David Hanigan, PhD, PE

Associate Professor
Associate Chair for Undergraduate Affairs, Civil and Environmental Engineering
Department of Civil and Environmental Engineering
University of Nevada, Reno

1664 N. Virginia St. MS-0258
Reno, NV 89557-0258
775-682-7517
DHanigan@UNR.edu
www.DHanigan.com

EDUCATION

Arizona State University

Ph.D. Environmental Engineering — August 2015
Dissertation Title: Identification of *N*-nitrosodimethylamine Precursors to Improve Their Control
Committee Members: Paul Westerhoff, Pierre Herckes, Bruce Rittmann

University of Missouri – Columbia

M.S. Civil Engineering — July 2011
Thesis Title: Removal of Disinfection By-product Precursors by Activated Carbon and MIEX®
Committee Members: Thomas Clevenger, Enos Inniss, Allen Thompson

B.S. Civil Engineering with Honors — December 2009

PRINCIPAL AREAS OF TEACHING AND RESEARCH EXPERTISE

Environmental chemistry, drinking water treatment, wastewater treatment, water quality, water reuse, analytical chemistry, mass spectrometry, emerging contaminants, per- and polyfluoroalkyl substances (PFAS), disinfection byproducts (DBPs), oxidation, natural organic matter, pollutant remediation, groundwater, agricultural reuse of wastewater, thermal treatment, thermal decomposition chemistry, combustion, pyrolysis, incineration, stack emissions.

EXPERIENCE

University of Nevada, *Reno, NV*

Associate Professor — July 2022-present
Associate Chair for Undergraduate Affairs, Department of Civil and Environmental Engineering — August 2025-present
Program Director, Environmental Engineering — January 2023-present
Assistant Professor — July 2016-June 2022

Arizona State University, *Tempe, AZ*

Postdoctoral Research Associate — August 2015-July 2016
Assessing the lifecycle impacts of engineered nanomaterials (EPA - LCNano). Development of a method to assess reactive oxygen species production of nanomaterials in environmental matrices and correlation with zebrafish embryo morphology and mortality.

Graduate Research Assistant — August 2011-August 2015
Removal and characterization of NDMA precursors at bench- (RSSCTs, bottle point) and full-scale using novel sorbents. Development of an isolation/TOF/MS method for NDMA precursor identification.

Teaching Assistant — January 2013-May 2013
Teaching assistant (full semester) and lecturer of record (4 lectures) for graduate level *Physical and Chemical Treatment of Water and Wastewater*. Greater than 10 other guest lecturers in other environmental engineering graduate level courses during PhD and post-doc.

University of Missouri, *Columbia, MO*

Graduate Research Assistant — January 2010-July 2011

Mitigation of disinfection by-product (trihalomethanes, haloacetic acids) formation in source waters containing elevated hydrophilic organic matter fractions.

Undergraduate Research Assistant — August 2009-December 2009
Investigated the effect of UV fluence on photoreactivation/photo repair of wastewater microorganisms.

Osage Constructors Inc. *Fulton, MO*

On-Site Engineer in Training (Matagorda, TX) — May 2009-August 2009
Site surveying, preliminary design/bid, safety officer.

On-Site Engineer in Training (Rosenberg, TX) — May 2008-August 2008
Site surveying, heavy construction.

HONORS AND AWARDS

University of Missouri Civil Engineering Academy of Distinguished Alumni Inductee — 2026
Environmental Science & Technology Best Papers 2022 and Clarivate Highly Cited Paper for "Critical Review of Thermal Decomposition of Per- and Polyfluoroalkyl Substances: Mechanisms and Implications for Thermal Treatment Processes" — 2024/2025
American Academy of Environmental Engineers and Scientists, 40 under 40 — 2024
Featured in Environmental Science: Water Research & Technology Emerging Investigator Series — 2021
Environmental Science: Water Research & Technology Best Paper Award for "Degradation and removal of poly- and per-fluoroalkyl substances from aqueous Systems by nano-enabled water treatment strategies". — 2020
Nevada IDeA Network of Biomedical Research Excellence, Scientific Service Award ($2k) — 2019
American Water Works Association, Abel Wolman Fellow ($30k/yr) — 2014-2016
Water Environment Federation, Canham Graduate Studies Scholar ($25K) — 2014
ACS, Graduate Student Award in Environmental Chemistry ($100) — 2014
Arizona State Sustainable Engineering and the Built Environment, Lab Safety Award — 2014
Arizona State University Engineering, Dean's Fellowship ($30k/yr) — 2011-2013
Arizona Water Association, Scholarship ($1,000) — 2012
Arizona State University, Ira A. Fulton Fellowship ($5k) — 2011-2012
University of Missouri, Paul Kufrin Memorial Scholarship ($5k) — 2010

Awards to Students in Hanigan's Group

Shaik Joarder – UNR Graduate Dean's Merit Scholarship ($5k) — 2026
Plabon Turzo – WateReuse Nevada Scholarship ($1k) — 2026
Plabon Turzo and Shaik Joarder – UNR CEE Department Graduate Research Symposium Shared 1st Place Poster Award — 2026
Plabon Turzo – UNR Graduate Student Association Poster Symposium 2nd Place — 2025
Isabela Blanco – UNR Graduate Dean's Merit Scholarship ($10k) — 2025
Srinidhi Lokesh – Gordon Research Conference on Water Disinfection, Byproducts and Health, Poster Competition Honorable Mention — 2025
Shaik Joarder – UNR Graduate School Outstanding Graduate Student Scholarship ($1k) — 2025
Shaik Joarder – Nevada Water Resources Association Student of the Month — 2025
Lauren Edwards – William F. & Nadine M. Pillsbury Engineering Endowed Graduate Fellowship ($10k) — 2024
Lauren Edwards – Nevada WateReuse Graduate Student Research Grant ($2k) — 2024
Jordyn Dashiell– Nevada WateReuse Undergraduate Student Research Grant ($800) — 2024
Haley Grable – Best Poster Competition, Third Place, RemTEC Summit — 2023
Kenny Hickenbottom – Whittell Forest Graduate Research Fellowship ($5k) — 2023
Kenny Hickenbottom – US Dept. of Ed. GAANN Fellowship (~32k/yr) — 2021-2023
Mingrui Song – Nevada Water Resources Association Scholarship ($500) — 2021
Mingrui Song – UNR Graduate Student's Association Travel Grant ($500) — 2021

Mingrui Song – Nevada Water Reuse Association Scholarship ($1k) 2021
Junli Wang – Nevada Water Reuse Association Scholarship ($1k) 2021
Elizabeth McKenna – AEESP Master's Thesis Award ($500) 2021
Junli Wang – Nevada Water Resource Association Scholarship ($400) 2021
Junli Wang – Air & Waste Management Association Scholarship ($2k) 2021
Kevin Stewart – US Dept. of Ed. GAANN Fellowship (~32k/yr) 2021
Ibrahim Abusallout – NV INBRE Core Services Award ($2k) 2020
Mingrui Song – Air & Waste Management Association Scholarship ($2k) 2020
Priyamvada Sharma – UNR Graduate Student's Association Travel Grant ($500) 2020
Elizabeth McKenna – Nevada WaterReuse Association Scholarship ($1k) 2020
Ibrahim Abusallout – UNR Postdoctoral Professional Development Award ($500) 2019
Elizabeth McKenna – First Place, AWWA WQTC Student Poster Competition 2019
Elizabeth McKenna – UNR Graduate Dean's Merit Scholarship ($5k) 2019
Saeed Arabi – UNR College of Engineering Differential Fees Assistantship ($13k) 2019
Elizabeth McKenna – 3rd Place NWEA Conference Poster Competition 2018
Chelsea Cluff – NSF Graduate Research Fellowship ($138k) 2017
Chelsea Cluff – AWWA Henry "Bud" Benjes/HDR Scholarship ($5k) 2017

SPONSORED RESEARCH

As PI

1. Surrogates for PFAS Breakthrough in Granular Activated Carbon Applications 2025-2028
   Nevada Department of Environmental Protection
   $437k
2. Understanding Wildfire Risks to Drinking Water Source Waters: Pyrogenic Changes to Organic Matter and Disinfection By-product Formation 2022-2026
   National Science Foundation OIA
   $248k
3. Gas Phase PFAS and Organofluorine Release from AFFF: Measurement, Identification, and Exposure Mitigation 2021-2026
   National Science Foundation CBET Environmental Engineering
   $330k
4. Rapid Site Profiling of Organofluorine: Quantification of PFASs by Combustion Gas Analysis 2019-2025
   Strategic Environmental Research and Development Program
   $784k
5. Securing the Future of Direct and Indirect Potable Reuse – *N*-nitrosodimethylamine (NDMA) Formation Pathways and Precursors 2018-2022
   National Science Foundation CBET Environmental Engineering
   $330k
6. Co-Funding - Securing the Future of Direct and Indirect Potable Reuse 2018-2021
   Water Research Foundation
   $50k
7. Understanding Formation of a Critical Disinfection Byproduct: NDMA and Previously Unidentified NDMA Precursors in Advanced Potable Reuse Treatment Plants 2018-2020
   Subcontracted from Orange County Water District, funding from United States Bureau of Reclamation
   $25k
8. Atmospheric CO_2 Capture Through Wastewater 2017-2018
   University of Nevada, Reno New Scholarly Endeavor Grant
   $2.5k
9. Mass spectrometry to identify NDMA forming amines isolated from Orange County Advanced Water Purification Facility – Phase 2 2017
   Orange County Water District
   $15k

