry.cato@csusb.edu *(TS #3A)*

The future of the academic side of the supply chain for professionals entering the engineering geology practice is uncertain. The number of academic programs where students discover or seek to enter engineering geology is declining, unlike geologic and geotechnical, hydraulic, and structural engineering. Many such programs in the United States have been terminated, with relatively few remaining. One of the biggest problems for engineering geology programs is sustainability because so many are driven by one person. When that professor retires, the decision to replace them with an engineering geologist is at risk and often at the discretion of the current department chair or dean. There are larger trends in education at play as well that effect the viability of general geology departments. For example, at the K–12 level, science standards no longer mention geology but rather refer to earth science as a part of the overall emphasis on systems science. At the university level, enrollment in the sciences is static and in many cases declining; thus, relatively small geology programs must contend with larger biology and chemistry programs. In this instance, the very identity of geology is as risk as geology departments are eliminated or combined with other departments. Solutions to the declining of traditional academic programs appear to take several options. We will review and present some of these options. As an example, setting up a funded chair can shore up an existing program or be used to create a new single-person program. Nontraditional competency-based programs are another option, but results from these programs are too new to evaluate, and there is currently no clear path to licensure. While it is true that engineering geologists currently represent a relatively small minority of practitioners in the engineering design and construction business, their societal role is vital.

Alluvial or Debris Flow Fan? Classifying Process from Fan and Catchment Geomorphometry

Chan, Elise, Colorado School of Mines, elise_chan@mines.edu*; Paul Santi,* psanti@mines.edu *(Poster)*

In mountainous regions, geomorphic fans are attractive locations for development due to their relative flatness, free draining soils, sediment availability, and access to groundwater. However, the same processes that build these fans may still be active and hazardous. Fan deposits are often lumped into the “alluvial” category despite resulting from a variety of processes, such as debris flow or rock fall in addition to alluvial or streamflow, and they each require different mitigation strategies. This study seeks to identify the most probable depositional process on fans in Colorado based on the geomorphometric characteristics of these fans. Fans will be classified into categories of debris flow, fluvial, debris flood (a combination of the former categories), or gravity-driven (composed predominantly of rockfall and talus). A robust dataset of fans was compiled for use in this study using remote sensing, and process type was verified in the field. Geomorphometric parameters were extracted from a Digital Elevation Model (DEM), and multivariate regression analyses were used to identify which parameters most effectively discriminated between fan types. The results of this study will provide a framework for classifying the probable fan-forming processes from deposits in Colorado and regions with similar climates using only remotely sensed data. With this tool, it is possible to conduct a preliminary identification

and screening over large land areas, with the goals of focusing and reducing field reconnaissance, as well as improving the accuracy of identification, especially for features that are obscured by vegetation, altered by subsequent erosion, or that present mixtures of genetic processes.

Harnessing Machine Learning for Simulating Underground Climate Change

Chu, Zhonghao, Subsurface Opportunities and Innovations Laboratory, SOIL, Department of Civil and Environmental Engineering, Northwestern University, zhonghaochu2026@u.northwestern.edu*; Alessandro F. Rotta Loria,* af-rottaloria@northwestern.edu *(TS #11)*

Heated basements, parking garages, and pipelines act as underground heat sources, leading to underground climate change––an increasingly pervasive ground warming beneath cities worldwide. Underground climate change can affect infrastructure serviceability, subsurface ecosystems, and public comfort and health, while also boosting the geothermal potential of cities. Despite growing awareness, research on this phenomenon remains constrained by the absence of efficient and accurate modeling techniques. This study presents a modeling approach based on machine learning for the simulation and prediction of ground temperatures and deformations induced by underground heat sources across the spatial and temporal domains. Using the Chicago Loop district as a case study, we identify key physical features that characterize the interactions between underground heat sources and their surrounding environment, which are then integrated into a random forest model trained with the results of experimentally validated finite element simulations. The results demonstrate that high-resolution temperature and deformation maps for an entire city district can be generated using data from only a few building blocks, with temperature errors remaining below 0.5°C and strain deviations under 7 με. Notably, this method retains the accuracy of traditional finite element simulations while achieving computational speeds over a hundred times faster. This approach not only deepens our understanding of underground climate change but also provides a robust modeling approach for scientific purposes, engineering applications, and urban policy development. Its implementation can aid in designing mitigation strategies to manage subsurface heat accumulation and its long-term environmental consequences.

Contaminants of Emerging Concern Identification Framework (Interstate Technology and Regulatory Council [ITRC], 2023)

Cibarich, Meaghan, Department of Toxic Substances Control, California Environmental Protection Agency, MeaghanE.Cibarich@wisconsin.gov *(TS #8)*

Contaminants of emerging concern (CEC) require a clear technical approach on how to identify, evaluate, and manage them while acknowledging uncertainties in their environmental fate and transport, receptor exposure, and/or toxicity. Such an approach can be conducive to improved allocation of regulatory response resources and provide a foundation for communicating potential risk to public stakeholders. The ITRC CEC team has published a technical decision framework intended to have broad utility to the states in addressing CEC in their respective jurisdictions. The framework consists of an inventory of CEC monitoring programs, a key variable decision tree, guidance on risk communication, and an overview on analytical methods. A white paper serves as the prologue for the CEC framework and targets regulatory personnel positioned to institute their own CEC program. The presenters will discuss the motivation for the framework and its utility for environmental regulators.

Arizona Department of Water Resources Hydrological and Land Subsidence Monitoring Using Satellite and Terrestrial Data

Conway, Brian, Arizona Department of Water Resources, bdconway@azwater.gov *(TS #6)*

The Arizona Department of Water Resources (ADWR) Geophysics/Surveying Unit has been monitoring land subsidence using global navigation satellite system (GNSS) and InSAR data since 1998 and 2002 respectively; monitoring change in aquifer storage using terrestrial micro-gravity data since 1998; and managing and operating the statewide Continuously Operating Reference Stations (AZCORS) Network since 2023. These different datasets provide a platform of data synergy for successfully monitoring

groundwater conditions and aquifer compaction throughout Arizona. ADWR has identified more than 28 active land subsidence features that cover an area of 4,300 square miles, determining the spatial extent, deformation rates, and time-series history of each land subsidence feature. The process of collecting, processing, and interpreting InSAR data has resulted in ADWR producing land subsidence maps for each land subsidence feature covering different time periods. There are currently 800 land subsidence maps available for download on ADWR's website: https://new.azwater.gov/hydrology/field-services/land-subsidence-arizona. Since taking over the management and operation of the AZCORS Network in 2023, ADWR has enhanced the network by upgrading all legacy equipment to quad-constellation capability, constructing 20 new braced monument CORS sites, expanding existing network solution clusters, and creating four new network solution clusters for end-users. With the recent launches of higher-resolution SAR satellites such as Sentinel-1 and the launch of NISAR, ADWR has seen and will continue to see an increase in data availability (spatially and temporally) that will greatly benefit various projects. Engineers, hydrologists, geologists, GIS professionals, and scientists involved in the fields of water resources, structural engineering, geological engineering, hydrological engineering, land planning, floodplain management, and surveying greatly benefit from the InSAR, GNSS, gravity, and AZCORS data to identify and evaluate the groundwater basins of Arizona by examining the change-in-storage, land subsidence, uplift, earth fissures, faults, and many other hydrologic and geologic features.

Engineering Geology Limits Pipeline Scour Mitigation Alternatives, Mississippi River near Dubuque, Iowa

Costamagna, Daniel G, WSP USA, daniel.costamagna@wsp.com*; Jeffrey R. Keaton,* jeff.keaton@wsp.com *(TS #14)*

Sand-wave migration on the Mississippi Riverbed discovered by repeated bathymetry surveys resulted in inadequate depth of cover for an existing 254mm (10in) diameter products pipeline. Conventional scour mitigation alternatives consist of restoring adequate depth of cover along the existing pipeline and replacing the river-crossing pipeline using horizontal directional drilling (HDD) methods. A feasibility-level evaluation considered restoring the required 1,219mm (4ft) minimum depth of cover and protecting the alignment with three types of scour-resistant material (riprap, grout-filled mats, and articulated concrete block mats) and HDD. Logistical issues at this pipeline crossing include the active navigation channel along the deepest part of the river, active railroad tracks and the Mines of Spain State Recreation Area on the Iowa side, and the Upper Mississippi River Wildlife and Fish Refuge on the Illinois side. Two geologic issues important for HDD feasibility are related to bedrock in this unglaciated area of the Midwest and glacial meltwater runoff across it. Dolostone bedrock is mineralized with galena and sphalerite and has chert zones and solution-opened joints. HDD cuttings from mineralized zones will be contaminated with lead, chert zones will cause tool wear, and open joints will cause circulation losses. Sustained runoff from glacial meltwater caused incision of the Mississippi River channel below a headward advancing knickpoint, which stopped approximately 2.5km (1.5mi) upstream of the pipeline crossing. Bedrock exposures along the railroad tracks in Iowa and deeper than 35m (115ft) in a water well on the floodplain adjacent to the pipeline in Illinois indicated that extensive geotechnical characterization would be required for HDD design and probably would lead to a conclusion that HDD was infeasible for the current pipeline alignment. The design was completed for grout-filled mats.

Field Evidence of Late Quaternary Faulting in the Eastern Tennessee Seismic Zone near Knoxville and Implications of Seismic Hazard

Cox, Randel Tom, Earth Sciences, University of Memphis, randycox@memphis.edu *(TS #4)*

Documenting paleoseismicity is crucial for assessing earthquake hazard posed to infrastructure, such as nuclear reactors and large dams. The ~400 km-long Eastern Tennessee seismic zone, USA, is the second-most active seismic zone east of the Rocky Mountains, although the largest earthquake has been M_w 4.8. Our field surveys revealed an 80 km-long, 060°–trending corridor containing northeast-striking Quaternary thrust and normal faults with displacements $\geq$1 m. It overlaps a collinear concentration of seismicity that extends 30

km farther southwest. So, this active faulting zone may extend ~110 km. Near Dandridge, Tennessee, a thrust fault in alluvium records two earthquakes since 40 ka. Fifty km southwest near Alcoa, Tennessee, a thrust fault cutting alluvium records two earthquakes between 15 and 10 ka. Thirty km farther southwest at Vonore, Tennessee, a thrust fault displaces bedrock ≥2 m over colluvium, and alluvium is normal faulted >2 m. This corridor parallels both a steep gradient in mid-crustal S-wave velocities, consistent with a basement fault at hypocentral depths, and the northwestern Blue Ridge escarpment. The corridor faults may be connected to basement faults or coseismic faults above a blind basement fault. Observed dip separations suggest earthquakes of M_w>6.5. This Quaternary fault corridor and collinear concentration of seismicity are within an area where numerical modeling predicts maximum fault unclamping due to erosional unloading of the Blue Ridge. Post-15 ka up-to-the-southeast slip rates on these Quaternary faults suggests uplift of 0.05 mm/yr (50 m/m.y.), greater than erosion rate of Blue Ridge summits from 10Be. Thus, this fault corridor could be a principal element of neotectonic Blue Ridge uplift. Lastly, slip indicators on Pleistocene faults show sHmax of ~130°, in contrast to an ~060° modern sHmax. This suggests faults moved in a rotated stress field, possibly due to glacial forebulge advance, and may not inform current seismic potential.

Response to Movement within an Open-Cut Rock Face: Case Study from Ottawa Light Rail Project, Ontario, Canada

Crockford, Anna, Brierley Associates, acrockford@brierleyassociates.com *(TS #2)*

The Kiewit Eurovia Vinci (KEV) Partnership have designed and are nearing completion of building the Ottawa Stage 2 Light Rail Transit (LRT) Project. The project includes a new 27-km LRT extension of the Confederation Line and includes 3.4 km of cut and cover tunnels and significant highway widening and structures scope. Brierley Associates supported KEV by providing temporary support of excavation system designs for various segments of the open-cut trench excavation through soils and rock. The rock along the project alignment consisted of layered limestone, dolostones and shale beds with predominantly subvertical and sub-horizontal jointing. Based on the site investigation top of rock data, it was assumed that several faults would cross the alignment, although they were not mapped. Given the rock mass conditions within the project area, a spot bolting rock support system was implemented for the vertical rock cuts in combination with regular rock face mapping and monitoring. Along one segment of the alignment, a large sub-vertical fault was exposed below the installed soldier pile and lagging shoring. During excavation, rock conditions and monitoring data indicated a potential rock slope instability in the vicinity of the fault along one wall of the excavation. The survey, engineering, and contractor teams responses were coordinated to mitigate the risks to the project and personnel. Sequence of events, response successes, and lessons learned are presented.

Multi-Method Geophysical Investigation of a Dam Spillway to Evaluate Failure Zones and Flow Conditions

Cross, Eric, Pyramid Geophysical Services, eric@pyramidenvironmental.com *(TS #5)*

The use of multiple geophysical methods to investigate a project site can provide a significantly more comprehensive understanding of subsurface conditions when compared to the utilization of only a single method. Examining multiple geophysical parameters and understanding correlations that may exist between them can result in a more accurate assessment of hazards and geologic behavior. Pyramid Geophysics conducted a multi-method geophysical investigation at a dam spillway site located in central Virginia. A ground collapse and void spaces were visible at the downstream end of a drainage channel that extended away from the dam spillway. It was suspected that a combination of improper drainage channel construction, lack of compaction of fill material within the channel, focused groundwater flow, and/or increased soil saturation may be contributing to the ground failures. A geophysical survey was requested to investigate the drainage channel itself as well as the surrounding area to identify the full extent of possible voids, areas containing disturbed soils, and/or zones of increased saturation that could be indicative of unstable conditions and focused groundwater flow. The survey used a combination of electrical resistivity tomography (ERT), ground penetrating radar (GPR),

and ground conductivity measurements. This testing helped provide a better understanding of hydrogeologic conditions across the project area, potential zones of focused groundwater flow, identification of possible voids, identification of geohazards, and an assessment of seepage from the reservoir associated with the dam structure.

Microplastics in the Little Blue River

Custis, Andrew, University of Missouri-Kansas City, atcustis@gmail.com*; Jejung Lee,* leej@umkc.edu
(Poster)

Microplastics were first identified in 2004; since then their study has exploded. With increased concern about the adverse effects on human health, there is a need to understand how many microplastics are in our environment, where they are, and how they move. Previous studies have shown microplastics are common in surface water. Microplastics in the atmosphere have also been documented, especially near urban areas, and while there is some understanding of the presence of microplastics in the ground and soil, the extent to which microplastics have managed to infiltrate underground still warrants study. This study analyzed samples from two locations along the Little Blue River. Samples were also taken from United States Geological Survey well A3, near Atherton, Missouri. All samples were filtered and chemically processed to isolate the plastics. They were then studied on a microscope, taking count of all identifiable microplastics and making rough notes of how common certain kinds of microplastics were. The samples taken from the Little Blue River were compared to the groundwater samples with the intention of finding a connection in the flow of microplastics between the two sources. Ultimately what was found was that both sources had large concentrations of small clear fibers. This indicates that the two sources are linked as isolated sources would likely have larger concentrations of unique fibers. The groundwater samples had one set of unique plastics that were clear film microplastics, which are theorized to be degraded pieces of tarp. Since those plastics are not found in the Little Blue River, the flow direction must be going away from the river. This is consistent with the topology of the basin, which sits in a floodplain below the river.

Intricacies of External Inspection of Earthen Dams in Maryland

Dalal, Visty, Maryland Dam Safety Program, visty.dalal@maryland.gov
(TS #5)

The Maryland Dam Safety Program (Department) is mandated by the state laws and regulations (Code of Maryland Regulations, or COMAR) to regulate the structures on its dam inventory. Currently, there are 520 man-made dams in Maryland that the Department is entrusted to conduct external inspections of, issue construction and repair permits, and review Emergency Action Plans (EAPs) based on the dam hazard classification. The *high-hazard* dams are inspected annually, *significant-hazard* dams every 3 years, and the *low-hazard* dams every 5 years. The nationally adopted hazard classification of dams is based on lives lost, downstream structures, and utilities affected during dam breach. The Department's 11 professional staff (10 engineers, and 1 engineering geologist) share the responsibility of inspecting the state's dams in coordination with dam owners and engineers. State laws and COMAR also mandate that owners of high and significant hazard dams have their infrastructure annually inspected (both internally and externally) by independent professional engineers experienced in dam construction and repairs in Maryland. The author, an engineering geologist with the State of Maryland for the past 34 years, provides in the presentation a systematic method of externally inspecting earthen dams with images collected over decades identifying areas of concern on the crest of the embankment, upstream/downstream slopes and toes, principal and auxiliary spillways, staff gauges, and plunge pools. This presentation is shared with dam owners and engineers in the state so that proper protocols and procedures are followed to ensure thorough and consistent dam inspections. Educating dam owners and managers in appropriately identifying deficiencies on the dam is a "win-win" solution for all stakeholders.

Predicting Missing Volcanic Vents for Ground-Truth Analysis: Case Study of Coyote Hills, Black Rock Desert (Utah)

Davis, Cassidy, University of Missouri, cld9ct@umsystem.edu; Tiffany Rivera, trivera@missouri.edu
(Poster)

The South Twin Complex (STC) rhyolites of the Black Rock Desert, Utah, are an understudied, potentially hazardous volcanic field. The Coyote Hills rhyolites, along with North Twin Peak, South Twin Peak, Mid Dome, and Cudahy Mine, are temporally related (40Ar/39Ar ages of ~2.4 Ma), and geochemical similarities of these flows point to a genetic relationship, which remains unclear. While volcanic vent structures are known for the North Twin and South Twin peaks, the vent locations for the remaining rhyolites of the STC are unclear. Furthermore, two samples from Coyote Hills show distinguishable eruption ages, which may indicate formation via the coalescence of several domes and multiple eruption vents. By conducting geospatial analysis utilizing ArcGIS Pro software, potential vent structure locations can be mapped and further used for ground-truth analysis. Geospatial analyses include the utilization of available data collections for access to the following: digital elevation model (DEM) (USGS 1-m lidar) models of the study area for topographic investigation (cross-referenced with geologic maps to correlate flow features), as well as remote sensing data to detect heat anomalies and/or altered ground. Structural and geophysical data are referenced for fault networks and gravity data to identify subsurface density contrasts. Further data processing in ArcGIS Pro results in an end map produced from overlay analysis to predict the vent locations; for visualization, heatmaps and raster layers depicting probability surfaces are generated, alongside buffer analysis to identify threshold distance to key geological structures. Future ground-truth analysis can be conducted in the Black Rock Desert to verify predicted volcanic vent locations, which is key to creating a comprehensive map of the STC and quantifying the number of eruptions that created Coyote Hills. This technique may be applied to predicting future vent openings in similar active volcanic fields.

Probabilistic Seismic Hazard and Site Effect Assessment at Musandam Gas Plant, Oman

El-Hussain, Issa, Sultan Qaboos University, Earthquake Monitoring Center, Oman, elhussain@squ.edu.om; Ahmed Deif, adeif@squ.edu.om; Adel Mohamed, geotec@squ.edu.om; Yousuf Al-Shijbi, alshijbi@squ.edu.om; Abdullah Ansari, a.ansari@squ.edu.om; Said Al Hadhrami, said.alhadhrami@oq.com
(TS #12)

A site-specific earthquake hazard assessment was conducted at the Musandam Gas Plant (MGP), located in the tectonically active Musandam Peninsula of north Oman. This multidisciplinary study integrates geological, geotechnical, and geophysical methods with probabilistic seismic hazard assessment (PSHA) to characterize seismic risks at both bedrock and surface levels. The PSHA was carried out using the Cornell-McGuire methodology and implemented in EZ-FRISK, incorporating aleatory and epistemic uncertainties through logic-tree analysis. Two seismic source models were constructed based on updated regional data, including the recently recognized Masirah fault. Hazard results were generated for 475- and 2,475-year return periods. Ground motion values at the bedrock ranged from 0.124 to 0.135 g, while deaggregation identified key contributors to peak ground acceleration (PGA) at spectral periods critical for engineered structures. Surface site response was analyzed using horizontal-to-vertical spectral ratio (HVSR), multichannel analysis of surface waves (MASW), and seismic refraction tomography (SRT). Site amplification modeling was performed with SHAKE91 using velocity profiles derived from seven historical and four newly evaluated sites. Fundamental site resonance frequencies and amplification curves were produced for design input. Results show low to moderate amplification, with most sites below a factor of 1.7. Design response spectra were derived and tailored for local soil conditions. These findings offer crucial insights for seismic design and resilience of critical infrastructure in the Musandam region.

Sinking Ground, Rising Concerns—A Century of Land Subsidence in California

Ellis, John, INTERA, jellis@intera.com; Leila Saberi, lsaberi@intera.com; Marisa Earll, mearll@intera.com (TS #6)

Over the past 100 years, California's Central Valley has experienced some of the most significant land subsidence ever recorded, with vertical displacements exceeding 30 feet in certain regions. Subsidence associated with groundwater extraction can threaten the operation of critical infrastructure leading to economic damages and impacts to beneficial uses/users of groundwater. Using a century's worth of water level and subsidence data, this talk explores the historical progression of subsidence, identifying key hydrologic factors such as critical head that are responsible for compaction of aquifer systems. At 50 benchmark locations distributed across California's Central Valley, we leverage historical and current water level and subsidence to construct a long-term time series spanning 1901 to the present. Groundwater observations from state, federal, and local sources within a 2.5-mile radius of each benchmark are grouped by aquifer depth sampling, assessed for data quality and similarity, and joined together to create a long record of water levels. The long-term subsidence time series relies primarily on leveling conducted at the benchmarks, with higher frequency measurements from nearby GPS, InSAR, and extensometer data registered to the late-time leveling observations. The results show highly differing patterns of subsidence across the Central Valley that have not previously been compiled on a valley-wide scale to date. These results indicate much greater subsidence than is probably known in some areas and rapidly increasing subsidence in other areas.

Vapor Intrusion, Conceptual Site Model (CSM), Hidden and Unexpected Sources

Fineis, Jim, Total Vapor Solutions, jim@totalvaporsolutions.com (TS #3B)

Background/Objectives: This presentation will define the key concepts of a CSM and highlight its importance. Case studies will show why the use of a CSM is critical to a vapor intrusion (VI) investigation.

Approach/Activities: Case studies will show where an inadequate CSM resulted in a failed VI investigation and a case study where a properly conducted CSM provided the proper framework for a complex VI investigation.
Results/Lessons Learned: A properly thought-out CSM is key to a proper and thorough vapor intrusion investigation.

