Enid J. (Jeri) Sullivan Graham

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Academic Degrees

Ph.D., Earth and Environmental Science (Hydrology), New Mexico Institute of Mining and Tech., 1997
M.S. Geochemistry, University of North Carolina, Chapel Hill, 1988
B.A. Chemistry, University of Virginia, 1982
Certified Professional Geologist, Virginia No. 768, by examination

Professional Positions

University of New Mexico, Research Professor, 2016-present
Graduate Faculty, New Mexico State University, 2016-2021 appointment.
Los Alamos National Laboratory, Technical Staff Member/R&D Scientist 2002-2016.
Los Alamos National Laboratory, Post-Doctoral Research Associate: 1999-2002
Bureau of Economic Geology, University of Texas-Austin: Research Associate, 1997-1999
New Mexico Institute of Mining and Technology: Research Assistant, 1992–1997
Versar, Inc.: Staff Geologist and Project Manager, 1986-1993

Selected Projects and Research

Science Fellow to NMED for produced water projects, 2019-present.
Water Data Initiative for New Mexico Tech, Developing water data management systems, July 2019-present.
Produced and Brackish Water Analysis for the NM Oil Conservation Division, 2017-2019
New Mexico Science Advisor, Brackish Water Work Group, New Mexico Energy, Minerals, and Natural Resources Department, Office of the Secretary (Secretary F. David Martin), 2014 to 2016.
Manager for Water and Energy, Science Programs Office-Applied Energy, 2013-2016.
CO2-PENS Water Treatment Model: Cost and treatment process model for extracted reservoir waters, including organic and inorganic treatment processes. Developed for the system model CO2-PENS for carbon capture, utilization, and storage systems (CCUS).
Algal Biofuels Cultivation Risk Evaluation of toxins, metal uptake, and VOC accumulation.
NAABB Algal Biofuel Consortium- aqueous geochemistry, metals cycling, uptake, and modeling.
Radioactive Waste Characterization and Disposal, WIPP Headspace Gas team, Advanced **GC/MS detection** of Volatile Organic Compounds, Hydrogen, and Methane in Waste Drums.
Chevron Energy Technology Projects-HES Hydraulic fracturing permeability studies.
Oil and Gas and Fracture-Flowback Produced Water Projects- projects for RPSEA and DOE to characterize, treat and reuse frac-flowback and produced waters, focus on VOCs, SVOCs, and metals
Statistical Analysis of Ground-Water Chemistry, Pajarito Plateau Region (5-year WQ project)

Patents and Copyrights

US Patent 8,236,181: "Purification of water from cooling towers and other heat exchange systems" by Enid J. Sullivan, Robert S. Wingo, and Bryan J. Carlson. Issued August 7, 2012.

US Patent 7,767,078: "System for Treating Produced Water", by Enid J. Sullivan, Robert S. Bowman, Lynn S. Katz, Soondong Kwon, and Kerry A. Kinney. Issued August 3, 2010.

C-09,050 titled: "Oil Well Produced Water Treatment – P&ID and Model", by Enid Joan Sullivan et al.

Awards

2014 Conservation Seed Grant Award, The Climate Change Leadership Institute-Energy-Water Nexus Initiative with the State of New Mexico.

NNSA 2011 Pollution Prevention Awards Program, Environmental Stewardship Award, LANL Algal Biofuels Consortium Development Team.

Distinguished Performance Award, LANL Algal Biofuels Consortium Development Team, 2009.

Professional Activities

New Mexico Desalination Association-Past President and founding member, 2018-present.

Lead Organizer, New Mexico Produced Water Conference, November 15-16, 2018, Santa Fe, NM. Sponsored by the NM Desalination Association.

Ground Water Protection Council Report on Produced Water (2019)-contributing author, Section 3, "Uses of produced water outside of the oil and gas industry".

Regional Lead Author, United Nations Global Environment Outlook (GEO-6), North American Regional Assessment Report, 2015-2016.

Invited Plenary Speaker, International Petroleum Environmental Conference, New Orleans, LA, November 8, 2016. "Leaping Hoops and Hurdles, overcoming regulatory, policy, and physical constraints to achieve beneficial uses with produced water"

Current Societies: American Geophysical Union, Geological Society of America, American Chemical Society, Society of Petroleum Engineers

Editorial Board: Algal Research, Environmental Biotechnology

Journal Reviewer: Environmental Science and Technology, J. Environmental Engineering, J. Environmental Quality Journal of Hazardous Materials, Chemosphere, Microporous and Mesoporous Materials, Applied Geochemistry, Soil Science Society of America, J. Porous Materials, UWM Research Foundation

Publications

Peer-Reviewed Articles

Hopkins, Thomas C., **Sullivan Graham, Enid J**; Schuler, Andrew J., 2019. "Biomass and lipid productivity of *Dunaliella tertiolecta* in a produced water-based medium over a range of salinities" J. Applied Phycology, https://doi.org/10.1007/s10811-019-01836-3.