As Co-PI

10. Statewide Wastewater Monitoring of Opioids, Sedatives, and Stimulants at NSHE Institutions and High Schools — 2024-2027
State of Nevada Department of Health and Human Services Fund for a Resilient Nevada
$2.25m ($600k to Hanigan)

11. Empowering Community Resilience with Sustainable Energy and Water Reuse Systems — 2024-2028
National Science Foundation OIA
$6m ($1.2m to Hanigan)

12. Real-time Analysis of Gas-phase Products of Incomplete Destruction During the Thermal Treatment of PFAS — 2024-2027
Strategic Environmental Research and Development Program
$1.4m ($347k to Hanigan)

13. Water Reuse Consortium for Water Resiliency and Self Sufficiency: Advanced Technologies and Systems for Water Reuse — 2023-2027
Federal Appropriation via US Army Engineer Research and Development Center
$10.4m ($7.2m to UNR, $737k to Hanigan)

14. A Complete Strategy for Pavements Impacted with PFAS: Rapid Quantification, Leaching Kinetics, In Situ Stabilization, Thermal Treatment, and Reusability — 2023-2026
Strategic Environmental Research and Development Program
$1.4m ($625k to Hanigan)

15. Collaborative Research: ERASE-PFAS: Thermal Regeneration of PFAS-laden Granular Activated Carbon Presents an Opportunity to Break the Forever PFAS Cycle — 2022-2025
National Science Foundation CBET Environmental Engineering
$500k ($250k to Hanigan)

16. Compost Filter Sock and Straw Wattle Efficacy for Capturing Waterborne Pollutants Following Urban Wildfire — 2022-2024
CalRecycle
$125k ($54k to Hanigan)

17. Investigation of Disinfection Byproduct Formation and Mitigation in Aquifer Storage and Recovery Operations — 2020-2023
Truckee Meadows Water Authority
$396k to UNR

18. Addressing Human Health Impacts from Emerging Contaminants in Reclaimed Water to Enhance its Use for Urban and Peri-urban Agriculture — 2017-2020
USDA AFRI Water for Agriculture
$500k to UNR

Significant Contribution as Author

19. Identifying NDMA Forming Amines from the Orange County Water Purification Facility — 2016-2017
Orange County Water District
Co-author with Paul Westerhoff (PI)
$18.5k

20. Understanding the Source and Fate of Polymer-Derived Nitrosamine Precursors — 2016-2018
Water Research Foundation #4622
Co-author with Paul Westerhoff (PI)
$350k

21. Determining the Relative Importance and Contribution of Anthropogenic and Natural Sources of Nitrosamine Precursors — 2014-2016
Water Research Foundation #4499
Co-author with Paul Westerhoff (PI)
$400k

PROFESSIONAL MEMBERSHIP AND DEVELOPMENT

Registered Professional Engineer in the State of Arizona	2016-present
Association of Environmental Engineering & Science Professors Member	2015-present
International Humic Substances Society Member	2015-present
American Chemical Society Member	2013-present
Water Environment Federation Member	2013-present
American Water Works Association Member	2012-present
UNR Supervisor Certificate Program	2025
UNR Teaching with Technology Certificate	2019
Association of College and University Educators: Effective Teaching Practices Certificate	2017
Preparing Future Faculty ASU Course Completed	2012-2013
DavidsonX EdX Course, 001X Medicinal Chemistry	2014
DelftX EdX Course, CTB3365x Introduction to Water Treatment	2013
HarvardX EdX Course, PH278x Human Health and Global Environmental Change	2013
BerkeleyX EdX Course, Stat2.1x Introduction to Statistics, Descriptive Statistics	2013
BerkeleyX EdX Course, Stat2.2x Introduction to Statistics, Probability	2013
BerkeleyX EdX course, Stat 2.3x Introduction to Statistics, Inference	2013

PUBLICATIONS AND PRESENTATIONS

Refereed Journal Publications (Corresponding author underlined, **UNR students, Postdocs, and Research Scientists directly supervised by Hanigan in blue**)

H index = 25 to 30 (Scopus, Web of Science, Google Scholar)

Times Cited = 2303 to 3129

1. Bahureksa, W., Rhoades, C., Fegel, T., Roth, H., **Hickenbottom, K.**, VanderRoest, J., Hanigan, D., McKenna, A., Wilkins, M., Borch, T. Changes in Molecular Chemistry of Stream Organic Matter and Low Molecular Weight Disinfection Byproduct Precursors Following Initial Post-Fire Rainstorms. *ACS ES&T Water*, 2026. *In press*
2. Monwar, M., Mondol, P., Barile, C., Jalil, T., Tung, R., Hanigan, D., Shamin Al Mamum, M., Khan, R. Investigating Physico-chemo-mechanical Changes of Eutectic Gallium Indium (eGaIn) Thin Films Induced by Fluorinated Aqueous Droplets. *Physical Chemistry Chemical Physics*, 2026. 28(27): p. 16562-16569.
3. **Hickenbottom, K., Lokesh, S.,** Pagilla, K., Hanigan, D. Wildfire Temperature and Oxygen Availability Alter Disinfection Byproduct Precursors in Laboratory and Weathered Forest Soils. *ACS ES&T Water,* 2026. 6(7): p. 4448-4459.
4. **Lokesh, S.,** Borch, T., VanderRoest, J., Fettrow, S., Hanigan, D. Enrichment of Disinfection Byproduct Precursors in Fire-Affected Soils from the 2025 Eaton Fire in Los Angeles, California. *ACS ES&T Water,* 2026. 6(7): p. 4254-4266.
5. Jiang, M., Curtis, E., **Joarder, S.**, Abou-Khalil, C., Corcoran, A., Hanigan, D., Doudrick, K. Low-temperature Thermal Treatment of Portland Cement Concrete Contaminated with Per- and Polyfluoroalkyl Substances. *Journal of Hazardous Materials,* 2026. 514: p. 142809.
6. **Wang, J., Dashiell, J., Castellano, D., Song, M., Grable, H., Edwards, L., Turzo, P.**, Holton, C., Hanigan, D. PFAS Screening in Soil by Combustion Gas Analysis with Fourier Transform Infrared Spectroscopy. *Analytical Chemistry,* 2026. 98(20): p. 14733-14740.
7. **Hickenbottom, K.,** Hanson, B., **Lokesh, S.,** Pagilla, K., Rosario-Ortiz, F., Hanigan, D. Combustion Temperature and Molecular Weight Fractionation Provide Insights into Soil-derived Wildfire-impacted Disinfection Byproduct Precursors. *ACS ES&T Water,* 2026. 6(5): p. 2815-2826.
8. Gokhale, D., Cerrón-Calle, G., Kim-Fu, M., Flores, K., Roman Santiago, A., Tsai,S., Aga, D., Aich, N., Diallo, M., Doudrick, K., Hanigan, D., Hernández Sánchez, R., Howarter, J., Jiang, J., Jones, G., Lee, L., Liu, H., Manz, K., McKenzie, E., Padhye, L., Sankaran, R.., Shepard, S., Strathmann, T., Venkatesan, A., Wong, M., Leet, R., Speed, D., Field, J., Westerhoff, P., Su, X. Challenges and Opportunities in PFAS Waste Management for Semiconductor Manufacturing. *Environmental Science & Technology*, 2026. 60(3): p. 2259-2276.

