

Kari Sholtes PE, PhD

Civil/Environmental Engineer

EDUCATION

University of Colorado Boulder, 2015-2019

- **PhD:** PhD in Environmental Engineering
- Research Assistant to Dr. Karl Linden with funding and support from the International Ultraviolet Association and private UV device manufacturing companies (Zodiac Water and Waste Systems, Crystal IS, and AquiSense Technologies)
- Research focus: Standardization of the measurement of wavelength and irradiance of UV-C LEDs, Impact of pulsing versus continuous UV-C LEDs on biofilm-associated microorganisms, and relationship between irradiation and total power for UV-C LEDs

University of North Carolina, Chapel Hill, 2007-2009

- **MSEE:** Masters of Science in Environmental Engineering from the Gillings School of Global Public Health, awarded 2009
- Research Assistant to Dr. Mark Sobsey with funding from WaterPLUS, a company I co-founded
- Research focus: Quantitative Analysis of the Efficacy of UV LED Technology in Treating Drinking Water

University of Colorado Boulder, 2001-2005

- **BSCE:** Bachelors of Science in Civil Engineering with concentration in Water Resources, awarded 2005
- Focused on health, sustainability, and engineering
- Independent Study: researched water quality test methods, devised testing regimes relating to public health, obtained grants for equipment and expenses, and implemented surveys and testing in Peru and Haiti

WORK and EXPERIENCE

Environmental and Water Resources Project Manager and Engineer

Lidstone and Associates, Inc, 2012-2015

Stewart Environmental Consultants LLC, 2011-2012

Matrix Design Group, 2005-2006

Project manager

- Small drinking water utility compliance, design, and optimization. Tasks include environmental monitoring and investigative sampling, surveying, system analysis, design, optimization, financial analysis, permitting, grant applications, overseeing construction and start-up, and interfacing with State of Colorado and Wyoming regulators. Design has included conventional drinking water treatment chains and advanced filtration chains.
- Environmental health lawsuits including a drinking water contamination class action lawsuit, an environmental contamination lawsuit associated with illegal drug manufacturing, and a lawsuit involving erosion control across an easement.

Project engineer

- Small wastewater utility compliance, design, and optimization. Tasks included design, grant writing, permitting, interfacing with State of Wyoming regulators, and overseeing construction and start-up. Projects have included treatment lagoons and primary and secondary treatment processes.
- Design of urban storm water infrastructure for municipalities. Design included conveyance pipes, detention ponds, and storm drain inlet configurations.
- Scientific and policy analysis of state-level uranium mining regulation development for the protection of surface water and ground water. Technical reports were completed for state legislators including recommendations for future water protection standards with respect to uranium.
- Numerous pre-operational, ongoing, and post-reclamation mining site monitoring programs throughout western states. Monitoring plans were developed to meet state and federal regulations; site sampling, data analysis, reporting, and oversight of subcontractor sampling was completed.
- Conventional underground and in situ uranium mine permitting processes in Wyoming and Utah. Tasks include data analysis; hydrologic, hydraulic, and sediment transport analyses; and permitting.

- Tribal and State hot springs redevelopment and design. Tasks include surveying and analysis of existing topography; design and hydraulic analysis of hot spring supply system; hot water augmentation system design; long term planning for facilities use, including community involvement and feedback through public meetings; potable water supply expansion design; interfacing with Tribal and State regulators; and permitting.

Environmental Engineer, Public Health Emergency Responder

Centers for Disease Control and Prevention; Global Water, Sanitation, and Hygiene Team, 2009-2011