Naturally Occurring Metals as Drivers for Ocean Disposal of Dredged Rock, and Comparison to Modern Sediments, Newport and Coos Bay, Oregon

Freitag, George, GRI, gfreitag@gri.com; Mike Marshall, mmarshall@gri.com; Alison Horst, ahorst@gri.com; Darlene Verduzco, dverduzco@gri.com (TS #8)

The Ports of Newport and Coos Bay, Oregon, each have planned improvement projects that involve dredging of modern river sediment and underlying bedrock. In Coos Bay, the rock unit is the Bastendorff Formation, an Eocene deep-water marine environment unit. In Newport, the rock unit is the Nye Mudstone, a Miocene shallow-water marine unit. In addition to conventional sediment chemical testing, regulatory agencies required testing of natural concentrations of metals (Sb, As, Cd, Cr, Cu, Pb, Ni, Se, Ag, and Zn) in these rock units for open-ocean disposal suitability (n=5 Coos Bay samples; n=7 Newport samples). Results indicated metals concentrations in both rock units were within the natural range of Oregon background metals for Coast Range/Southern Willamette Valley soils, and within suitability screening levels for ocean disposal. Metals concentrations in Newport and Coos Bay units are roughly similar, except Newport Ni is two times that of Coos Bay Ni. As, Cu, Ni, and Zn in bedrock is roughly two times that of the sediment concentrations for both Newport (n=11) and Coos Bay (n=22). Newport sediment Cr, Cu, and Zn are two to ten times higher than that of Coos Bay. Higher metals in Newport sediments could be indicative of modern anthropogenic sources, or dilution of modern Coos Bay channel sediment with nearby relatively clean Quaternary dune sources. Elevated Ni in Newport bedrock and sediment compared to Coos Bay may represent basin exhumation of upland Miocene Ni source (Riddle area?) or possibly contribution from an ancestral Columbia River source.

Constraints on Deformation in Tectonically Active Intraplate Regions: Hidden Hazards in Plain Sight

Furlong, Kevin, Penn State University, kpf1@psu.edu*; Eric Kirby,* ekirby@unc.edu *(TS #4)*

Intraplate regions are often thought to have reduced hazards as they do not often exhibit typical evidence for active deformation, such as earthquakes; however, there are numerous examples of apparently low-deformation zones that experience significant local events. Such major earthquake events such as the 2010 Christchurch (Darfield, New Zealand), and the 2008 Wenchuan (Sichuan, China) earthquakes both occurred in "intraplate" settings, which had not been previously identified as the most likely locations for devastating events. In this work, we attempt to quantify the rates and locations of intraplate deformation in order to provide additional constraints for hazard preparations and mitigation. Integrating thermal-tectonic-chronologic modeling with other geologic data, we can place constraints on the rate of active tectonics in regions that otherwise may be considered relatively low-activity. Specific examples include evidence for substantial Oligocene to present uplift along the eastern margin of Tibet along the Longmenshan (host of the 2008 Wenchuan earthquake) that shows a complex pattern of variation in activity on the main structures in the region, constraints on timing/rate of uplift along the western slope of the Rocky Mountains in Colorado (Rifle, Colorado), and evidence for the response to far-field plate tectonic changes along the Cascadia subduction zone for deformation within the eastern Klamath Mountain terrane in California–Oregon. Our principal tools are low-temperature thermochronology [(U-TH)/He, Fission Track dating] coupled with detailed constraints from local and regional geologic units. Following this approach, we can identify the rates, geographical extent and longevity of these intraplate tectonics, which can then be incorporated into assessments of possible hazards in these regions.

Hydraulics Considerations for Erodibility Analyses for Concrete Dams

Gagnon, Hawkins, Schnabel Engineering, jgagnon@schnabel-eng.com*; Greg Paxson,* gpaxson@schnabel-eng.com *(TS #5)*

Rock erodibility studies for concrete dams, regulated by the Federal Energy Regulatory Commission (FERC), are typically performed using guidance contained in Appendix 11A of Chapter 11 of FERC's *Engineering Guidelines for the Evaluation of Hydropower Projects*. These guidelines were developed based on the Erodibility Index Method (Annandale, 1995) and principally focus on erosion caused by plunging jets to estimate the likelihood of initiation of rock erosion. For tall concrete dams, there are some specific considerations related to the assumed hydraulic conditions, primarily the jet impact location and the potential for jet breakup. This presentation will focus on lessons learned in recent applications of rock erodibility estimates at concrete arch dams and will highlight suggested changes to the FERC guidance.

Neotectonic Development and Seismic Hazard of the Puente Hills in Orange County, Southern California

Gath, Eldon, Earth Consultants International, gath@earthconsultants.com *(TS #7)*

The Puente Hills, an actively uplifting antiform created by the Puente Hills thrust, trends N65°W through the eastern Los Angeles Basin in Southern California. The age and uplift rate of the Puente Hills were determined by two independent approaches: 1) soil development and optically stimulated luminescence (OSL) age dating of fluvial terraces correlated to eustatic sea level highstands, and 2) drainage basin development rates calibrated by retro deforming the streams across the Whittier fault. The ~3.0 mm/yr, right-lateral Whittier fault trends across the southern margin, laterally deforming all (383) fault-crossing streams and gullies. Four fluvial fill terraces and three erosional strath surfaces were mapped in the eastern Puente Hills. Reconstructing the stream offsets yields age of formation for each of the drainage basins. The basin areas for the principal Puente Hills drainages (15) were calculated, ranging from 0.5 to 24 square km. Regressing basin area against basin age yields an age of about 600 ka for the largest drainages and initial uplift rate

of 0.3 mm/yr. That rate has increased to 1.25 mm/yr by the end of the Pleistocene. The rate increase is proposed to be due to the Santa Ana Mountains indenter closing the Santa Ana River gap at ~6 mm/yr and colliding with the Puente Hills ~200–250 ka. This collision has tripled the slip rate on the eastern Puente Hills thrust to 3.0 mm/yr, significantly increasing the hazard. A 3 mm/yr slip rate could result in an M7 earthquake every 1,000 years. The Whittier and Puente Hills faults, both M7 sources individually, now have similar 3 mm/yr rates and are probably co-seismically linked, leading to an M7.4 hazard potential. Considering that the last event on the Whittier fault is ~2,000 years ago, the hazard posed by the Puente Hills fault system must be considered as very serious.

Exploring the Value, Challenges, and Future of Geoscience Field Education from Field Camp to Early-Career Job Sites

Guido, Lauren, Colorado School of Mines, laurenmiller@mines.edu *(TS #1)*

Field education has long been considered a cornerstone of geoscience training, offering essential experiential learning that deepens understanding of geoscientific principles, tools, and techniques. These experiences provide unmatched opportunities to study real-world environments, reinforce classroom instruction, and build a complex conceptual framework by linking primary observations to previously studied phenomena. Despite its recognized value, field education is increasingly under threat. To better understand the current landscape and navigate conflicting initiatives, we conducted a comprehensive survey campaign targeting both field camp alumni and instructors. Our goal was threefold: to identify areas for improvement based on direct feedback; to highlight successful field education initiatives and understand why they worked; and to uncover blind spots—persistent or overlooked issues that remain unresolved in field settings. The findings extend beyond traditional academic field camps and are broadly applicable to early-career field training as well. Our results reinforce that field education not only enhances conceptual understanding and real-world application but also fosters a strong sense of community and belonging—both of which contribute to more effective learning outcomes. At the same time, the data reveal a growing disconnect between learners and instructors that undermines motivation, engagement, and the overall success of field experiences. Notably, the surveys emphasize the critical role of agency and learner voice in shaping meaningful field education. These tensions, along with insights from the literature and observed trends, inform a set of proposed strategies aimed at strengthening field education in both academic and professional contexts. These strategies include means to fully engage participants in the investigation process, solicit participant opinions, and organically foster community through mutual trust and understanding. In doing so, we advocate for a renewed commitment to field training as a vital component of geoscience education and early-career development.

Mechanisms of Postfire Debris Flow Sediment Recruitment in the Grizzly Creek Burn Area and Implications for Mitigation

Guido, Lauren, Colorado School of Mines, lguido@usgs.gov*; Lauren Miller,* laurenmiller@mines.edu*; Paul Santi,* psanti@mines.edu*; Francis Rengers,* frengers@usgs.gov *(TS #10)*

Runoff-initiated debris flows are known to mobilize large volumes of sediment as they travel downslope, primarily through the entrainment of material along their flow path. This process is quantified using yield rate—volume of sediment recruited per unit channel length—which is a critical metric for estimating debris flow magnitude and associated hazards. While laboratory flume experiments and models have largely focused on quantifying sediment entrainment from channel beds, field-scale observations reveal a more complex reality. In the Grizzly Creek Burn Area near Glenwood Springs, Colorado, we implemented a remote-sensing workflow designed to identify patterns in channel erosion and deposition and locate abrupt thresholds or changes in yield rate. Our analysis integrates geomorphometric, hydrologic, and field observations to evaluate sediment recruitment mechanisms in a postfire landscape. Results confirm that while channel bed erosion contributes consistently to sediment yield along the debris flow path, it is bank sediment recruitment—through progressive channel expansion and en-masse bank failures—that drives the majority of variability in yield rate. These processes dominate the mechanics of

observed sediment recruitment, hinting at the possible causes of documented scaling challenges with flume models. Key geomorphic controls on these recruitment mechanisms include channel gradient, catchment area, knickpoint presence, and geologic setting, all of which interact with postfire hydrology to influence sediment flux. By resolving where and how sediment is recruited at the field scale, this study builds on previous work identifying abrupt increases in yield rate and has direct implications for hazard assessment and mitigation. Recognizing the spatial and process-driven variability in sediment recruitment—especially from channel banks—can improve predictions of debris flow volume and inform targeted interventions aimed at reducing downstream risk in postfire environments.

Benefits of High Frequency Continuous Monitoring Data to Vapor Intrusion Investigations & Mitigation

Hartman, Blayne, Hartman Environmental Geoscience, blayne@hartmaneg.com *(TS #3B)*

Traditional sampling methods using passivated canisters or passive collectors are not a cost-effective nor time-effective approach to investigating the vapor intrusion pathway. Even the U.S. Environmental Protection Agency (EPA) admitted this when presenting the following statements at the Association for Environmental Health and Sciences (AEHS) conference in San Diego in 2023:

- Traditional methods result in false-negative decisions and poor characterization of long-term exposures,
- 1–4 rounds of 24-hr Summa are rarely ideal, and
- Well-established tools that can improve some assessments include real-time, on-site continuous gas chromatograph (GC) systems.

Why these statements? Because traditional sampling methods using canisters or passive samplers offer little chance of answering key questions in a timely manner. The methods simply do not collect enough data over a sufficient period of time and generally lack supporting data, such as differential pressure and climatic data, to answer the questions. The typical result is additional sampling rounds months later with the same limitations as the initial sampling event. This process can repeat itself and go on for years. Here's what real-time high-resolution data can do that traditional methods cannot do:

- Identify factors controlling indoor air concentrations,
- Differentiate between an indoor vs subsurface source in one site visit,
- Evaluation of maximum vapor intrusion potential using cross-slab pressure,
- Determining a building-specific attenuation factor,

Testing of potential mitigation remedies in real time. Continuous monitoring enables the collection of indoor air volatile organic compound (VOC) data while various mitigation remedies are being tried, such as sub-foundation vapor collection systems, coatings on the slab, modification of heating, ventilation, and air conditioning (HVAC) operating conditions, indoor air filtration units, and air exchange. Data collected from many actual sites will be presented to illustrate all of the "can do" items listed above. The ultimate benefit of this technology is significant cost and time savings for the responsible party.

Vertebrae™ Segmented Horizontal Wells for Monitoring Groundwater Flux and PFAS Contaminant Mass Discharge

Hasbrouck, Kristen, ERM, kristen.hasbrouck@erm.com*; Craig Divine,* craig.divine@arcadis.com*; Jesse Wright,* jesse.wright@arcadis.com*; Timothy Blount,* timothy.blount@arcadis.com*; Beth Parker,* bparker@uoguelph.ca*; Jonathan Munn,* jmunn@uoguelph.ca*; Steven Chapman,* schapman@uoguelph.ca*; Bonnie Packer (TS #14)*

Contaminant mass flux/mass discharge serve as critical metrics for understanding plume dynamics, identifying key source areas, and evaluating downgradient transport pathways. These measurements offer a representative framework for assessing risks to receptors, prioritizing sources, and optimizing remedial approaches. Long-term reduction in mass flux/mass discharge is increasingly recognized as essential for successful remediation strategies. New approaches that emphasize monitoring mobile contaminant mass and tracking temporal changes in mass flux/mass discharge are poised to become integral to future risk evaluation and management efforts. Flux-focused monitoring is particularly relevant for assessing per- and polyfluoroalkyl substances (PFAS), where the

complexity of transport and persistence presents unique challenges. The Vertebrae™ segmented nested horizontal well system (VWS) has been field-validated under the Environmental Security Technology Certification Program (ESTCP, ER20-5026) as a reliable tool for long-term monitoring of contaminant mass flux/mass discharge. Designed to quantify changes in mass flux/mass discharge over time due to remediation actions or plume dynamics, the VWS offers an innovative and cost-effective alternative to traditional vertical well transects. It consists of a single, small-diameter horizontal bore containing multiple isolated screen segments, each plumbed individually to the surface through small-diameter tubing. Tremied grout isolates tailored screen intervals, enabling precise monitoring within high-concentration and flux zones. This horizontal well system improves spatial coverage by targeting the width of the plume at depths with the highest contaminant concentrations and flux. Compared to vertical well transects, the VWS provides multiple close-spaced monitoring points from a single borehole, reducing installation costs while enabling characterization of zones previously inaccessible to vertical wells. Optimizing the placement of VWS installations requires a detailed understanding of site hydrostratigraphy, informed by thorough site characterization data. These data also establish baseline mass flux/mass discharge metrics and guide the selection of monitoring intervals. Field testing of the VWS involved three 500-foot-long installations, with screen intervals strategically placed in high-concentration zones identified through advanced site characterization techniques. Mass flux/mass discharge measurements were conducted approximately quarterly for eight performance-monitoring events using Earth Volumetric Studio™ software and traditional tabulation methods based on hydraulic conductivity, Darcy flux, and gradient estimates derived from hydraulic profiling borings, hydraulic and tracer testing, and fiber optic distributed temperature sensing. The VWS delivered precise, repeatable mass discharge measurements, demonstrating its applicability to a wide range of groundwater contamination scenarios. By enabling high-resolution, cost-effective monitoring of mass flux/mass discharge, this technology supports more accurate risk assessment, improves remediation performance evaluation, and enhances optimization efforts. The VWS represents a significant advancement in monitoring tools for site remediation and risk management, particularly for complex contaminants such as PFAS.

Evaluation of Airflow and Pressure Differential as VIMS Performance Metrics

Hatton, Thomas E., Clean Vapor LLC, thatton@cleanvapor.com *(TS #3B)*

Over the past three decades, the effectiveness of vapor intrusion mitigation systems (VIMS) has been primarily evaluated using pressure differential as the metric to determine a system's success. Regulatory agencies have adopted target pressure differential values that differ as much as an order of magnitude from state to state. Consultants promoting the benefits of mass flux and concerned about the expense of creating excessive vacuum fields have suggested that total system exhaust volume be used as a metric to determine the success of a VIMS. To determine the benefit of this option, a decision was made to investigate the relationship between pressure differentials and airflow as it applies to determining the efficacy of a VIMS. The objective of the study was to quantify the relationship between the pressure differential, airflow and the influencing variables based on slab integrity, soil permeability, indoor-to-outdoor temperature differential, and other seasonal environmental factors. The presentation will examine the root causes and relationships between the forces that result in VIMS performance variability. Vacuum field extension and airflow data from buildings with both permeable and low permeable fill material will be compared. The importance of quantifying the origin and having a method of measuring source airflow should be a prerequisite for accepting airflow as a credible performance metric. The presentation will demonstrate the measurement methods for both pressure field extension and source airflow evaluation as well as the benefit of establishing operational control of each metric. The finding will present a valuable tool available to regulators and those responsible for establishing best practices and reasonable performance criteria for long-term operational and energy sustainability.

An Overview of Geotechnical Baseline Reports (GBRs), Ground Characterization, & Risk for Underground Projects

Headland, Paul, Aldea, pheadland@aldeaservices.com (TS #2)

Ground characterization plays an important role in the development and implementation of Geotechnical Baseline Reports (GBRs) for underground construction projects. GBRs are contractual documents that establish anticipated subsurface conditions and ground behaviors, facilitating the efficient allocation and management of ground-related risks. Effective ground characterization, encompassing detailed subsurface investigations, testing, and interpretation of geotechnical data, is fundamental to establishing realistic and measurable baselines in a GBR. This presentation will walk through a historical perspective and development of guidelines (how we got to GBRs), structure and content of GBRs, and discuss ground characterization, construction considerations, and ground-related risks for underground work.

Noted Impacts of the New Madrid Earthquake Series

Hempen, Gregory, EcoBlast, LC, hempen69@gmail.com (TS #7)

The impacts of the 1811-12 Great New Madrid Earthquake Series (NMES) have been studied consistently since 1970. The NMES began on Monday, December 16, 1811, with the first principal event on the Southwest limb of the NM Fault. The second principal earthquake occurred on January 23 on the Northeast Fault limb. The last and largest principal earthquake occurred on February 7, 1812, with the break of the Central Trust Fault. In the 90 days through March 15, 1812, there were: three great, five major, 10 large, and 1,874 total earthquakes. A conceptual, spatial model of the daily, largest events' Modified Mercalli Intensity for the first 90 days will be provided. The paleoseismic assessments pertaining to the NMES will note that three primary earthquakes occurred on the three NM Fault limbs in ~900 and ~1450 AD, besides 1811-12. Several studies were conducted for, and since, the 2011 200th Anniversary of the NMES. Major central U.S. earthquake research, developments and tools will be noted.

New Madrid Earthquake Scenarios' (NMES') Recognition for Central U.S. (CUS) Earthquakes' Mitigation, Response and Recovery

Hempen, Gregory, EcoBlast, LC, hempen69@gmail.com (TS #7)

Significant strides in Earthquake Hazard Assessment have been achieved in the last 20 years. The U.S. Geological Survey and the American Society of Civil Engineers have led the advancement of models and tools for design and construction of new structures. The Building Seismic Safety Council has advanced the International Building Code for its adoption on a 3-year cycle. Earthquake preparedness actions are improving, such as performance-based design and sustainable systems. Post-disaster earthquake response is more organized in many CUS states than any time in the past. Functional recovery is an improvement to prior earthquake assistance. The glaring concern is whether our infrastructure and societal system can mitigate for, respond to, and recover from so many large, New Madrid earthquakes occurring over 3 months within the next 150 to 330 years (or tomorrow).

Surface Deformation Monitoring using Terrestrial Lidar and Unmanned Aerial Vehicle (UAV)-Multispectral Orthomosaics of the Axial Coal Mine Fire

Hiatt, Jessie, Colorado School of Mines and Tetra Tech, jhiatt@mines.edu; Wendy Zhou, wzhou@mines.edu; Lesli Wood, lwood@mines.edu (Poster)

The Axial Underground Coal Mine Fire in northwestern Colorado presents significant geotechnical hazards due to ongoing subsurface combustion and induced slope instability near a major highway corridor. The fire, active for over 70 years, has a documented history of sparking wildfires as recently as 2020, and recent investigations have shown that fire is present in multiple coal seams. A multidisciplinary approach integrating terrestrial light detection and ranging (lidar) scanning and unmanned aerial vehicle (UAV)-based thermal and optical mapping to assess slope movement and potential failure zones. A Trimble SX-10 lidar scanner was deployed to collect high-resolution point cloud data at three intervals (March, May, and June), allowing for temporal change detection. Drone-acquired optical imagery complemented the lidar data to generate a digital

elevation model (DEM) for movement analysis, while drone-acquired thermal imagery was used to create orthomosaics and assess thermal anomalies in relation to developing fractures and subsidence. The study highlights the effectiveness of repeat terrestrial lidar scanning for identifying and quantifying movements in unstable and hazardous terrain. It presents findings critical to risk mitigation efforts adjacent to Highway 13. The methodology and results contribute valuable insights into the application of remote sensing for long-term monitoring of geohazards associated with legacy coal mine fires.

Subsidence Induced Collapse Triggers Intensification of Kenilworth Coal Mine Fire

Hibbard, David, Brierley Associates, dhibbard@brierleyassociates.com *(TS #6)*

In 2024, the Kenilworth Mine Fire in Carbon County, Utah, intensified due to a subsidence-related ground collapse that reactivated and ventilated an underlying coal seam fire. The abandoned mine, part of a historic underground complex inactive since the mid-20th century, had been under intermittent observation by the Utah Division of Oil, Gas, and Mining (UDOGM) since initial thermal anomalies were recorded in 2021. However, a critical event occurred in August 2024 when a localized subsidence collapse breached the overburden, forming a new vent structure that allowed atmospheric oxygen to access the combustion zone. This subsidence-induced ventilation substantially increased the rate of coal oxidation and combustion by establishing a convective airflow system. The sudden increase in fire intensity was marked by smoke emissions, elevated surface temperatures, and increased levels of carbon monoxide near the vent. The root cause of the fire's resurgence was thus determined to be the unintentional creation of a vertical air pathway due to geomechanical failure of previously collapsed, poorly supported roof strata above the mined seam. Emergency design and mitigation efforts began by Brierley Associates and Applied Geologic in November 2024. Due to the site's steep, inaccessible terrain, all materials and equipment were airlifted. Utah's Abandoned Mine Reclamation Program implemented a rapid vent-sealing campaign using high-expansion polyurethane foam and engineered grout to cut off oxygen flow and reduce thermal output. The main subsidence vent and several secondary fissures were successfully sealed by mid-December, sharply reducing smoke emissions. The incident underscores the importance of ongoing geotechnical monitoring at abandoned underground mine sites, particularly where subsidence may expose long smoldering coal seams to new oxygen sources.

Shoreline Roadway Hazard Assessment of Bainbridge Island, Washington

Hill, Monica, Geosyntec Consultants, Inc., Monica.Hill@Geosyntec.com*; Alison Dennison,* Alison.Dennison@Geosyntec.com *(Poster)*

Bainbridge Island, located in Puget Sound region of western Washington, lies within a complex geologic and tectonic setting where landslides, seismically active fault zones, and coastal processes pose significant hazards to shoreline infrastructure. We conducted a high-level assessment of geologic hazards for 10 segments of roadway located along shorelines throughout Bainbridge Island to support a quantitative prioritization ranking of each segment for capital improvements, maintenance, or other adaptation strategies. Our approach included a comprehensive desktop review of available geologic maps, lidar imagery, existing subsurface exploration data and reports, and aerial imagery for each of the roadway segments. Based on this data review, we conducted targeted site investigations to evaluate threats to roadways and adjacent infrastructure from landslides, steep slopes, coastal erosion, flooding, and liquefaction. Using the combined findings from the desktop review and field investigations, we characterized the hazards present at each segment, assigned relative numerical ranks for each hazard identified, and developed an overall hazard ranking across all ten segments. In this presentation, we provide an overview of the varied hazards observed throughout the island and the methodology used to develop an "island-specific" quantitative hazard ranking.