9. **Lokesh, S., Jathan, Y.**, Marchand, E., Hanigan, D. Recent Improvements in Understanding the Impacts of Wildfire on Disinfection Byproduct Formation Potential. *Current Opinion in Environmental Science & Health*, 2026. 49.
10. Hatinoglu, D., **Edwards, L., Turzo, P.,** Hanigan, D., Apul, O. Interplay of Surface Oxygen Content and Pore Water on Thermal Regeneration of Granular Activated Carbons. *Journal of Hazardous Materials,* 2025. 491: p. 137885.
11. Hayes, H., Lutes, C., Watson, N., Benton, N., Hanigan, D., **McCoy, S.,** Holton, C., Bronstein, K., Schumacher, B., Zimmerman, J., Williams, A. Laboratory Development and Validation of Vapor Phase PFAS Methods for Soil Gas, Sewer Gas, and Indoor Air. *Environmental Science: Atmospheres*, 2025. 5(1): p. 94-109.
12. **Song, M., Wang, J., DeNicola, M.,** and Hanigan, D. Natural Vs. Anthropogenic Sources of *N*-Nitrosodimethylamine Precursors in Surface Water. *Water Research*, 2024. 265: p. 122313.
13. Lacroix, A., Goli, T., Hanigan, D., and Pagilla, K. Formation, Speciation, and Temporal Variability of DBPs in Drinking Water Distribution Systems in the Context of ASR Operations and Extended Storage Periods. *Chemosphere*, 2024: 364: p. 143154.
14. Lacroix, A., Goli, T., Hanigan, D., Pagilla, K. Full-scale Granular Activated Carbon and Chloramine Pretreatment of Drinking Water for Aquifer Storage and Recovery. *ACS ES&T Water,* 2024. 4(5): p. 2159-2169.
15. **Abusallout, I., Song, M., Chan, A., McKenna, E.,** Van Buren, J., **McCoy, S.,** Ledvina, Z., Jeffrey, C., McCurry, D., Hanigan, D. Bacterial dealkylation of benzalkonium chlorides in wastewater produces benzyldimethylamine, a potent *N*-nitrosodimethylamine precursor. *Water Research*, 2024. 260: p. 121945
16. **Stewart, K.,** An, D., Hanigan, D. Reduction of Haloacetonitrile-associated Risk by Adjustment of Distribution System pH. *Environmental Science: Water Research & Technology,* 2023. 9: p. 2725-2732.
17. **DeNicola, M.,** Lin, Z., Quiñones, O., Vanderford, B., **Song, M.,** Westerhoff, P., Dickenson, E., Hanigan, D. Per- and Polyfluoroalkyl Substances and Organofluorine in Lakes and Waterways of the Northwestern Great Basin and Sierra Nevada. *Science of the Total Environment,* 2023. 905: p. 166971.
18. **Hickenbottom, K.,** Pagilla, K., and Hanigan, D. Wildfire Impact on Disinfection Byproduct Precursor Loading in Mountain Streams and Rivers. *Water Research*, 2023. 244: p. 120474.
19. Shi, Y., Ma, J., Hanigan, D., Chen, Y., Qian, Y., Guo, J., An, D. Magnetically recoverable Fe_3O_4/MoS_2/BiOI microspheres for visible light water disinfection: molecular mechanism and transcriptomic insights. *Separation and Purification Technology*, 2023. 320: p. 124140.
20. **Wang, J., Song, M., Abusallout, I.,** Hanigan, D. Thermal Decomposition of Two Gaseous Perfluorocarboxylic Acids: Products and Mechanisms. *Environmental Science & Technology*, 2023. 57(15): p. 6179-6187.
21. **Song, M., McKenna, E.,** Thurman, E.M., Ferrer, I., Taylor-Edmonds, L., Hofmann, R., Ishida, K., Roback, S., Plumlee, M., Hanigan, D. Comparison of Oxidants Used in Advanced Oxidation for Potable Reuse: Non-Target Analysis and Bioassays. *ACS ES&T Water*, 2023. 3: p. 690-700.
22. Qian, Y., Shi, Y., Guo, J., Chen, Y., Hanigan, D., An, D. Molecular Characterization of Disinfection Byproduct Precursors in Filter Backwash Water from 10 Drinking Water Treatment Plants. *Science of the Total Environment*, 2023. 856(Pt 1): p.159027
23. **Song, M.,** Roback, S., Ishida, K., Wang, J., Plumlee, M., Hanigan, D. Contribution of Dimethylamine to *N*-nitrosodimethylamine Formation at Reverse Osmosis Water Reclamation Facilities. *Environmental Science & Technology Letters*, 2022. 10(1): p. 66
24. **Abusallout, I.,** Holton, C., **Wang, J.,** Hanigan, D. Henry's Law Constants of 15 Per- and Polyfluoroalkyl Substances Determined by Static Headspace Analysis. *Journal of Hazardous Materials Letters*, 2022. 3: p. 100070
25. Shahriar, A., Hanigan, D., Verburg, P., Pagilla, K., Yang, Y. Modeling the fate of ionizable pharmaceutical and personal care products (iPPCPs) in soil-plant systems: pH and speciation. *Environmental Pollution*, 2022. 315: p. 120367
26. **Wang, J.**, Lin, Z., He, X., Song, M., Westerhoff, P., Doudrick, K., Hanigan, D. Critical Review of Thermal Decomposition of Per- and Polyfluoroalkyl Substances: Mechanisms, and Implications for Thermal Treatment Processes. *Environmental Science & Technology,* 2022.

56(9): p. 5355. **(Second joint runner up in the category 'Critical Review' in the 2022 Environmental Science & Technology Best Paper Awards, Web of Science Highly Cited Paper in the field of Environment/Ecology)**

27. Qian, Y., Chen, Y., Hanigan, D., Shi, Y., Sun, S., Hu, Y., An, D. pH Adjustment Improves the Removal of Disinfection Byproduct Precursors from Sedimentation Sludge Water. *Resources, Conservation & Recycling*, 2022. 179: p. 106135
28. **Arabi, S. M., Alicata, J.,** Hanigan, D., Hiibel, S. R. Capturing Atmospheric Carbon Dioxide by Depleting Inorganic Carbon in Municipal Wastewater. *International Journal of Greenhouse Gas Control*, 2021. 111: p. 103472
29. **Wang, J., Abusallout, I., Song, M.,** Marfil-Vega, R., Hanigan, D. Quantification of Per- and Polyfluoroalkyl Substances with a Modified Total Organic Carbon Analyzer and Ion Chromatography. *AWWA Water Science*, 2021. 3(4): p. e1235
30. **Sharma, P.,** Hanigan, D. Evidence of Low Levels of Trace Organic Contaminants in Terminal Lakes. *Chemosphere*, 2021. 285: p. 131408
31. **Abusallout, I., Wang, J.,** Hanigan, D. Emerging investigator series: Rapid Defluorination of 22 Per- and Polyfluoroalkyl Substances in Water Using Sulfite Irradiated by Medium-Pressure UV. *Environmental Science: Water Research and Technology*, 2021. 7(9): p. 1552
32. **Thapa, U., Sharma, P.,** Hanigan, D. Quantification of Pharmaceuticals in the Sealant Fluids of Actively Used Waterless Urinals. *Water Environment Research*, 2021. 93: pg. 1837
33. Shahriar, A., Tan, J., **Sharma, P.,** Hanigan, D., Verburg, P., Pagilla, K., Yang, Y. Modeling the Fate and Human Health Impacts of Pharmaceuticals and Personal Care Products in Reclaimed Wastewater Irrigation for Agriculture. *Environmental Pollution*, 2021. 276: pg. 116532
34. Qian, Y., Chen, Y., Hu, Y., Hanigan, D., Westerhoff, P., An, D. Formation and Control of C- and N-DBPs during Disinfection of Filter Backwash and Sedimentation Sludge Water in Drinking Water Treatment. *Water Research*, 2021. 194: p. 116964.
35. Qian, Y., Hu, Y., Chen, Y., An, D., Westerhoff, P., Hanigan, D., Chu, W. Haloacetonitrile and Haloacetamide Precursors in Filter Backwash and Sedimentation Sludge Water during Drinking Water Treatment. *Water Research*, 2020. 186: p. 116346.
36. Rand, L., **Poustie, A.,** Bednar, A. J., Hanigan, D., Westerhoff, P., Ranville, J. F. Quantifying Temporal and Geographic Variation in Sunscreen and Mineralogic Titanium-containing Nanoparticles in Three Recreational Rivers. *Science of the Total Environment*, 2020. 743: p. 140845.
37. **Sharma, P., Poustie, A.,** Verburg, P., Pagilla, K., Yang, Y., Hanigan, D. Trace Organic Contaminants in Field-scale Cultivated Alfalfa, Soil, and Pore Water after 10 Years of Irrigation with Reclaimed Wastewater. *Science of the Total Environment*, 2020. 744: p. 140698.
38. Liu, S., Liu, J., Wang, H., Yang, Y., Liu, S., Hanigan, D., Zhao, H. A New Antifouling and Antibacterial Membrane Material for Highly Selective Removal of Nitrate and Phosphate. *Industrial & Engineering Chemistry Research,* 2020. 59(26): p. 12114-12122.
39. **Poustie, A.,** Yang, Y., Verburg, P., Pagilla, P., Hanigan, D. Reclaimed Wastewater as a Viable Water Source for Agricultural Irrigation: A Review of Food Crop Growth Inhibition and Promotion in the Context of Environmental Change. *Science of the Total Environment*, 2020. 739: p. 139756.
40. **Thapa, U.,** Hanigan, D. Waterless Urinals Remove Select Pharmaceuticals from Urine by Phase Partitioning. *Environmental Science & Technology,* 2020. 54(10): p. 6344-6352.
41. Roth, J., **Abusallout, I.,** Hill, T., Holton, C., Thapa, U., Hanigan, D. Release of Volatile Per- and Polyfluoroalkyl Substances from Aqueous Film-Forming Foam. *Environmental Science & Technology Letters,* 2020. 7(3): p. 164-170. *(*Roth and Abusallout contributed equally).
42. **McKenna, E.,** Thompson, K., Taylor-Edmonds, L., McCurry, D., Hanigan, D. Summation of Disinfection By-product CHO Cell Relative Toxicity Indices: Sampling Bias, Uncertainty, and a Path Forward. *Environmental Science: Processes and Impacts*, 2020. 22: p. 708-718.
43. Kidd, J., Bi, Y., Hanigan, D., Herckes, P., Westerhoff, P. Yttrium Residues in MWCNT Enable Assessment of MWCNT Removal During Wastewater Treatment. *Nanomaterials,* 2019. 9(5): p. 670.
44. Saleh, N., Khalid, A., Tian, Y., Ayres, C., Sabaraya, I., Pietari, J., Hanigan, D., Chowdhury, I., Apul, O. Degradation and removal of poly- and per-fluoroalkyl substances from aqueous