- Supported Latin American and Caribbean governments, utilities, and stakeholders in the process of assessing and managing risks associated with drinking water at community, municipal, and federal levels.
- Developed drinking water treatment operator training package for initial implementation in Guyana.
 - Completed Level D Operator coursework in small drinking water systems operations.
- Researched and reported on long-term health impacts and questions of sustained access to water, sanitation, and hygiene improvements in Latin America and the Caribbean.
- Analyzed efficacy of drinking and industrial water treatment systems, assessed risk, and assisted in creating technical, political, and financial frameworks by which to better manage risk.
- Supported domestic partners and entities involved in public health emergencies including industrial and domestic water supplies and wastewater treatment. Analysis included field investigations, sampling, data analysis, system and component optimization (including treatment, conveyance, pumping, and analytical equipment), and reporting to inform utilities, water treatment entities, regulating agencies, and the CDC in public health protective responses.
 - On-site support for field investigations, technical support, programmatic implementation, and capacity building.
 - Supported CDC, foreign governments, and partners in response to emergencies such as natural and man-made disasters and disease outbreaks, including the 2010 Haiti cholera outbreak.
 - Trained in Environmental Health Training in Emergency Response, 2010
- Developed guidance documents and technical materials to inform decision making and training materials for implementation in-country. These included guidelines for chlorination of water used for both hygiene and consumption during Haitian and Dominican Republic cholera outbreaks.

Drinking Water Technology Consultant

International Finance Corporation, World Bank, 2008-2008

- Identified opportunities in technologies for household drinking water treatment in East Africa for capital investments by the IFC and commercialization by in-country partners. Data were drawn via site visits from various markets, technologies and technology types, provenance, delivery models, and organizations.
- Traveled to Kenya and Uganda to meet with various entities to explore technologies and investment options

Service

Rural Communities Assistance Program, Boulder, Colorado, 2011

- Developed course materials and course content, coordinated logistics and programming for rural water operator training course
- Served as an engineering resource for operators troubleshooting system components and processes

Engineers Without Borders CU and USA, 2002-2006, Univ. of N. Carolina 2007-2009

- Served on the board of EWB CU (2003-2005, Fundraising Lead and Operations Committee linking both EWB-USA and EWB-CU)
- Designed environmental health and public health assessments for water sanitation and hygiene interventions for communities in Haiti and Peru (CU Boulder)
- Conducted field work to construct the Bayonnais, Haiti Bridge Project and the Peru water storage tank project (CU Boulder)
- Raised money to fund equipment and trips (helped raise >\$150,000 over four years at CU Boulder)
- Mentored students performing water quality sampling and public health assessments in Rwanda and Belize
- Served on the Technical Advisory Committee mentoring and reviewing water and sanitation projects worldwide (CU Boulder)
- Served as EWB President and President pro-tempore at University of North Carolina, Chapel Hill

- Student representative in Moldova to explore partnerships with UNIFEC, Peace Corps, the Ambassador to Moldova, and the US Army in improving water quality in schools/consulted UNICEF on sanitation in schools.

RESEARCH and DEVELOPMENT

Founder/Owner/Engineer, WaterPLUS, 2007-2010

- Launched WaterPLUS LLC, a triple bottom line private company
- Won \$30k in business plan design competitions nationally
- Developed (designed and prototyped) a device to treat drinking water with ultraviolet light emitting diodes (UV LEDs), including hydraulic and optic engineering design and microbial efficacy trials

UV-LED Drinking Water Treatment Researcher & Environmental Engineer, CU Boulder 2015-2019 and UNC Chapel Hill, 2007-2008

- Developed and validated a protocol for the measurement of UV LED output (emission spectrum and irradiance)
 - Coordinated and managed logistics and troubleshooting for a UV LED output measurement standardization study with 14 international partners
 - Analyzed study data and developed industry-wide tolerances to error for the emission spectrum, peak wavelength, and irradiance measurements of UV LED devices
- Designed a UV LED point of use device for use on aircraft potable water systems
 - Developed irradiance model tool for the estimation of the number of UV LEDs required to achieve specific disinfection targets, given various water quality and UV LED output conditions
 - Designed and optimized various reactors by modeling both the fluid hydraulics and radiation fields using a three-dimensional computation fluid dynamics model (ANSYS Fluent 18.1)
- Manage and conduct microbial efficacy trials to evaluate water treatment reactors and research lamps
 - Quantify the efficacy of devices with regards to a variety of microorganisms relevant to drinking water systems
- Design and conduct research regarding microbial inactivation kinetics of various UV wavelengths and operational conditions (continuous, pulsing, wavelength sequencing, and combined wavelengths) for both planktonic and biofilm-associated microorganisms
 - Operate, maintain, perform QA/QC, and analyze and synthesize data for these experimental testing systems and troubleshoot shared laboratory equipment in the Environmental Engineering Laboratories
- Developing an equation to relate the irradiance of a Lambertian UV LED source to the total power output as a modification to the Keitz equation