Paleoseismic and Tectonic Geomorphic Study of the Meers Fault, Oklahoma, Reveals a Longer Fault Length, Variable Rupture Lengths, and Multiple Holocene Surface-Deforming Earthquakes

Hornsby, Kristofer T., BGC Engineering, khornsby@bgcengineering.ca*; Ashley R. Streig,* streig@pdx.edu*; Scott E.K. Bennett,* sekbennett@usgs.gov *(TS #4)*

Characterizing the frequency and size (displacement and rupture length) of large earthquakes on intraplate faults is critical to improve seismic hazard models for the central and eastern United States. Earthquake frequency, co-seismic displacement, rupture area, and length data are fundamental inputs for estimates of maximum earthquake magnitude and seismic hazard assessment. The WNW-trending, left-lateral Meers fault in southwestern Oklahoma is the only mapped Quaternary-active fault in the state; despite this, its surface rupture parameters and along-fault paleoseismic history remain poorly constrained. Previous paleoseismic studies reported at least two surface deforming earthquakes in the last 2,900 years (Crone and Luza, 1990). We analyzed high-resolution topography derived from lidar and balloon-based photogrammetry to map tectonic geomorphic evidence of recent co-seismic surface deformation and coupled this mapping with paleoseismic trenching. We mapped subtle monoclinal folding of Holocene deposits ~6 km farther to the WNW than previously mapped Holocene traces, corroborated by paleoseismic trench evidence of at least two north-side-up Holocene surface-folding events. Surface deformation transitions towards the ESE from folding above a blind fault to discrete surface rupture, coincident with an along-strike change in bedrock lithology. New OxCal modeling of earthquake ages from two previous paleoseismic trenches (Crone and Luza, 1990) combined with results from our three paleoseismic trenches, one of which is the re-excavation and resampling of an earlier trench, suggest that at least four, possibly five, surface-deforming earthquakes have occurred in the last ~7,000 years. These observations indicate at least two different scenarios of slip distribution along strike and at least two different rupture lengths. Our results demonstrate non-characteristic, multi-mode strain release through partially blind fault rupture in this intraplate setting and will help refine future seismic hazard models and maps.

Identifying Habitable Extraterrestrial Lava Tubes Using Electrical Resistivity Tomography (ERT) & Lidar Detection

Howe, Aidan, University of Missouri, awhb6c@umsystem.edu*; Fransico Gomez,* fgmoez@missouri.edu *(Poster)*

Using remote sensing to identify lava tubes is currently a significant topic of interest in planetary exploration, as the possibility of using lunar lava tubes to house a moon base becomes a more viable possibility. This study aims to relate microtopography differences of the surface with the size and depth of lava tubes, by surveying lava tubes of the Tabernacle Hill Lava Flow. The Tabernacle Hill Lava Flow is a flow that is part of the Ice Springs Subfield in the Black Rock Desert Volcanic Field of West-Central Utah. The flow hosts a network of lava tubes ranging from 1–90 square m in cross sectional area and ranging from 1–15m deep. These tubes often exhibit collapsed sky-lighting, intact passages, and display varying levels of surface expression (sagging). This study tests the hypothesis that lidar can be utilized to reliably detect as well as predict the size of subsurface lava tubes when a sufficient amount of surface expression is present. Using electrical resistivity tomography (ERT) with a 3-m electrode spacing lava tube structure and size are recorded. This spacing produces a profile that is approximately 128m long by 25m deep at ~1.5m horizontal and ~0.75m vertical resolutions. Lidar drones are then utilized to produce point clouds recording the surface expression of the tubes. Point clouds are subsequently classified in Cloud Compare and processed in ArcGIS Pro to generate high resolution digital elevation models (DEMs). By correlating lidar-derived data of surface expression with ERT data of subsurface geometry, a relationship between tube size and surface expression will be developed to create a reliable method of detection and subsurface geometry prediction.

Geologic and Geotechnical Investigations at Nolichucky Dam, Tennessee, following Record Inflows from Hurricane Helene

Huebner, Matthew, Tennessee Valley Authority, mthuebner@tva.gov (TS #5)

The remnants of Hurricane Helene produced record rainfall across eastern portions of the Tennessee Valley in late September 2024. Record flows on the Nolichucky River caused overtopping of Nolichucky Dam, with erosion at both abutments, along the downstream riverbank, and damage to the previously decommissioned powerhouse. This presentation focuses on the geologic and geotechnical investigations following response and recovery efforts at the site. Nolichucky Dam is a run-of-the-river facility with no flood control function. The dam was constructed in 1912–13 by the Tennessee Eastern Power Company, raised in 1923, and ultimately acquired by the Tennessee Valley Authority (TVA) in 1945. Little construction-era information is available regarding the condition and/or treatment of the dam foundation, which consists primarily of carbonate rocks with some interbedded shale. Several risk-driving potential failure modes related to flood loadings and downstream erosion were identified in 2019. In response, drone-based lidar data were collected during reservoir drawdown, with the primary objective focused on preliminary characterization of rock mass discontinuities (e.g., joints, bedding) exposed in the left abutment. This included mapping and identification of specific blocks that may be susceptible to erosion. Additionally, updated geologic mapping was conducted in the vicinity of the dam, although sparse exposures led to minimal map revisions. Extensive scour during Hurricane Helene exposed a complete stratigraphic section of the foundation rock along the downstream riverbanks. TVA acquired drone-based lidar and aerial imagery, comparable to data acquired prior to the hurricane, to perform lidar change detection and erodibility evaluations. Additionally, focused geophysical and geotechnical investigations were also performed to better characterize conditions on the right abutment. The pairing of investigations before and after this extreme event provide valuable benefit to TVA's understanding of the potential vulnerabilities at this site, particularly for hydrologic loadings with remote probabilities and long return intervals, such as those imparted by Hurricane Helene.

Machine Learning for Predicting Electrokinetic Remediation Performance: Initial Study and Challenges

Janga, Jagadeesh Kumar, University of Illinois Chicago, jreddy3@uic.edu; Krishna Reddy, kreddy@uic.edu (Poster)

Heavy metal-contaminated soils are frequently encountered, resulting from improper waste disposal practices and accidental spills, posing a significant threat to public health and the environment. Electrokinetic remediation (EKR) is proven to be effective in remediating heavy metal-contaminated soils, especially in low-permeable clays and heterogeneous soils. EKR involves applying a low electric potential gradient to facilitate contaminant transport through electrophoresis, electroosmosis, and electromigration toward the electrodes for subsequent removal. The overall success of EKR depends on multiple factors, including soil type, contaminant nature and concentration, and electric potential, among others. The objective of the current study is to preliminarily assess the effectiveness of machine learning (ML) in predicting the EKR-induced migration and removal of heavy metals in contaminated soils using a comprehensive database derived from past laboratory studies conducted at the University of Illinois Chicago. This database encompassed various variables related to EKR, which include soil type, and contaminant properties alongside normalized distance from the cathode and the corresponding pH variations and metal concentrations. Four different ML models - Random Forest (RF), gradient boosting (GB), categorical boosting (CatBoost), and artificial neural network (ANN)- were trained and tested using the compiled database to predict pH distribution and metal migration post-EKR. Notably, both the RF and GB models effectively predicted pH distribution post-EKR. All the models except RF effectively predicted selected metal migration with similar migration patterns. However, none of the models effectively predicted EKR-induced migration for metals that exist in different oxidation states (e.g., chromium) at different pH conditions or when trained on data with different contaminants with

diverse properties. To address this, process-informed AI could be explored in future studies to accurately capture various complex underlying variables and processes to accurately predict the EKR performance.

Building the Deepest Slurry Wall in Colorado

Johnson, Erinn P., Schnabel Engineering, ejohnson@schnabel-eng.com*; Philip Alani, Schnabel Engineering,* palani@schnabel-eng.com *(TS #5)*

Located near Greeley, Colorado, at the confluence of the Cache la Poudre and the South Platte rivers lies the deepest soil-bentonite slurry wall in Colorado, Delta Water. The deepest point of the Delta Water slurry wall is 115 feet, making it the deepest slurry wall in Colorado by approximately 30 feet. The Delta Water slurry wall sits in the alluvial deposits of the surrounding rivers and is keyed into the Laramie/Fox Hills formation. These formations interfinger in this area and consist of claystone, shale, and sandstone. As with most slurry walls in Colorado, there are two project stages after the slurry wall has been constructed. The first stage is aggregate mining. The Delta Water Slurry wall has an expected mining life of 8 years. After the aggregate has been mined out, the second stage is converting the mine into water storage. The future Delta Water reservoir will provide water for a private farming company for decades to come. Slurry wall excavation was completed in two phases. The first phase was completed using conventional methods excavation using a long-stick excavator to dig a key into bedrock, or as deep as they could go. The second phase utilized a clamshell crane operation where bedrock key was not reached by the excavator. This presentation will focus on the lessons learned and challenges encountered during construction, including hardwater challenges of the slurry mix and sand contents, trench stability, determining “key” rock, clay lenses, paleochannels, and more.

Engineering Geologists in Tunnel Repair and Rehabilitation

Jurich, David, Mott MacDonald, David.jurich@mottmac.com *(TS #2)*

Tunnel repair and rehabilitation is often completed with little to no information on geological conditions or documentation of the original design and construction. To further complicate matters, tunnel repairs are occasionally performed on an emergency basis. Therefore, an in-depth understanding of the principals of engineering geology and rock mechanics and the ability to quickly assess ground conditions and select appropriate ground support measures are valuable skills for successful tunnel repairs. An engineering geologist must draw on their prior experience and judgement to make decisions based on less-than-ideal conditions. Researching a tunnel’s history and making design decisions when there is little to no geotechnical information and using the Observational Approach to make ground support decisions when working in unstable ground conditions under time constraints are reviewed. Also discussed are experiences of working closely with the contractor before and during repairs to deliver the best value solutions. To illustrate the various roles and responsibilities of an engineering geologist, three case studies of unlined rock tunnel repair and rehabilitation projects are reviewed that include a dual-purpose highway/railroad tunnel in Alaska, a high head hydropower tunnel in California, and a Colorado water conveyance tunnel with a colorful history.

Analysis of Sand Flow Slides in Haines, Alaska

Kalev, Christopher, University of Alaska Fairbanks, ckalev@alaska.edu*; Margaret M. Darrow,* mmdarrow@alaska.edu *(Presented by Margaret Darrow) (TS #10)*

A significant (i.e., 1 in 1,000-year event) atmospheric river (AR) impacted Southeast Alaska in early December 2020. The greater Haines area experienced flooding, erosion, and over 100 landslides, including the deadly Beach Road landslide. Landslides impacted many of the major roads, including the area along Lutak Spur Road. This road runs along the beach between Lutak Inlet and a steep, forested bluff that is composed almost entirely of sand. The bluff is part of a feature we call the Lutak Spur (LS), which we postulate is a kame delta that formed at the margin of a valley glacier and has since been uplifted due to glacial isostatic adjustment. The area is currently forested, with near-surface iron-cemented soil layers visible in exposures. Rainfall and snowmelt from the 2020 AR event initiated multiple sand flows along Lutak Spur Road, several of which impacted houses that were built at the base of the steep bluff. During site visits,

we observed fallen trees in the head scarps of these sand flows and other landslides in the area, leading us to hypothesize that tree throw was a trigger for these mass movement events. In order to test this hypothesis, we conducted field work in 2024, collecting soil samples, bedding orientation measurements, and general field observations. We also talked with local residents about their experiences during the 2020 AR event. Once back from the field, we conducted direct shear and permeability tests on the sand, modeled the hydrology, and used these results as part of slope stability modeling. Our results suggest that tree throw was an important component in the 2020 sand flows along Lutak Spur Road. Here, we present an overview of our study and provide a conceptual model of the formation of the Lutak Spur landform.

The State of Naturally Occurring Asbestos (NOA) Regulations—A Call for Unity and Harmonization

Kalika, Sarah, DiabloGeo, skalika@diablogeo.com *(TS #9A)*

Twenty-five years ago, Naturally Occurring Asbestos (NOA) was brought to the attention of the U.S. Environmental Protection Agency in El Dorado Hills, California. Activity based sampling and eventual capping of surficial soil occurred at several schools in the area. California Air Resources Board, California Department of Toxic Substances Control, and California Geological Survey sprang into action to provide methods for assessment, laboratory preparation and analysis methods, and mitigation measures when asbestos is encountered during construction projects and in surface mining operations. Since then, what was intended to be a clear approach in California has become a patchwork of assessment strategies, misinterpretations of policy, differing thresholds for regulation using multiple analysis methods, and prescribed mitigation measures that vary by location and project size. In other U.S. states, NOA is often not addressed by any agency outside of the federal Occupational Safety and Health Administration (OSHA), concerned solely about worker safety. Most states treat NOA similarly to asbestos in building materials or consumer products and are under the false assumption that asbestos does not exist within soil, rock, or air in their jurisdiction. In 2024, Canada declared a threshold for what is considered to be "trace" quantities of asbestos as a contaminant in consumer products for sale, use, and import. Canada acknowledged that asbestos is a naturally occurring substance and that "low levels of asbestos fibers are omnipresent in the environment, including in both indoor and outdoor air." Canada specified counting rules and a weight percent quantity, which has simplified the determination of how much asbestos is "too much" in products, while not imposing restrictions to zero nor allowing up to 1 percent. This presentation will use several case studies to summarize the various agencies, regulatory thresholds, and often contradictory mitigation requirements in place across California and other U.S. states and will make the case for better training and harmonization.

Using Machine Learning and Iterative Ensemble Smoothing to Evaluate Groundwater Model Parameter Sensitivity

Kamp, Tyler, WSP USA, tyler.kamp@wsp.com*; Skyler Sorsby,* skyler.sorsby@wsp.com*; Roselyne Laboso,* roselyne.laboso@wsp.com*; William Gottobrio,* william.gottobrio@wsp.com*; Cliff Baines,* cliff.baines@wsp.com *(TS #13)*

Groundwater model calibration is a critical step in ensuring the reliability and predictive capability of hydrogeologic simulations. The ability of the model to achieve project objectives relies on the modeler's ability to identify optimal parameter values and understand what parameters have the most effect on calibration (sensitivity analysis) and what the plausible range of calibrated values might be for each parameter (uncertainty analyses). Depending on project budget and time constraints, it may not be feasible to run both sensitivity and uncertainty analyses on all model input parameters due to long run times (i.e., many days or weeks). On large, highly parameterized models, computational costs alone may make calibration of many model parameters prohibitive with traditional automated parameter estimation (PEST) routines. The iterative ensemble smoother version of PEST (PESTPP-IES) partially addresses this hindrance by calibrating the model using many combinations of parameter values (realizations) to perform a focused uncertainty analysis, but at the expense of a linear sensitivity analysis where the effects of incremental changes to each parameter are evaluated separately. However, a

machine learning (ML) method can be used to evaluate the interaction effects of multiple synchronous parameter changes using the results of the PESTPP-IES realizations, thus providing both sensitivity and uncertainty analyses from the results of a single PESTPP-IES run. The advent of ML statistical models enables new avenues for assessing multivariate influences of model parameters on an outcome (i.e., goodness-of-fit, phi). To showcase this approach, an objective comparison of a random forest ML model, which accounts for the multivariate correlation structure of many parameters simultaneously, to a traditional linear sensitivity analysis was performed using the Fox-Wolf-Peshtigo (FWP) groundwater flow model. The FWP model simulates the groundwater flow in the glacial aquifer system in northeastern Wisconsin and is part of the greater Lake Michigan Basin model.

The Changing Undergraduate Curriculum

Kath, Randy L., Department of Natural Sciences, University of West Georgia, rlkath@comcast.net; Deana S. Sneyd, dsneyd@asbog.org (TS #3A)

The undergraduate curriculum of traditional geology programs has been changing over the past decade. Due to declining enrollment and other financial pressures, geology programs have begun to change their course offerings and descriptions to attract more students to the program. Many programs are combining traditional geology courses into less traditional course names that appeal to new generations of students, thereby increasing enrollment and allowing the program to survive. For example, Earth Materials is a common "new" course in many geology programs that combines Mineralogy, Petrology, and possibly Economic Geology. Traditionally, these courses would require 8 to 12 hours of lecture/lab, which is combined into a single 4-hour course. To cover the required content of the three courses in a single course, degreed undergraduate majors are graduating with less comprehension than a traditional geology program. Furthermore, most of these students do not realize that they will be deficient in their educational requirements when applying for professional licensure/registration. If exact course titles are not listed on the transcript, but the candidate believes that they have taken the course work under a different name, the candidate must submit a course syllabus and written explanation to their board to demonstrate the necessary course work has been completed. Course compression is designed to allow geology majors more flexibility and provides a mechanism for additional elective hours. However, the lack of traditional geology courses is causing a disconnect between state licensing boards and degreed students applying for licensure. Most state licensing boards require a degree in geology, engineering geology, or geological engineering. This is in direct conflict with the newly named degree programs with compressed course content that are not aligned with state statutes. These new programs names have triggered geology state licensing boards to evaluate students' transcripts for traditional geology courses.

How Geoscience Programs Can Face the Ongoing External Pressures

Keane, Christopher, American Geosciences Institute, keane@americangeosciences.org; Leila Gonzales, lmg@americangeosciences.org (TS #3A)

The geoscience enterprise is at a crossroads with substantial changes in the social, technical, and economic environment while simultaneously facing new societal expectations from the geosciences. In 2022, the American Geosciences Institute (AGI) noted a significant shift in geosciences: more doctorates were awarded than master's degrees. This has only happened twice before—1962 and 1989—both times the geosciences entered new structural regimes in response to changing economic and social needs. Where and how geoscientists are being employed is also changing and with it the requirements for a program to be successful, such as aligning curriculum with state licensure to successfully compete with engineering programs for students. Meanwhile, growing challenges also face departments with negative pressure on undergraduate enrollment across the country, decreases in federal funding and student support while financial pressures rise for institutions. We will look at some of the current trends and a few successful actions in the past to help geoscience departments weather the storm. Additionally, we will look at emerging alternative pathway models both here in the United States and internationally that may challenge, or be potential opportunities, for geoscience departments into the future.

Historical Seismicity and Source Zone Activity Comparison: Canadian Shield Example

Keaton, Jeffrey, WSP, jeff.keaton@wsp.com (TS #7)

Probabilistic seismic hazard analyses (PSHAs) can be performed with open-source software that has been vetted to produce results that are accepted as valid. In addition to peak and spectral acceleration values (i.e., acceleration response spectra) consistent with a desired annual exceedance probability and site stiffness, the ground motion output also includes mean magnitude and distance for reported spectral acceleration values. The only site-specific geological parameter required for PSHA input is site stiffness expressed as the average shear wave velocity in the upper 30m of the site geotechnical profile. Reports describing site conditions and listing PSHA results commonly include a plot of earthquake epicenter locations within some nominal distance of the site, such as 300km, and a list of earthquake date, magnitude, depth, and epicentral distance. Most PSHA models are based on source zones with geographic boundaries and active faults with geographic locations, both with earthquake activity functions. Historical seismicity can be modeled for comparison with source zone seismic hazard results. Historical earthquakes above a specified minimum magnitude within a specified site distance (e.g., $M_w \geq 2$ within 300km) can be sorted by cumulative frequency and plotted with the seismic hazard source zone activity functions. For comparison, the two types of earthquake activity functions need to be normalized to a common area, such as 1,000 square km. An arbitrary site location in the Canadian Shield of eastern Ontario, Canada, provides a useful example of this comparison.

Innovative AI-Based Monitoring for Predicting Unstable Rock Events: EdgeAI, Vision Language Models, and Gaussian Splats

Kemeny, John, University of Arizona, kemeny@arizona.edu; Kwangmin Kim, k.kwangmin@gmail.com; Seokwon Jeon, sjeon@snu.ac.kr (TS #13)

Monitoring of natural and engineered geologic environments is important and enables the prediction and control of unstable rock events such as rockfall, slope, and underground failure. Even though modern geospatial tools and techniques currently exist to accurately predict rock failure (inverse velocity for example), it is not currently feasible to instrument all possible locations where unstable events could occur. As a result, hundreds of fatal landslides continue to occur each year worldwide, which particularly impacts resource-constrained countries and communities, where the use of modern geospatial technologies is often cost prohibitive. In just the last few years, several new AI-based techniques have been developed that have the potential to vastly expand our ability to predict unstable geologic events. First of all, these AI techniques focus on sound and vision to predict time-dependent rock failure, similar to how humans and animals use their ears and eyes to alert themselves to dangerous conditions. Secondly, EdgeAI brings the power of trained sound and vision AI models and even generative AI models (including vision language models) to compact energy-efficient field sensors that can easily be deployed in a variety of terrains. Thirdly, a novel AI-based neural 3D rendering technique called Gaussian Splats has recently been developed that, when combined with traditional 3D point clouds, can be used to accurately monitor large geologic expanses (thousands of miles of mountain roads in Colorado could be monitored with drones, for example) for change and failure prediction. The talk will briefly describe some preliminary work that has been conducted in each of these three areas.

Vapor Intrusion Barrier Technologies and Installation

Knight, Jordan, MTN Inc., Jordan.Knight@mtn-inc.com (TS #3B)

As awareness of vapor intrusion (VI) continues to grow, the science behind its mitigation has progressed significantly. With this evolution comes a wide array of advanced membrane technologies specifically designed for use in new construction projects. These technologies are increasingly critical for protecting indoor air quality and ensuring compliance with environmental regulations. This session will explore the current landscape of VI mitigation systems, with a particular focus on the performance, application, and durability of modern barrier technologies. Designing an effective VI mitigation system involves a detailed understanding of site-specific conditions and the properties of available membranes. Participants will

gain insights into the technical factors that influence material selection, such as chemical resistance, installation requirements, and compatibility with building components. The session will also address regulatory drivers and evolving industry standards that affect VI mitigation design and implementation. To bridge theory and practice, the presentation will feature several case studies illustrating the use of various barrier technologies in real-world scenarios. These examples will highlight the challenges faced and the solutions applied, demonstrating how thoughtful design and material choice can lead to successful outcomes. Attendees will leave with a deeper understanding of how to approach VI mitigation with confidence, applying the latest technologies to meet environmental and project-specific goals.

