

**STATE OF CALIFORNIA CONSTITUENTS OF EMERGING CONCERN
AQUATIC ECOSYSTEMS SCIENCE ADVISORY PANEL
OCTOBER 2013**

HUMAN HEALTH TOXICOLOGIST

Dr. Paul Anderson

Vice President and Principal Scientist

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Education:

Postdoctoral Fellowship, Harvard School of Public Health, Interdisciplinary Programs in Health

Postdoctoral Fellowship, Harvard University, Biology Department

Ph.D., Biology, Harvard University

M.A., Biology, Harvard University

B.A., Biology, Boston University

Dr. Anderson has over 20 years of experience in human health and ecological risk assessment. Since 2000, Dr. Anderson has led several research efforts investigating the potential presence and effects of pharmaceuticals and personal care products in surface water and other environmental media. His research on constituents of emerging concern (CECs) began with the development of a screening level model (the Pharmaceutical Assessment and Transport Evaluation or *PhATE*[™] model) that predicts the concentration in surface water of pharmaceuticals and other compounds released from wastewater treatment plants (WWTPs) across the U.S. (including the Sacramento and Lower Colorado Rivers). The model has since been corroborated and published in *Environmental Science and Technology*. Dr. Anderson helped develop and continues to oversee the use of a database that summarizes the English language peer-reviewed literature on aquatic toxicity, environmental fate in surface water and treatment plant removal of pharmaceuticals. The database is designed to make historical and current information easily accessible to users. Dr. Anderson and colleagues have used these tools to conduct several evaluations, including an assessment of the potential human health effects of several therapeutic classes of pharmaceuticals in surface waters; the development of a predicted no effect concentration for protection of aquatic receptors from ethinyl estradiol (EE2); a comparison of predicted to measured concentrations of EE2 in surface water; and characterization of the potential ecological risk associated with EE2 in surface water. Recently, Dr. Anderson has expanded his research to include two reviews of existing information and ongoing research efforts, the first on endocrine disrupting compounds (EDCs) and the implications of their presence for wastewater treatment. It described the sources of EDCs in wastewater, their fate in WWTPs, and impacts in the environment as a result of discharges. The second covered the full range of organic EDCs that may occur at trace levels in WWTP effluents. The research included: a review of the different sources and categories of trace organic compounds; how they are measured; their removal in treatment plants; an introduction to the potential ecological and human health effects associated with trace organics in treated wastewater, recycled water, and receiving streams; and an overview of current research needs including a summary of web-links describing major current research initiatives. Dr. Anderson is also an adjunct professor in the Center for Energy and Environmental Studies within Boston University's Geography Department.

ENVIRONMENTAL TOXICOLOGIST

Dr. Daniel Schlenk (Chair)

Professor

Department of Environmental Sciences

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Education:

Postdoctoral Fellow, Duke University

Ph.D., Biochemical Toxicology, Oregon State University

B.S., Toxicology, Northeast Louisiana University

The overall focus of Dr. Schlenk's laboratory has been to evaluate mechanisms of action of chemicals in aquatic and marine organisms. For the past 15 years, Dr. Schlenk has been interested in the estrogenic effects of legacy and emerging chemicals of concern. Initial work began with exploring the stereoselective biotransformation and activation of the legacy contaminant, methoxychlor. His lab helped develop a method to measure the egg yolk protein, vitellogenin in channel catfish and Japanese medaka. This metric was used to evaluate estrogenic activity in wastewater treatment plants in the south and east coasts and waterways of the United States. From there, his laboratory evaluated the effects of β -adrenergic antagonists and other pharmaceutical agents on aquatic fish and invertebrates. Dr. Schlenk's research in California has focused on the impacts of feminization on marine fish reproduction and populations as well as the identification of causal agents in sediments and water receiving oceanic discharge from municipal wastewater treatment facilities, particularly off the coast of Orange County. In addition, his laboratory conducted studies evaluating the long-term effects of recycled water on fish health. Current studies are underway to identify unknown estrogenic compounds in surface waters of the Central Valley and Santa Ana River. Specific agents that have been examined include current use pesticides (such as pyrethroids and herbicides), surfactants and UV-sunscreen agents. It is his goal to understand the modes of action of these compounds alone and in mixtures to determine the interactive roles each may have in endocrine disruption. In 2008, Dr. Schlenk served on the USEPA Science Advisory Board to evaluate potential changes to the Aquatic Life Criteria for Compounds of Emerging Concern. From 2003-2006, he was a member of the Board of Directors for the North American Society of Environmental Toxicology and Chemistry. He is the co-Editor-in Chief of *Aquatic Toxicology* and serves on the editorial boards of *Toxicological Sciences*, *The Asian Journal of Ecotoxicology* and *Marine Environmental Research*. He has been a permanent member of the USEPA FIFRA Science Advisory Panel since 2007, and has participated in proposal review panels for the USEPA, NOAA, and the National Institute of Environmental Health Sciences.