Hopkins, Thomas C., **Sullivan Graham, Enid**, Schwilling, Jonathan, Ingram, Serena, Gomez, Stephen Schuler, Andrew J., 2019. "Effects of salinity and nitrogen source on growth and lipid production for a wild algal polyculture in produced water media", Algal Research, V. 38, 101406. https://doi.org/10.1016/j.algal.2018.101406.

Zemlick, Katie; Kalhor, Elmira; Thomson, Bruce; Chermak, Janie; **Sullivan Graham, Enid**; Tidwell, Vincent, 2018. "Mapping the Energy Footprint of Produced Water Management in New Mexico". Environmental Research Letters, v. 13, No.2, https://doi.org/10.1088/1748-9326/aa9e54.

Sullivan Graham, E.J., Dean, C.A., Yoshida, T.M., Twary, S.N., Teshima, M., Alvarez, M.A., Zidenga, T., Heikoop, J.M., Perkins, G.B., Rahn, T.A., Wagner, G.L, and Laur, P.M. "Oil and gas produced water as a growth medium for microalgae cultivation: A review and feasibility analysis", Algal Res. (2017), http://dx.doi.org/10.1016/j.algal.2017.01.009.

Ziemkiewicz, P., Stauffer, P.H., **Sullivan Graham, E.J**., Chu, S.P., Bourcier, W.L., Buscheck, T.A., Carry, T., Donovan, J., Jiao, Z., Lin, L., Song, L., and Wagoner, J.L. 2016. "Opportunities for increasing CO2 Storage in deep saline formations by active reservoir management and treatment of extracted formation water: case Study at the GreenGen IGCC facility, Tianjin, China.", Int. J. Greenhouse Gas Control 54P2 pp. 538-556 DOI: 10.1016/j.ijggc.2016.07.039.

Sullivan Graham, E.J., Chu, S.P., Middleton, R., and Pawar, R.J., 2015. "Probabilistic cost estimation methods for treatment of water extracted during CO2 storage and EOR". Int. J. Greenhouse Gas Control, 41: 316-327. http://dx.doi.org/10.1016/j.ijggc.2015.07.026.

Sullivan Graham, E.J., Jakle, A.C., and Martin, F.D., 2015. "Reuse of Oil and Gas Produced Water in New Mexico-Resource Assessment, Treatment Processes, and Policy", Water International, 40: No. 5-6, 809-823. http://dx.doi.org/10.1080/02508060.2015.1096126.

Sullivan Graham, E.J, Chu, S., Pawar, R.J., Stauffer, P.H. 2014. "The CO2-PENS Water Treatment Model: evaluation of cost profiles and importance scenarios for brackish water extracted during carbon storage", Energy Procedia,7205-7214, DOI: 10.1016/j.egypro.2014.11.756

Sullivan, E.J., Chu, S.P., Middleton, R., and Pawar, R.J., 2013. A method and cost model for treatment of water extracted during geologic CO2 storage. Int. J. Greenhouse Gas Control, 12: 372-381. http://dx.doi.org/10.1016/j.ijggc.2012.11.007.

Sullivan, Enid J., Chu, Shaoping P., Stauffer, Philip H., Pawar, Rajesh J. 2012, A CO2-PENS model of methods and costs for treatment of water extracted during geologic carbon sequestration. Desalination and Water Treatment Journal, published online August 9, 2012. http://www.tandfonline.com/doi/abs/10.1080/19443994.2012.714727

Middleton, R.S., Keating, G.N., Stauffer, P.H., Jordan, A.B., Viswanathan, H.S., Kang, Q., Carey, J.W., Mulkey, M.L., **Sullivan**, E.J., Chu, S.P., and Esposito, R.A., 2012. The cross-scale science of CO2 capture and storage: from pore scale to regional scale. Energy & Environmental Science, 5(6), 7328 – 7345 (C2EE03227A).

Kwon, S., **Sullivan**, E. J., Katz, L. E., Bowman, R.S., and Kinney, K.A., 2011. Laboratory and field evaluation of a pretreatment system for removing organics from produced water. Water Environment Research 83, (9): 843-854.

Altare, C.R., Bowman, R.S., Katz, L.E., Kinney, K.A., **Sullivan**, E.J., 2007. Regeneration and long-term stability of surfactant-modified zeolite for removal of volatile organic compounds from produced water. Microporous and Mesoporous Materials, 105: 305-316.