Electrical Resistivity Imaging on the Missouri River Levee System

Korth, Ryan, Terracon, Ryan.Korth@terracon.com

Extreme weather events, including intense rainfall and rapid snowmelt, have increasingly triggered severe flooding along major river systems such as the Missouri River. These events challenge the integrity of flood control infrastructure, particularly levees, which are critical for protecting surrounding communities and ecosystems. As climate variability intensifies, the need for robust levee evaluation becomes paramount. This presentation includes examples of levee evaluation using geophysical methods, with a focus on 2D Electrical Resistivity Imaging (ERI). ERI provides a non-invasive means to assess subsurface conditions, detect potential seepage paths, and identify zones of weakness within levee structures.

Integrating Geophysical Testing in "Smart Exploration Plan" for Site Exploration and Characterization

Kramer, Rob, Terracon Consultants, Inc., rob.kramer@terracon.com *(TS #14)*

Effective site exploration and characterization are pivotal for successful engineering and construction projects. In recent years, the integration of geophysical testing has emerged as a cornerstone in formulating Smart Exploration Plans (SEPs) aimed at optimizing resource utilization and enhancing project outcomes. This presentation explores the multifaceted role of geophysical testing within SEPs, highlighting its utility in identifying subsurface features, assessing soil properties, and mitigating geological risks. Drawing from case studies and innovative methodologies, the presentation describes how geophysical techniques such as seismic surveys, ground-penetrating radar, electromagnetic induction, and other methodologies are harnessed to delineate geological structures and detect potential hazards. Furthermore, it examines the integration of geophysical data with advanced analytics and modeling tools to streamline decision-making processes and enhance the accuracy of site characterization.

Professional Development: An Overlooked Inclusion Strategy

Lawson, Masai, GFT, mlawson@gftinc.com *(TS #1)*

It's no secret in the architecture, engineering, and construction (AEC) industry that members of underrepresented groups are not advancing in the ranks of leadership at the same pace as their colleagues. A stalled career and a perception of too few opportunities for advancement will prompt many to look for greener pastures. On the other hand, professional development opportunities can lead to a more engaged workforce where employees are more inclined to stay with an organization. Yet despite progress in the workplace over the past decade, parity for all women is almost 50 years away. And at the current pace, it will take 22 years for white women to achieve leadership parity—and twice as long for women of color. Diversity, equity, and inclusion is not just about changing skills. And it's not about taking an underrepresented group and teaching them how to "fit" within organizations. It's about changing cultures and behavior. It's about developing safe, fair, and inclusive work environments, building trust and a sense of belonging for all employees to feel empowered to innovate and do their best work. It's about creating a whole ecosystem to truly have an impact. Creating a diverse workforce isn't just about recruiting from outside the company; it's also about recruiting from within. During this presentation, we will discuss where and how investing in leadership and professional development can help your organizations cultivate an

engaged and inclusive workforce that not only can be tapped for the next generation of leaders but also become a powerful recruiting and retention tool.

Ground-truthing Landslide Inventories to Support Hazard Mitigation in Indiana State Parks

Leffel, Victoria, Indiana Geological and Water Survey, vleffel@iu.edu; Nicholas Angelos, nangelos@iu.edu (TS #10)

As part of an ongoing effort to inventory and assess landslide hazards in southeastern Indiana, field verification was conducted for landslides initially identified using high-resolution Light Detection and Ranging (lidar) data. This work represents one cycle of a broader project to develop a comprehensive landslide inventory for Indiana, focused on areas with high susceptibility due to geologic, topographic, and infrastructure-related factors. Field verification targeted landslide features on public lands and near local transportation corridors. Site visits were conducted at Clifty Falls State Park, Clark State Forest, Brookville Lake and Dam, and Versailles State Park and Dam. These areas were selected based on the density of mapped features and land access. The field team assessed slope morphology, material types, and hydrologic conditions to confirm feature classification and identify potential triggering mechanisms. Multiple landslide types were confirmed during fieldwork, including translational, rotational, and rockfall failures. Common contributing factors included steep slopes, interbedded shale and limestone units, and drainage alterations. Each park exhibited a range of landslide morphologies reflective of underlying geologic controls and site history. This effort involved collaboration with the Indiana Department of Natural Resources (DNR), whose staff joined site visits and contributed valuable insights on land management. The project was supported by the U.S. Geological Survey's Landslide Risk Reduction Grant. These partnerships play a key role in connecting field observations to broader strategies for risk communication and mitigation planning.

From Legacy to Innovation: Reshaping Perceptions of Nuclear Power

Lo, Collin, The JFK Redevelopment Aviation and Aeronautics Academy at York College, collinlo360@gmail.com; Andrew Singh, asingh1@york.cuny.edu; Omadevi Singh, osingh4@york.cuny.edu; Gabriel Garcia, ggarcia901@york.cuny.edu; Nazrul Khandaker, nkhandaker@york.cuny.edu (Poster)

Nuclear power offers a low-carbon energy solution, producing only 12 grams of CO_2 per kWh (CK-12, 2021). However, accidents like Chernobyl and Fukushima have created lasting public concerns. While Chernobyl caused 31 immediate deaths, long-term estimates suggest approximately 6,000 cancer-related fatalities (WHO, 2006). Fukushima demonstrated how concern often outweighs actual risk, with evacuation stress proving more harmful than radiation exposure (IAEA, 2015). A survey using Likert scale questions revealed divided public opinions:

- Over 50 percent remained neutral about nuclear energy,
- 80 percent considered environmental impact their primary concern,
- 90 percent identified health risks as their main worry,
- 45 percent supported nuclear energy for climate change mitigation with stricter safety measures, and
- 50 percent opposed local plant construction.

Most respondents believed media coverage exaggerates nuclear dangers, creating a perception gap. Psychological research explains this disconnect, showing people's disproportionate concern over rare catastrophic events (Slovic, 1987). Statistically, nuclear energy causes fewer deaths than fossil fuels or even solar power when including installation accidents (Our World in Data, 2021). Modern advancements have improved safety significantly (NRC, 2020; NEI, 2022; NRC, 2019):

- 90 percent of nuclear waste is now low-risk,
- New reactor designs reduce waste by 80 percent,
- Enhanced safety protocols exist post-Fukushima.

The challenge lies in educating the public about nuclear energy's evolution. While past accidents created legitimate concerns, current technology offers a safer, cleaner energy alternative that could play a crucial role in addressing climate change.

Deep ReMi Surveying to 1-km Depths for Earthquake Hazards, Mining, and Water Resources

Louie, John, Terēan® and the Univ. of Nevada, Reno, jlouie@terean.com; Alison Starr, astarr@terean.com; Daniel Sturmer, sturmedm@ucmail.uc.edu (TS #12)

The U.S. Geological Survey National Seismic Hazard Map has evolved to include data in addition to fault locations, earthquake probabilities, and Vs30. The need to account for the frequently observed amplification of earthquake shaking by deep sediments has led to testing the factors Z1.0 and Z2.5 and their influence on ground motions. Z1.0 and Z2.5 are the depth at which the shear-wave velocity property of rocks first exceeds 1.0 km/s, and 2.5 km/s, respectively. ReMi surveys employing arrays of geophones 0.5 to 20 km long and processed with Terēan ReMi® software are consistently able to directly measure Z1.0 and Z2.5 to depths of 1 km. Terēan® Deep ReMi surveys provide a faster and more efficient approach to deep subsurface imaging compared to active-source P-wave and S-wave seismic surveys, passive-seismic surveys using non-linear arrays, HVSR surveys with single stations, and deep electromagnetic surveys. An additional advantage of Deep ReMi is its ability to easily incorporate a triggerless/wireless source (such as a 12-lb sledgehammer) anywhere along the seismic line to enhance near-surface data quality with minimal effort. In 2023 the USGS funded comparisons of Deep ReMi, horizontal-to-vertical spectral ration (HVSR), and gravity surveying the industrial areas north and east of Reno, Nevada, where basin thicknesses are <1.0 km. Where basin sediments sit atop Mesozoic basement, the HVSR and gravity results closely follow Z2.5 depth results from the Deep ReMi surveys. Where basin sediments sit on Tertiary volcanics, gravity results instead follow Z1.0 depths from Deep ReMi. Terēan® Deep ReMi surveys have also been effective in characterizing complexly faulted mining prospects to 0.8-km depths, even in quiet rural areas far from any urban microtremor noise. Water-supply agencies also employ the basin shear-velocity cross sections recovered by Deep ReMi, since they help define aquifer geometry and allow more informed well drilling.

Lidar-Based Mapping of Alluvial Fans and High-Angle Fans for Post-Wildfire Geohazard Assessment in Colorado

Lovekin, Jonathan, Colorado Geological Survey, jlovekin@mines.edu; Amy Crandall, acrandall@mines.edu (TS #12)

Following the destructive 2021 debris flows in Glenwood Canyon and nearby regions of Colorado, the Colorado Geological Survey (CGS) initiated a lidar-based mapping project to improve geologic hazard delineation of alluvial fans and high-angle fans in response to developing wildfire-ready watersheds. These landforms, shaped by episodic sediment-laden flows, pose significant risks, particularly post-wildfire, and are often misrepresented on conventional maps. CGS delineated fan landforms with improved precision using 1-meter resolution lidar data, lidar-derived terrain metrics (e.g., slope and contour surfaces), hydrologic analysis, and spatial analysis tools within ArcGIS Pro. Alluvial fans and high-angle fans were classified based on the fan's mean slope: alluvial fans at ≤20° and high-angle fans at >20°, capturing both traditional and complex geomorphic features. Mapping emphasized areas modified by development or other anthropogenic activity, with field verification and cross-review contributing to quality assurance/quality control (QA/QC) efforts and improved mapping accuracy. Results reveal previously unmapped or misclassified alluvial or high-angle fans in areas undergoing increasing development pressure, where low gradient terrain indicates high hazard potential. This work highlights the critical role of high-resolution lidar data, spatial analysis techniques, and systematic QA/QC protocols in refining hazard awareness. The resulting dataset supports proactive land-use planning and wildfire resilience by identifying potential debris-flow and flood-prone areas. Although not intended for site-specific design, these maps are critical for prioritizing geologic evaluations and guiding mitigation planning across Colorado's wildfire-affected landscapes.

Infrastructure Upgrades and Ecological Uplift: Environmental and Engineering Geology of the Kellogg

Creek Restoration and Community Enhancement Project

Martin, Greg, GRI, gmartin@gri.com*, George Freitag,* gfreitag@gri.com *(TS #5)*

Kellogg Dam, constructed in the 1850s and obsolete by the 1890s, underlies a 1930s-era bridge on Highway 99E in Milwaukie, Oregon (suburban Portland). It blocks upstream fish passage to over 17 miles of habitat and forms an approximately 14-acre reservoir impoundment, largely filled with accumulated sediment. The North Clackamas Watersheds Council, American Rivers, the Oregon Department of Transportation (ODOT), and the City of Milwaukie are primary project partners in the Kellogg Creek Restoration & Community Enhancement Project (KCRCEP). The KCRCEP will remove Kellogg Dam and upgrade critical infrastructure by constructing a channel-spanning highway bridge; increase accessibility and public safety with a new multi-use pathway; re-establish fish passage to the upstream watershed and connectivity at the lower Kellogg Creek–Willamette River confluence; and restore ecological functionality to several acres of currently submerged or buried riparian habitat. On-water work in summer 2024 included 31 machine-drilled borings, 8 cone penetration test probes, 21 sediment sampling locations, and 16 limited-access explorations. A combination of barge-mounted, amphibious/difficult access drilling equipment and hand exploration tools were used. GRI's geotechnical exploration program was designed with input from ODOT, project restoration design engineers, and biologists. Sediment sampling and analysis activities were completed under multi-agency Portland Sediment Evaluation Team (PSET) oversight. Data acquired during this field campaign informed the project environmental sediment management approach including excavated soil handling and disposal options of contaminated sediments; provided geotechnical data informing design details for bridge replacement, dam removal, and post-restoration channel and floodplain features; and supplied essential engineering information for slope stability evaluations.

Soil Freezing in Tunnel Applications and Beyond

McCain, Aaron, SoilFreeze, amccain@soilfreeze.com*, Lisa Dunham,* ldunham@soilfreeze.com *(TS #2)*

The use of frozen soil in the tunneling industry has gained in popularity due to its inherent advantages. Frozen soil serves as ground improvement and temporary ground support for tunneling applications including the excavation and construction of shafts, breakout blocks, cross passages, and adits. Frozen soil offers a waterproof and structurally stable barrier that can be adapted to unique geometries of projects and work in a wide range of soil types. Soil freezing systems are flexible, allowing the use of the system for projects with site constraints. Applications highlight the capabilities of soil freezing in challenging environments. A brief look into a few case studies from around the nation illustrate the diverse application for the frozen soil technology. A receiving shaft was constructed in environmentally sensitive area of San Francisco Bay utilizing patented zone freeze technology to create a watertight system and with no adverse impacts on surrounding environment or infrastructure. An 85-foot-deep, watertight shaft was constructed approximately 50 feet from the Mississippi River to support a micro-tunneling operation through sandstone layers with artesian pressures. Breakout/break-in blocks have been built to stabilize the ground outside of shafts for projects in Seattle, Miami, and Minneapolis. Soil freezing technology was implemented in various orientations to facilitate the excavation of cross passages/adits in challenging ground conditions and beneath existing utilities and sensitive infrastructure in Seattle, San Francisco, and Washington, DC. In addition to the tunneling industry, ground freezing has become more widely accepted in smaller scale civil, development, and environmental projects.

Predicting Distributed Fault Displacements at Forsmark Nuclear Waste Repository, Sweden

McCalpin, James, GEO-HAZ Consulting, Inc., mccalpin@geohaz.com *(TS #4)*

With the evolving energy picture, there is renewed interest in nuclear power, and in building high-level nuclear waste repositories. This talk centers on the planned Forsmark Repository 120 km north of Stockholm in the Fennoscandian Shield (a Stable Continental Region). Surface faulting in Sweden occurred during and after the MIS2 deglaciation and is thus a concern for repository design over the ~100 kyr planning period, spanning the next

glacial–deglacial cycle. Several bedrock faults near the repository were identified as susceptible to reverse-fault reactivation during the next deglacial cycle. Distributed faulting hazards from these faults were *not* analyzed by probabilistic fault displacement hazard analysis (PFDHA), as done for the U.S. Yucca Mountain repository. Instead, earthquake-induced slip-on fractures and faults at Forsmark were calculated using discrete-element rock mechanics software 3DEC. 3DEC scenario displacements on fractures are invariably smaller than distributed fault displacements observed in historic surface ruptures, for the same earthquake magnitudes and distances from principal (seismogenic) fault. Fracture displacements predicted from particle-flow code (PFC 3D v4) software are closer to historically-observed slips, and PFC slips on deformation/shear zones are closer still. This implies that most distributed faulting observed in historic surface ruptures probably represents reactivations of shear zones, not simple fractures. At present PFDHA regressions for distributed faulting do not consider what type of fracture/fault/shear zone is being reactivated.

Awakening of the Ancient Altamira/Portuguese Bend Landslide

McCormick, William, Geo-Logic Associates, bmccormick@geo-logic.com*; Michael Phipps,* mphipps@cottonshires.com*; Patrick Shires,* cottonshires@icloud.com *(TS #10)*

The Altamira Landslide encompasses four historically active landslides in the city of Rancho Palos Verdes, California: the Portuguese Bend (PBL), the Abalone Cove (ACL), the Klondike Canyon (KCL), and the Beach Club (BCL) landslides. Semi-continuous to episodic, relatively slow movement of these landslides has been well documented during different time intervals since at least 1956. These active slides are present within the ancient Altamira Landslide that has been mapped by various agencies. Following two significantly wetter-than-average rain seasons, a major landslide developed that extended to near the mapped boundaries of the ancient landslide in 2023–24. Recent investigations indicate that movement of the Altamira Landslide is significantly deeper than the PBL and extends beyond the ACL, PBL, and KCL, in some cases involving two separate slip surfaces moving in different directions. This deeper and more extensive movement was never previously documented. The deep landslide movement is believed to have been activated primarily by very high pore pressures (in some cases artesian or near-artesian) discovered beneath the deep landslide failure surface as well as between the deep and shallower (historic) failure surfaces. Surface manifestation of failure is substantially larger (growing from 380 to over 700 acres), accelerated movement rates exceeding 12 inches per week and uplift along the coastline creating up to 500 feet of new beach. Emergency mitigation measures included development of a deep dewatering program consisting of several dewatering wells near the toe of the landslide. Monitoring showed a rapid decrease in groundwater pore pressures at various levels within the landslide and GPS surveys of monuments confirmed that dewatering significantly reduced landslide movement, including cessation locally.

Plastic Shakedown in Thermo-Mechanically Loaded Granular Media

Mehraeen, Naghmeh, Northwestern University, Department of Civil and Environmental Engineering, Subsurface Opportunities and Innovations Laboratory, naghmehmehraeen2026@u.northwestern.edu*; Alessandro F. Rotta Loria,* af-rottaloria@northwestern.edu *(TS #11)*

Granular materials, including sands and beads, are prevalent in both natural and engineered environments. The macroscopic behavior of these materials is intrinsically governed by the microscopic interactions among their constituting particles, which are particularly complex under thermal cycling. Despite increasing studies on the thermal effects on the mechanics of granular materials, a fundamental understanding of the microscopic particle interactions that govern these materials remains elusive. This work addresses, via discrete element simulations, the mechanics of granular materials subjected to long-term thermal loading

involving up to 10,000 heating and cooling cycles. The investigation examines the effects of key parameters on the mechanics of granular materials, including effective stress, temperature fluctuation amplitude, relative density, and particle properties such as size distribution, Young's modulus, thermal expansion coefficient, and friction coefficient. Through detailed analysis of fabric anisotropy, force chains, and energy distributions (kinetic and potential), this work provides new insights into the microstructural evolution that occurs under thermal cycling, thereby advancing the quantitative understanding of the mechanics of granular materials under non-isothermal conditions. This study contributes to the broader understanding of thermo-mechanical processes in granular materials and informs the development of predictive models in granular mechanics.

Methods for Site Characterization of Inaccessible Highwall Slopes

Millar, Robert, Brierley Associates, rmillar@brierleyassociates.com*; Dave Hibbard,* dhibbard@brierleyassociates.com *(TS #6)*

Illinois coal fields were heavily mined from the late 1800s to the mid-1900s, and most were never reclaimed at the time of closure. In Oakwood Township, the Pollywog Association property currently exhibits a dangerous, 8,500-ft highwall, which was formed by the United Electric No. 4 Coal Mine. Roughly, one-third of the highwall is undermined by the United Electric No. 3 Coal Mine and the Swisher Coal Mine. Brierley Associates used a combination of Leapfrog Works modeling, unmanned aircraft system (UAS) lidar, field mapping, and geotechnical drilling to characterize the slope of the highwall. The model allowed for a cost-efficient method of site characterization of eight hazard areas for the beginning stages of design. This presentation will summarize the process used to conduct this type of assessment for preliminary mitigation design.

A 5,000-Year Paleoenvironmental Record Based on Macro- and Microfossil Analysis of Cores from Clear Pond, San Salvador Island, the Bahamas

Mitchell, Madison, Department of Earth and Environmental Sciences, University of Missouri-Kansas City, mhmttf@umkc.edu*; Tina Niemi,* niemit@umkc.edu *(Poster)*

San Salvador Island in the Bahamas has many inland lakes that have been previously cored to study the past environment and climate of the region. Clear Pond is a coastal lake located on the southwestern side of the island and has a known freshwater conduit and marine conduits that connect to the ocean thus impacting its salinity and biota throughout time. In this study, I use macrofossil and microfossil identification as a proxy indicator to determine the paleoenvironmental conditions over time. I analyzed the biota from three core sections with a total length of 2.3 m collected from the southern part of Clear Pond in 2016. Radiocarbon age dating indicates that the sediment at the base of the core dates to 5,000 years ago. Because ostracod species have sensitivity to various conditions, identification can lead to information about changes in precipitation, salinity, and storminess. Analyses of the biota from the cores show a progression from open marine conditions that progress upsection to brackish water. Additional core samples were obtained in March 2025, which can serve as an update to data from the previous coring campaigns. Vegetation and snorkel surveys were conducted to provide further context for the study of the lake biota. Batophora oerstedi (fuzzy fingers) and Thalassia testudinum (turtle grass) were abundant across the lake bottom. The lake floor was littered with mollusk shells, including gastropods (such as the black and white striped Batillaria minima) and bivalves. Throughout the lake, various species of pupfish were present, and a Great Barracuda was discovered near the conduit. The current environmental conditions vary significantly from evidence obtained from the core data suggesting the environment has gone through various phases of change likely driven by global shifts in atmospheric patterns.

Using 3D Electrical Resistivity (ER) to Image an Active Fault at Porter Gap, New Madrid Seismic Zone

Mitra, Ipsita, CERI, University of Memphis, ipsita.mitra@memphis.edu; Randy Cox, randycox@memphis.edu; Kaushik Sarker, K.Sarker@memphis.edu; Kapil Karki, Karki.Kapil@memphis.edu; Chris Cramer, ccramer@memphis.edu (Poster)

Shallow active faults are three dimensional (3D) geological structures that hold information about the tectonic framework of the region. One dimensional (1D) or two-dimensional (2D) surveys are insufficient to provide a complete picture of subsurface structure, whereas 3D electrical resistivity is a relatively easy method to investigate shallow faults but has not been widely applied for this use. Identifying the location and orientation of shallow active faults will give valuable insights into rupture length, area, and net slip during earthquakes and therefore help predicting level of seismic hazard in the region. The survey was conducted in Lauderdale, Tennessee, along the Eastern Reelfoot Rift Margin (ERRM) at Porter Gap, the northernmost paleoseismic trench site previously on the ERRM. A 57-m fault-perpendicular line with 1-m electrode spacing and 16 fault-parallel lines 28 m in length with 2 m electrode spacing were chosen for the study. The ER survey was performed using Advanced Geoscience Inc. (AGI) Supersting R8 to image subsurface faulting. Using a dipole-dipole array, each electrode served alternatively as a current and potential electrode making it useful for identifying lateral resistivity changes in the subsurface associated with vertical structures such as faults.