systems by nano-enabled water treatment strategies. *Environmental Science: Water Research and Technology*, 2019. 5(2): p. 198-208. **(Cover Article, Best Papers 2019 collection)**
45. An, D., Chen, Y., Gu, B., Westerhoff, P., Hanigan, D., Herckes, P., Fischer, N., Donovan, S., Croué, J. P., Atkinson, A. Lower Molecular Weight Fractions of PolyDADMAC Coagulants Disproportionately Contribute to *N*-nitrosodimethylamine Formation During Water Treatment. *Water Research*, 2019. 150: p. 466-472.
46. Gao, Q., Wang, C.-Z., Liu, S., Hanigan, D., Liu, S.-T., Zhao, H.-Z. Ultrafiltration Membrane Microreactor (MMR) for Simultaneous Removal of Nitrate and Phosphate from Water. *Chemical Engineering Journal*, 2019. 355: p. 238-246
47. Roback, S., Ferrer, I., Thurman, E. M., Ishida, K., Plumlee, M. H., **Poustie, A.**, Westerhoff, P., Hanigan, D. Non-Target Mass Spectroscopy Analysis of NDMA Precursors in Advanced Treatment for Potable Reuse. *Environmental Science: Water Research and Technology*, 2018. 4(12): p. 1944-1955.
48. Krasner, S. W., Westerhoff, P., Mitch, W. A., Hanigan, D., McCurry, D. L., von Gunten, U. Behavior of NDMA Precursors at 21 Full-Scale Water Treatment Facilities. *Environmental Science: Water Research & Technology*, 2018. 4(12): p. 1966-1978.
49. Hanigan, D., Truong, L., Schoepf, J., Nosaka, T., Mulchandani, A., Tanguay, R. L., Westerhoff, P. Trade-offs in Ecosystem Impacts from Nanomaterial versus Organic Chemical Ultraviolet Filters in Sunscreens. *Water Research*, 2018. 139: p. 281-290.
50. Kidd, J., Hanigan, D., Truong, L., Hristovski, K., Tanguay, R., Westerhoff, P. Developing and Interpreting Aqueous Functional Assays for Comparative Property-Risk Relationships of Different Nanoparticles. *Science of the Total Environment*, 2018. 628-629: p. 1609-1616.
51. Chen, S., Yuan, Z., Hanigan, D., Westerhoff, P., Zhao, H., Ni, J. Coagulation Behaviors of New Covalently Bound Hybrid Coagulants (CBHyC) in Surface Water Treatment. *Separation and Purification Technology*, 2018. 192(Supplement C): p. 322-328
52. Venkatesan, A. K., Reed, R. B., Lee, S., Bi, X., Hanigan, D., Yang, Y., Ranville, J. F., Herckes, P., Westerhoff, P. Detection and Sizing of Ti-containing Particles in Recreational Waters Using Single Particle ICP-MS. *Bulletin of Environmental Contamination and Toxicology*, 2018. 100(1): p. 120-126.
53. Lankone, R., Challis, K., Bi, Y., Hanigan, D., Reed, R., Zaikova, T., Hutchison, J., Westerhoff, P., Ranville, J. F., Fairbrother, F., Gilbertson, L. Methodology for Quantifying Engineered Nanomaterial Release from Diverse Product Matrices Under Outdoor Weathering Conditions and Implications for Life Cycle Assessment. *Environmental Science: Nano*, 2017. 4(9): p. 1784-1797 **(Cover article and selected by editorial team as top 10% published in ES: Nano)**
54. Hanigan, D., Truong, L., Simonich, M., Tanguay, R., Westerhoff, P. Zebrafish Embryo Toxicity of 15 Chlorinated, Brominated, and Iodinated Disinfection By-products. *Journal of Environmental Sciences*, 2017. 58: p. 302-310.
55. Hanigan, D., Ferrer, I., Thurman, E. M., Herckes, P., Westerhoff, P. LC/QTOF-MS Fragmentation of *N*-nitrosodimethylamine Precursors in Drinking Water Supplies is Predictable and Aids Their Identification. *Journal of Hazardous Materials*, 2017. 323(Part A): p. 18-25.
56. Krasner, S. W., Lee, T.F.L., Westerhoff, P., Fischer, N., Hanigan, D., Karanfil, T., Beita-Sandi, W., Taylor-Edmonds, L., Andrews, R.C. Granular Activated Carbon Treatment May Result in Higher Predicted Genotoxicity in the Presence of Bromide. *Environmental Science & Technology,* 2016. 50(17): p. 9583-9591.
57. Hicks, A. L., Reed, R., Theis, T. L., Hanigan, D., Huling, H., Zaikova, T., Hutchinson, J. E., Miller, J. Environmental Impacts of Reusable Nanoscale Silver-coated Hospital Gowns Compared to Single-use, Disposable Gowns. *Environmental Science: Nano*, 2016. 3(5): p.1124-1132.
58. Hanigan, D., Liao, X., Zhang, J., Herckes, P., Westerhoff, P. Sorption and Desorption of Organic Matter on Solid-phase Extraction Media to Isolate and Identify *N*-nitrosodimethylamine Precursors. *Journal of Separation Science*, 2016. 39(14): p. 2661-2884.
59. Zhao, H., Wang, L., Hanigan, D., Westerhoff, P., Ni, J. Novel Ion-exchange Coagulants Remove More Low Molecular Weight Organics than Traditional Coagulants. *Environmental Science & Technology,* 2016. 50(7): p. 3897-3904.

60. Zhang, J. Hanigan, D., Westerhoff, P., Herckes, P. *N*-Nitrosamine Formation Kinetics in Wastewater Effluents and Surface Waters. *Environmental Science: Water Research & Technology,* 2016. 2(2): p. 312-319. **(Editor's Choice - 2016)**
61. Liao, X., Chen, C., Xie, S., Hanigan, D., Wang, J., Zhang, X., Westerhoff, P., Krasner, S.W. Nitrosamine Precursor Removal by BAC: Adsorption versus Biotreatment Case Study. *Journal American Water Works Association*, 2015. 107(9): p. E454-E463.
62. Hanigan, D., Thurman, E. M., Ferrer, I., Zhao, Y., Andrews, S., Zhang, J., Herckes, P., and Westerhoff, P. Methadone Contributes to *N*-nitrosodimethylamine Formation in Surface Waters and Wastewaters during Chloramination. *Environmental Science & Technology Letters*, 2015. 2(6): p. 151-157. **(2nd most read article ES&TL March 2015, Highly cited article published in ES&TL, 2018)**
63. Hanigan, D., Krasner, S. W., Zhu, E., Zhang, J., Herckes, P., Westerhoff, P. Contribution and Removal of Watershed and Cationic Polymer N-nitrosodimethylamine Precursors. *Journal American Water Works Association,* 2015. 107(3): p. E152-E163. **(Listed under Most Read Articles consecutively from April 2015 to Jan 2016)**
64. Krasner, S. W., Mitch, W. A., McCurry, D. L., Hanigan, D., Westerhoff, P. Formation, Precursors, Control, and Occurrence of Nitrosamines in Drinking Water: A Review. *Water Research,* 2013. 47(13): p.4433-4450 **(Web of Science Highly Cited in Field)**
65. Hanigan, D., Inniss, E., Clevenger, T. E. Removal of Natural Organic Matter Fractions by MIEX® and Activated Carbon with Regard to Disinfection By-product Formation. *Journal American Water Works Association,* 2013. 105(3): p. E84-E92.
66. Hanigan, D., Zhang, J., Herckes, P., Krasner, S. W., Chen, C., and Westerhoff, P. Adsorption of N-Nitrosodimethylamine Precursors by Powdered and Granular Activated Carbon. *Environmental Science & Technology*, 2012**.** 46(22): p.12630-12639.

Refereed Book Chapters and Other Refereed Publications

1. Busse, G., Hanigan, D., **Sharma, P.,** Yang, Y., Singletary, L., Verburg, P. The Fate of Pharmaceuticals and Personal Care Products in Reclaimed Water Used for Irrigation of Agricultural Crops in Nevada. *University of Nevada Cooperative Extension Fact Sheet*, 2021. SP-21-07.
2. **Sharma, P.,** Pagilla, K., Singletary, L., Hanigan, D. Pharmaceuticals and Personal Care Products (PPCPs) in Alfalfa Irrigated with Reclaimed Water. *University of Nevada Cooperative Extension Fact Sheet*, 2020. FS-20-05
3. Sterle, K., Ormerod, K. J., Singletary, L., Pagilla, K., Hanigan D., Verburg, P., Yang, Y. Reclaiming Water for Urban Foodsheds: State of Nevada Regulations and Permitting. *University of Nevada Cooperative Extension Fact Sheet*, 2020. FS-20-11
4. Pagilla, K., Hanigan, D., Yang, Y., Verburg, P., Sterle, L., Singletary, L. Reclaiming Water for Urban Foodsheds: Program Overview. *University of Nevada Cooperative Extension Fact Sheet,* 2020. FS-19-08
5. Chen, C., Hanigan, D., Liao, X., Wang, J., Zhang, X., Suffet, I. H., Krasner, S. W., Westerhoff, P. pH Effect on Nitrosamine Precursor Removal by Activated Carbon Adsorption, *in Recent Advances in Disinfection By-Products,* pp. 173-185, 2015, American Chemical Society.
6. Zhang, J., Hanigan, D., Shen, E., Andrews, S., Westerhoff, P., Herckes, P. Modeling NDMA Formation Kinetics During Chloramination of Model Compounds and Surface Waters Impacted by Wastewater Discharges, in *Recent Advances in Disinfection By-Products*, pp. 79-95, 2015, American Chemical Society.