Public Health Researcher, Costa Rican Ministry of Health, Institute for Investigations in Health (INISA), 2006-2007

- Researched and surveyed communities regarding public health, environmental health, maternal and child health, and high risk behaviors
- Contributed to multi-stakeholder group tasked with prioritizing public health needs in relation to resources provided by the government
- Wrote grants and applied for funding for science-based prevention and intervention of health problems spanning maternal and child health, high risk behaviors, and environmental health in underserved communities, specifically, Nicaraguan enclaves

TEACHING, MENTORSHIP, and TRAINING

Assistant Professor of Teaching

University of Colorado Boulder and Colorado Mesa University Partnership Program, 2019-Present

- MCEN 4086, Writing for Senior Design, Spring Semesters
- CVEN 3414, Fundamentals of Environmental Engineering, Fall Semesters
- CVEN 3708, Geotechnical Engineering I, Fall Semesters
- CVEN 3424, Water and Wastewater Treatment, Spring Semesters
- MCEN 3012, Engineering Thermodynamics

Teaching Assistant

Teaching Assistant to Dr. Ross Corotis at CU Boulder, 2018

- CVEN 3227, Probability, Statistics, and Decision Making, Spring 2018

Teaching Assistant to Dr. Greg Gangi at UNC Chapel Hill, 2007-2009

- Environment and Society, Fall 2007, Spring and Fall 2008
- Co-instructed Coral Reef Ecology, Spring 2009
- Developed curriculum and course materials for an undergraduate water policy and technology course to be taught through the UNC CH Institute for the Environment

Drinking Water and Wastewater Facilities Operator Trainer

Operator trainer as the design engineer for drinking water and wastewater treatment facilities and environmental monitoring sites, 2009-2015

- Trained operators in the operation, maintenance, ongoing optimization, troubleshooting, sampling, data collection, and reporting of new existing projects. Projects included municipal drinking water and wastewater treatment facilities and processes and environmental permitting and compliance sites.
- Developed training materials and operation and maintenance manuals for new and existing facilities
- Developed course material and taught math and decision making at the Colorado Rural Communities Assistance Program Operator Training Course in 2011

Drinking water treatment operator trainer at the Centers for Disease Control and Prevention, 2009-2011

- Developed a national drinking water treatment operator training package for Guyana, South America as part of a World Health Organization Water Safety Plan. Training materials included water quality and public health, technology and operations of conventional and membrane filtration water treatment facilities, troubleshooting, and data collection and reporting.
- Completed Level D Operator coursework in small drinking water systems operations

AWARDS and CERTIFICATIONS

- Licensed Professional Engineer, Colorado #49971
- National Rural Water Association Member
- Colorado Rural Water Association Member
- Environmental Health Training in Emergency Response, CDC 2010
- Won \$30,000 in business plan competitions: UW Global Social Entrepreneur Competition, Duke Start-Up Challenge, Carolina Challenge, 2008-2009
- Awarded the UNC-MSEE Bunker Award for demonstrating “The most outstanding scholarship and professional promise”, 2009
- Certified in Microsurgery (summer course) by the University of Miami Medical School Department of Microsurgery, 2005
- Awarded “Movers and Shakers” Award for making the biggest difference in my community by the National Youth Leadership Council, 2001

ACEDEMIC and PROFESSIONAL PUBLICATIONS

Sholtes K.A. and Linden K.G., (2019). Pulsed and continuous light UV LED: microbial inactivation, electrical, and time efficiency. *Water Research*. Vol 165(114965).