Characterization of Faulting Style Along the Eastern Reelfoot Rift Margin at Union City, Tennessee

Mitra, Ipsita, CERI, University of Memphis, ipsita.mitra@memphis.edu; Randy Cox, randycox@memphis.edu; Kaushik Sarker, K.Sarker@memphis.edu; Sahidul Islam, mislam11@memphis.edu; Thomas Brackman, thomas.brackman@nsginnovations.com; Chris Cramer, ccramer@memphis.edu (Poster)

A corridor of northeast-trending topographic ridges along the Eastern Reelfoot Rift Margin (ERRM) has been identified as probable sites of neotectonic deformation associated with reactivation of basement faults within the Reelfoot rift region. Combined earthquake epicenters and paleoseismological studies reveal that the ERRM was active during the late Quaternary south of a restraining bend in the New Madrid fault complex, but the ERRM north of the restraining bend and underlying the corridor of linear ridges is seismically quiescent. We collected 2D electric resistivity (ER) profiles to image the subsurface structure of a prominent linear topographic ridge along the northern segment of the ERRM. The study site is in close proximity to the Union City airport. Five survey lines were run perpendicular to the fault with 2-m electrode spacing. The ER survey was performed using Advanced Geoscience Inc. (AGI) Supersting R8 to image subsurface faulting. Using a dipole-dipole array, each electrode served alternatively as a current and potential electrode making it useful for identifying lateral resistivity changes in the subsurface associated with vertical structures such as faults. Data were processed and interpreted using EarthImager 3D inversion software. Five 2D surveys were combined into a 3D model in EarthImager and then subjected to further inversion. The 3D model was updated by solving linearized inversion problems to minimize data misfit. The maximum vertical depth of 3D model is 25.2 m. It images eastward verging drag folds from a depth of 10m to 20m, suggesting a transpressional flower structure controls the linear ridge. These results will improve our understanding of the history of linked components of the New Madrid complex transferring the activity between different fault segments, thus giving insights into the seismotectonic model of the ERRM. These results will also give valuable understanding regarding the evolution of strike-slip restraining bends in general.

Unfriendly Skies, Unsafe Waters: (T)raveling for Work in 2025

Mullin, Lee, Arcadis U.S., Inc, Lee.Mullin@arcadis.com; Minda Moe, Minda.Moe@arcadis.com (TS #1)

How do you travel for work when you can be arrested for using a bathroom? If your only licensed professional can't safely travel to a state without risking losing their license, does your firm really operate that service in that state? How can you support your colleagues and/or employees as they decide if they can safely perform their work duties or attend a conference? The presenters will share their perspectives on the

impacts of current legislative challenges and gender-based discrimination upon working professionals in the environmental and engineering fields. They will discuss the current era of legal uncertainty for transgender employees who need to access public spaces when traveling for work, especially as it pertains to performing their job duties.

Development of Novel Chitosan-Biochar-Bentonite Composite (CBBC) for Contaminant Barriers

Nagaraja, Banuchandra, University of Illinois Chicago, bn20@uic.edu; Krishna R. Reddy, kreddy@uic.edu; Anjelica Palomino, Palomino,apalomin@utk.edu (Poster)

Bentonite is widely used in environmental barrier systems due to its low permeability. However, its limited effectiveness in removal of a wide range of contaminants reduces its usefulness as a barrier material. While several amendments and modifications have been proposed to enhance bentonite's adsorption performance, there is a pressing need for sustainable materials in such modifications. The current study investigates the development of a novel chitosan-biochar-bentonite composite (CBBC) barrier to improve the functionality of bentonite in terms of environmental containment. Chitosan, derived from the deacetylation of chitin—a naturally abundant polymer—has been extensively studied for its ability to remove a wide range of contaminants. Biochar, a carbon-rich material made by thermal decomposition of organic matter in the absence of oxygen, is recognized for its adsorption potential due to its large surface area and favorable surface functional groups. Specifically, chitosan derived from crustacean shells and biochar prepared using cornstalk were selected for this study. A novel methodology was developed for synthesizing CBBC from its constituent materials. The CBBC synthesized was tested for its ability to remove nutrients, specifically phosphate and nitrate, from synthetic stormwater. Batch tests were conducted with phosphate and nitrate solutions at varying concentrations (1 to 8 mg/L for phosphate and 0.5 to 10 mg/L for nitrate), representing typical concentrations in stormwater runoff. The results showed a significant increase in the phosphate and nitrate adsorption capacity for CBBC (102.04 PO4-3-P mg/kg and 93.46 NO3--N mg/kg) compared to bentonite alone (41.49 PO4-3-P mg/kg and 84.03 NO3--N mg/kg). The adsorption capacities of bentonite and CBBC were modeled using isotherms to understand potential underlying mechanisms. The results of this study offer valuable insights into the effectiveness of CBBC in removing nutrients—highlighting its potential as an efficient barrier in stormwater retention ponds or other waste-containing impoundments.

High Spatial Resolution Ground Motions in the Eel River Basin, California: Site Response Implications of Nodal Data Following the 2024 M_w 7.0 Mendocino Earthquake

Namazie, Leyla, U.S. Geological Survey, Earthquake Science Center; lnamazie@usgs.gov; Walter D. Mooney, mooney@usgs.gov (Poster)

Humboldt County, California, has been heavily impacted by numerous offshore earthquakes due to faulting within the subducting Gorda Plate and its associated Mendocino Triple Junction. The Eel River basin, home to one quarter of the county's population, is being studied for its role in guiding seismic energy from offshore events, amplifying seismic waves, and potentially increasing local hazards. On December 5th, 2024, a M_w 7.0 strike-slip earthquake struck 70 km offshore from Cape Mendocino. While the impact on infrastructure was minor compared to the more proximal M_w 6.4 earthquake that occurred in 2022, damage to municipal pipelines and foundations was concentrated in the basin towns of Ferndale, Fortuna, and Rio Dell, reinvigorating previous investigations of basin effects from these subduction zone events. In the days after the mainshock, the U.S. Geological Survey (USGS) deployed 114 seismic nodes across Cape Mendocino, the Eel River basin, and along Highway 101, where they recorded continuously for 5 weeks. Nodal data recordings of more than 20 onshore and offshore earthquakes were incorporated into the study to complement records from permanent stations. Preliminary analysis of mainshock Fourier spectra from strong ground motion accelerometers shows amplified signals near Petrolia (along the rupture line) around 0.6–0.8 Hz, indicating potential earthquake directivity effects. Signals within the Eel River basin are weakly amplified between 1 and 5 Hz, similar to amplification ranges identified in the M_w 6.4 event. Using the nodal data, we calculate peak ground velocity (PGV) and

cumulative displacement at each sensor, identifying regions of the basin that experience increased shaking at high spatial resolution. Correlation with geologic cross-sections reveals a complex relationship between ground motions and the basin's shallow subsurface structure. Future work will aim to better constrain these effects, as well as basin resonance, using single-station site response methods including horizontal-to-vertical spectral ratios.

Advances in Stochastic Modeling for Large Intraplate Faults

Neely, James, Cotality, janeely@cotality.com (TS #7)

Accurately modeling the recurrence of large earthquakes in intraplate settings is a particularly challenging problem in seismology. Deformation rates are slow, and the historical and geologic record contain relatively few events. Paleoseismic analyses reveal that many of these intraplate faults show significant earthquake clustering in both space and time. The commonly applied Poisson model can reproduce this clustering due to chance, but such a time-independent model ignores the time-dependent processes that drive the clustered behavior. We will present how Cotality is modeling these clustered hazards for the insurance industry and examine potential new applications of stochastic models, like the Long-Term Fault Memory model, for accurately estimating earthquake probabilities in intraplate settings.

Performance of Plane Energy Geostructures Serving as Thermal Batteries

Nulisch, Jack, Subsurface Opportunities and Innovations Laboratory, SOIL, Department of Civil and Environmental Engineering, Northwestern University, jacknulisch2029@u.northwestern.edu; Alessandro F. Rotta Loria, af-rottaloria@northwestern.edu (TS #11)

This study presents an investigation of the thermal energy storage potential of plane earth-contact structures used as heat exchangers, often called energy geostructures. To date, various investigations have explored the performance of plane energy geostructures in the context of heat extraction and injection operations, but none appear to have ventured into the analysis of the thermal energy storage potential of these planar structural heat exchangers. This work addresses this knowledge gap by performing thermo-hydro-mechanical finite element simulations to model the behavior of plane energy geostructures under the uninvestigated thermal energy storage operations. Sensitivity analyses are conducted using a representative model of a parking garage in the Chicago Loop district that modifies the material properties and operating conditions to comprehensively analyze the energy, geotechnical, and structural performance of plane energy geostructures used as thermal batteries. These analyses aim to develop a fundamental understanding of the mechanisms and phenomena governing the operation of such technologies, underpinning future advances in science, engineering, and technology. The widespread utilization of the subsurface as a heat transfer and storage medium can uniquely support the establishment of a more sustainable society.

Subsurface Characterization for Deep Tunnels in Delta Soils; Lessons Learned from an Early Career California-Based Professional

O'Hara, Emma, WSP USA, emma.ohara@wsp.com; Kenneth Johnson, kenneth.johnson@wsp.com (TS #2)

Currently, there are two major water conveyance tunnels that are planned in the Sacramento-San Joaquin Delta (the Delta) in California. WSP USA was brought on to conduct a geotechnical investigation to help better characterize the subsurface materials in an area of interest on one of the many islands in the Delta. This geotechnical investigation consisted of four seismic cone penetration tests and two rotary wash boreholes to 180-ft and 200-ft depths, one of which was utilized for downhole geophysical suspension logging. Select SPT, ModCal, Shelby Tubes, and punch core samples were utilized for a suite of geotechnical laboratory testing and one radiocarbon dating test was also performed on a piece of wood encountered at a 180-ft depth in the borehole. This presentation will summarize the lessons learned for geotechnical investigations and subsurface characterization specifically related to deep tunnel design in thick delta soils. This presentation will also summarize the lessons learned as an early career professional in effective subcontracting, planning, coordination,

time management, and field communication. General considerations for geotechnical investigations in rural or remote regions will also be discussed and presented.

Stabilization of Boron in Coal Combustion Wastewaters Using Industrial Byproducts: Insights from Fourier-Transform Infrared Spectroscopy (FTIR) and X-ray Diffraction (XRD) Analyses

Oladipo, Olajide, University of Georgia, Athens, GA, olajide.oladipo@uga.edu*; Oyindamola Oseni,* oyinoseni@uga.edu*; Valentine Nzengung,* vnzengun@uga.edu *(TS #8)*

Coal combustion wastewaters, including coal ash leachate (CAL) and flue gas desulfurization (FGD) effluent, frequently contain elevated concentrations of boron, which is a trace element known for its high mobility, persistence, and toxicity at elevated levels. Boron's complex aqueous chemistry and weak interaction with conventional treatment materials often render traditional remediation technologies inefficient or cost prohibitive. This study investigates the potential of using low-cost industrial byproducts, specifically steel slag, bone biochar, and recycled aluminum materials as sustainable treatment media for boron removal and stabilization from these waste streams. It further examines the underlying mechanisms responsible for boron removal and stabilization.

Several treatment configurations were developed with varying ratios of slag and biochar to assess how media composition affects boron immobilization. Batch experiments were conducted under alkaline pH conditions (10–12), and the solid residues were analyzed using Fourier-transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD). FTIR spectra revealed that systems with higher slag content produced prominent B–O, SO_4^{2-}, and CO_3^{2-} absorption bands, suggesting the formation of borate minerals and ettringite. XRD results confirmed the presence of stable boron-containing mineral phases, including colemanite, inyoite, and ettringite. In contrast, biochar-dominant treatments showed weaker spectral signals for boron, indicating that adsorption mechanisms, rather than co-precipitation or mineralization, were likely predominant. The integration of spectroscopic and mineralogical evidence demonstrates that boron is more effectively removed and stabilized through co-precipitation pathways facilitated by calcium- and aluminum-rich inputs. These findings underscore the potential of engineered geochemical systems to convert industrial residues into high-performance sorbents for environmental remediation. Beyond improving treatment efficiency, this approach promotes circular resource use and provides a scalable solution for mitigating boron contamination in coal-fired power generation sites and other industrial wastewater sources.

The Best Method to Measure Indoor Air Concentrations to Assess Vapor Intrusion Risks—The Preference for Passive Samplers

O'Neill, Harry, BEACON, Harry.ONeill@Beacon-usa.com *(TS #3B)*

Indoor air samples historically have been collected in the United States over an 8- or 24-hour period because of the successful promotion of evacuated canister sampling by Method TO-15. However, research completed over the past decade at universities, as well as data collected on commercial projects, has clearly demonstrated that the temporal variability of indoor air concentrations can differ by orders of magnitude in both long and short time periods. Therefore, there is a growing trend by regulators in the United States to require data be collected over an extended time period (e.g., 10 to 14 days). The collection of daily 24-hour samples over these extended time periods is cost prohibitive; therefore, the use of passive samplers to collect long-duration, time-integrated samples is being advanced and adopted as a best practice to reliably determine average concentrations of volatile organic compounds (VOCs) in air and confidently determine whether mitigation is required. In other countries, such as Denmark, passive samplers have long been the preferred methodology. Passive samplers can also be used to measure concentrations of ambient air, soil gas, sub-slab soil vapor, crawl space air, and conduit gas.

Approach / Activities:

The use of sorbent samplers to passively sample air over days or weeks provides long-duration average concentrations to assess health risks, which overcomes the challenges from temporal variability and episodic occurrences of vapor intrusion. Passive samplers are low-profile and are more readily adopted by building

occupants and easier to manage by field technicians than evacuated canisters. An ongoing community sampling program involves the collection of indoor air samples at hundreds of homes annually by use of passive samplers, with uptake rates that were verified to be linear out to 26 days by a robust study completed by an independent third party. In this sampling program, the passive samplers provide a 26-day, time-weighted average concentration that represents with one sample more than 25 percent of the entire winter season. The prior sampling program used inert stainless steel evacuated canisters to collect discrete, 24-hour point-in-time samples. The results from these samples were not found to reliably represent the actual exposure risks of the building occupants and homes with non-detects were still not removed from the monitoring program. By collecting long-duration samples with parts per trillion by volume (pptv) reporting limits following a U.S. Environmental Protection Agency (EPA) analytical method, greater confidence was achieved that the health risks were properly assessed, and ongoing monitoring and mitigation strategies could be determined, including removing homes from annual testing.

Results / Lessons Learned:
The use of passive samples to collect samples over 26-day periods has produced data that are of higher confidence for determining health risks than when 24-hour samples were collected and regulators are now more confident in determining which homes require no further sampling and which require mitigation. Passive samplers additionally have gained acceptance because they are light weight, easy to transport, and are a more green and sustainable technology then the use of bulky, evacuated stainless steel canisters. The simplicity of use of these devices results in fewer errors in the field and an easier-to-clean sampler that can eliminate cross contamination issues that are known to be common for canister samplers. In addition, this simplicity of use allows residents the option of hanging the samplers in their own homes. The ability to have residents receive samplers at their doors and hang them in their homes following documented procedures and conditions will increase the number of homes that are able to be sampled in both ongoing and future sampling programs by overcoming the stigma of having someone enter one's home.

Enhanced Phytoremediation of Perchlorate and Nitrate in Sand-Biochar Bioreactors
Oseni, Oyindamola, University of Georgia, oyinoseni@uga.edu*; Olajide Oladipo,* Olajide.oladipo@uga.edu*; Valentine Nzengung,* vnzengun@uga.edu *(Poster)*

Perchlorate and nitrate are widespread co-contaminants in water bodies and present significant challenges for environmental remediation. Although phytoremediation is a low-cost and effective method for perchlorate degradation, its effectiveness is limited when nitrate is present. As a competing terminal electron acceptor, nitrate inhibits rhizodegradation of perchlorate and promotes phytoaccumulation, increasing the risk of contaminant transfer into the food chain. This study investigates an enhanced phytoremediation system employing sand-biochar bioreactors planted with willow trees. Biochar, a carbon-rich material known for promoting microbial activity, was introduced into the system to improve microbial community structure and enhance contaminant degradation. Compost tea and chicken manure extract were also tested as electron sources to facilitate concurrent nitrate and perchlorate reduction. Microbial community analysis was performed on the bioreactor media before introducing contaminants and electron sources to characterize and identify the baseline microbial populations. After spiking the bioreactors with perchlorate, preliminary results show a reduction in perchlorate concentrations within planted sand-biochar bioreactors following treatment. However, the dominant mechanism responsible for perchlorate reduction, whether through microbial degradation, adsorption onto biochar, or a combination of processes, remains under investigation. Results from batch adsorption tests suggest that adsorption is not the dominant mechanism responsible for perchlorate and nitrate removal in the reactors. Understanding the interplay between these mechanisms is crucial for optimizing biochar-based phytoremediation systems. Future studies will include plant tissue extraction analyses to assess phytoaccumulation levels and further distinguish between microbial degradation and physical adsorption pathways. This research advances knowledge on enhanced rhizoremediation strategies

for managing perchlorate and nitrate co-contamination, providing insight into sustainable and scalable solutions for environmental cleanup.

Moving the Big Iron: How to get your Tunnel Boring Machine (TBM) to your Site

Piepenburg, Michael A., Mott MacDonald, michael.piepenburg@mottmac.com*; Ryan P. Sullivan (TS #2)*

Tunnel Boring Machines (TBMs) are typically manufactured overseas, and the pre-assembled pieces are transported to the project site in the United States and then lowered into the shaft to begin tunnel excavation. This set of events is easier said than done as the cutterhead and three shield sections of a 28-foot-diameter TBM weigh in excess of one million pounds. As a result, the transport and maneuvering of the TBM to the site and into the shaft is often a significant and time-consuming task in itself. Special design concerns for the shaft walls, crane foundations, and temporary machine support are often required as is the procurement of unique equipment designed to lift the TBM sections. Examples are presented to show some of the considerations and equipment needed to get a TBM underground for the construction of some Great Lakes area tunnels.

Crossroads of Fire and Ice: How Glacial Drift and Lava Flows Control Debris Flow Paths at Mount Adams, Washington, USA

Pope, Isaac E., Missouri University of Science and Technology, ipkby@mst.edu*; Paul M. Santi,* psanti@mines.edu *(TS #12)*

Since construction of its edifice began around 540ka, Mount Adams in Washington State has developed a rich history of both volcanic eruptions and glaciation. Though it remains largely quiescent since its last eruption a millennium ago, the volcanic field as a whole has seen over two dozen lava flows since widespread glaciation ceased around 20ka. As is readily visible from lidar-derived digital elevation models (DEMs), these lava flows overlie the extensive glacial drift that mantles much of the volcanic field. The intersection of the lava flows, and glacial drift creates a unique topography that controls many of the debris flow paths that have since formed around the volcanic center. These debris flows are often sourced from either loose volcanic material or glacial drift and may continue to bulk downstream through erosion of the deposits along its path. Farther downstream, debris flow paths can be redirected by glacial landforms, volcanic landforms, or a combination of them. First, debris flows may simply follow old glacial valleys, which may themselves be controlled by older lava flows now buried by glacial drift. Second, debris flows may circumnavigate the edge of lava flows, which present large, relatively erosion-resistant barrier landforms. Third, debris flows may incise into topographic lows bounded on one side by a glacial moraine and on the other side by a lava flow. In some cases, debris flows may erode the margin of a lava flow, but erosion is generally focused on the more erodible glacial drift. Governed by these three scenarios, modern debris flow paths are controlled by the cross-roads of these two unrelated and temporally distinct processes (glacial and volcanism) that have in combination shaped the topography of the Mount Adams Volcanic Field.

Morphometrics of Modern Lava Flows: What Physicochemical Properties Control Surface Roughness and its Evolution through Time?

Pope, Isaac E., Missouri University of Science and Technology, ipkby@mst.edu*; Paul M. Santi,* psanti@mines.edu*; Jeremy Maurer,* jmaurer@mst.edu *(Poster)*

Surface roughness of lava flows presents a unique topographic signature useful for relative dating or calibrated absolute dating of lava flows. Previous work at Mount Adams demonstrated that the surface roughness of a flow decreases over time as its surface is gradually smoothed. This has potential to improve hazard analysis by facilitating rapid identification and approximate dating of lava flows across a volcanic system using topographic data. How such a calibration curve transfers to other volcanic systems depends on what properties control the initial surface roughness of a lava flow, as well as environmental factors. The appearance of a flow (such as pahoehoe versus a'a) can vary widely depending on its chemistry, viscosity, and other variables, indicating that not all flows may begin with comparable initial surface roughness. Consequently, the purpose of this study is to compile a global dataset of lava flows produced during the past 50 years to study the range of initial surface roughness

values and their controlling variables. Preliminary results indicate that eruption style can likely be used as a reliable proxy in governing surface roughness. Ranges of initial roughness values are grouped by lava type to establish typical starting values for future calibration curves. Flows analyzed by the authors previously at Mount Adams produced a promising calibration curve because all flows resulted from a consistent eruption style through time. However, the same curve may not transfer to other locations with other eruption styles. Better understanding the variables that control the initial surface roughness may lead to better constraints for developing calibration curves that transcend a single volcanic system and offer broader application for hazards studies.

The Extent and Effects of Nuclear Proliferation

Ramnauth, Avishai, The JFK Redevelopment Aviation and Aeronautics Academy at York College, keenanramnauth@gmail.com; Omadevi Singh, osingh4@york.cuny.edu; Andrew Singh, asingh1@york.cuny.edu; Nazrul Khandaker, nkhandaker@york.cuny.edu (Presented by Andrew Singh) (Poster)

After World War II, significant technological changes took place globally with medicine, crafts, national security-related weaponry, and engineering tools. Of course, with such advancements comes a price, such as the case with nuclear proliferation. Nuclear proliferation refers to the spread of nuclear weapons and related nuclear technology. After World War II and the bombing of Hiroshima and Nagasaki, countries such as the Soviet Union, Great Britain, and China were the first to begin creating nuclear weapons of their own. Russia (former Soviet Union) and the United States now hold 90 percent of the world's nuclear warheads, while China possesses 4 percent of the world's largest nuclear superpowers. But nuclear proliferation is not only limited to nuclear weaponry, but the use of nuclear energy as a whole. Nuclear energy accounts for 10 percent of the world's energy supply, only being beaten by fossil fuels. Despite efforts to prevent it, nuclear proliferation will continue to exist as nuclear energy becomes increasingly more popular and may be considered as a replacement for fossil fuels. Nuclear energy, while offering a significant advantage over fossil fuels by producing minimal greenhouse gas emissions during electricity generation, increases the imminent risk of expanding the rate of nuclear proliferation. Investigating the negative connotation typically associated with nuclear proliferation leads to questions such as: how common is the production of nuclear energy, what are the possible effects of a nuclear war, and can nuclear energy truly replace fossil fuels? Answering these questions may help determine whether nuclear proliferation deserves to be seen negatively, or if it may ultimately benefit society.

