

## Professor Dr.-Ing. JÖRG E. DREWES

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### EDUCATION

Doctorate in Environmental Engineering (Ph.D.), Technical University of Berlin, Germany 1997

Dipl. Ing. Environmental Engineering (M.S.), Technical University of Berlin, Germany 1992

### EXPERIENCE

8/2011-present: **Director of Research**. NSF Engineering Research Center on Reinventing the Nation's Urban Water Infrastructure (ReNUWIt). Stanford, UC-Berkeley, New Mexico State University and Colorado School of Mines.

8/2010-present: **Visiting Professor**. Water Desalination and Reuse Center (WDRC), King Abdullah University of Science and Technology, Thuwal, Saudi-Arabia.

7/2007-present: **Adjunct Professor**, UNSW Water Research Centre, The University of New South Wales, Sydney, Australia.

3/2010-present: **Professor**, Civil and Environmental Engineering, Colorado School of Mines, Golden CO. **Co-Director**, Advanced Water Technology Center (AQWATEC). Research and teaching in water supply engineering with an emphasis on advanced water treatment and fate of organic compounds in engineered and natural systems.

4/2006-3/2010: **Associate Professor**, Environmental Science and Engineering Division, Colorado School of Mines, Golden CO.

8/2001-4/2006: **Assistant Professor**, Environmental Science and Engineering Division, Colorado School of Mines, Golden CO.

9/1999-7/2001: **Associate Director**, National Center for Sustainable Water Supply (NCSWS), Arizona State University, Tempe, AZ. Coordination of multi-agency and multi-university research and research on character and fate of organics in natural and engineered systems leading to indirect potable reuse.

8/1997-8/1999: **Visiting Professor**, Arizona State University, Tempe, AZ. Research on advanced characterization techniques for organic carbon in groundwater recharge systems.

7/1992-7/1997: **Research Associate**, Technical University of Berlin, Germany, Research on advanced wastewater treatment using powdered activated carbon and ozonation prior to groundwater recharge. Teaching design of water treatment processes, water chemistry, and environmental analytical chemistry.

### RESEARCH INTEREST

Water and wastewater treatment engineering; desalination; treatment of co-produced water; potable and non-potable water reuse (soil-aquifer treatment, advanced oxidation and microfiltration/reverse osmosis); natural treatment systems (riverbank filtration, aquifer recharge and recovery); process performance assessments in indirect potable reuse; state-of-the-art characterization of natural and effluent organic matter; fate and transport of emerging contaminants (endocrine disrupting compounds, pharmaceutical residues, household chemicals) in natural and engineered systems.

### AWARDS and HONORS

Panel Member, National Research Council (NRC) on Water Reuse 2008-2011; Member, Research Advisory Council WaterReuse Foundation (WRF); Chair, Science Advisory Committee on Compounds of Emerging Concern in Recycled Water, California State Water Resources Control Board; American Water Works Association Rocky Mountain Section Outstanding Research Award, 2007; Dr. Nevis Cook Graduate Teaching Award, Colorado School of Mines, 2003. Quentin Mees Research Award for outstanding water-related environmental research in the State of Arizona, 1999. Research Scholarship administered by the Deutsche Forschungsgemeinschaft (DFG), 1997 – 1999. Willy-Hager Award for outstanding research in the field of water and wastewater treatment, Germany, 1997.

### CURRENT AND COMPLETED RESEARCH PROJECTS (exceeding \$13.5M, selected projects listed)

PI – “Role of Retention Time in the Environmental Buffer of Indirect Potable Reuse Projects. 2012-2014. Co-PIs Drs. Snyder (UofA), Gerba (UofA), Missimer (KAUST), and Dickenson (CSM/SNWA). WaterReuse Research Foundation (WRRF-10-05).

Co-PI – “Reinventing the Nation's Urban Water Infrastructure”. Engineering Research Center. 2011-2016. PI Dr. Luthy (Stanford), co-PIs Drs. Sedlak (Berkeley) and Khandan (NMSU). National Science Foundation.

