

# David Hanigan, PhD, PE

Assistant Professor  
Department of Civil and Environmental Engineering  
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## 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

## PROFESSIONAL EXPERIENCE

### University of Nevada, Reno, NV

Assistant Professor July 2016 – Present

### 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. (OCCI) 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

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### Awards to Hanigan

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 College of Engineering, Ira A. Fulton Fellowship (\$5k)	2011-2012
University of Missouri, Paul Kufrin Memorial Scholarship (\$5k)	2010

### Awards to Students in Hanigan's Group

Kevin Stewart – US Dept. of Ed. GAANN Fellowship (~32k/yr)	2021
Ibrahim Abusallout – NV INBRE Core Services Award (\$2k)	2020
Mingrui Song – Air and 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 – 3 <sup>rd</sup> 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

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### As PI

1. Rapid Site Profiling of Organofluorine: Quantification of PFASs by Combustion Gas Analysis <i>Strategic Environmental Research and Development Program, DoD, EPA, DOE</i> \$784k	2019-2022
2. Securing the Future of Direct and Indirect Potable Reuse – <i>N</i> -nitrosodimethylamine (NDMA) Formation Pathways and Precursors <i>National Science Foundation CBET</i> \$330k	2018-2021
3. Co-Funding - Securing the Future of Direct and Indirect Potable Reuse <i>Water Research Foundation</i> \$50k	2018-2021
4. Understanding Formation of a Critical Disinfection Byproduct: NDMA and Previously Unidentified NDMA Precursors in Advanced Potable Reuse Treatment Plants <i>Subcontracted from Orange County Water District, funding from United States Bureau of Reclamation</i> \$25k	2018-2020
5. Atmospheric CO <sub>2</sub> Capture Through Wastewater <i>University of Nevada, Reno New Scholarly Endeavor Grant</i> \$2.5k	2017-2018
6. Mass spectrometry to identify NDMA forming amines isolated from Orange County Advanced Water Purification Facility – Phase 2 <i>Orange County Water District</i> \$15k	2017

### As Co-PI

7. Investigation of Disinfection Byproduct Formation and Mitigation in Aquifer Storage and Recovery Operations <i>Truckee Meadows Water Authority</i>	2020-2023
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\$396k		
8. Addressing Human Health Impacts from Emerging Contaminants in Reclaimed Water to Enhance its Use for Urban and Peri-urban Agriculture <i>USDA AFRI Water for Agriculture</i>		2017-2020
\$500k		
<b>Significant Contribution as Author</b>		
9. Identifying NDMA Forming Amines from the Orange County Water Purification Facility <i>Orange County Water District</i> Co-author with Paul Westerhoff (PI)		2016-2017
\$18.5k		
10. Understanding the Source and Fate of Polymer-Derived Nitrosamine Precursors <i>Water Research Foundation #4622</i> Co-author with Paul Westerhoff (PI)		2016-2018
\$350k		
11. Determining the Relative Importance and Contribution of Anthropogenic and Natural Sources of Nitrosamine Precursors <i>Water Research Foundation #4499</i> Co-author with Paul Westerhoff (PI)		2014-2016
\$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 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 and postdocs supervised by Hanigan in blue**)

*H index = 12 to 14 (Scopus, Web of Science, Google Scholar)*

*Times Cited = 718 to 993*

*Citations per Publication = 21 to 23*

1. **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. *Environmental Science & Technology*, 202X. *In Review*.
2. **Sharma, P., Hanigan, D.** Occurrence of 10 Trace Organic Contaminants in Terminal Lakes Receiving Reclaimed Wastewater. *ACS ES&T Water*, 202X. *In Review*
3. **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*, 202X. *In review*.

4. **Thapa, U., Sharma, P., Hanigan, D.** Quantification of Pharmaceuticals and Personal Care Products in Waterless Urinal Sealant Fluids. *Environmental Science: Water Research & Technology*, 202X. *In submission*
5. 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. *In press*.
6. 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.
7. **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.
8. **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.
9. 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.
10. **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.
11. **Thapa, U., Hanigan, D.** Waterless Urinals Remove Select Pharmaceuticals from Urine by Phase Partitioning. *Environmental Science & Technology*, 2020. 54(10): p. 6344-6352.
12. 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).
13. **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.
14. 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.
15. 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)**
16. **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.
17. 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
18. **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.
19. **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.
20. **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.