Timing and Trigger Mechanisms of the Buckeye Canyon Rockslide, North of Yosemite National Park, California

Rodriguez, Marco, California State University, Fresno, marcordrgzc@mail.fresnostate.edu; Christopher Pluhar; Mathieu Richaud (Poster)

The Buckeye Canyon rockslide, west of the Robinson Creek fault zone, sits within a system of major active faults of the Walker Lane (Wesnousky et al., 2012). Due to the abundance of nearby faults to our field area, and the rockslide being in a canyon once occupied by glaciers during the Last Glacial Maximum (LGM), we hypothesize several trigger mechanisms. We are dating the rockslide to determine the likely cause of its triggering mechanism—whether it was an earthquake, glacial debuttressing, or another factor. Seismicity in the Sierra Nevada, particularly in areas like the Walker Lane, has been well-documented as a mechanism for rock slope failures (Keefer, 1994) and hypothesized as a mechanism for ancient landslides (Pluhar et al., 2021; Stock & Uhrhammer, 2010)California, is one of the best-documented sites of historical rockfalls and other rock slope failures; however, past work shows that this record does not capture the infrequent largest occurrences, prehistoric events orders of magnitude larger than the largest historic ones. These large prehistoric events are evident as voluminous bouldery landslide deposits, permitting volume and age quantification to better understand local volume–frequency relationships, potential triggering mechanisms, and the hazard such events might pose. The Tiltill rockslide in northern Yosemite is one such example, consisting of 2.1 × 106 m3 ± 1.6 × 106 m3 of talus (1.5 × 106 m3 original volume of rock mass. The impact of past glacial debuttressing is crucial for

understanding the natural cycles that could influence slope failure. The use of geochronological techniques, such as cosmogenic nuclide dating (10Be) will help determine the age of the landslide and test the correlation of landslides with seismic events or glacial processes. This will not only improve our understanding of the history of slope failures in the region but also help refine models to help prioritize areas for monitoring and mitigation. The study also features the use of modern technological tools like unmanned aerial vehicle (UAV) lidar mapping and geographic information system (GIS) software such as ArcGIS Pro, which improve the precision of volume calculations, and cross-sectional analysis. The findings from this study will contribute to a more comprehensive regional landslide database, improving risk assessments across the wider Yosemite area. This poster presentation will discuss the methods mentioned above, the importance of understanding slope failure triggers, and the rockslide's age depending on analysis of rock samples being completed.

The Urban Underground: A Mine of Heat

Rotta Loria, Alessandro F., Subsurface Opportunities and Innovations Laboratory, Department of Civil and Environmental Engineering, Northwestern University, af-rottaloria@northwestern.edu *(TS #11)*

This talk will unveil a stark and overlooked reality: beneath our cities, ground temperatures have risen to levels exceeding even the hottest surface records from places like Death Valley. These extreme conditions are the result of a silent but pervasive phenomenon known as subsurface urban heat islands—an underground climate change. The presentation will not only explore the challenges this warming poses to cities but will also highlight a powerful opportunity: the urban underground as a vast, untapped reservoir of heat that can be harnessed to sustainably power the built environment.

From Data to Decision: Predicting Future Subsidence Under Varying Management Strategies

Saberi, Leila, INTERA, lsaberi@intera.com*, John Ellis,* jellis@intera.com*; Jeremy White,* jwhite@intera.com*; Marisa Earll,* mearll@intera.com *(TS #6)*

Land subsidence remains a persistent threat to infrastructure and groundwater sustainability in regions such as California's Central Valley and parts of Illinois, where aquifer systems are stressed by intensive groundwater use. To better understand and forecast subsidence behavior under varying hydrologic conditions, we developed a suite of one-dimensional MODFLOW 6 models using the skeletal storage, compaction, and subsidence (CSUB) package, integrated with long-term observational datasets including leveling, InSAR, extensometers, and groundwater level records. This work emphasizes the important role of modeling in estimating the critical head—defined as the groundwater level below which permanent subsidence initiates—and in quantifying residual compaction due to delayed drainage of thick fine-grained interbeds. Using ensemble-based data assimilation, we constrained model parameters across more than 50 benchmark sites and projected subsidence under a range of groundwater management scenarios. Results indicate that managing groundwater levels to historical lows or even to critical head values is insufficient to eliminate future subsidence. Instead, recovery well above the critical head is necessary to accelerate equilibration of pore-water pressure gradients and reduce residual compaction. These modeling strategies and findings offer valuable guidance for setting Sustainable Management Criteria (SMCs) in California and can be extended to other regions like Illinois, where legacy groundwater use and thick clay sequences pose similar long-term risks to land stability and infrastructure.

Prediction and Case Studies of Debris-Flow Avulsion

Santi, Paul, Colorado School of Mines, psanti@mines.edu *(TS #10)*

Debris-flow deposits typically create geomorphic fan landforms, which develop over time as multiple flow events direct themselves towards topographic lows. This process of changing flow paths, termed avulsion, means that the focal point of debris-flow hazards is constantly changing, and the risk to humans and built structures is also changing. Avulsions can follow a variety of pathways, including single channel shift, distributary, split, braided, and sharp directional change. Analysis of map views of fan development indicate that while single avulsions can take entirely new paths, multiple avulsions over time may result in

general migration of the active sector across the fan. Databases of avulsion indicate that it is more common if there are channel obstructions, channel constrictions, longer flow paths, low lateral confinement of channels, gradual or sudden decreases in channel slope angle, high expect flow thickness to average slope ratio, and high availability of boulder-sized material. Avulsion likelihood can also be predicted using stratigraphic analysis tools such as calculation of compensational stacking. Flow modeling of avulsion at locations predicted by these factors helps to identify future hazard locations and is an important step beyond simply modeling runout of current conditions. Examples of debris flows that experience avulsion and damming are given from Colorado, Utah, and California, and the implications for mitigation are summarized. In these cases, effective methods could include channelization, directional berms, maintaining channel slope and velocity, and creating deposition zones in safe areas.

Seeing the Big Picture: Constructability in Landslide Remediation

Saraceno, Nathan, GFT, nsaraceno@gftinc.com *(TS #10)*

From field reconnaissance to final stabilization, successful geotechnical projects rely on more than solid technical design. They require practical, buildable solutions that work in the real world. Yet constructability is often overlooked by those early in their careers, especially when they're focused on specialized roles. This presentation offers a practical introduction to constructability for geologists and engineers, using examples from Appalachian landslide remediation projects to explore how site access, materials, regulatory constraints, and long-term maintenance all impact project success. More importantly, it encourages a shift in mindset: to see beyond the task at hand and ask the right questions early on. With real-world stories, visuals, and field-tested advice, attendees will leave with tools to recognize risks sooner, collaborate better, and bring more value to any project, regardless of discipline.

Practical AI for Professionals: How Custom GPTs Can Empower Your Team, Your Workflows, and Your Mission

Saraceno, Nathan, GFT, nsaraceno@gftinc.com *(TS #13)*

Artificial intelligence (AI) has quickly evolved from a buzzword to a practical tool. Geoscience professionals, small business owners, and organizational leaders can now access and deploy it without any coding experience or major investment. This presentation introduces a hands-on, cost-effective approach to creating custom GPTs. These tools can streamline internal communication, support consistent information-sharing, and make institutional knowledge more accessible within your company, committee, or professional network. We will explore three real-world examples:

- The AEG Executive Assistant GPT—designed to help AEG leaders quickly access governing documents and policies,
- PER Pro GPT—a custom assistant used to guide employee performance reviews, helping to align employee goals with both company strategy and career development plans, and
- Civic Scribe GPT—developed to support legislative literacy and internal advocacy strategy.

You will learn how these tools were created, how they are used, and how you can build something similar for your own team. No advanced technical skills or large budget is required. Whether you are running a small consulting practice, managing chapter operations, or chairing a committee, this session will show how AI can

- act as a 24/7 assistant trained on your documents,
- support onboarding and knowledge transfer,
- reduce repetitive questions and improve internal clarity, and
- help you stay organized and focused on high-value work.

AI is not replacing people; it is reinforcing them. This session will give you the tools and confidence to begin using AI to support the work you are already doing, with greater efficiency and ease.

"Not Permeable, but will Hold Water": A Discussion of Rim Leakage Issues at Tennessee Valley Authority Reservoirs

Shinpaugh, Joshua, Tennessee Valley Authority, jeshinpaugh0@tva.gov *(TS #5)*

The Tennessee Valley Authority (TVA) maintains a portfolio of 49 hydro projects across six states. The diversity of foundation conditions across the valley is reflected in the geologic hazards that have impacted the fleet's performance histories. While dam safety's focus mostly remains on the water-impounding structures themselves, there are notable cases of the ineffectiveness of the foundations upstream. Three dams experiencing significant post-closure rim leakage will be presented: 1) Bear Creek Dam in Franklin County, Alabama, 2) Tims Ford Dam in Franklin County, Tennessee, and 3) Great Falls Dam in Warren and White Counties, Tennessee. All sites share issues associated with karst of the Interior Low Plateaus. Discussion will include the nature of leakage, remedial efforts, current performance, and the potential need for future action.

Advances in Digital Solutions for Site Characterization: Insights from Allegheny County Sanitary Authority's (ALCOSAN's) Ohio River Tunnel Project (ORT)

Sibley, Erin, Mott MacDonald, Erin.Sibley@mottmac.com*; Shih-Han Su,* Shih-Han.Su@mottmac.com*; Zach Hughes,* zachary.hughes@alcosan.org *(TS #2)*

Many underground projects have benefited from the value that digital field tools provide for more holistic interpretation of geological and geotechnical information. The implementation of a Digital Field Tracking System (DFTS) in conjunction with the geologic modeling software, Leapfrog©, for the Allegheny County Sanitary Authority (ALCOSAN)'s Ohio River Tunnel (ORT) Geotechnical Investigation Program (GIP) showcases these benefits. This presentation will discuss the application of state-of-the-art tools for subsurface characterization, such as a cloud-based field report application, digital data planning and management tools, and 3D geologic modeling software, and how they are utilized for seamless, integrated design for tunneling projects. In particular, we will highlight the advantages this approach has when applied to sedimentary deposits and specifically rock classification, as exemplified on the ORT project in Pittsburgh, Pennsylvania.

Using Storm Direction and Runoff Thresholds to Distinguish Between Post-Fire Debris Flows and Flash Floods

Skene, Francesca, Colorado School of Mines, francesca_skene@mines.edu*; Paul Santi,* psanti@mines.edu *(TS #10)*

High intensity rainfall following wildfires in the intermountain west creates conditions for dangerous hydromorphic responses in burned watersheds that take the form of flash floods or debris flows. Both flow types have destructive potential, but debris flows can be orders of magnitude greater in volume, speed, and impact forces when compared to flash floods. Understanding which response type to expect based on the watershed and storm characteristics provides valuable information for mitigation planning. While previous studies have established the importance of rainfall intensity thresholds in predicting debris-flow initiation, we evaluate the importance of storm direction on the likelihood of causing a flash flood or a debris flow. First, we measure outlet discharge for storms moving upstream, downstream, and perpendicular to the watershed axis. Next, the discharge is modelled using a combined Green-Ampt Infiltration and 2D Kinematic Wave Model. Then we define a discharge threshold between flash floods and debris flows for a site that produced both flow responses, using data from rain gauges at the top and bottom of the watershed. Finally, we model a synthetic rainstorm with constant intensity and duration translated upstream, downstream, and perpendicular to the watershed at varying velocities to compare discharges at the watershed outlet to the debris flow threshold. This improved understanding of storm-watershed interactions will enhance current intensity threshold data to improve the prediction of debris flows.

Integrating Remote Sensing Techniques to Analyze Rock Glacier Movement and Morphology

Smith, Margi, University of Missouri, Columbia, margismith001@gmail.com; Francisco Gomez, fgomez@missouri.edu; Nathan Hopkins, nathanhopikins@missouri.edu (Poster)

This study presents a remote sensing and geophysical investigation of rock glaciers in Southern Colorado to assess water resource potential. Rock glaciers are unique geomorphological alpine landforms, made up of rock debris and subsurface ice mass contained within pore spaces. With an estimated 10,000 rock glaciers across the United States, these ice-rich landforms influence hydrology and weathering processes in alpine regions. Despite their abundance and significance, rock glaciers remain widely understudied, leaving gaps in interpretation of their movement kinematics and internal structure and hydrological contributions. This study aims to interpret how subsurface ice volume influences overall movement rates and to assess the effects of anthropogenic material removal on rock glaciers on Mt. Mestas in the Sangre de Cristo Range. The project employs lidar-derived elevation models and aerial photogrammetry to accurately delineate the surface morphology and spatial extent of rock glaciers in the Mt. Mestas region. These data are integrated within a geographic information system (GIS) environment to perform volumetric calculations, enabling the estimation of total material of ice and debris contained within the rock glacier bodies. Movement rates are quantified using satellite-based Synthetic Aperture Radar Interferometry (InSAR), which detects ground deformation at millimeter-scale precision over time. This is complemented by historical photogrammetry, which utilize archived aerial photographs to assess surface displacement patterns over decadal timescales. By integrating remote sensing techniques with multi-temporal deformation analysis, this study not only enhances our understanding of rock glacier dynamics at Mt. Mestas but also establishes a reproducible framework for monitoring alpine periglacial environments. The methodologies and insights developed herein lay critical groundwork for in situ geophysical investigations into cryospheric processes, climate sensitivity, and hydrological resource contributions of rock glaciers.

Seismic vs. Climatic Triggers: Evaluating Landslide Evolution Near the Motagua Fault, Guatemala

Spellman, Huston, University of Missouri, hosdrv@umsystem.edu; Francisco Gomez, fgomez@missouri.edu; Diana Jimenez, jimenezd@uindy.edu; Jason Navarro-Lopez, jsnl@stanford.edu; Omar Flores Belteton; Corlos Perez Arias; Tina Niemi, niemit@umkc.edu (Poster)

Earthquake-triggered landslides can remain hazardous for decades, with storms reactivating unstable slopes in tectonically active regions like Guatemala's Motagua Fault Zone. In February 1976, a magnitude 7.6 earthquake along the Motagua Fault triggered landslides near Guastatoya, Guatemala. Subsequent high-intensity precipitation events, such as Hurricane Mitch in 1998, have additionally contributed to mass-wasting activity, raising questions about the relative roles of seismic and hydrologic triggers in landscape evolution. Are recent, climatically initiated mass movements concentrated on landslides originally caused by the 1976 earthquake? This study investigates the temporal distribution of landslides in the region by integrating remote sensing techniques with geomorphic analysis. High-resolution digital elevation models (DEMs) generated from lidar drone flights were used to delineate landslide scars and assess erosion morphology. These data were cleaned and assessed, revealing fault lineation and topological texture of the landslides. The bare-earth DEM allows identification of offset landscape features that relate to the 1976 earthquake and long-term faulting. The data was also compared with imagery from the Corona satellite mission and Google Earth to identify features present shortly after the 1976 earthquake. We can distinguish between earthquake-induced and precipitation-driven landslides by evaluating degradation, surface roughness, and indicators of relative age. The results contribute to an improved understanding of hazard recurrence and long-term slope stability in tectonically active regions subject to extreme rainfall. Though infrastructure is not currently threatened, the city of Guastatoya is expanding toward the study area, making these findings increasingly relevant for proactive hazard assessment and future development planning.

Multi-Scale Remote Sensing and RocScience Slide

3 Integration for Assessing Slope Instability and Displacement along Transportation Corridors: A Study of Paonia Reservoir, Colorado

Staubach, Asher, University of Mississippi, ajstauba@go.olemiss.edu*; Thomas Oommen,* toommen@olemiss.edu*; Anush Kasargod,* akasarag@mtu.edu*; Noha Ismail,* niismail@olemiss.edu*; Chris Cook,* clcook2@mtu.edu *(TS #10)*

Slope instability, including rockfalls, poses a significant risk to transportation corridors in mountainous regions such as the Paonia Reservoir area of Colorado. Traditional hazard assessment methods are often time-consuming, spatially limited, and costly. This study introduces a multi-scale remote sensing framework that leverages Sentinel-1 Synthetic Aperture Radar (SAR) data and advanced Interferometric SAR (InSAR) processing to quantify slope displacement, together with high-resolution digital terrain models derived from drones to detect early deformation signals. Surface displacement vectors derived from InSAR are integrated in ArcGIS Pro and fed into RocScience Slide 3 to model slope stability, infer velocity fields, and compute factor of safety (FOS), enabling probabilistic estimates of slope failure. Focused on a steep, lithologically diverse study area (sandstone, silt, and shale), and this framework aims to identify high-risk zones, detect early precursors of rockfall, and reveal spatiotemporal deformation dynamics. Results provide actionable insights into slope mechanical behavior and failure progression, thus enhancing the efficiency of monitoring and mitigating strategies. Bridging remote sensing with geotechnical modeling offers a scalable solution for prioritizing hazard mitigation along transportation corridors, improving safety in mountainous regions globally.

Promoting Nontraditional Paths to Careers in Earth Science

Stohr, Christopher, Earth Sciences Category Chair, Illinois Junior Academy of Sciences. cstohr@illinois.edu*; Jann Hawkins, Illinois Junior Academy of Sciences,* jannaggie.hawkins@gmail.com *(TS #1)*

In the recent past, Illinois high school students conducting Earth Science projects at the Illinois Junior Academy of Sciences Exposition (IJAS) declined to the level where the category is omitted or combined with another category at science fairs. Discussions with IJAS volunteer leadership suggested that awarding cash prizes to top projects would alert students and teachers to the category and encourage students to conduct Earth Science projects. The AEG Chicago Chapter provides $1,000 annually for Junior, Senior and Special Projects at the Illinois Junior Academy of Sciences Exposition, a strategy that has increased the number of projects and interest in geosciences by students and teachers.

Block Sliding and Seismic Events Occurring in Chicago Metropolitan Area

Stohr, Chris, Mahomet Aquifer Council, chair.aeg.chicago@gmail.com *(TS #7)*

Three geologic phenomena have occurred in the vicinity of McCook Reservoir Combined Sewage and Stormwater Storage, which lies between the Des Plaines River and the Chicago Ship and Sanitary Canal:

1. CORS station movement,
2. Joliet Road closure, and
3. Seismic Events.

Movement was observed at a GPS/GNSS Continuously Operating Reference Station (CORS) in 2006 by the National Geodetic Survey (NGS). A colleague, Chuck DeMets at University of Wisconsin, processed the CORS data against more than 1,000 CORS in North America to find that there was anomalous movement in Chicago metro area. The data from 2004–08 showed that the CORS moved 8 mm/y N52E, 32mm over 4 years total movement toward a nearby quarry. Analysis of the CORS data found that there was a seasonal cycle linear rise in latitude. Longitude exhibited punctuated linear rise. There was -4.4 mm/y in linear declining movement. There was no reported cracking or distress at the CORS station. Joliet Road, aka Route 66, was unexpectedly closed when pavement buckled and heaved in 1998. An active quarry operating on both sides of Joliet Road was excavating a “glory hole” exploration for an anticipated tunnel beneath the highway. The cause for the road closure was attributed to lateral displacements along a horizontal thin shaley layer in Silurian dolostone, which is mined at several nearby quarries. USGS reported a 3.2 magnitude earthquake about 1.4 km deep on November 4, 2013. The vibrations were attributed to

a quarry blast followed by an earthquake. The tremor knocked ceiling tiles loose at a hot dog stand in Countryside and rattled a bank in LaGrange sufficiently for the manager to close early. The Illinois Department of Natural Resources conducted an inspection following the seismic event and reported the blasts at Hanson Material Service quarry in McCook were within statutory limits.

Subsidence Rates in Thawing Permafrost Regions of the Arctic

Streletskiy, Dimitry, George Washington University, strelets@gwu.edu *(TS #6)*

Thaw subsidence and thermokarst development are common problems associated with exploration and construction on permafrost due to changes in conditions of heat and water exchange resulting from vegetation removal, snow redistribution, and waterlogging and known issues that can be prevented, detected, and minimized. There is also mounting but limited evidence from field monitoring measurements and remote sensing techniques that thaw subsidence is occurring in natural undisturbed landscapes as warming climatic conditions lead to melting of ground ice during warm seasons that is not compensated by ice segregation over cold seasons. The review of available thaw subsidence measurements and remote sensing data from permafrost regions of North America and Eurasia shows that thaw subsidence rates vary depending on local climatic and geologic conditions. In areas with ice-rich permafrost, thaw subsidence is responsible for lack of apparent thickening of active layer thickness, which is measured relative to the ground surface and therefore does not show the full extent of permafrost degradation under warming climatic conditions. This suggests that thaw subsidence monitoring and data exchange are urgently needed to better understand the reaction of permafrost and its feedback to the global climate system.

Methane & Vapor Intrusion—Ongoing and Long-Term Affects

Szocinski, Thomas R., tszocinski@gesonline.com *(TS #3B)*

Background/Objectives:
The session will review how methane can and does affect sites and often how it is overlooked until the last moments of development. The presentation will include methane source considerations, national and international guidances, screening levels, regulatory response, mitigation and monitoring, and ongoing system and building operations, maintenance, and monitoring.
Approach/Activities:
The session will review methane vapor intrusion (VI) guidances and methane sources (i.e., landfill, volatile organic compounds [VOCs], petroleum, peat/bogs and naturally occurring productions).
Results/Lessons Learned:
The presentation will discuss what the long-term effects are when methane has been discovered at a Brownfield site and how it affects 1) the cleanup goals, 2) overall development, and 3) long term operations, monitoring, and maintenance (OM&M).

Enhancing Resiliency of Coastal Levees with Pressed-in Piles Against Strong Earthquakes and Tsunamis

Takuma, Takefumi, Giken America Corp., ttakuma@gikenamerica.com*; Ian Vaz,* ivaz@gikenamerica.com *(TS #12)*

With quickly changing climate and rising sea level, coastal levees are at higher risk than ever before. One of the major factors contributing to serious damage of levees and other coastal structures is liquefaction of the foundation soil and the body of an earthen levee caused by a strong earthquake. Kochi Prefecture of Japan, with a long south-facing coastline, is expecting strong earthquakes at any time due to its proximity to a major offshore fault zone. Japan's central government in collaboration with the prefectural government retrofitted a total of 13.3 kilometers of coastal levees on the east and west sides of the region's central city of Kochi. The existing levee structures were 30 to 40 years old and made of earthen fill materials with concrete

linings and parapets on top. Liquefaction of levee foundations was a great concern for these locations due to its sandy soil and high ground water. The main purpose of the project was to enhance the levees' stability and resiliency against potential liquefaction and resultant settlement rather than increasing their height. Sheet pile and pipe pile-supported structures were constructed inside the existing levees to minimize the chance of liquefaction during the construction. Both piles were being pressed-in through a liquefiable sandy layer and gravel/cobbles underneath without removing or compromising existing structures.