RISK ASSESSOR / CIVIL & ENVIRONMENTAL ENGINEER

Dr. Adam Olivieri, P.E.

Vice President

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Education:

Postdoctoral Fellow, School of Public Health, University of California, Berkeley

Dr. P.H., University of California, Berkeley

M.P.H., University of California, Berkeley

M.S., Civil and Sanitary Engineering, University of Connecticut

B.S., Civil Engineering, University of Connecticut

Dr. Olivieri has over 30 years of experience in the technical and regulatory aspects of water recycling, groundwater contamination by hazardous materials, water quality and public health risk assessments, water quality planning, wastewater facility planning, urban runoff management, and on-site waste treatment systems. He is a Registered Civil Engineer and a Registered Environmental Assessor with the State of California. Dr. Olivieri has extensive experience in the area of microbial risk assessment and the application of models to make engineering and public policy decisions. He served as Principal Investigator on the development of a user friendly microbial risk assessment tool (MRAIT) for the Water Environment Research Foundation. He was the co-project director at the Public Health Institute/Western Consortium for Public Health, where he directed the City of San Diego's Health Effects Studies at Mission Valley and San Pasqual, investigating the health risks of potable reuse of recycled municipal wastewater. This project was developed to address the fundamental issues raised by the National Research Council, and consistent with their recommendations involved a comprehensive investigation and comparison of both a recycled and a current potable water supply. The research project involved developing research plans and managing research across a wide base of California's prestigious universities including Berkeley, Davis, Los Angeles, San Francisco, and Scripps, San Diego State University and several laboratories of the California Department of Public Health Services. The project involved research in: a) Infectious Disease Agents – pathogenic viruses, parasites, and bacteria (and indicator organisms), b) Chemical Screening – volatile and semi-volatile organics, metals, PCBs, dioxins, TOC, and TOX, c) Genetic Toxicity Bioassay – Micronucleus tests, Ames, 6-Thioguanine Resistance, and Cellular Transformation Assays, d) Fish Biomonitoring, e) Plant Reliability – performance and mechanical reliability analysis and chemical and microbial agent unit and plant spiking studies, f) Chemical Risk Assessment – carcinogenic and non-carcinogenic, g) Epidemiology – baseline information (reproductive outcomes, vital statistics, and neural tube defects), and h) a Long-Term Health Effects Monitoring Plan. The San Diego Health Effects investigations have been recognized by the Science Advisory Board, the Australian government and the University of New South Wales, and in a special publication by the Water Environment Federation and the American Water Works Association. Dr. Olivieri has served on a number of national technical review panels, e.g., for the National Water Research Institute (evaluating the alternative disinfection options for a wastewater treatment plant and potential public health implications), and Monterey County (CA), which is evaluating groundwater recharge using recycled water. At the request of the US House of Representatives – Subcommittee on Water Resources and Environment, he provided testimony on April 13, 2005 on microbial agents and risk assessment relative to the national wastewater blending issue.

