

ANNE HOLLAND MENEFFEE

Assistant Professor | Energy and Mineral Engineering, Pennsylvania State University
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EDUCATION

University of Michigan, Dept. of Civil and Environmental Engineering Ann Arbor, MI
Dissertation: Carbon Mineralization in Fractured Basalt
Ph.D., Environmental Engineering 2020
M.S.E., Environmental Engineering 2016
University of Virginia, School of Engineering and Applied Science Charlottesville, VA
B.S., Civil & Environmental Engineering | Minor, Global Sustainability | Highest Distinction 2015

RESEARCH POSITIONS

Assistant Professor **Dept. of Energy and Mineral Engineering, Penn State University**
Aug 2021 – Present *Co-funded by the Institutes of Energy and the Environment*

Director's Postdoctoral Fellow **Los Alamos National Laboratory**
Aug 2020 – Aug 2021 *Project: Geochemical-Geomechanical Feedback in Stressed Fracture Systems*

Graduate Research Assistant **University of Michigan Dept. of Civil & Environmental Engineering**
Aug 2015-2020 *Integrating high-pressure experiments and reactive transport modeling to evaluate geochemical controls on CO₂ mineralization in fractured basalts.*
Advisor: Dr. Brian Ellis

Graduate Research Fellow **Los Alamos National Laboratory**
Jan-May 2019 *Conducted triaxial shear experiments to evaluate how fractures generated under subsurface stress conditions respond to penetration of reactive fluids.*
Advisor: Dr. Bill Carey

Research Assistant **Virginia Environmentally Sustainable Technologies lab (UVa)**
May 2015-July 2015 *Applied life cycle assessment and techno-economic analysis to evaluate the sustainability of systems-level carbon management strategies.*
Advisor: Dr. Andres Clarens

Select publications (Google scholar: 345 total citations; h-index 10; i10-index 10)

- Menefee, A.H.;** Shwartz, B.S. "Quantifying the value of geologic carbon mineralization for project risk management in carbon capture and removal pathways." *Energy & Fuels* 2024, 38 (6), 5365-5373.
- Schwartz, B.S.; **Menefee, A.H.** Techno-economic analysis of coupling wind-powered green hydrogen production with geologic storage. *Geological Society of London (Special Issue – Enabling Secure Subsurface Storage in Future Energy System)* 2023, 528(1).
- Welch, N. J.; Carey, J. W.; Frash, L. P.; Hyman, J. D.; Hicks, W.; Meng, M.; Li, W.; **Menefee, A. H.** Effect of Shear Displacement and Stress Changes on Fracture Hydraulic Aperture and Flow Anisotropy. *Transp Porous Med* 2022, 141 (1), 17–47.
- Menefee, A.H.;** Ellis, B.R. Carbon mineralization in reactive silicate zones. *ACS Environmental Science and Technology - Engineering* 2021, 1(8), 1193-1204.
- Menefee, A.H.;** Welch, N.J.; Frash, L.P.; Hicks, W.; Carey, J.W.; Ellis, B.R. Rapid mineral precipitation during shear fracturing of carbonate-rich shales. *Journal of Geophysical Research: Solid Earth* 2020, 125(6).
- Menefee, A.H.;** Ellis, B.R. Regional-scale greenhouse gas utilization strategies for enhanced shale oil recovery and carbon management. *Energy & Fuels* 2020, 34(5), 6136-6147.
- Menefee, A.H.;** Ellis, B.R. Wastewater management strategies for sustained shale gas production. *Environ. Res. Lett.* 2020, 15 (2), 024001.
- Menefee, A.H.;** Giammar, D.E.; Ellis, B.R. Permanent CO₂ trapping through localized and chemical gradient-driven basalt carbonation. *Environmental Science & Technology* 2018, 52 (15), 8954–8964.

9. **Menefee, A.H.**; Li, P.; Giammar, D.E.; Ellis, B.R. Roles of transport limitations and mineral heterogeneity in carbonation of fractured basalts. *Environmental Science & Technology* **2017**, *51* (16), 9352–9362.
10. Adeoye, J.T.; **Menefee, A.H.**; Xiong, W.; Wells, R.K.; Skemer, P.; Giammar, D.E.; Ellis, B.R. Effect of transport limitations and fluid properties on reaction products in fractures of unaltered and serpentinized basalt exposed to high P_{CO_2} fluids. *International Journal of Greenhouse Gas Control* **2017**, *63*, 310–320.
11. Wilkins, R.; **Menefee, A.H.**; Clarens, A.F. Environmental life cycle analysis of water and CO_2 -based fracturing fluids used in unconventional gas production. *Environmental Science & Technology* **2016**, *50*(23), 13134-13141.

Select conference proceedings

1. **Menefee, A.H.**; Schwartz, B.S. Carbon Mineralization to Enable Negative Emissions Technologies. *Proceedings of the 16th International Conference on Greenhouse Gas Control Technologies (GHGT-16)*, Lyon, France, **2022**.
2. **Menefee, A. H.**; Frash, L. P.; Hicks, W.; Carey, J. W. Coupled Geochemical-Geomechanical Alterations in Shale Fracture Systems. *Proceedings of the American Rock Mechanics Association, U.S. Rock Mechanics/Geomechanics Symposium*, Santa Fe, NM, USA, 2022.
3. Carey, J.W.; Frash, L. P.; Hicks, W.; **Menefee, A. H.** An experimental study of fracture-induced chemical reactions. *Proceedings of the American Rock Mechanics Association, U.S. Rock Mechanics/Geomechanics Symposium*, Santa Fe, NM, USA, 2022.