Geological Survey and Geotechnical Analysis of Trapezoidal Cemented Sand and Gravel (CSG) Dam

Tanaka, Tomoki, CTI Engineering Co., Ltd. tmki-tanaka@ctie.co.jp *(TS #5)*

Trapezoidal (cemented sand and gravel) CSG dams (JP 4918378 B2) are a type of dam developed in Japan with the aim of "rationalization of materials, design, and construction." CSG is made by mixing materials such as sand and gravel generated around construction sites with cement and water without classification and adjustment of aggregate material particle size and cleaning. By using low-quality materials compared to the aggregate material used in concrete dams, that have a reduced environmental impact. A trapezoidal CSG dam with a dam height of 81m is planned in the Tohoku region of Japan. This dam was originally planned as a rockfill dam, but the plans were changed to a trapezoidal CSG dam in order to make effective use of the thick sediments of gravel that has accumulated at the dam site as dam body material, and geological surveys and design are currently being conducted. Geological surveys for the design of this dam included boring surveys, test adit, borehole load tests, and laboratory tests, and rock mass classification of the foundation rock was carried out based on the results of these surveys. In trapezoidal CSG dams, the elastic modulus of the foundation rock is used as an index to evaluate the stability of the dam body and the foundation rock, so it is important to properly evaluate the elastic modulus of the foundation rock from the survey results. Since a correlation is observed between the rock mass classification and the elastic modulus of the foundation rock of this dam, an elastic modulus classification was set for each subdivision of the rock mass classification (hardness, crack interval, and crack weathering), and an elastic modulus classification diagram was created. The foundation excavation range was appropriately set based on the elastic modulus classification.

Michigan's Regulatory Approach for Addressing PFAS in Wastewater, Stormwater, Groundwater, and Biosolids

Tavalire, Anne, Michigan Department of Environment, Great Lakes, and Energy, tavalirea@michigan.gov *(TS #8)*

The Emerging Pollutants Section (EPS) has assisted Michigan's Water Resources Division in developing and implementing a regulatory framework to address PFAS in wastewater, stormwater, groundwater, and biosolids. The Industrial Pretreatment Plan (IPP) PFAS Initiative was the first of its kind and aimed to reduce and eliminate perfluorooctanesulfonic acid (PFOS) from industrial sources that may interfere with management of solids at municipal wastewater treatment plants (WWTPs) and pass through the WWTP to enter our lakes and streams, potentially causing fish consumption advisories or contaminating public drinking water supplies. The results from the IPP PFAS Initiative and from a 2018 statewide study looking at the occurrence of PFAS in influent, effluent, and associated solids at municipal WWTPs were utilized to create the Interim Strategy for Land Application of Biosolids Containing PFAS (Interim Strategy), which first went into effect in April of 2021. The Interim Strategy established tiers that dictate certain requirements of biosolids based on PFOS concentrations. EPS is prioritizing the National Pollutant Discharge Elimination System (NPDES) permitted industrial discharges as it gathers information regarding the potential for those discharges, both wastewater and stormwater, to exceed Michigan's PFAS surface water quality values. This strategy will ensure facilities that exceed PFAS criteria have an appropriate control document in place to achieve compliance with federal and state regulations. EPS will require public and private municipal WWTPs with existing PFAS data for permitted groundwater discharges to conduct monitoring, source evaluation, and reduction of PFAS. Facilities where contaminated groundwater has the potential to migrate off-site and impact downgradient

receptors will be prioritized. Select public and private municipal WWTPs with groundwater discharges and a history of groundwater contamination with other chemicals of concern will undergo annual screening. This presentation will summarize EPS' regulatory programs to address PFAS and how we focus on prioritizing efforts and resources towards addressing sources to have the biggest impact in protecting the environment and public health.

Stress Changes from Industrial Excavation and their Potential Role in the 2013 M3.2 Chicago Area Earthquake

Thomas, Ann Mariam, Northwestern University, annthomas2025@u.northwestern.edu*; Lucas Schirbel,* LucasSchirbel2029@u.northwestern.edu*; Suzan van der Lee,* suzan@northwestern.edu *(TS #7)*

On November 4, 2013, a magnitude 3.2 earthquake occurred in the southwest suburbs of Chicago, near an industrial area with active quarrying operations and a flood-control reservoir. The earthquake was covered extensively in the media because of its potential connection with a local quarry, where dynamite was blasted about seven seconds before the earthquake. With its unique location and timing, it is possible that the M3.2 earthquake was induced by local industrial operations. Rock mass removal, dynamite blasting, and other industrial operations can generate stress changes to trigger an earthquake in an otherwise seismically quiescent area. In this study, we estimate 1) static stress changes from rock mass removal and 2) dynamic stress changes from quarry blasting in an industrial corridor near Chicago to assess if these operations can trigger an event with similar source parameters as the M3.2 earthquake. To estimate static stresses, we first leveraged data from existing digital elevation models, lidar surveys, and legacy Landsat imagery to estimate rock mass removal in the area for the past 30 years. We then computed static stresses using Boussinesq's solution for a surface load distribution on an isotropic elastic half-space. Dynamic stresses from quarry blasting were estimated from peak ground velocities recorded by local (<100 km) seismic stations. We will present visualizations of our stress estimates and discuss their implications for the potential of human-induced earthquakes in the Chicago area.

2025 Interstate Technology and Regulatory Council (ITRC) PFAS Team Update

Thomassen, Claire, BBJ Group LLC, cthomassen@bbjgroup.com*; Ted Campbell,* ted.campbell@deq.nc.gov*; Krisit Herzer,* kristi.herzer@vermont.gov*; Mitchell Olson,* mitchell.olson@colostate.edu*; Jeff Wenzel,* jeff.Wenzel@health.mo.gov *(TS #14)*

The Interstate Technology and Regulatory Council (ITRC) is a national coalition focused on developing tools and strategies to reduce interstate barriers to the deployment of innovative environmental technologies. The ITRC Technical Team on Per- and Polyfluoroalkyl Substances (ITRC PFAS Team) is comprised of over 500 environmental professionals from state, local, and federal government, private industry, academia, and public stakeholders, collaborating to produce resources to address the challenges of PFAS contamination. Since its inception in 2017, the ITRC PFAS Team has been producing and updating PFAS-related resources, including a Technical and Regulatory Guidance document, fact sheets, data tables, training resources, and a regularly updated summary table of state/federal regulatory and guidance values. In September 2023, the team significantly enhanced the online Technical and Regulatory Guidance document (https://pfas-1.itrcweb.org/) with up-to-date information relevant to PFAS professionals, including "PFAS Beyond the Basics" training courses. Looking forward, the focus of the PFAS Team is priority topics and case studies for emerging concerns that have attracted recent attention from both regulators and the scientific community. In addition, supplemental guidance on sorption-based treatment technologies is under development. The new content will be published as part of the current PFAS-1 website and will be linked and/or integrated into the existing guidance document text as needed to maintain accuracy. This presentation will provide an overview of the expected priority topics and the sorption-based treatment guidance that are currently under development, including,

- biosolids and residuals management
- history, use, naming conventions
- human and ecological health effects
- sampling and analysis
- fate, transport, site characterization
- treatment technologies

- firefighting foams
- PFAS and microplastics
- PFAS vapor intrusion

Updating the Subsurface Characterization across the Chicago Loop: Bridging Geological and Geotechnical Insights

Thota, Anjali N., Subsurface Opportunities and Innovations Laboratory, SOIL, Department of Civil and Environmental Engineering, Northwestern University, anjali.thota@u.northwestern.edu; Andrew C. Phillips, aphillps@illinois.edu; Andrew J. Stumpf, astumpf@illinois.edu; Alexandra Theresa Sanchez, ats10@illinois.edu; Alessandro Rotta Loria, af-rottaloria@northwestern.edu (TS #11)

Understanding subsurface conditions is critical for predicting soil behavior and ensuring the stability of infrastructure, particularly in urban areas where construction interacts with complex geological formations. In the downtown area of the city of Chicago––the Loop district––the natural glacial deposits and lake sediment and the subsequent anthropogenic modifications have created a highly heterogeneous subsurface environment. This study refines the characterization of the Loop's subsurface by integrating recent geological classification updates with legacy geotechnical data from approximately 150 boring logs. Traditional correlations between the glacial tills and engineering soil classifications are reassessed to address inconsistencies and improve alignment with the modern geology and engineering geology frameworks. The research resulted in an updated classification that reconciles geological and engineering perspectives, which enhances our subsurface modeling accuracy. Additionally, a 3D subsurface model of the Loop was developed to visualize both the geological and engineering data. This model is a valuable tool for geotechnical engineers, urban planners, and geoscientists supporting activities such as risk assessments, foundation design, and infrastructure resilience. By integrating geological and geotechnical data and leveraging legacy data, we can enhance our understanding of subsurface conditions, which can also inform assessments of heat transfer in the subsurface and the stability of structures impacted by temperature variations. The findings may contribute to improved construction practices, urban development strategies, and hazard mitigation efforts, offering insights that are applicable in other cities with similarly complex subsurface conditions.

Automated Analysis of Microplastics Using a Quantum Cascade-based Infrared Analyzer

Tisinger, Louis, Agilent Technologies, Louis.Tisinger@agilent.com (TS #8)

Interest in investigating microplastics in the environment has been increasing rapidly in recent years. Much research is being done to attempt to understand the environmental impacts of the seemingly ubiquitous presence of microplastics. Plastics never fully degrade; larger plastic waste eventually breaks down into smaller particles, and even relatively inert polymers, e.g., polyethylene, can act as vectors for various pollutants. Unfortunately, regulations (in the U.S.) on microplastics have not yet been adopted—although they are being considered. In addition, standard methods by which to test water for microplastics have not yet been adopted; however, the Southern California Coastal Water Reclamation Projects (SCCWRP) has developed a method for using vibrational spectroscopy, and ASTM has a similar draft standard for their measurement. To that end, this presentation will focus on the description of a new automated quantum cascade laser-infrared analyzer for the quick analysis of microplastics. The analyzer can be operated by scientists/technicians at all skill levels, providing identification, size, count, size classifications, photographs, and quantitative numbers related to morphology for every particle. This presentation will describe the analyzer and its microplastics workflow and show actual data from a microplastic sample.

Trouble With Metals: Importance of Background Threshold Values in Risk Assessment

Tramm, Kenneth, Modern Geosciences, ktramm@moderngeosciences.com (TS #14)

In the absence of realistic background concentrations for metals in soil, many risk-based screening programs across the United States inadvertently screen in ambient conditions as a release. This then leads to significant costs and project delays across the

commercial real estate and brownfield redevelopment fields as work is undertaken to address the confusion. Modern Geosciences, a Texas-based Environmental Engineering firm, worked with affected parties from the public and private sectors to highlight the causes, impacts, and solutions to this issue. Two research papers were published to help fill this gap that remains with the U.S. Environmental Protection Agency's (EPA's) Risked-Based Corrective Action approach that serves as the foundation for most state-based regulatory programs. Dr. Tramm will provide a summary of the lessons learned from this extensive effort and options to better account for spatial variability using conservative approaches that meet EPA and most state regulatory needs—often with the use of existing data sets.

Composition and Compressive Strength of Baroque-Era Churches in Antigua, Guatemala: Testing Earthquake Resistance

Trudell, Taylor, Earth and Environmental Sciences, University of Missouri–Kansas City, tmt5cb@umsystem.edu*; Tina Niemi* niemit@umkc.edu*; Jim Murowchick* murowchickj@umkc.edu *(Poster)*

Guatemala is highly vulnerable to seismic activity due to its location along the transform plate boundary fault, subduction zone trench, and active volcanic arc. Antigua, a UNESCO World Heritage site, is the historical capital of Spanish Latin America and has a long record of historical earthquake damage. Despite efforts to reinforce Colonial-era structures in Antigua, gaps remain in understanding the composition and structural integrity of existing buildings and their materials. Building components from four churches were analyzed using X-ray powder diffraction, scanning electron microscopy (SEM), and petrographic analyses. Compressive strength was measured *in situ* using a N-type Schmidt Hammer. Most samples (rock, mortar, brick, and plaster) were found to have a strength under 25 MPa, while the highest value belonged to a rock within the wall of La Recoleccion at ~65 MPa. Mortar samples also had high compressive strengths. Calcite and plagioclase are common in most samples. The deposition of secondary calcite through weathering may help to strengthen the walls. While some trace minerals are present, no trend in mineralogy was detected. Furthermore, no correlation between strength and mineralogy was found. Understanding building materials and techniques will aid conservation efforts for historic buildings. While site-specific anti-seismic architecture has kept these churches standing, this project aims to find out if the composition of the walls has aided in longevity. Identifying these factors that have historically increased a structure's seismic resilience will contribute to policy recommendations for conservation and new construction in Antigua.

Probabilistic Subsidence Forecast Model for Engineering Evaluation of the California Aqueduct

Unruh, Jeffrey, Lettis Consultants International, Inc., unruh@lettisci.com*; Gabriel Toro,* toro@lettisci.com*; William Swanson,* william.swanson@stantec.com*; Ken Kirby,* ken@evotoco.com*; James Lopes,* james.lopes@water.ca.gov *(TS #6)*

Land subsidence principally caused by groundwater pumping in the San Joaquin Valley has reduced conveyance capacity and operational flexibility of up to 200 miles of the California Aqueduct, which is the major facility transferring water from northern California to agricultural and municipal users in the southern parts of the state. The California Department of Water Resources developed a probabilistic model to forecast future subsidence conditions for use by the State Water Project in a program to restore the aqueduct to design capacity. The subsidence forecast model (SFM) explicitly incorporates uncertainty in future climate conditions and in implementation of the Sustainable Groundwater Management Act (SGMA), a state law passed in 2014 that requires sustainable groundwater management in critically over-drafted basins by 2040. The SFM represents three conditions: 1) a "No SGMA" or status quo condition that is modeled by extrapolating the historical relationship between subsidence rate and droughts into the future, including uncertainty in the frequency and duration of future droughts; 2) a "Partial SGMA" condition that represents reduction of groundwater overdraft during the period of implementation of actions to comply with SGMA, and which is modeled by a gradual decline in subsidence rate; and 3) a "No Overdraft" condition upon full implementation of SGMA that is characterized by cessation of subsidence. The model includes aleatory

uncertainty in future subsidence rates for the "No SGMA" condition, and epistemic uncertainty in the timing of SGMA implementation to achieve a condition of no overdraft. A formal methodology developed by Budnitz et al. (1997) was used to evaluate expert opinion for parameterizing epistemic uncertainty in the timing and implementation of SGMA. Key features of the Budnitz et al. (1997) approach include: extensive communication and feedback within the project team and with outside experts; sensitivity analysis; participatory peer review during the project; and full documentation.

Logging Core Defects Using Computer Vision: Enhancing Speed and Accuracy in Geotechnical Investigations

Vanderhor, Declan, TabLogs, declan@tablogs.com *(TS #13)*

Field geologists and geotechnical engineers have long relied on manual borehole logs and core photography to interpret subsurface conditions—a process rich in detail but often burdened by inefficiencies, transcription errors, and challenges in digitization. At TabLogs, we are bridging the gap between traditional field practices and modern digital workflows by integrating computer vision and large language models (LLMs) to streamline and enhance subsurface data capture. This presentation will introduce an end-to-end AI-powered pipeline that automates the interpretation of borehole logs and core imagery. Using convolutional neural networks (CNNs), the system identifies geological features and defects in high-resolution images, while LLMs extract structured data from legacy PDF logs. The results are machine-readable, enabling rapid reporting, spatial visualization, and augmented reality (AR)-enhanced analysis. This innovation offers geologists a powerful tool for improving site assessments, risk communication, and the overall quality of geotechnical investigations.

PFAS Regulatory Updates and Analytical Methods

Verheul, JP, Enthalpy Analytical, jp.verheul@enthalpy.com *(TS #8)*

As the analytical landscape continues to change in regard to PFAS testing, having a clear understanding of the current regulations and available analytical methods becomes increasingly critical for operators, consultants, and regulators. This presentation, led by a senior chemist, will provide a high-level overview of the current federal and state regulations and the following methods: the chemistry and history of PFAS; the various analytical methods currently available and key differences between them (EPA 537.1, EPA 533, Draft EPA 1633, DoD QSM B-15, OTM-45); method applicability; and best practices when sampling. Attendees will get a clear explanation and develop a conceptual understanding of how to apply each method, as well as how to evaluate historical data against newer methods that may be available. The audience will also receive an education on best practices regarding sampling techniques, as well as tips on how to optimize the overall lab experience. The presentation is designed for all members of AEG and does not require a depth of understanding of chemistry or analytical methods.

Rapid PFAS Testing with no Compromises: Direct Inject Analysis

Verheul, JP, Enthalpy Analytical, jp.verheul@enthalpy.com *(TS #8)*

As the demand for PFAS testing increases, the laboratory's ability to hit required turnaround times becomes increasingly critical to project success. Enthalpy Analytical has developed a rapid turnaround time procedure based on the SW-8327 and ASTM D-8421 methods for analysis of up to 65 compounds using Isotope Dilution with results available in 1 to 2 business days. This presentation will include a basic overview of the approved and promulgated methods currently available (including EPA 537.1, EPA 533, EPA Draft 1633) as well as an overview of the newly developed Direct Inject Analytical technique. Material will be presented by a senior chemist with 20+ years of analytical laboratory experience, and focus on the approach, challenges, and solutions to this newly developed method through the use of

comparative data from real-world samples. Attendees will develop a stronger understanding of existing methods while being exposed to emerging technology. The presentation is designed for all members of AEG and does not require a depth of understanding of chemistry or analytical methods.

Tennessee Valley Authority's (TVA's) Hiwassee Basin Dams: Hydropower, Flood Control, Tunnels, and… Torpedoes?

Walker, Scott, Tennessee Valley Authority, srwalker3@tva.gov *(TS #5)*

Between 1936 and 1943, the Tennessee Valley Authority constructed five dams in the Hiwassee River Basin of western North Carolina, north Georgia, and southeast Tennessee. Completed in 1940 as part of TVA's original development plan for the Tennessee Valley, Hiwassee Dam is a 307-foot-tall straight concrete gravity structure that (at the time) was the tallest dam in the world with an overflow spillway. It impounds a multipurpose reservoir that provides flood protection, hydroelectric power, recreation, and supplemental flow for navigation in the Tennessee River. The other four dams (Nottely, Chatuge, Apalachia, and Ocoee No. 3) were constructed on an emergency basis during World War 2 and include concrete gravity, rolled earthfill, and earthfill-rockfill structures. Now also utilized as multipurpose projects, these dams were originally completed under an aggressive schedule to provide additional and more reliable hydroelectric power to support the war effort. All five projects are located within the Blue Ridge-Piedmont megathrust sheet; Chatuge is the easternmost dam in the system and is primarily founded on Neoproterozoic to early Paleozoic biotite schist of the Coweeta Group, while the other four dams are founded on Neoproterozoic to early Cambrian metasediments of the Great Smoky Group. Geologic challenges at the various sites include differential weathering and thick layers of saprolite, strained quartz (susceptible to alkali-aggregate reaction), and low-angle weak seams in the bedrock. Three of the dams include tunnels, ranging in length from a little under 800 feet to more than 8 miles. In 1956, what was then the largest and most powerful reversible pump-turbine in the world (and first in the United States for the sole purpose of storing electrical energy) was installed in the Hiwassee powerhouse. Finally, because of its depth and remote location, the Naval Ordnance Laboratory utilized Hiwassee Reservoir for testing of underwater munitions.

Academic Burnout in STEM Students: Causes and Effects

Walters, Sophie, The JFK Redevelopment Aviation and Aeronautics Academy at York College, SophieW62028@gmail.com*; Isaiah Jamna,* ijaiah23@gmail.com*; Andrew Singh,* asingh1@york.cuny.edu*; Nazrul Khandaker,* nkhandaker@york.cuny.edu *(Poster)*

The World Health Organization (WHO) describes burnout as a result of "chronic workplace stress that has not been successfully managed" (NLM, 2024; WHO, 2018). Burnout is often observed in science, technology, engineering, and mathematics (STEM) students. These fields put a great deal of pressure on young academics, and demand constant study and attentiveness. Burnout has several adverse effects including stress, anxiety, and insomnia. High levels of academic engagement and social support have been found to be helpful in decreasing burnout rates. Around 13.3 percent of engineering students experience severe depression, and 15.5 percent of engineering students experience extremely severe depression. Burnout can hinder professional and academic development, and high rates of burnout are often paired with high dropout rates. Considering the correlation between burnout and depression, it can be determined that engineering students experience high rates of burnout compared to other students. Research on burnout tends to be focused on medical students, with occasional concentration on engineering students. The intention of this poster is to raise awareness of the effects of burnout rates in STEM academia. Burnout is an issue in all academic disciplines, although STEM students are disproportionately affected. Discussions of burnout by educators need to be more widespread. Increased social support and high academic engagement have been found to mitigate burnout. Ultimately, recognizing burnout as a critical issue in STEM education is essential for sustaining student success and mental health. Proactive measures can enhance both individual resilience and institutional support, ensuring a healthier, more productive academic culture.

Modeling Three-Dimensional Rock Scour of Unlined Spillways Using a New Analytical–Numerical Method

Weidner, Luke, BGC Engineering, lweidner@bgcengineering.ca*; Michael George,* mgeorge@bgcengineering.ca *(TS #5)*

Scour of rock is a critical issue for dam/spillway safety. The rock scouring process is inherently complex, particularly for unlined spillways, given non-uniform 3D flow conditions as well as 3D geologic structural controls. This can make prediction of rock scour in spillways challenging. Empirical methods are fast to apply at the project scale but tend to be conservative due to necessary simplifying assumptions. Analytical methods require many inputs, which can be time-consuming to estimate. More recently, coupled numerical methods have been used to model plucking of single blocks directly but are not yet practical at the spillway scale due to prohibitively large computational requirements. Traditional industry approaches either focus on detailed modeling of a few "characteristic" 3D blocks or apply broad simplifications to enhance computational efficiency, such as assuming a uniform cubic shape for all rock blocks. Our proposed technique, BLOCK-F3D, creates a Python programming interface to integrate an open-source 3D discrete fracture network and block slicing algorithm, in conjunction with a computational fluid dynamics program (FLOW-3D Hydro). A specialized adaptation of 3D limit equilibrium block theory has been developed for this purpose, allowing eroded blocks to have any convex polyhedral shape. As blocks are removed from the model, the surface is updated in the FLOW-3D simulation, which updates the flow velocity information used to compute block stability. Overall, the BLOCK-F3D system has the potential to enable more realistic spillway-scale simulations of rock scour and provide more confidence in predicted scour behavior. This presentation will provide an overview of this modeling technique and highlight current challenges and opportunities for further development.