Other Publications and Reports

1. Adams, H., Hanigan, D., Marfil-Vega, R., Ryan, D., McCurry, D., Keen, O., Ash, S., Southard, M. Operators Need to Know About Organic Contaminants. *Opflow*, 2023. 49(6): p.10-17.
2. Hanigan, D., McKenna, E., Song, M., Thurman, E. M., Ferrer, I., Roback, S., Plumlee, M. Nitrosamine Precursors in Direct and Indirect Potable Reuse Water. *Water Research Foundation Final Report,* 2022. Water Research Foundation: Denver, CO.
3. Roback, S., Plumlee, S., Hanigan, D. Understanding the Formation of a Critical Disinfection Byproduct: NDMA and NDMA Precursors in Advanced Potable Reuse Treatment Plants. *Bureau of Reclamation Final Report,* 2022. U.S. Department of the Interior: Denver, CO

4. **McKenna, E.,** Sharma, P., McCurry, D., Hanigan, D. A Layman's Guide to High-resolution Mass Spectrometry. *Journal American Water Works Association*, 2020. 112(4): p. 40-49.
5. Ferrer, I., Thurman, E. M., Hanigan, D., Westerhoff, P. Finding NDMA Precursors Using Accurate Mass Tools with an Agilent 6540 Q-TOF LC/MS. *Agilent Application Note,* 2017. Agilent Technologies.
6. Westerhoff, P., Hanigan, D., Herckes, P., Thurman, E. M., Ferrer, I., Andrews, S., Zhao, V., Bukhari, Z. Relative Importance and Contribution of Anthropogenic and Natural Sources of Nitrosamine Precursors. *Water Research Foundation Final Report*, 2017. Water Research Foundation: Denver, CO.
7. Hanigan, D., Westerhoff, P. Recovery and Mass Spectrometry Aimed at Identifying NDMA Forming Amines Isolated from the Orange County Advanced Water Purification Facility. *Orange County Water District Final Report*, 2016.
8. Hanigan, D. Identification of *N*-nitrosodimethylamine Precursors to Improve Their Control. Arizona State University, 2015. (PhD Dissertation)
9. Krasner, S. W., Shirkhani, R., Westerhoff, P., Hanigan, D., Mitch, W. A., McCurry, D. L., Chen, C., Skadsen, J., von Gunten, U. Controlling the Formation of Nitrosamines During Water Treatment. *Water Research Foundation Final Report*, 2015. Water Research Foundation: Denver, CO.
10. Hanigan, D. Removal of Disinfection By-product Precursors by Activated Carbon and MIEX®. University of Missouri, 2011. (Masters Thesis)

Invited Presentations

1. Hanigan, D. Anthropogenic Small Molecules in the Environment and Engineered Solutions. University of Missouri Environmental Engineering Seminar. Columbia, MO. April 3rd, 2026.
2. Hanigan, D. Untangling Natural and Anthropogenic Sources of DBP Precursors. Gordon Research Conference on Water Disinfection, Byproducts, and Health. Mount Holyoke College. July 28th, 2025.
3. Hanigan, D. Anthropogenic Small Molecules in the Environment and Engineered Solutions. Colorado School of Mines Environmental Engineering Seminar. Golden, CO. July 14th, 2025.
4. Hanigan, D., Hickenbottom, K., Pagilla, K. Wildfire Impacts on Source Water Quality. Truckee River Watershed Symposium. Reno, NV. May 1st, 2025.
5. Hanigan, D. Finding Needles in a Haystack: *N*-nitrosodimethylamine Precursors in Potable Reuse and Treated Wastewater. Hong Kong University of Science and Technology Forum 2024 on Novel Advanced Oxidation, (Chemical/Photo/Electro-)Disinfection, and Their Byproducts. Online. December 6th, 2024.
6. Hanigan, D. Anthropogenic Small Molecules in the Environment and Engineered Solutions. University of Colorado Environmental Engineering Seminar. Boulder, CO. April 5th, 2024.
7. Hanigan, D. Anthropogenic Small Molecules in the Environment and Engineered Solutions. Colorado State University Seminar. Fort Collins, CO. March 28th, 2024.
8. Hanigan, D. Anthropogenic Impacts on Water Quality: Everybody is Downstream from Somebody. Kiwanis Club of Montgomery County. March 7th, 2024.
9. Hanigan, D. PFAS Occurrence in Waterways of the Great Basin and Northern Sierra Nevada, and Challenges to Remediation. Desert Research Institute DHS Colloquium. Reno, NV. November 13th, 2023.
10. Hanigan, D., DeNicola, M, Dickenson, E. PFAS in the Great Basin and Sierra Nevada Alpine Lakes. American Chemical Society Western Regional Meeting. Las Vegas, NV. October 20th, 2022.
11. Hanigan, D. Rapid Site Profiling of Organofluorine: Quantification of PFASs by Combustion Gas Analysis. SERDP PFAS Summer Meeting. Long Beach, CA. July 18th, 2022.
12. Hanigan, D. Anthropogenic Small Molecules in the Environment and Engineered Solutions. University of Arizona Chemical and Environmental Engineering Symposium. Tucson, AZ. March 25th, 2022.
13. Hanigan, D. Anthropogenic Small Molecules in the Environment and Engineered Solutions. Washington State University. Pullman, WA. March 23rd, 2022.
14. Hanigan, D. Anthropogenic Small Molecules in the Environment and Engineered Solutions. WateReuse Nevada Symposium. Las Vegas, NV. February 1st, 2022.

15. Hanigan, D. Tapping into the Future: Potable Reuse in Tomorrow's World. Water UCI Colloquium. May 7th, 2021.
16. Hanigan, D. Anthropogenic Small Molecules in the Environment, How They Are Measured, and Engineered Solutions. Arizona State University Environmental Engineering Seminar. April 13th, 2021.
17. Hanigan, D. Rapid Site Profiling of Organofluorine: Quantification of PFASs by Combustion Gas Analysis. SERDP PFAS Summer Meeting. July 28th, 2020.
18. Hanigan, D. Advances in Engineering Impact Public Policy. Engineering Club at Davidson Academy. Reno, NV. Jan 14, 2020.
19. Hanigan, D. Past, Present, and Future of Per- and Polyfluoroalkyl Substances Analysis in the Field. SERDP Symposium. Washington D.C., November 28th, 2018.
20. Hanigan, D. Advances in Mass Spectrometry Identify a New Wave of Ultra-low Concentration Hazards. University of Nevada Geography Colloquium Series, Reno NV. Feb 15, 2017. (**selected as the semester student favorite**)
21. Hanigan, D., Zhang, J., Herckes, P., Westerhoff, P. Removal and Control of Watershed and Cationic Polymer N-nitrosodimethylamine Precursors During Drinking Water Treatment. Arizona State University, School of Sustainable Engineering and the Built Environment, Tempe, AZ. 2013.
22. Hanigan, D., Clevenger, T. E., and Inniss, E. Removal of DBP Precursors by Activated Carbon and MIEX. Arizona State University, School of Sustainable Engineering and the Built Environment, Tempe, AZ. 2011.

Conference Presentations (Presenter underlined, **UNR students, Postdocs, and Research Scientists directly supervised by Hanigan in blue**)

1. Zhao, B., **Lokesh, S.,** VanderRoest, J., Fettrow, S., Hanigan, D., Borch, T. Characterization of per- and polyfluoroalkyl substances (PFAS) within residential properties after the 2025 Los Angeles wildland-urban interface fire. American Chemistry Society National Meeting, Atlanta GA. March, 2026.
2. **Edwards, L.**, Hatinoglu, D., Apul, O., Hanigan, D. Thermal Destruction of PFAS-Loaded GAC: Byproducts and Mechanisms. Nevada Water Environment Association Annual Conference, Las Vegas, NV. February 2026.
3. **Loganathan, S.**, Ma, B., Hanigan, D. Complete Defluorination of PFAS using a Far-UVC (222 nm) Excimer Lamp. American Chemical Society National Meeting, Washington DC. August 2025.
4. Shamim Al Mamun, M., Terefe, D., Monwar, M., Mondal, P., Barile, C., Jalil, M. T., Tung, R. C., Hanigan, D., Khan, R. Observing Interfacial Changes of Eutectic Gallium Indium (eGaIn) Thin Films Induced By Fluorinated Aqueous Droplets. AIChE Annual Meeting, Boston, MA. November 2025.
5. **Joarder, S.,** Jiang, M., Doudrick, K., Hanigan, D. Semi-quantification of Gas Phase Organofluorine from Per- and Polyfluoroalkyl Substances Released During Thermal Reactivation of Granular Activated Carbon. Nevada Water Resources Association Science and Engineering Committee Meeting, Online, June 2025.
6. **Lokesh, S.,** Vanderroest, J., Fettrow, S., Borch, T., Hanigan, D. Assessment of Disinfection Byproduct Precursors in Drinking Water Following Urban Fires. Eaton Fire Conference, Chapman University, Los Angeles, CA. June 2025.
7. Hatinoglu, D., **Turzo, P., Edwards, L.,** Hanigan, D., Apul, O. Thermal Regeneration of Spent Activated Carbon to Break the PFAS Cycle. NEWWA 27th Annual Water Quality Symposium, Devens, MA. May 2025
8. **Edwards, L.,** Hatinoglu, D., Apul, O., Hanigan, D. Thermal Destruction of Perfluoroalkyl Substances Sorbed to Granular Activated Carbon: Byproducts and Mechanisms. American Water Works Association Annual Conference and Exposition, Denver, CO. June 2025.
9. **Joarder, S.,** Jiang, M., Doudrick, K., Hanigan, D. Identification and Semi-Quantification of Gas Phase Organofluorine from Thermal Treatment of Portland Cement Concrete Contaminated with Per-And Polyfluoroalkyl Substances. Association of Environmental Engineering and Science Professors Annual Conference, Durham, NC. May 2025.