TEACHING EXPERIENCE

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| Instructor, EME 597 (Negative Emissions Technologies) | 2022-Present |
| <ul style="list-style-type: none"> ○ Graduate level course covering technologies for carbon removal or capture and sequestration, with a focus on integrated systems capable of achieving net-negative emissions. | |
| Instructor, PNG 405/406 (Rock and Fluid Properties) | 2021-Present |
| <ul style="list-style-type: none"> ○ Fundamental course introducing students to reservoir rock properties and mechanics; fluid behavior; and fluid-rock interactions, including both lecture (405) and lab (406) components. | |
| Co-instructor, CEE 501 (Subsurface Energy Systems) | Winter 2020 |
| <ul style="list-style-type: none"> ○ Co-developed and co-taught (with Dr. Brian Ellis) a course on fundamentals of reservoir geology, fluid-rock interactions, and reactive transport modeling in the context of subsurface energy. | |
| Graduate student instructor, CEE 265 (Sustainable Engineering Principles) | Fall 2017 & 2018 |
| <ul style="list-style-type: none"> ○ Developed homework assignments and exams; held weekly office hours; managed team of graders; helped with developing course content and covered lectures during instructor absences | |
| Teaching assistant, CE 2100 (Intro to Environmental Engineering) | Spring 2014 & 2015 |

AWARDS AND HONORS

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| ProQuest Distinguished Dissertation Award, University of Michigan | 2021 |
| <ul style="list-style-type: none"> ○ Recognize highly accomplished graduate students who have produced exceptional dissertations of outstanding scholarly quality" (10 selected from >800 dissertations submitted each year) | |
| Director's Postdoctoral Fellowship, Los Alamos National Laboratory | 2020 |
| <ul style="list-style-type: none"> ○ Selected based on strength of accomplishments, proposed research, and potential impact at LANL | |
| Department of Energy Office of Science Graduate Student Research Award | 2018 |
| <ul style="list-style-type: none"> ○ Received funding to work under Dr. Bill Carey at Los Alamos National Lab (appointment Jan-May 2019) ○ Proposal title: "Reaction-driven changes in fracture permeability and geomechanical stability" | |
| National Science Foundation Graduate Research Fellowship | 2017 |
| Rader Award, UVa Dept. of Civil and Environmental Engineering | 2015 |
| <ul style="list-style-type: none"> ○ Awarded annually to "fourth-year students who have excelled academically, demonstrated a capacity for hard work, and who have shown a willingness and ability to get along with their colleagues." | |

PROFESSIONAL SERVICE

American Geophysical Union, member 2016-present

- Co-chair, Session H55I – Reactive Transport and Chemomechanical Processes in Porous Media (convened at the AGU annual meetings in 2022, 2023).

American Rock Mechanics Association, member

- Co-chair, workshop: “Emerging Opportunities in Geologic Hydrogen Storage and Carbon Sequestration,” ARMA annual meeting, June 2022

Journal reviewer 2017-Present

- *Environmental Science and Technology, Environ. Sci. Technol. Letters, Intl. J. of Greenhouse Gas Control, Applied Geochemistry, Geochemica et Cosmochemica Acta, Energy & Fuels, Advances in Water Resources, Water Resources Research, Proceedings of the National Academy of Sciences (PNAS)*

AEESP Conference Student Delegate Co-Chair Jan-June 2017

- Led the student delegation involved in planning and facilitating the 2017 AEESP (Association of Environmental Engineering and Science Professors) biennial meeting with 700+ attendees

Society of Women Engineers

- Professional development chair, University of Michigan graduate student chapter, 2017-2018

American Society of Civil Engineers

- Secretary, UVa student chapter, 2013-2014
- First place, Marr Technical Paper competition, 2015 ASCE Virginia’s Conference

OUTREACH AND PROFESSIONAL PROGRAMS

Discover Engineering Instructor 2018-2019

- Led hands-on workshops introducing high school students to the civil engineering profession
- Chaperoned students funded through the Detroit Area Pre-College Engineering Program

Graduate Environmental Engineering Network of Professionals, Educators, and Students (University of Michigan) - President, 2016-2017

- Facilitated networking among EWRE faculty and students, collaboration with other departments, and organized recruiting events for new students

IEAGHG Carbon Capture and Storage Summer School, Saskatchewan, Canada July 17-23, 2017

- Selected as “most outstanding student” in a week-long summer school program on technical, social, economic, political, and environmental aspects of carbon capture and storage

Research Experience in Carbon Sequestration (RECS) June 12-20, 2016

- Selected to participate in an intensive 10-day interactive education and training program focused on all aspects of carbon capture, utilization, and storage (sponsored by the US DOE)

Females Excelling More in Mathematics, Engineering, and Science (FEMMES) 2015-2020

- Organize activities exposing 3rd- to 6th-grade girls in underserved communities to STEM fields

PROFESSIONAL CERTIFICATION

Engineer-in-Training, Virginia Dept. of Professional and Occupational Regulation 2015