Sholtes K.A., Keliher R, and Linden K.G., (2019). Standardization of a UV LED Peak Wavelength, Emission Spectrum, and Irradiance Measurement and Comparison Protocol. *Environ. Sci. Technol.* 53(16)9755-9763. <https://pubs.acs.org/doi/abs/10.1021/acs.est.9b02567>

Sholtes K.A. and Linden K.G., (Under review). Relating Irradiance to Total Power for Two-Dimensional Light Sources using a Modified Keitz Equation. *Applied Optics*. Submitted December 2019.

Sholtes K.A., Lowe K, Walters G.W., Sobsey, M.D., Linden K.G., Casanova L.M. (2016) Comparison of ultraviolet light-emitting diodes and low pressure mercury-arc lamps for disinfection of water. *Environmental Technology*. 37(17) 2183-3.

Mettee Zarecki SL1, Bennett SD, Hall J, Yaeger J, Lujan K, Adams-Cameron M, Winpisinger Quinn K, Brenden R, Biggerstaff G, Hill VR, Sholtes K, Garrett NM, Lafon PC, Barton Behravesh C, Sodha SV.

(2013) U.S. Outbreak of Human Salmonella Infections Associated With Aquatic Frogs, 2008-2011. *Journal of Pediatrics*. 131(4): 724-31.

Caribbean Environmental Health Institute, Pan-American Health Organization, and Centers for Disease Control and Prevention. (2011) Water Safety Plan: St Lucia.

Centers for Disease Control and Prevention. (2010) Community Health Worker Training Materials for Cholera Prevention and Control. Online. Available: http://www.cdc.gov/haiticholera/training/chw_materials.htm

Centers for Disease Control and Prevention. (2010) Multistate Outbreak of Human Salmonella Typhimurium Infections Associated with Aquatic Frogs—United States, 2009. *Morbidity and Mortality Weekly Report*. 8;58(51):1433-6.

Centers for Disease Control and Prevention. (2009) Guidance documents: Guidance for workers exposed to human waste, cholera survival in composting latrines, and chlorination of drinking water in high-density polyethylene containers.

International Finance Corporation, World Bank Group. (2008) Safe Water for All: Harnessing the Private Sector to Reach the Underserved. Online. Available: [http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/p_SafeWaterReport/\\$FILE/IFC_WaterReport.pdf](http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/p_SafeWaterReport/$FILE/IFC_WaterReport.pdf)

SELECTED PRESENTATIONS of WORK

Sholtes K.A. and Linden K. (2018) Testing Protocol for Measurement of UV-C LED Device Output: Industry-wide Tolerance to Error. IUVA World Congress. Berlin, Germany.

Sholtes K.A. and Linden K. (2017) Testing Protocol for Measurement of UV-C LED Lamp Output: Round Robin Report & Next Steps. IUVA World Congress. Dubrovnic, Croatia.

Sholtes K.A. and Linden K. (2016) Proposed Testing Protocol for Measurement of UV-LED Lamp Output. International Ultraviolet Association (IUVA) World Congress, Vancouver, BC, Canada.

Metee S., Sodha S., and Sholtes K.A. (2010) Multistate Outbreak of Human Salmonella Typhimurium Infections Associated with Aquatic Frogs—United States, 2009. *Infectious Diseases Society of America (IDSA)*.

Sobsey M.D. and Leech (Sholtes) K.A. (2009) Evaluation of light emitting diode (LED) UV radiation as an emerging technology for point of use, household disinfection of drinking water. WHO Household water treatment working group.

Leech (Sholtes) K.A., Shaw N.D., Thomas J.D., and Patrick W.E. (2008-9) The gaps in access to safe water and the potential of UV LED technology to inactivate those gaps. Business plan competitions: Global Social Entrepreneurship Competition, Duke Start-up Challenge, Carolina Challenge.

PUBLICATION REVIEWER

World Bank: water, sanitation, and hygiene publications

World Health Organization: water safety plan reports and tool publications

Centers for Disease Control and Prevention: water, sanitation, and hygiene publications and guidance documents

Water Research: manuscripts

Water Quality, Exposure, and Health: manuscripts