10. Hatinoglu, D., **Turzo, P.**, **Edwards, L.**, Hanigan, D., Apul, Oc. Association of Environmental Engineering and Science Professors Annual Conference, Durham, NC. May 2025.
11. Hatinoglu, D., **Edwards, L.**, Hanigan, D., Apul, O. Granular Activated Carbon Catalyzes PFOS Mineralization During Thermal Regeneration. American Chemical Society National Meeting, Denver, CO. August 2024.
12. **Dashiell, J., Hickenbottom, K., Castellano, D.,** Hanigan, D. Disinfection By-Product Formation from Point of Use Water "Purifying" Tablets. Nevada WateReuse Symposium, Las Vegas, NV. January 2024.
13. **Edwards, L.,** Hanigan, D. Thermal Combustion Byproducts of C3, C4, C5 chain PFCAs Adsorbed to Granular Activated Carbon. Nevada WateReuse Symposium, Las Vegas, NV. January 2024.
14. Hatinoglu, D., Alulema, P., Hanigan, D., Apul, O. Thermal regeneration of PFAS-laden granular activated carbon: An opportunity to break the forever PFAS cycle. American Water Works Association Water Quality and Technology Conference, Dallas, TX. November 2023.
15. **Hickenbottom, K.,** Pagilla, K., Hanigan, D. Wildfire Impact on Disinfection Byproduct Precursor Loading in Mountain Streams and Rivers. American Water Works Association Water Quality and Technology Conference, Dallas, TX. November 2023.
16. **DeNicola, M.** Lin, Z., Westerhoff, P., Dickenson, E., Hanigan, D. Per- and Polyfluoroalkyl Substances in Lakes and Waterways of the Northwestern Great Basin. Nevada Water Environment Association Annual Conference, Reno, NV. March 2023.
17. **Hickenbottom, K.,** Pagilla, K., Hanigan, D. Effects of Wildfire on the Formation of Haloacetonitriles, Haloacetamides, and Regulated Disinfection By-products. American Water Works Association Water Quality Technology Conference, Cincinnati, OH. November, 2022.
18. **Stewart, K.,** Dong, A., Hanigan, D. Reduction of Disinfection Byproduct-associated Toxicity by Adjustment of Distribution System pH. American Water Works Association Water Quality Technology Conference, Cincinnati, OH. November, 2022.
19. Hanigan, D., **Song, M.**, Roback, S., Plumlee, M. Dimethylamine is an important NDMA precursor in full advanced treated water from potable reuse facilities. American Chemical Society National Meeting, Chicago, IL. August 2022.
20. **He, X.,** Hanigan, D. Operation and Species Dependent Carbon Recovery Rates for Per- and polyfluoroalkyl Substances as Measured by a Total Organic Carbon Analyzer. American Chemical Society National Meeting, Chicago, IL. August 2022.
21. **Abusallout, I.,** Holton, C., Hanigan, D. Are PFAS a Vapor Intrusion Threat? Association of Environmental Engineering Scientists and Professors Conference, St. Louis, MO. June 2022.
22. Hanigan, D., **Song, M., Abusallout, I.** Benzyldimethylamine and dimethylamine are key N-nitrosodimethylamine precursors in wastewater and potable reuse waters. 3rd International Water Association Disinfection and Disinfection By-products Conference, Milan, Italy. June 2022.
23. **Song, M.**, Roback, S., Plumlee, S., Hanigan, D. Comparison of Oxidants Used in Advanced Oxidation Processes with Non-target Analysis and Bioassays. International Water Association Leading Edge Technology Conference, Reno, NV. March 2022.
24. **He, X.,** Hanigan, D. Adsorptive separation of fluoride and per- and polyfluoroalkyl substances (PFAS) for direct total organic fluorine (TOF) measurement. American Chemical Society National Meeting, San Diego, CA. March 2022.
25. **Wang, J.,** Marfil-Vega, R., Hanigan, D. Quantification of Per- and Polyfluoroalkyl Substances with a Modified Total Organic Carbon Analyzer and Ion Chromatography. American Water Works Association Water Quality Technology Conference, Tacoma, WA. November 2021.
26. **Song, M.,** Roback, S., Plumlee, M., Hanigan, D. Dimethylamine is an Important NDMA Precursor in Full Advanced Treated Water from Potable Reuse Facilities. American Water Works Association Water Quality Technology Conference, Tacoma, WA. November 2021.
27. Hanigan, D., **Abusallout, I., Chan, A., Song, M.** Benzalkonium chloride is present in wastewater and is biotransformed to the potent *N*-nitrosodimethylamine precursor benzyldimethylamine during secondary treatment. American Chemical Society National Meeting, Atlanta, GA. August 2021.

28. **Wang, J.,** Marfil-Vega, R., Hanigan, D. PFAS Analysis With a Total Organic Carbon Instrument. Society of Environmental Toxicology and Chemistry North America 41st Annual Meeting. November 2020.
29. Hanigan, D., **Abusallout, I., Wang, J.,** Marfil-Vega, R. Quantification of PFASs via total organofluorine measurements with a TOC instrument. American Chemical Society National Meeting. August 2020.
30. **Sharma, P.,** Hanigan, D. Pharmaceutical and Personal Care Product Accumulation in Terminal Lakes Receiving Reclaimed Wastewater. American Chemical Society National Meeting, Philadelphia, PA. March 2020.
31. **Abusallout, I.,** Roth, J., Hill, T., Holton, C., Hanigan, D. Volatile Per- and Polyfluoroalkyl Substances Released from Aqueous Film-Forming Foam. American Chemical Society National Meeting, Philadelphia, PA. March 2020.
32. **Abusallout, I., Wang, J.**, Hanigan, D. Rapid Quantification of Per- and Polyfluoroalkyl Substances by Combustion Gas Analysis. National Environmental Monitoring Conference, Jacksonville, Fl. August 2019.
33. Roth, J., Holton, C., Hill, T., **Thapa, U.**, Hanigan, D. Are Per- and Polyfluoroalkyl Substances (PFAS) a Vapor Intrusion Concern? RemTEC Summit, Denver, CO. February 2019.
34. **Sharma, P., Poustie, A.,** Hanigan, D. Pharmaceuticals and Personal Care Products Accumulation in Plants at the Field-scale and in Terminal Lakes. Nevada Water Environment Association Annual Conference, Sparks, NV. January 2019.
35. **Thapa, U.,** Hanigan, D. Using Waterless Urinal Sealant to Remove Pharmaceuticals from the Urine. Nevada Water Environment Association Annual Conference, Sparks, NV. January 2019.
36. **Thapa, U., Cluff, C.,** Hanigan, D. Waterless Urinal 2.0: Removing Pharmaceuticals at the Source. American Water Works Association Water Quality Technology Conference, Toronto, ON. November 13, 2018.
37. Hanigan, D., Truong, L., Simonich, M., Tanguay, R., Westerhoff, P. Evaluating Toxicity Using Zebrafish Embryo Development: Sunscreens and Disinfection By-products. American Water Works Association Annual Conference and Exposition, Las Vegas, NV. June 13, 2018.
38. Hanigan, D., **Poustie, A.,** Thurman, E. M., Ferrer, I., Westerhoff, P., Roback, S. L., Ishida, K. P., Plumlee, M. H. Identifying NDMA Precursors in Advanced Treated Water for Potable Reuse. International Water Association 2nd Disinfection and Disinfection By-products Conference, Beijing, PRC. May 16, 2018.
39. **Poustie, A.,** Hanigan, D. Pharmaceutical Uptake in Crops Irrigated with Treated Wastewater. Nevada Water Environment Association Annual Conference, Sparks, NV. April 2018
40. Pagilla, K., Verburg, P., Hanigan, D., Yang, Y. Water Reuse Project at University of Nevada-Reno: Addressing Human Health Impacts from Emerging Contaminants in Reclaimed Water to Enhance Its Use for Urban and Peri-Urban Agriculture. American Chemical Society National Meeting, New Orleans, LA. March 2018.
41. Lankone, R., Wang, J., Challis, K., Bi, Y., Hanigan, D., Wang, Y., Garland, M., Reed, R., Zaikova, T., Westerhoff, P. K., Gilbertson, L. M., Ranville, J. F., Fairbrother, H. Characterization of Engineered Nanomaterial Release from Nanoenabled Products Following Accelerated and Natural Weathering. American Chemical Society National Meeting, New Orleans, LA. March 2018.
42. Hanigan, D., Ferrer, I., Thurman, E. M., Roback, S., Ishida, K., Plumlee, M., Westerhoff, P. NDMA Precursor Transformation and Identification during Reverse Osmosis and UV/Peroxide Water Treatment for Indirect Potable Reuse. American Chemical Society National Meeting, San Francisco, CA. April 3, 2017.
43. Thurman, E. M., Ferrer, I., Hanigan, D., Westerhoff, P. Using Dark Matter Accurate Mass to Discover NDMA Precursors in Wastewater. American Chemical Society National Meeting, San Francisco, CA. April 3, 2017.
44. Westerhoff, P., Rice, J., Hanigan, D., Dotson, A. Reactivity Towards N-Nitrosamines of bulk and Trace Organics of Wastewater Origin. American Chemical Society National Meeting, San Francisco, CA. April 3, 2017.
45. Lee, C. F. T., Krasner, S. W., Westerhoff, P., Fischer, N. L., Hanigan, D. Karanfil, T., Beita-Sandi, W., Taylor-Edmonds, L. Unintended Consequences of GAC on Emerging DBPs. American Chemical Society National Meeting, San Diego, CA. March 2016.

46. Hanigan, D., Herckes, P., Westerhoff, P. Total Nitrosamines in Wastewaters, Surface Waters, and Foodstuffs by TONO and TONO-HPLC. AWWA Water Quality and Technology Conference, Salt Lake City, UT. Nov 15-19, 2015.
47. Hanigan, D., Herckes, P., Andrews, S., Ferrer, I., Thurman, E. M., Westerhoff, P. Identification of Nitrosamine Precursors in Waste and Surface Waters. AWWA Water Quality and Technology Conference, New Orleans, LA. Nov 17-20, 2014.
48. Hanigan, D., Krasner, S., Herckes, P., Westerhoff, P. Removal of Polymer-Derived N-nitrosamine Precursors by Activated Carbon. AWWA Water Quality and Technology Conference, Long Beach, CA. Nov 3-7, 2013.
49. Hanigan, D., Westerhoff, P., Zhang, J., Herckes, P., and Krasner, S. W. Reduction of NDMA Formation by Granular and Powdered Activated Carbon. AWWA Water Quality Technology Conference, Toronto, Canada. Nov 5, 2012.
50. Hanigan, D., Herckes, P., and Westerhoff, P. Activated Carbon for N-Nitrosodimethylamine (NDMA) Precursor Removal from Drinking Water Treatment Plant Influent. AZ Water Annual Conference, Glendale, AZ. May 3-5, 2012.