BIOCHEMIST

Dr. Nancy Denslow

Professor

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Education:

Postdoctoral Fellow, University of Florida

Ph.D., Biochemistry and Molecular Biology, University of Florida

M.S., Biochemistry and Molecular Biology, Yale University

B.S., Chemistry, Mary Washington College

Dr. Denslow's research involves environmental toxicology with a special focus on endocrine disruptors and pharmaceuticals in the environment. Her interests include defining molecular mechanisms of action of endocrine disrupting chemicals that adversely affect reproduction in fish that are exposed to the contaminants in surface waters. Her research covers both sex hormone receptor mediated and independent mechanisms. Favorite model systems include largemouth bass, fathead minnow, sheepshead minnow and zebrafish. Common research tools include traditional toxicology assays, biochemical pathways, histopathology, microarrays, real time PCR, proteomics, tissue culture based assays, transfections and *in vivo* determination of reproductive endpoints. In addition, Dr. Denslow has initiated research to understand the effect of nanomaterials on fish health. These experiments are integrated to look at gill function, histopathology, nanomaterial uptake and nanomaterial characterization. In addition, microarrays and proteomics tools are used to characterize the effects of the exposures. She has published more than 120 peer-reviewed publications and has led research projects supported by NIH/NIEHS, NSF, USEPA, and the US Army Corps of Engineers. Dr. Denslow also serves as Associate Editor for *Comparative Biochemistry and Physiology Part D Toxicogenomics and Ecotoxicology and Environmental Safety*, and received the Pfizer Award for Research Excellence in 2007 and a UFRF professor designation for 2009-2012. Dr. Denslow previously served for 15 years as the Director of the Protein Chemistry and Molecular Biomarkers Core Facility at the University of Florida. She has served on the Executive Board of the Association for Biomolecular Research Facilities (ABRF) and is a member of the Society of Environmental Toxicology and Chemistry (SETAC) and the Society of Toxicology (SOT) serving as senior councilor in the Molecular Biology Specialty Section. She is also a member of the American Association for Biochemistry and Molecular Biology (ASBMB).

CIVIL ENGINEER FAMILIAR WITH THE DESIGN AND CONSTRUCTION OF RECYCLED WATER TREATMENT FACILITIES

Dr. Jörg E. Drewes

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Education:

Postdoctoral Fellow, Arizona State University
Ph.D., Environmental Engineering, Technical University of Berlin, Germany
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Dr. Drewes has been actively involved in research in the area of water treatment and non-potable and potable water reuse for more than 20 years. For the last 16 years, Dr. Drewes has been conducting research on indirect potable reuse projects in the State of California, including surface spreading as well as direct injection projects. The main focus of these studies has been the fate and transport of trace organic chemicals in these systems. He has led research as the principal investigator (PI) or Co-PI to better understand the rejection of trace organic chemicals during high-pressure membrane treatment (nanofiltration, reverse osmosis) as well as the fate and transport of micropollutants in soil-aquifer treatment systems. A common theme in all these projects was to identify meaningful trace organic compounds that can serve as indicator compounds for system performance assessments. He has also conducted tailored studies to further develop this concept for multiple treatment processes commonly employed in indirect potable reuse followed by more focused efforts for surface spreading and direct injection projects. This indicator concept has been adopted in the Australian Water Recycling Guidelines for Drinking Water Augmentation in 2008. In addition, he has been involved in several studies addressing the occurrence of emerging contaminants in recycled water and to provide guidance to the water industry regarding occurrence, fate and transport, health effects, analytical methods and communication. Dr. Drewes research group is currently working on developing more predictive tools for the fate of trace organic chemicals in various reuse schemes using quantitative structural property relationships (QSPRs) coupled with process models. Dr. Drewes has published more than 250 journal papers, book contributions, and conference proceedings. He was awarded the 2007 AWWA Rocky Mountain Section Outstanding Research Award, the 2003 Dr. Nevis Cook Excellent in Teaching Award, the Quentin Mees Research Award in 1999, and the Willy-Hager Award in 1997. In 2008 and 2013, he was appointed to the National Research Council Committees on “Water Reuse as an Approach for Meeting Future Water Supply Needs” and “Onsite Reuse of Graywater”. Since 2007, Dr. Drewes has held an Adjunct Professor appointment at the University of New South Wales, Sydney, Australia and since 2013, a Research Professor appointment at the Colorado School of Mines.