21. 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.
22. 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
23. 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.
24. 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)**
25. 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.
26. 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.
27. 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.
28. 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.
29. 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.
30. 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.
31. 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)**
32. 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.
33. 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. **(2<sup>nd</sup> most read article ES&TL March 2015, Highly cited article published in ES&TL, 2018)**
34. 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)**
35. 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)**
36. 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.

37. 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, 202X. In Review*
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. **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.
2. 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.
3. 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.
4. 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.
5. Hanigan, D. Identification of N-nitrosodimethylamine Precursors to Improve Their Control. Arizona State University, 2015. (PhD Dissertation)
6. 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.
7. McGuire, M. J., Karanfil, T., Krasner, S. W., Reckhow, D. A., Roberson, J. A., Summers, R.S., Westerhoff, P., Xie, Y. Not Your Granddad's Disinfection By-product Problems and Solutions. *Journal American Water Works Association*, 2014. 106(8): p.54. (Coauthored Alternative Disinfectants section, listed in Acknowledgements)
8. Hanigan, D. Removal of Disinfection By-product Precursors by Activated Carbon and MIEX®. University of Missouri, 2011. (Masters Thesis)

#### Invited Presentations

1. Hanigan, D. Rapid Site Profiling of Organofluorine: Quantification of PFASs by Combustion Gas Analysis. SERDP PFAS Summer Meeting. July 28<sup>th</sup>, 2020.

2. Hanigan, D. Advances in Engineering Impact Public Policy. Engineering Club at Davidson Academy. Reno, NV. Jan 14, 2020.
3. Hanigan, D. Past, Present, and Future of Per- and Polyfluoroalkyl Substances Analysis in the Field. SERDP Symposium. Washington D.C., November 28<sup>th</sup>, 2018.
4. 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)**
5. 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.
6. 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 in blue)

1. Wang, J., Marfil-Vega, R., Hanigan, D. PFAS Analysis With a Total Organic Carbon Instrument. Society of Environmental Toxicology and Chemistry North America 41<sup>st</sup> Annual Meeting. November, 2020
2. 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
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. Thapa, U., Hanigan, D. Using Waterless Urinal Sealant to Remove Pharmaceuticals from the Urine. Nevada Water Environment Association Annual Conference, Sparks, NV. January, 2019.
9. 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.
10. 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.
11. 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 2<sup>nd</sup> Disinfection and Disinfection By-products Conference, Beijing, PRC. May 16, 2018.
12. Poustie, A., Hanigan, D. Pharmaceutical Uptake in Crops Irrigated with Treated Wastewater. Nevada Water Environment Association Annual Conference, Sparks, NV. April, 2018
13. 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.
14. 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.
15. 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.
  16. 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.
  17. 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.
  18. 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.
  19. 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.
  20. 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.
  21. 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.
  22. 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.
  23. 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 in blue)

1. Abusallout, I., Hanigan, D. Defluorination of Per- and Polyfluoroalkyl Substances (PFASs) by Medium-pressure UV Irradiated Sulfite. SERDP & ESTCP Symposium. December, 2020.
2. Wang, J., Hanigan, D. Quantification of PFASs via Total organofluorine measurements with a TOC instrument. SERDP & ESTCP Symposium. December, 2020.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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.
9. [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.
  10. [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.
  11. [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.
  12. [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.
  13. [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
  14. [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. **(2<sup>nd</sup> Place – Best Poster)**
  15. [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.
  16. [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.
  17. [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.
  18. [Hanigan, D.](#), Truong, L., Tanguay, R., Westerhoff, P. Comparing Human- and Eco-toxicity of Nanomaterial and Organic Chemical Active Ingredients in Sunscreens. 13<sup>th</sup> International Water Association Leading Edge Conference on Water and Wastewater Technologies, Jerez de la Frontera, Spain. June 14, 2016.
  19. [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.
  20. [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.
  21. [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.
  22. [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)**
  23. [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.