Ranck, J.M., Bowman, R.S., Weeber, J.L., Katz, L.E., and **Sullivan**, E.J., 2005. BTEX removal from produced water using surfactant-modified zeolite. J. Environ. Eng.131:434-442.

Sullivan, E.J., Reimus, P.W., Chipera, S.J., and Counce, D., 2003. Effects of mineralogy, exchange capacity, surface area, and grain size on lithium sorption to zeolitic alluvium near Yucca Mountain, Nevada. Clays Clay Minerals, 51, 6, 634-643.

Sullivan, E.J., Bowman, R.S., and Legiec, I.A., 2003. Sorption of arsenate from soil-washing leachate by surfactant-modified zeolite. J. Environ. Quality, 32, 2387-2391.

Sullivan, E.J., Carey, J.W., and Bowman, R.S., 1998, Thermodynamics of cationic surfactant sorption onto natural clinoptilolite: J. Colloid Interface Science, v. 206, p. 369-380.

Sullivan, E. J., Hunter, D. B., and Bowman, R. S., 1998, Fourier-transform Raman spectroscopy of sorbed HDTMA and the mechanism of chromate sorption to surfactant-modified clinoptilolite: Environmental Science and Technology, v. 32, no. 13, p. 1948–1955.

Sullivan, E. J., Hunter, D. B., and Bowman, R. S., 1997, Topological and thermal properties of surfactant-modified clinoptilolite studied by tapping-mode™ atomic force microscopy and high-resolution thermogravimetric analysis: Clays and Clay Minerals, v. 45, no. 1, p. 42–53.

Book Chapters

Sullivan Graham, E.J.,"Oil and Gas Produced Water, High-Salinity Brines, and Associated Cost Modeling. In "Encyclopedia of Water" 29 December 2019 **https://doi.org/10.1002/9781119300762.wsts0041**

Sullivan, E.J., Reimus, P.W., and Counce, D.A., 2003. Transport behavior of a reactive tracer in saturated alluvium described using a three-component ion-exchange model. J. Contam. Hydrology 62-63, pp. 675-694. Special Book Issue: Bodvarsson, G.S., Ho, C.K, and Robinson, B.A., Eds.

Bowman, R.S., **Sullivan**, E.J., and Li, Z., 2000, Uptake of cations, anions, and nonpolar organic molecules by surfactant-modified clinoptilolite-rich tuff. In: Natural Zeolites for the Third Millenium. C.Collela, and F.A. Mumpton, Eds. De Frede Editore, Napoli, Italy, pp. 287-297.

Reports

Sullivan Graham, E.J., Hightower, M.M., Thomson, B., Balch, R., and Cather, M. New Mexico Produced Water Conference – 2018 "Policy, Regulations, and Economics to Support Total Resource Recovery" Draft Final Report, February 1, 2019. https://nmdesalassociation.com/wp-content/uploads/2019/03/2018-NM-Prod-H2O-Conf-Sum-Report-Draft.pdf.

Sullivan Graham E.J. 2016. Draft Report on Water Rights for Energy in Colorado, Texas, and Arizona. Submitted to U.S. DOE Office of Energy Policy and Systems Analysis, December, 2016.

Sullivan Graham, E.J., and Yoshida, T.M. 2016. Study of Zeolite Exchange Properties for St. Cloud Mining, LLC. An NMSBA project, December 9, 2016. LA-UR-16-29212, Los Alamos National Laboratory.

Neal, K., Bossert, E., **Sullivan Graham, E.J**., and Bibeault, M.L., 2016. Continued Preliminary Engineering Study for Beyond Laundry LLC Facility. An NMSBA project, November 30, 2016. Los Alamos National Laboratory.

William L. Bourcier, Thomas A. Buscheck, Jeffrey L. Wagoner, Shaoping Chu, **Jeri Sullivan Graham,** Philip Stauffer, Zunsheng Jiao, Mark Northam, Scott Quilinan, Timothy Carr, Joseph Donovan, Lianshin Lin, Liaosha Song, Paul Ziemkiewicz, "Pre-feasibility Study to Identify Opportunities for Increasing CO2 Storage in Deep, Saline Aquifers by Active Aquifer Management and Treatment of Produced Water", a report to the U.S.-China Clean Energy Research Consortium, September, 2014.

Sullivan, E.J., and C.E. Bagwell. "Human Health Risk Assessment of Algal Production Systems: Characterization of Toxins and Toxic Components, Harmful VOCs, Metal Speciation/Bioconcentration, and Pathogenic Microorganisms Associated with Large-Scale Algae Cultivation Systems: Final Report-Results and Risk Analysis Framework". DOE-EERE Report, September, 2013.