Poster Presentations (Presenter underlined, **UNR students, Postdocs, and Research Scientists in blue**)

1. **Adepoju, A.**, Hanigan, D., Pagilla, K. Enhancing Water Security in Rural Communities Through Mobile Decentralized Treatment Technologies. Nevada Water Resources Association Annual Conference, Las Vegas, NV. February 2026.
2. **Turzo, P.**, Hatinoglu, D., Apul, O., Hanigan, D. Thermal Regeneration of PFOS-Laden Granular Activated Carbon: Influence of Carbon Type and Reagent Gas on Decomposition Pathways. RemTEC and Emerging Contaminants Summit, Westminster, CO. October 2025.
3. **McCoy, S.,** Hanigan, D. Total Organofluorine Analysis via Reductive Defluorination of PFAS with Sodium Biphenyl Complex. American Chemical Society National Meeting, Washington DC. August 2025.
4. **Lokesh, S.**, Borch, T., VanderRoest, J., Fettrow, S., Hanigan, D. Changes to Disinfection Byproduct Precursors Leached From Soil Following the Eaton Fire. Gordon Research Conference: Water Disinfection, Byproduct, and Health, South Hadley, MA. July 2025.
5. Hatinoglu, D., Choudhary, M., **Turzo, P.,** Loganathan, S, Hanigan, D., Apul, O. Understanding the Effect of Oxygen Content on Thermal Regeneration of Granular Activated Carbon as a Step Toward PFAS Destruction. Association of Environmental Engineering and Science Professors Annual Conference, Durham, NC. May 2025
6. Hatinoglu, D., **Edwards, L.**, Hanigan, D., Apul, O. Mechanistic Insights into Thermal Regeneration of PFAS-laden Granular Activated Carbons. RemTEC and Emerging Contaminants Summit, Westminster, CO. October 2024.
7. **Hickenbottom, K.**, Pagilla, K., Hanigan, D. Wildfire Impact on Disinfection Byproduct Precursor Loading in Mountain Streams and Rivers. Gordon Research Conference: Water Disinfection, Byproducts, and Health, South Hadley, MA. July 2023.
8. **Hickenbottom, K**., Pagilla, K., Hanigan, D. Wildfire Impact on Disinfection Byproduct Precursor Loading in Mountain Streams and Rivers. Nevada Water Environment Association Conference, Reno, NV. March 2023
9. **Grable, H.,** Syed, A., Matiasek, S., Webster, J., Hanigan, D. PFAS in Camp Fire (Paradise, CA) Sediment Control Devices. Nevada Water Environment Association Conference, Reno, NV. March 2023.
10. **Wang, J.,** Marfil-Vega, R., Hanigan, D. Thermal Decomposition of Gas-Phase Perfluorocarboxylic Acids: Formation of Gaseous Products and Mechanisms. International Water Association Leading Edge Technology Conference, Reno, NV. March 2022.
11. **Abusallout, I.,** Holton, C., Hanigan, D. Determination of Experimental Henry's Law Constants for 15 Poly- and Per-fluoroalkyl Substances (PFAS) Using Static Headspace Analysis. 12th International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Battelle). Palm Springs, CA. May 2022.
12. **Abusallout, I.,** Hanigan, D. Defluorination of Per- and Polyfluoroalkyl Substances (PFASs) by Medium-pressure UV Irradiated Sulfite. SERDP & ESTCP Symposium. December 2020.

13. **Wang, J.,** Hanigan, D. Quantification of PFASs via Total organofluorine measurements with a TOC instrument. SERDP & ESTCP Symposium. December 2020.
14. **Abusallout, I., Wang, J.,** Schlessel, A., Marfil-Vega, R., Hanigan, D. Rapid Quantification of Per- and Polyfluoroalkyl Substances by Combustion Gas Analysis. SERDP & ESTCP Symposium, Washington D.C. December 2019.
15. **McKenna, E.,** Thompson, K., Taylor-Edmonds, L., McCurry, D. L., Hanigan, D. Summation of Disinfection By-product Relative Toxicity Indices: Sampling Bias, Uncertainty, and a Path Forward. American Water Works Association Water Quality Technology Conference, Dallas, TX. November 3, 2019.
16. **McKenna, E.,** Thompson, K., Taylor-Edmonds, L., McCurry, D. L., Hanigan, D. Summation of Disinfection By-product Relative Toxicity Indices: Sampling Bias, Uncertainty, and a Path Forward. University of Nevada, Reno Graduate Student Association Symposium, Reno, NV. October 22, 2019.
17. **Arabi, S.**, Alicata, J., Hanigan, D., Hiibel, S.R. Capturing Atmospheric Carbon Dioxide by Depleting Wastewater Inorganic Carbon with Polymeric Membranes. UNR Global Climate Change Summit, Reno, NV. September 2019.
18. **Wang, J., Abusallout, I., Song, M.,** Hanigan, D. Rapid Site Profiling of Organofluorine: Quantification of PFASs by Combustion Gas Analysis (ER19-C2-1214). SERDP & ESTCP PFAS Project Meeting, San Diego, Ca. July 2019.
19. Hanigan, D., **Poustie, A., McKenna, E.,** Roback, S., Thurman, E. M., Ferrer, I., Plumlee, M. Identifying Nitrosamine Precursors in the Effluent of a Full Advanced Treatment Facility. Gordon Research Conference: Water Disinfection, Byproducts, and Health, South Hadley, MA. July 2019.
20. Roback, S., Ishida, K., Plumlee, M., Mitch, W., Chuang, Y. H., Zhang, Z., Taylor-Edmonds, L., Hofmann, R., Hanigan, D., Ferrer, I., Thurman, E. M., Hoh, E. UV/monochloramine, UV/free chlorine, UV/hydrogen peroxide and UV Alone for the Removal of NDMA, NDMA Precursors, Non-target Analytes and Bioassay-indicated Toxicity. Gordon Research Conference: Water Disinfection, Byproducts, and Health, South Hadley, MA. July 2019.
21. Hanigan, D., **Sharma, P., Thapa, U.** Rethinking Toilet Design to Reduce Environmental Pharmaceutical Loading. Association of Environmental Engineering Science Professors Biannual Conference, Tempe, AZ. May 2019.
22. **McKenna, E.,** Roback, S., Poustie, A., Thurman, E. M., Ferrer, I., Westerhoff, P., Plumlee, M., Hanigan, D. Identifying NDMA Precursors in Reuse Water Using Non-target Mass Spectrometry. Nevada Water Environment Association Annual Conference, Sparks, NV. January 2019.
23. **Sharma, P.,** Pagilla, K., Hanigan, D. Pharmaceuticals and Personal Care Product Accumulation in Plants at the Field Scale and in a Terminal Lake. American Water Works Association Water Quality Technology Conference, Toronto, ON. November 13, 2018.
24. Rand, L., Bi, Y., **Poustie, A.,** Bednar, A., Hanigan, D., Westerhoff, P., Ranville, J. Daily Cycling of Sunscreen and Mineralogic Ti-containing Nanoparticles in Three Rivers During Recreational Water Use. International Conference on the Environmental Effects of Nanoparticles and Nanomaterials, Durham, NC. September 2018
25. **Thapa, U., Cluff, C.,** Hanigan, D. Waterless Urinals: A Potential Extraction Media for Wastewater Pharmaceuticals. Nevada Water Environment Association Annual Conference, Sparks, NV. April 2018. **(2nd Place – Best Poster)**
26. **Poustie, A.** Roback, S., Ishida, K., Thurman, E. M., Ferrer, I., Plumlee, M. H., Westerhoff, P., Hanigan, D. NDMA Precursor Transformation During RO/UV/AOP for Indirect Potable Reuse. Gordon Research Conference: Drinking Water Disinfection By-products, South Hadley, MA. July 2017.
27. Taylor-Edmonds, L., Chih Fen Lee, T., Fischer, N., Hanigan, D., Beita-Sandi, W., Westerhoff, P., Karanfil, T., Krasner, S. W., Andrews, R. C. Genotoxicity and DBP Breakthrough Study: Granular Activated Carbon. Gordon Research Conference: Drinking Water Disinfection By-products, South Hadley, MA. 2017.
28. **Cluff, C.,** Hanigan, D. Taking Advantage of Waterless Urinal Design to Removal Pharmaceuticals at the Source. Association of Environmental Engineering and Science Professors Biannual Conference, Ann Arbor, MI. June 22, 2017.