24. 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.
25. 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.
26. 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

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### Post Docs at UNR

- |    |                    |              |
|----|--------------------|--------------|
| 1. | Ibrahim Abusallout | 2019-Present |
|----|--------------------|--------------|

### Chair for UNR PhD Students

- |    |                   |                |
|----|-------------------|----------------|
| 1. | Kevin Stewart     | 2021 - Present |
| 2. | Mingrui Song      | Expected 2022  |
| 3. | Junli Wang        | Expected 2022  |
| 4. | Priyamvada Sharma | 2021           |
| 5. | Utsav Thapa       | 2021           |

### Chair for UNR MS Students

- |    |                   |      |
|----|-------------------|------|
| 1. | Elizabeth McKenna | 2020 |
| 2. | Saeed Arabi       | 2020 |
| 3. | Andrew Poustie    | 2018 |

### Undergraduate mentees at UNR

- |    |                     |              |
|----|---------------------|--------------|
| 1. | Aron Chan           | 2019-Present |
| 2. | Jackson Alicata     | 2018-2019    |
| 3. | Paul Wilkerson      | 2018         |
| 4. | Richard Mannschreck | 2018         |
| 5. | Chelsea Cluff       | 2016-2017    |

### Committee member at UNR

- |    |                       |              |
|----|-----------------------|--------------|
| 1. | Srinidhi Lokesh – PhD | 2020-Present |
| 2. | Nicolas Silva – PhD   | 2018-Present |
| 3. | Laura Haak – PhD      | 2018-2020    |
| 4. | Jacob Parker – MS     | 2018-2020    |
| 5. | Grant Busse – MS      | 2019-2020    |
| 6. | Dinesh Adhikari – PhD | 2018         |
| 7. | 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

- |  |                 |           |
|--|-----------------|-----------|
|  | Arthur Petit    | 2010-2015 |
|  | Hanna Huling    |           |
|  | Nora Aoudjehane |           |
|  | Dylan Lesan     |           |
|  | Harsha Sharma   |           |
|  | Lesley Le       |           |
|  | Ted Grimes      |           |

## SERVICE

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American Water Works Association Organic Contaminants Research Committee	
Chair	2019-Present
Vice Chair	2018 - 2019
American Water Works Association Scholarship Committee	2019 - Present
Stead Elementary School Volunteer	2016 - Present
Water Environment Federation Awards & Recognition Committee	2015 - Present
IWA Leading Edge Technology Conference Organizing Core Committee	2021
AWWA ACE Special Topics Session Chair	2021
ACS Fall Conference ENVR Symposium Co-Chair	2020
NSF CBET Review Panelist	2019
Water Reuse Research Foundation Project Advisory Committee Member	2016 - 2019
American Water Works Association Organic Contaminants Control Committee	2016-2018
National Science Foundation Environmental Chemical Sciences ad hoc reviewer	2018
Nevada Regional Science Olympiad Dynamic Planet Event Supervisor	2018
Nevada State Science Olympiad Hydrogeology Event Supervisor	2017
National Science Foundation Graduate Research Fellowship Program (NSF GRFP) Civil and Environmental Engineering Review Panelist	2016
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	2011-2012
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

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Environmental Engineering Systems: Principles and Design (CEE 390)	S18, S19, S20, S21
Design of Water Treatment Systems (CEE 456/656)	F17, F18, F20
Physiochemical Water Treatment (CEE 752)	S17, F18, S20

## IN PUBLIC MEDIA

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PBS Newshour Science Wednesday – “Scientists Trace Cancer-causing Chemical in Drinking Water back to Methadone”

<http://www.pbs.org/newshour/updates/methadone-cancer-carcinogen-drinking-water/>

American Chemical Society Chemical & Engineering News – “Heroin Analog May Form Carcinogen in Drinking Water”

<http://cen.acs.org/articles/93/web/2015/05/Heroin-Analog-Form-Carcinogen-Drinking.html>

Chromatography Online – “Methadone Linked to NDMA Contamination in Drinking Water”

<http://www.chromatographyonline.com/methadone-linked-ndma-contamination-drinking-water?rel=canonical>

Water Online – “Methadone in the Water: What’s the Real Risk?”

<http://www.wateronline.com/doc/methadone-in-the-water-what-s-the-real-risk-0001>

US Finance Post – “Drinking Polluted Water Could Cause Cancer?”

<http://usfinancepost.com/drinking-polluted-water-could-cause-cancer-25163.html>

Water Online – “Chloramination May Introduce Cancer-Causing Chemicals”

<http://www.wateronline.com/doc/chloramination-may-introduce-cancer-causing-chemicals-0001>

Water Conditioning & Purification Magazine – “On Tap: Methadone Creates Harmful Byproducts in Treated Drinking Water”

<http://www.wcponline.com/2015/10/21/methadone-creates-harmful-byproducts-in-treated-drinking-water/>