Co-PI – “Trace Organic Compounds Removal during Wastewater Treatment – Categorizing Wastewater Treatment Processes by their Efficacy in Reduction of a Suite of Indicator TOxC”. 2009-2011. PI A. Salvesson (Carollo), Co-PIs Drs. Snyder (SNWA), Dickenson (CSM), Rauch-Williams (Carollo). Water Environment Research Foundation (WERF) CEC4R08.

PI – “An Integrated Framework for Management and Treatment of Produced Water”. 2008-2010. Co-PIs Drs. Cath and Xu (CSM), J. Graydon (Kennedy/Jenks), and J. Veil and S. Synder (Argonne Ant. Lab.) U.S. Dept. of Energy.

Co-PI – “Maximizing Recovery of Recycled Water for Groundwater Recharge”. 2009-2010. PI. C. Yu (PSOMAS). Co-PI C. Bellona (CSM). WaterReuse Foundation WRF-08-010.

PI - “Predictive Models to Aid in the Design of Membrane Systems for Organic Micropollutants Removal”. 2008-2010. Co-PIs Dr. Chris Bellona and Mark Eberhart (CSM) and Dr. Shankar Chellam (University of Houston). WaterReuse Foundation WRF-06-009.

- PI – “Field Evaluation of a Sequencing batch/Membrane Bioreactor Hybrid System for Decentralized Wastewater Treatment”. 2008-2013. Co-PI T. Cath (CSM). Aqua-Aerobics Systems, Inc.
- PI - “Development of Surrogates to Determine the Efficacy of Groundwater Recharge Systems for the Removal of Trace Organic Chemicals”. 2006-2009. Co-PIs Dr. Eric Dickenson (CSM) and Dr. Shane Snyder (SNWA). WaterReuse Foundation WRF-05-004.
- PI – “Aquifer Recharge and Recovery City of Aurora”. CH2MHill/City of Aurora. 2/05-12/07.
- Co-PI – “Evaluation of River Bank Filtration Systems to Optimize Removal of Bulk Organic Matter, Emerging Organic Micropollutants and Nutrients”. Awwa Research Foundation #3180. 1/06/12/07 (PI Ken Thompson, CH2MHill).
- PI – “Contributions of Household Chemicals to Municipal Wastewater Systems and the Environment”. Water Environment Research Foundation 03-CTS-21UR. 10/04-2/07.
- PI - Development of Indicators and Surrogates for Chemical Contaminants in Water Reclamation Systems. WaterReuse Foundation 03-WRF-014. 1/05-12/06.
- PI – “Comparison of NF and RO in terms of water quality and operational performance”. Awwa Research Foundation #3012. 1/04-4/06.