29. Hanigan, D., Truong, L., Tanguay, R., Westerhoff, P. Comparing Human- and Eco-toxicity of Nanomaterial and Organic Chemical Active Ingredients in Sunscreens. 13th International Water Association Leading Edge Conference on Water and Wastewater Technologies, Jerez de la Frontera, Spain. June 14, 2016.
30. Hanigan, D., Reed, R., Yang, Y., Lee, S., Westerhoff, P. Measuring Nanoparticulate and Dissolved Titanium in Urban Recreational Waterways near Phoenix, AZ. Central Arizona-Phoenix Long-Term Ecological Research Project Annual Symposium, Scottsdale, AZ. Jan 15, 2016.
31. Hanigan, D., Thurman, M., Ferrer, I., Westerhoff, P. Matlab Enabled Trawling of QqTOF Spectra for NDMA Specific Diagnostic Neutral Ion Fragments. Gordon Research Conference: Drinking Water Disinfection By-products, South Hadley, MA. 2015.
32. Hanigan, D., Thurman, M., Ferrer, I., Herckes, P., Andrews, S., Westerhoff, P. Methadone Contributes to *N*-nitrosodimethylamine Formation in Surface and Wastewater. AZ Water Annual Conference, Glendale AZ. May 6-8, 2015.
33. Hanigan, D., Herckes, P., Krasner, S. W., Westerhoff, P. Contribution and Sources of NDMA in Drinking Water. AZ Water Annual Conference, Glendale, AZ. May 7-9, 2014. **(Best Poster)**
34. Hanigan, D., Zhu, E., Herckes, P., Krasner, S. W., Westerhoff, P. Physical Removal and Control of Cationic Polymer NDMA Precursors During Drinking Water Treatment. AZ Water Annual Conference, Glendale, AZ. May 1-3, 2013.
35. Hanigan, D., Herckes, P., Krasner, S., Westerhoff, P. Adsorption of N-Nitrosodimethylamine Precursors by Powdered and Granular Activated Carbon. Gordon Research Conference: Drinking Water Disinfection By-products, South Hadley, MA. 2012.
36. Hanigan, D., Westerhoff, P. and Herckes, P. Reduction of N-Nitrosodimethylamine Formation during Chloramination by Activated Carbon Precursor Adsorption. Arizona State University Graduate Research Symposium, Tempe, AZ. Mar 15, 2012.
37. Hanigan, D. and T. E. Clevenger. Understanding MIEX® and Activated Carbon NOM Removal Mechanisms in Relation to Disinfection By-product Formation Potential. Mid America Environmental Engineering Conference, Rolla, MO. 2010.

MENTORSHIP (affiliation after graduating in parentheses, if known)

Research Scientists at UNR

1. Srinidhi Lokesh	2024-present
2. Sivachandiran Loganathan (Nevada State Public Health Lab)	2024-2026

Post Docs at UNR

1. Zhizhang (Peter) Yin	2025-present
2. Xuexiang He	2021-2022
3. Ibrahim Abusallout (CDM-Smith)	2019-2021

Chair for UNR PhD Students

1. Plabon Turzo	2024-present
2. Shaik Mohammed Joarder	2024-present
3. Seth McCoy	2022-present
4. Kenny Hickenbottom (DOWL)	2023
5. Mingrui Song (post-doc at UC-Riverside)	2022
6. Junli Wang (post-doc at UC-Riverside)	2022
7. Priyamvada Sharma (Geosyntec)	2021
8. Utsav Thapa (post-doc at SUNY-Buffalo)	2021

Chair for UNR MS Students

1. Isabela Blanco	2025-present
2. Samiul Ahsan	2024-2026
3. Lauren Edwards (Keller Associates)	2025
4. Haley Grable (Keller Associates)	2023
5. Michael DeNicola (USGS)	2023
6. Kevin Stewart (Keller Associates)	2022

7. Elizabeth McKenna (Corona Environmental) 2020
8. Saeed Arabi 2020
9. Andrew Poustie (Stantec) 2018

Undergraduate mentees at UNR

1. Pheobe Schreiber 2025-present
2. Naomi Gardiner 2025-present
3. Diego Castellano 2023-2025
4. Jordyn Dashiell 2023-2025
5. Vivian Fyda 2023, 2024
6. Eden Ansell 2022-2023
7. AJ Mathew 2022-2023
8. Aditya Prathap 2022-2023
9. Dalia Marin-Rios (Lumos and Associates) 2022-2023
10. Jacquelyne Kittredge (Keller and Associates) 2021-2022
11. Aron Chan (NV DOT) 2019-2021
12. Jackson Alicata 2018-2019
13. Paul Wilkerson 2018
14. Richard Mannschreck 2018
15. Chelsea Cluff 2016-2017

Committee member while at UNR

1. Ishtiaq Jawad – PhD 2026-present
2. Eric Torres – PhD 2026-present
3. Angesom Gebretsadkan – PhD 2026-present
4. Menglin Jiang (U of Notre Dame) – PhD 2025-present
5. Sudarshan Basyal – PhD 2025-present
6. Alyssa Radakovich – PhD 2024-2026
7. Dilara Hatinoglu (U Maine) – PhD 2023-2026
8. Anil Timilsina – PhD 2024-2025
9. Zhizhen Zhang – PhD 2021-2024
10. Abrar Shahriar – PhD 2022-2023
11. Niloufar Gharoon Dastjerdi - PhD 2022-2023
12. Srinidhi Lokesh – PhD 2020-2023
13. Nicolas Silva – PhD 2018-2022
14. Laura Haak – PhD 2018-2020
15. Grant Busse – MS 2019-2020
16. Dinesh Adhikari – PhD 2018
17. Nicole Furtaw – MS 2017

Visiting Scholars

Richard Jacquet, France 2017

Graduate mentees while at ASU

Xiaobin Liao 2013-2014

Undergraduate mentees while at ASU and MU 2010-2015

Arthur Petit
Hanna Huling
Nora Aoudjehane
Dylan Lesan
Harsha Sharma
Lesley Le
Ted Grimes

SERVICE

Associate Chair for Undergraduate Affairs, Civil and Environmental Engineering	2025-present
Environmental Science & Technology Early Career Editorial Board	2025-2027
ACS Spring Conference ENVR Symposium Co-Chair	2026
AEESP Annual Conference Session Co-Chair	2025
Environmental Engineering Program Director, Civil and Environmental Engineering	2023-2026
American Water Works Association Organic Contaminants Research Committee	
Chair	2019-2023
Vice Chair	2018-2019
Stead Elementary School Volunteer	2016-2024
Water Environment Federation Awards & Recognition Committee	2015-present
IWA Leading Edge Technology Conference Organizing Core Committee	2021-2022
AWWA ACE Special Topics Session Chair	2021
ACS Fall Conference ENVR Symposium Co-Chair	2020
American Water Works Association Scholarship Committee	2019
Water Reuse Research Foundation Project Advisory Committee Member	2016-2019
American Water Works Association Organic Contaminants Control Committee	2016-2018
Nevada Regional Science Olympiad Dynamic Planet Event Supervisor	2018
Nevada State Science Olympiad Hydrogeology Event Supervisor	2017
Founder and President, Graduate Students for the Environment, Arizona State University	2013-2014
Social Chair, Association of Graduate Civil Engineers, School of Sustainable Engineering and the Built Environment, Arizona State University	2013-2014

Grant Panelist – I regularly review and participate in panels for the following funding programs: NSF CBET, NSF EPSCOR, NSF Environmental Chemical Sciences. NSF GRFP, SERDP, Joint Fire Science Program, UNR internal grants, BARD, EREF, International Foundation for Science, Water Research Foundation

Journal Reviewer - I regularly review for the following journals: Industrial & Engineering Chemistry Research, Separation Science and Technology, Water Research, ACS Symposium Series Book Chapter, Environmental Science and Pollution Research, Environmental Engineering Science, Science of the Total Environment, Environmental Science & Technology, Journal of Environmental Sciences, RSC Advances, Chemosphere, Journal American Water Works Association, Environmental Science & Technology Letters, Journal of Cleaner Production, Environmental Science: Water Research & Technology

TEACHING

Environmental Engineering Systems: Principles and Design (CEE 390)	Every Spring, 2018-2023
Design of Water Treatment Systems (CEE 456/656)	Every Fall since 2017
Physiochemical Water Treatment (CEE 752)	Every Fall since 2017

OTHER EXPERIENCE

Hanigan Consulting LLC, *Reno, NV*

Understanding PFAS Fate During GAC Regeneration, IDE Water Technologies	2024-Present
Development and Validation of Vapor Phase PFAS Methods, RTI International	2023-2024
Disinfection By-product mitigation, Keller Associates	2022-2024

IN PUBLIC MEDIA

1. Tahoe Environmental Observatory Network – Drinking Water Contamination After Wildfires
2. Breaking the Forever Cycle: PFAS Destruction & EPA Methodologies (concentratingonchromatography.com)
3. Maine Is a Warning for America's PFAS Future - The Atlantic
4. 'Forever chemicals' confirmed at multiple North Valleys locations: What we know (thisisreno.com)
5. "Forever chemicals" in Swan Lake remain unconfirmed but have officials concerned (thisisreno.com)
6. PFAS in Swan Lake | City of Reno

7. Officials: Swan Lake contaminated with ‘forever chemicals’ (thisisreno.com)
8. "Forever chemicals" found in Swan Lake | KRNV (mynews4.com)
9. High Level of 'Forever Chemicals' Found in Swan Lake | Local News | 2news.com
10. Swan Lake: New worries, same distrust (kolotv.com)
11. High Levels Of PFA Chemicals Found In Swan Lake | News | 2news.com
12. The National Journal – “California burning: How wildfires are threatening the West’s water”
13. Environmental Science: Water Research & Technology blog – “Emerging Investigator Series – David Hanigan”
14. PBS Newshour Science Wednesday – “Scientists Trace Cancer-causing Chemical in Drinking Water back to Methadone”
15. American Chemical Society Chemical & Engineering News – “Heroin Analog May Form Carcinogen in Drinking Water”
16. Chromatography Online – “Methadone Linked to NDMA Contamination in Drinking Water”
17. Water Online – “Methadone in the Water: What’s the Real Risk?”
18. US Finance Post – “Drinking Polluted Water Could Cause Cancer?”
19. Water Online – “Chloramination May Introduce Cancer-Causing Chemicals”
20. Water Conditioning & Purification Magazine – “On Tap: Methadone Creates Harmful Byproducts in Treated Drinking Water”