Automatic, Distributed Rock Slope Monitoring Using Low-Cost, Daily Photo Monitoring

Weidner, Luke, BGC Engineering, lweidner@bgcengineering.ca *(TS #10)*

Monitoring highway rockfall hazards using daily photography can reveal potentially problematic blocks before or soon after they fail, and at a relatively low cost compared to other alternatives. However, permanently installed cameras provide coverage for only a small fraction of exposed highways in high-consequence areas and are labor-intensive to install, limiting their use at scale. To improve wide-scale data collection across the state and automate analysis, we developed a low-cost modular time lapse rock slope monitoring system. The system consists of a single-board computer (SBU) with an attached camera, network modem, solar panel, all housed in a free-standing "fake rock" to provide weather resistance and reduce visibility. The system captures pictures and/or videos at any number of pre-defined intervals and transfers them to a remote computer. We installed a pilot system in a rockfall catchment ditch below an interbedded sedimentary rock slope in Manitou Springs, Colorado. The installation of two cameras took about one hour, and the system automatically began collecting and transmitting data. Because the system is based only on photos and not 3D derivatives, a variety of existing computer vision techniques can be used to automatically detect changes in the images over time and send notifications. We used a system based on a combination of the structural similarity index measure (SSIM) and background removal to identify changes in the ditch over time. The system successfully detected several rockfalls that occurred after a spring rain event, illustrating the potential to install similar systems at corridor to network wide scale.

Building a Strong Foundation—Bringing Geoscience to Underrepresented Students

White, Earl, CABPES and Dolan Integration Group, white.j.earl@gmail.com; Jill Carlson, carlson@mines.edu; Casey Dowling, cdowling@bgcengineering.ca; Madison Bowen, mbowen@bgcengineering.ca (Presented by Earl White, Jill Carlson, Casey Dowling, and Madison Bowen) (TS #1)

The Colorado Association of Black Professional Engineers and Scientists (CABPES) is a non-profit organization based in Denver, Colorado, whose mission is to encourage Black and other underrepresented youth to pursue science, technology, engineering, and math (STEM) careers. The organization offers various programs to fulfill this mission including an afterschool STEM program (Junior Engineers and Tomorrow's Scientists, or JETS) and after-school and summer math tutoring programs (Math Enrichment Program, or MEP). In 2023, BGC Engineering become a sponsor of CABPES and participated in Corporate Sponsor Weeks for the MEP. After building a relationship through multiple successful MEP events, BGC and CABPES began considering how to incorporate the geosciences into the JETS program, which had never had a geoscience class before. Realizing that developing a semester-long geoscience course intended for high school students was ambitious, BGC reached out to geoscience professionals already involved with CABPES and the AEG Mile High Chapter to help develop and implement the program. Over the 2024–25 school year, members of the Mile High Chapter worked closely with CABPES to develop and teach the geoscience program covering everything from mineralogy and rock types to geohazards, geochemistry, and climate change. The program required the support of many members of the Mile High Chapter and their network of practicing geoscientists to develop material, activities, and teach the courses. This talk will discuss BGC and the Mile High Chapter's involvement in the CABPES MEP and JETS programs, including how the programs were conceived, learnings from volunteer events and the development and teaching of the JETS geoscience course, and plans for the future. The hope is that these insights inspire and provide guidance to other AEG chapters to engage with communities across the U.S. to introduce geoscience to communities that are not typically represented in the profession today.

Intraplate Neotectonics of Northwestern Australia

Whitney, Beau, ROW Geoconsulting, Montpellier, France, whitney@rowgeo.com; James Hengesh, hengesh@igeohaz.com (TS #4)

Studies reveal neotectonic reactivation in Australia's former passive margin, along the Western Australian Shear Zone (WASZ), a 2,000-km-long zone of dextral-oblique neotectonic faults and folds. Bathymetric data indicate broad-scale crustal down warping of the continental shelf as evidenced by subsidence of paleo-sea level low-stand estuary systems and elevation reconstructions of paleo-sea level features. Seismic data show near sea-bottom and seafloor expressions of faults in offshore basins on the North West Shelf. High-precision leveling of modern and late Pleistocene shoreline features indicates systematic changes in relative paleo-sea level elevations along onshore anticlines. Analyses of ephemeral stream morphodynamics demonstrate that tectonically driven land-level changes are affecting channel form and fluvial processes. Trenching investigations indicate multiple late Quaternary morphogenic earthquakes have occurred in the Mt. Narryer fault zone in the southern WASZ. Folding in the near surface sediments is the predominant style of surface expression of reactivated Mt. Narryer basement faults. The WASZ reoccupies older rift-related structures formed during periods of continental-scale fragmentation in the Paleozoic and Mesozoic eras. The WASZ accommodates continental-scale differential motion within a zone of extended crust between oceanic and non-extended continental tectonic blocks. Deformation in the WASZ is inferred to be driven by a transition in plate boundary architecture. Reactivation coincides with late Neogene and Quaternary reorganization of Australia's northern plate boundary and realignment of the intraplate stress field. North-directed subduction of oceanic crust is occurring along the Java trench while south-directed obduction of foreland deposits onto continental lithosphere is occurring along the Banda Arc. The change from subduction to collision is reactivating former passive margin structures within the WASZ. Deformation rates within the WASZ decrease from north to south, with greater distance from the plate boundary, as indicated by historical seismicity and tectonic geomorphology

Coding for Geotechnical Engineers: Necessity or Niche?

Zarrelli, Gary, NewFields Mining Design & Technical Services, LLC, gzarrelli@newfieldsmining.com (TS #13)

As technology advances and datasets grow in size, a pressing question arises: should geotechnical engineers learn to code? This paper explores programming as a practical skill for engineers, emphasizing its value in enhancing data analysis, automating workflows, and solving complex problems. While commercial software remains the industry standard, the ability to create custom tools offers engineers greater flexibility and deeper insight into analytical processes. To illustrate this, the paper presents a case study on the development of a browser-based application for Cone Penetration Test (CPT) data analysis. Built using Python and Streamlit, the application integrates open-source libraries such as NumPy, SciPy, pandas, and Matplotlib. It supports a range of CPT correlations, including soil behavior classification, static and dynamic liquefaction assessment, strength estimation, and pore pressure analysis. Customizable inputs allow adaptation to project-specific conditions. The case examines CPT data from impounded gold tailings in a seismically active mining region (M7.2; PGA = 0.3g) to depths of 27 meters. Modern visualization techniques and density distributions (e.g., Gaussian, KDE) aid in interpretation. Results align with those produced by commercial software, reinforcing the credibility of user-developed tools. Beyond the case study, this paper examines the broader role of coding in geotechnical practice. While engineers are not expected to become software developers, basic programming literacy can streamline tasks and foster innovation. Challenges remain—including institutional resistance, perceived difficulty, and integration with existing systems—but as the industry becomes more data-driven, coding offers a competitive advantage. By drawing on lessons learned from the development process—such as iterative problem-solving, user-centered design, and data management—this paper demonstrates how even a modest investment in programming skills can transform early-stage ideas into scalable, robust engineering solutions.

Late Quaternary Reactivation of the Cheraw Fault on the Western North American Craton

Zellman, Mark, BGC Engineering, Inc., mzellman@bgcengineering.com; Dean, Ostenaa, deano3geo@gmail.com (TS #4)

The Cheraw fault is an >80-km-long normal fault on the Great Plains of southeastern Colorado. It is one of the few faults within the North American intraplate setting east of the Rocky Mountains known to have ruptured the ground surface during the Quaternary, and it is often cited as an example of fault behavior typical of stable continental regions. The Cheraw fault has a northeast trend along the western flank of the Las Animas Arch, where 2D seismic reflection profiles indicate a steep northwest dip (75°±0.5°) and recurrent activity since at least the Paleozoic, with likely <30m of late Cenozoic normal faulting. Down-to-the-northwest normal faulting has resulted in an uphill-facing scarp that obstructs southeast flowing tributaries of the Arkansas River. The scarp has a subtle expression (less than 10m high) in lidar-data across gently sloping erosive bedrock slopes and Quaternary alluvial pediment surfaces. Fluvial, eolian, and paludal deposits with buried soils from the Old Ranch trench site on the central section of the fault suggest five events, four since ~19 ka and one slightly older. The average slip rate since ~19 ka is ~0.16 ± 0.3 mm/yr, with a recurrence of 3 to 5 ka. Estimated per-event displacements (0.75±.15 m) from the Old Ranch site are suggestive of partial or segmented ruptures. Ages from mid- to late-Quaternary geomorphic surfaces cut by the Cheraw fault imply rapid incision from ~145 to ~100 ka. Maximum vertical offsets of 7–9m for these surfaces indicate that from ~19 to >200 ka the average slip rate was no greater than ~0.03 mm/yr. The accelerated slip rate since ~19 ka indicates a possible response to rapid erosional unloading and/or a limited late Cenozoic, <40 ka, paleoseismic history for the Cheraw fault.

Monitoring Ground Subsidence Induced by Underground Excavation or Tunneling in Urban Environments Using InSAR Techniques

Zhou, Wendy, Colorado School of Mines, wzhou@mines.edu *(TS #6)*

Ground subsidence is characterized by the downward movement of the ground surface, resulting from natural phenomena or human activities. When Earth materials are extracted, rock or soil can collapse into voids from loss of support. This redistributes stress and strain within the rock mass and soil, damaging above-ground infrastructure such as roads, buildings, utility lines, and pipelines. Ground subsidence caused by underground excavation or tunneling must remain within tolerable thresholds to prevent damage to surface structures. Therefore, monitoring ground settlements induced by tunneling is essential, especially in urban environments. Researchers and practitioners have studied tunnel-induced ground subsidence using various methods, including in situ monitoring, analytical or numerical modeling, interferometric synthetic aperture radar (InSAR) monitoring, and subsidence prediction through machine learning. InSAR is a formidable technique for monitoring surface deformation, with detection capabilities down to submillimeters. Recently, several case studies have been conducted at the Colorado School of Mines on the applications of advanced InSAR technology for mapping ground subsidence caused by tunneling and underground excavations in urban settings. Case studies include 1) tunneling- and dewatering-induced rapid differential ground rebound and delayed subsidence measured by InSAR in Seattle, WA, 2) mapping 3D deformation caused by cavern excavation in downtown Los Angeles, CA, using multiplatform InSAR time-series analysis, and 3) twin-tunneling-induced non-uniform ground subsidence mapping using Sentinel-1 InSAR and a parametric study employing machine learning in Los Angeles. Our case studies demonstrate that the InSAR technique complements conventional methods for measuring ground subsidence. Since SAR satellite images are collected regularly, InSAR could serve as a routine monitoring technique for ground subsidence induced by underground excavation and tunneling in urban environments.The Colorado Association of Black Professional Engineers and Scientists (CABPES) is a non-profit organization based in Denver, Colorado, whose mission is to encourage Black and other underrepresented youth to pursue science, technology, engineering, and math (STEM) careers. The organization offers various programs to fulfill this mission including an afterschool STEM program (Junior Engineers and Tomorrow's Scientists, or JETS) and after-school and summer math tutoring programs (Math Enrichment Program, or MEP). In 2023, BGC Engineering become a sponsor of CABPES and participated in Corporate Sponsor Weeks for the MEP. After building a relationship through multiple successful MEP events, BGC and CABPES began considering how to incorporate the geosciences into the JETS program, which had never had a geoscience class before. Realizing that developing a semester-long geoscience course intended for high school students was ambitious, BGC reached out to geoscience professionals already involved with CABPES and the AEG Mile High Chapter to help develop and implement the program. Over the 2024–25 school year, members of the Mile High Chapter worked closely with CABPES to develop and teach the geoscience program covering everything from mineralogy and rock types to geohazards, geochemistry, and climate change. The program required the support of many members of the Mile High Chapter and their network of practicing geoscientists to develop material, activities, and teach the courses. This talk will discuss BGC and the Mile High Chapter's involvement in the CABPES MEP and JETS programs, including how the programs were conceived, learnings from volunteer events and the development and teaching of the JETS geoscience course, and plans for the future. The hope is that these insights inspire and provide guidance to other AEG chapters to engage with communities across the U.S. to introduce geoscience to communities that are not typically represented in the profession today.

Intraplate Neotectonics of Northwestern Australia

Whitney, Beau, ROW Geoconsulting, Montpellier, France, whitney@rowgeo.com; James Hengesh, hengesh@igeohaz.com (TS #4)

Studies reveal neotectonic reactivation in Australia's former passive margin, along the Western Australian Shear Zone (WASZ), a 2,000-km-long zone of dextral-oblique neotectonic faults and folds. Bathymetric data indicate broad-scale crustal down warping of the continental shelf as evidenced by subsidence of paleo-sea level low-stand estuary systems and elevation reconstructions of paleo-sea level features. Seismic data show near sea-bottom and seafloor expressions of faults in offshore basins on the North West Shelf. High-precision leveling of modern and late Pleistocene shoreline features indicates systematic changes in relative paleo-sea level elevations along onshore anticlines. Analyses of ephemeral stream morphodynamics demonstrate that tectonically driven land-level changes are affecting channel form and fluvial processes. Trenching investigations indicate multiple late Quaternary morphogenic earthquakes have occurred in the Mt. Narryer fault zone in the southern WASZ. Folding in the near surface sediments is the predominant style of surface expression of reactivated Mt. Narryer basement faults. The WASZ reoccupies older rift-related structures formed during periods of continental-scale fragmentation in the Paleozoic and Mesozoic eras. The WASZ accommodates continental-scale differential motion within a zone of extended crust between oceanic and non-extended continental tectonic blocks. Deformation in the WASZ is inferred to be driven by a transition in plate boundary architecture. Reactivation coincides with late Neogene and Quaternary reorganization of Australia's northern plate boundary and realignment of the intraplate stress field. North-directed subduction of oceanic crust is occurring along the Java trench while south-directed obduction of foreland deposits onto continental lithosphere is occurring along the Banda Arc. The change from subduction to collision is reactivating former passive margin structures within the WASZ. Deformation rates within the WASZ decrease from north to south, with greater distance from the plate boundary, as indicated by historical seismicity and tectonic geomorphology.

Coding for Geotechnical Engineers: Necessity or Niche?

Zarrelli, Gary, NewFields Mining Design & Technical Services, LLC, gzarrelli@newfieldsmining.com (TS #13)

As technology advances and datasets grow in size, a pressing question arises: should geotechnical engineers learn to code? This paper explores programming as a practical skill for engineers, emphasizing its value in enhancing data analysis, automating workflows, and solving complex problems. While commercial software remains the industry standard, the ability to create custom tools offers engineers greater flexibility and deeper insight into analytical processes. To illustrate this, the paper presents a case study on the development of a browser-based application for Cone Penetration Test (CPT) data analysis. Built using Python and Streamlit, the application integrates open-source libraries such as NumPy, SciPy, pandas, and Matplotlib. It supports a range of CPT correlations, including soil behavior classification, static and dynamic liquefaction assessment, strength estimation, and pore pressure analysis. Customizable inputs allow adaptation to project-specific conditions. The case examines CPT data from impounded gold tailings in a seismically active mining region (M7.2; PGA = 0.3g) to depths of 27 meters. Modern visualization techniques and density distributions (e.g., Gaussian, KDE) aid in interpretation. Results align with those produced by commercial software, reinforcing the credibility of user-developed tools. Beyond the case study, this paper examines the broader role of coding in geotechnical practice. While engineers are not expected to become software developers, basic programming literacy can streamline tasks and foster innovation. Challenges remain—including institutional resistance, perceived difficulty, and integration with existing systems—but as the industry becomes more data-driven, coding offers a competitive advantage. By drawing on lessons learned from the development process—such as iterative problem-solving, user-centered design, and data management—this paper demonstrates how even a modest investment in programming skills can transform early-stage ideas into scalable, robust engineering solutions.

Late Quaternary Reactivation of the Cheraw Fault on the Western North American Craton

Zellman, Mark, BGC Engineering, Inc., mzellman@bgcengineering.com*; Dean, Ostenaa,* deano3geo@gmail.com *(TS #4)*

The Cheraw fault is an >80-km-long normal fault on the Great Plains of southeastern Colorado. It is one of the few faults within the North American intraplate setting east of the Rocky Mountains known to have ruptured the ground surface during the Quaternary, and it is often cited as an example of fault behavior typical of stable continental regions. The Cheraw fault has a northeast trend along the western flank of the Las Animas Arch, where 2D seismic reflection profiles indicate a steep northwest dip (75°±0.5°) and recurrent activity since at least the Paleozoic, with likely <30m of late Cenozoic normal faulting. Down-to-the-northwest normal faulting has resulted in an uphill-facing scarp that obstructs southeast flowing tributaries of the Arkansas River. The scarp has a subtle expression (less than 10m high) in lidar-data across gently sloping erosive bedrock slopes and Quaternary alluvial pediment surfaces. Fluvial, eolian, and paludal deposits with buried soils from the Old Ranch trench site on the central section of the fault suggest five events, four since ~19 ka and one slightly older. The average slip rate since ~19 ka is ~0.16 ± 0.3 mm/yr, with a recurrence of 3 to 5 ka. Estimated per-event displacements (0.75±.15 m) from the Old Ranch site are suggestive of partial or segmented ruptures. Ages from mid- to late-Quaternary geomorphic surfaces cut by the Cheraw fault imply rapid incision from ~145 to ~100 ka. Maximum vertical offsets of 7–9m for these surfaces indicate that from ~19 to >200 ka the average slip rate was no greater than ~0.03 mm/yr. The accelerated slip rate since ~19 ka indicates a possible response to rapid erosional unloading and/or a limited late Cenozoic, <40 ka, paleoseismic history for the Cheraw fault.

Monitoring Ground Subsidence Induced by Underground Excavation or Tunneling in Urban Environments Using InSAR Techniques

Zhou, Wendy, Colorado School of Mines, wzhou@mines.edu *(TS #6)*

Ground subsidence is characterized by the downward movement of the ground surface, resulting from natural phenomena or human activities. When Earth materials are extracted, rock or soil can collapse into voids from loss of support. This redistributes stress and strain within the rock mass and soil, damaging above-ground infrastructure such as roads, buildings, utility lines, and pipelines. Ground subsidence caused by underground excavation or tunneling must remain within tolerable thresholds to prevent damage to surface structures. Therefore, monitoring ground settlements induced by tunneling is essential, especially in urban environments. Researchers and practitioners have studied tunnel-induced ground subsidence using various methods, including in situ monitoring, analytical or numerical modeling, interferometric synthetic aperture radar (InSAR) monitoring, and subsidence prediction through machine learning. InSAR is a formidable technique for monitoring surface deformation, with detection capabilities down to submillimeters. Recently, several case studies have been conducted at the Colorado School of Mines on the applications of advanced InSAR technology for mapping ground subsidence caused by tunneling and underground excavations in urban settings. Case studies include 1) tunneling- and dewatering-induced rapid differential ground rebound and delayed subsidence measured by InSAR in Seattle, WA, 2) mapping 3D deformation caused by cavern excavation in downtown Los Angeles, CA, using multiplatform InSAR time-series analysis, and 3) twin-tunneling-induced non-uniform ground subsidence mapping using Sentinel-1 InSAR and a parametric study employing machine learning in Los Angeles. Our case studies demonstrate that the InSAR technique complements conventional methods for measuring ground subsidence. Since SAR satellite images are collected regularly, InSAR could serve as a routine monitoring technique for ground subsidence induced by underground excavation and tunneling in urban environments.

Author Index

	Early Career California-Based Professional
Oladipo, Olajide	Stabilization of Boron in Coal Combustion Wastewaters Using Industrial Byproducts: Insights from Fourier-Transform Infrared Spectroscopy (FTIR) and X-ray Diffraction (XRD) Analyses
Oladipo, Olajide	See Oseni, Oyindamola
Olson, Mitchell	See Thomassen, Claire
O'Neill, Harry	The Best Method to Measure Indoor Air Concentrations to Assess Vapor Intrusion Risks—The Preference for Passive Samplers
Oo, Chit W.	See Brown, Megan R.M
Oommen, Thomas	See Staubach, Asher
Oseni, Oyindamola	Enhanced Phytoremediation of Perchlorate and Nitrate in Sand-Biochar Bioreactors
Oseni, Oyindamola	See Oladipo, Olajide
Ostenaa, Dean	See Zellman, Mark
Packer, Bonnie	See Hasbrouck, Kristen
Palomino, Anjelica	See Nagaraja, Banuchandra
Parker, Beth	See Hasbrouck, Kristen
Paxson, Greg	See Gagnon, Hawkins
Perez Arias, Corlos	See Spellman, Huston
Phillips, Andrew C.	See Thota, Anjali N.
Phipps, Michael	See McCormick, William
Piepenburg, Michael A.	Moving the Big Iron: How to get your Tunnel Boring Machine (TBM) to your Site
Pluhar Christopher	See Rodriguez, Marco A.
Pope, Isaac E.	Crossroads of Fire and Ice: How Glacial Drift and Lava Flows Control Debris Flow Paths at Mount Adams, Washington, USA (1)
Pope, Isaac E.	Morphometrics of Modern Lava Flows: What Physicochemical Properties Control Surface Roughness and its Evolution through Time? (2)
Ramnauth, Avishai	The Extent and Effects of Nuclear Proliferation
Reddy, Elizabeth	See Bezanson, Noah
Reddy, Krishna R.	See Nagaraja, Banuchandra
Reddy, Krishna R.	See Janga, Jagadeesh Kumar
Rengers, Francis	See Guido, Lauren
Richaud, Mathieu	See Rodriguez, Marco
Rivera, Tiffany	See Davis, Cassidy
Rodriguez, Marco	Timing and Trigger Mechanisms of the Buckeye Canyon Rockslide, North of Yosemite National Park, California
Rotta Loria, Alessandro F.	The Urban Underground: A Mine of Heat
Rotta Loria, Alessandro F.	See Chu, Zhonghao

Penn's Applied Geosciences Program

Advance your career and make an impact in environmental geology, hydrogeology, and engineering geology—all online.

- Expand your applied geoscience or engineering geology knowledge
- Learn from experienced industry experts
- Prepare for your next professional move ahead

Earn a master's degree, complete a graduate certificate, or take a class.

Details at:

www.upenn.edu/msag

Penn
Applied Geosciences Program