## PUBLICATIONS (Selection)

### Papers in peer-reviewed journals

- Drewes, J. E., Reinhard, M., & Fox, P. (2003). Comparing microfiltration-reverse osmosis and soil-aquifer treatment for indirect potable reuse of water. *Water Research* **37**, 3612-3621.
- Kimura, K., Amy, G., Drewes, J. E., & Watanabe, Y. (2003). Adsorption of hydrophobic compounds onto NF/RO membranes – an artifact leading to overestimation of rejection. *J. Membrane Science* **221**, 89-101.
- Bellona, C., Drewes, J. E., Xu, P. & Amy, G. (2004). Factors affecting the rejection of organic solutes during NF/RO treatment – A literature review. *Water Research* **38**, 2795-2809.
- Bellona, C. & Drewes, J. E. (2005). The role of physico-chemical properties of membranes and solutes for rejection of organic acids by nanofiltration membranes. *Journal of Membrane Science* **249**, 227-234.
- Drewes, J. E., Hemming, J., Ladenburger, S., Schauer, J. & Sonzogni, W. (2005). An assessment of endocrine disrupting activity changes in water reclamation systems through the use of bioassays and chemical measurements. *Water Environment Research* **77**, 1, 12-23.
- Rauch-Williams, T. & Drewes, J. E. (2006). Using soil biomass as an indicator for the biological removal of effluent-derived organic carbon during soil infiltration. *Water Research* **40**, 961-968.
- Drewes, J. E., Quanrud, D., Amy, G. & Westerhoff, P. (2006). Character of Organic Matter in Soil-Aquifer Treatment Systems. *J. Environmental Engineering* **11**, 1447-1458.
- Xu, P., Drewes, J. E., Kim, T. Bellona, C. & Amy, G. (2006). Effect of membrane fouling on transport of emerging organic contaminants in NF/RO membrane applications. *J. Membrane Science* **279**, 165-175.
- Drewes, J. E., Hoppe, C., & Jennings, T. (2006). Fate and transport of N-nitrosamines under conditions simulating full-scale groundwater recharge operations. *Water Environment Research* **78**, 13, 2466-2473.
- Bellona, C. and Drewes, J. E. (2007). Viability of a low pressure nanofilter in treating recycled water for water reuse applications – A pilot-scale study. *Water Research* **41**, 3948-3958.
- Trenholm, B., Vanderford, B.J., Drewes, J.E., & Snyder, S.A. (2008). Determination of household chemicals using gas chromatography and liquid chromatography with tandem mass spectroscopy. *J. Chromatography A*. **1190**: 253-262.
- Bellona C., Oelker, G., Luna, J., Filteau, G., Amy, G. & Drewes, J.E. (2008). Comparing nanofiltration and reverse osmosis for drinking water augmentation. *J. American Water Works Association* **100**:9, 102-116.
- Dickenson, E.R.V., Drewes, J.E., Sedlak, D.L., Wert, E., and Snyder, S.A. (2009). Applying Surrogates and Indicators to Assess Removal Efficiency of Trace Organic Chemicals during Chemical Oxidation of Wastewater. *Environ. Sci. and Technol.* **43**, 6242-6247.
- Xu, P., Bellona, C., and Drewes, J.E. (2010). Fouling of Nanofiltration and Reverse Osmosis Membranes during Municipal Wastewater Reclamation: Membrane Autopsy Results from Pilot-scale Investigations. *J. Membrane Science* **353**, 111-121.
- Hoppe-Jones, C., Oldham, G., and Drewes, J.E. (2010). Attenuation of Total Organic Carbon and Unregulated Trace Organic Chemicals in U.S. Riverbank Filtration Systems. *Water Research* **44**, 4643-4659.
- Stevens-Garmon, J., Drewes, J.E., Khan, S., McDonald, J., Dickenson, E. (2011). Sorption of Emerging Trace Organic Compounds onto Wastewater Sludge Solids. *Water Research* **45**, 3417-3426.
- Dahm, K., Guerra, K., Xu, P., Drewes, J.E. (2011). A Composite Geochemical Database for Coalbed Methane Produced Water Quality in the Rocky Mountain Region. *Environmental Science and Technology* **45**, 7655-7663.
- Bellona, C., Heil, D., Yu, C., Fu, P., and Drewes, J. E. (2012). The pros and cons of using nanofiltration in lieu of reverse osmosis for indirect potable reuse applications. *Separation and Purification Technology* **85**. 69-76.
- Hyland, K.C., Dickenson, E., Drewes, J.E., and C.P. Higgins (in press) Sorption of Ionized and Neutral Emerging Trace Organic Compounds onto Activated Sludge from Different Wastewater Treatment Configurations. *Water Research*.
- Fujioka, T., Nghiem, L., Khan, S., McDonald, J., Poussade, Y., Drewes, J.E. (2012). Effects of feed solution characteristics on the rejection of N-nitrosamines by reverse osmosis membranes. *J. Membrane Science* **409-410**, 66-74.
- Teerlink, J., Hering, A., Higgins, C., Drewes, J.E. (2012). Variability of Trace Organic Chemical Concentrations in Raw Wastewater at Three Distinct Watershed Scales. *Water Research* **46**, 3261-3271.
- Missimer, T., Drewes, J.E., Amy, G., Maliva, R., Keller, S. (2012). Restoration of Wadi Aquifer by Artificial Recharge with Treated Waste Water. *Ground Water*, **50**(4):514-27.
- Teerlink, J., Martinez-Hernandez, V., Higgins, C., Drewes, J.E. (2012). Attenuation of trace organic chemicals in onsite wastewater soil treatment units. *Water Research* (in press).