MARINE SCIENTIST FAMILIAR WITH TOXICITY AND OCEAN LIFE

Dr. Geoffrey I. Scott

Director

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Education:

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M.S., Marine Science, University of South Carolina

B.S., Biology, Wofford College

Dr. Geoffrey I. Scott is an environmental toxicologist with special interest in the ecotoxicology of water chlorination products, urban nonpoint source pollutants (e.g., PAHs/oil spills), and pesticides. Currently, Dr. Scott serves as Director of NOAA's Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) in Charleston, South Carolina. CCEHBR is one of 5 Centers of the National Centers for Coastal Ocean Science within the National Ocean Service of NOAA. CCEHBR also directs research at the Oxford Cooperative Laboratory in Oxford, MD. CCEHBR scientists conduct multidisciplinary environmental research focused on four major themes: Science to manage threats of harmful algal blooms, to understand impacts of coastal pollution, to support coastal & marine spatial planning, and to advance research on climate change impact to coastal ecosystems. Dr. Scott's research has focused on understanding the ecotoxicology of agricultural pesticide and urbanization nonpoint source runoff on estuarine ecosystems, and the health of estuarine organisms as well as methods for measuring bacterial pollution sources emanating from coastal development. Dr. Scott is an Associate Professor in the Medical University of South Carolina's Marine Biomedicine Program, Tenured Associate and Adjunct Professor at the Arnold School of Public Health at the University of South Carolina, Adjunct Associate Professor, The Institute of Human and Environmental Health, Texas Tech. University, Lubbock, TX and Associate Adjunct Professor in the Marine Biology Program at the University of Charleston. Dr. Scott has served on 100 graduate student research committees and has directed the research of > 50 Masters and PhD Students at various institutions where he holds faculty appointments. He has published > 120 peer reviewed scientific publications and has authored/co-authored > 23 national reports. Dr. Scott has served on numerous advisory panels to government and industry including: (1) the Interstate Shellfish Sanitation Conference, which regulates the harvesting, processing and shipment of molluscan shellfish in the U.S.; (2) EPA's Advisory Board, Panel on Endocrine Disrupting Chemicals; (3) EPA's Food Quality Protection Act Board, Scientific Panel Member on Genetically Modified Crops and on Atrazine Risk Assessment for Freshwater Areas of the US; (4) EPA's Environmental Technology Verification Program, Water Stakeholder Committee Member; (5) SC Governor's Primary Health Care Task Force; (6) the SC Coastal Pesticide Advisory Committee; (7) United Nations Gulf of Guinea Large Marine Ecosystem Team Member; (8) Research Delegation Exchange with the Black Sea Research Institute; (9) Think Tec Board Member Greater Charleston Chamber of Commerce; (10) Chairman, Bluffton Technical Advisory Committee on Water Quality; (11) EPA's Advisory Board, FIFRA Panel on Climate Change Effects on Pesticide Registration Criteria; and (12) three FIFRA Panel on Adverse Outcome Pathways and Endocrine Disruptors.

CHEMIST FAMILIAR WITH THE DESIGN AND OPERATION OF ADVANCED LABORATORY METHODS FOR THE DETECTION OF EMERGING CONSTITUENTS

Dr. Shane A. Snyder

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Education:

Ph.D., Zoology and Environmental Toxicology, Michigan State University
B.A., Chemistry, Thiel College

Dr. Shane Snyder is a Professor in the College of Engineering at the University of Arizona. He is also the Co-Director of the Arizona Laboratory for Emerging Contaminants. For over 15 years, Dr. Snyder's research has focused on the identification, fate, and health relevance of emerging water pollutants. Dr. Snyder and his team have published over 100 peer-reviewed manuscripts and book chapters on emerging contaminant analysis, treatment, and toxicology. In April of 2008, Dr. Snyder was one of six experts invited to testify before the U.S. Senate regarding pharmaceuticals in US waters. He has since been invited to brief the U.S. Congress three additional times. Dr. Snyder has served two terms on the federal advisory committee to EPA's Endocrine Disruptor Screening Program and was an invited expert panel member for the development of EPA's CCL3. Dr. Snyder is a member of the National Academy of Science's National Research Council Committee on Water Reuse and has served two appointments on the California Chemicals of Emerging Concern Expert Panels. Dr. Snyder is also a visiting professor at the National University of Singapore where he leads research on water reuse technologies and implications for public health.