

373 CECs – Why the Big Fuss? S. Aminzadeh, California Coastkeeper Alliance. Contaminants of emerging concern (CECs) are increasingly detected at low levels in California's waterbodies. Some CECs are similar to conventional toxic pollutants in that they are associated with industrial releases, whereas many others are used by the general public in pharmaceuticals and personal care products. CECs are released directly to the environment after passing through wastewater treatment processes, which are typically not designed to remove CECs from the effluent. These contaminants are relatively unmonitored and found to occur at trace levels in wastewater discharges, ambient receiving waters, and drinking water supplies. Many CECs are so new that standardized measurement methods and toxicological data for interpreting their potential human or ecosystem health effects are unavailable. This lack of basic information and technology to efficiently measure CECs hampers California's ability to assess their potential risks and develop regulatory protocols. The discharge of CECs to California's receiving waters occurs on a daily basis due to recycled water. As recycled water becomes an increasingly important part of California's water supply portfolio, the State faces the challenge of monitoring and regulating the discharge of CECs into surface and groundwater. Many streams in southern California are effluent-dominated streams with 80-95% of dry weather flows coming from recycled water discharges, and many northern California streams receiving recycled water effluent interact regularly and closely with groundwater. As such, the importance of monitoring for CECs is absolutely critical to identify risks posed to public health and aquatic life. Some CECs have been shown to cause endocrine disruption after being released to the environment, as they interfere with the action of reproductive hormones such as estrogen and testosterone. CEC standards are critical to build public confidence in the use of recycled water; and the absence of monitoring data for CECs is an impediment to the promotion of recycled water as a sustainable water supply for California.

374 Regulatory Aspects of Managing CECs in California Waters J. Bishop, California Water Resources Control Board. California recycles approximately 650,000 acre-feet of water per year, but has identified the potential to reuse an additional 1.5 million acre-feet in the future. To encourage expanded reuse in a state that experiences periodic water shortages, the California State Water Resources Control Board (SWRCB) adopted a Recycled Water Policy in 2009 intended to provide permitting clarity for recycled water projects. One challenge in developing that policy was how to address new classes of chemicals, such as pharmaceuticals, current use pesticides, and industrial chemicals, collectively referred to as chemicals of emerging concern (CECs). Many CECs are potentially present not only in recycled water, but also in ambient waters that receive discharge of treated municipal wastewater effluent and stormwater runoff. After discharge to receiving waters, CECs may have direct impacts to aquatic life, or may associate with particles, accumulate in sediments and work their way up the food chain to higher biota, including humans. The mission of the SWRCB is to protect beneficial uses of water resources in California through promulgation of water quality standards and monitoring requirements for permitted discharges, ground and surface waters. To address the different challenges that CECs present, the Water Board also supports research and technology development that facilitates science-based decision and policy making. One such example is the development of bioanalytical screening tools, a means for detection of many known and unknown chemicals based on their mode of biological action, thus de-emphasizing the need to develop chemical specific analytical methods for the next generation of CECs.

375 Monitoring CECs in San Francisco Bay M. Sedlak, D. Yee, J. Davis, San Francisco Estuary Institute. The Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) has been investigating contaminants of emerging concern (CECs) since 2001 and developed a formal workgroup to address the issue in 2006. The RMP Emerging Contaminants Workgroup (ECWG) includes representatives from RMP stakeholder groups (wastewater, stormwater, and industrial dischargers, dredgers, and regulatory agencies) and an advisory panel of expert researchers that work together to address the workgroup's guiding management question – Which CECs have the potential to adversely impact beneficial uses in San Francisco Bay? The overarching goal of the ECWG is to develop cost-effective strategies to identify and monitor CECs so that potentially problematic chemicals can be identified as early as possible and thus minimize impacts to the Estuary. The ECWG works toward this goal by evaluating available information on chemical occurrence, fate,

toxicity, volume use, and potential sources, and then recommends CECs for investigation in special studies. Each year the highest priority studies are conducted, and the results guide whether or not these CECs are added to routine monitoring by the RMP. Using this process, the RMP has generated one of the most comprehensive datasets for CECs in an aquatic ecosystem. CECs investigated to date include perfluorinated compounds, alkylphenols, more than 100 pharmaceuticals and personal care product ingredients, and a variety of flame retardants including polybrominated diphenyl ethers and their replacements. This presentation will summarize results from the CEC studies conducted to date and highlight the ECWG approach to prioritizing CECs for monitoring.

376 CA Science Advisory Panel recommendations for CEC monitoring in recycled water P. Anderson, Ohio EPA; N.D. Denslow, University of Florida / Department of Physiological Sciences and Center for Environmental and Human Toxicology; J. Drewes, Colorado School of Mines / Environmental Science and Engineering; K.A. Maruya, SCCWRP, Southern California Coastal Water Research Project; A. Olivieri, EOA, Inc.; D. Schlenk, University of California-Riverside / Department of Environmental Sciences; G.I. Scott, National Ocean Services / Center for Coastal Environ. Health & Biomolecular; S. Snyder, University of Arizona / Chemical and Environmental Engineering. The paucity of information on the occurrence and potential impacts of chemicals of emerging concern (CECs) in natural and treated waters currently limits our ability to define and, thus, manage risks associated with CECs. In response, the State of California tasked Southern California Coastal Water Research Project (SCCWRP) to convene an expert panel to provide recommendations for effective monitoring of CECs in recycled water. Through an open and transparent process, SCCWRP convened a panel of six national experts in the fields of chemistry, biochemistry, toxicology, epidemiology, risk assessment and engineering, with more than 100 years of combined experience investigating CEC issues. The Panel was asked to address five charge questions. They held several meetings during which they considered a wide range of CECs and identified the scenarios most likely to be associated with exposure to CECs. The Panel created a framework to prioritize CECs based on occurrence and toxicological relevance, applied this framework using statewide data and provided recommendations for monitoring of high priority CECs and treatment performance indicators and surrogates. In addition, the Panel identified data gaps, research needs and programmatic issues that would result in future improvements to the framework and increase the overall relevance and effectiveness of CEC monitoring in recycled water.

377 Monitoring Strategies for Chemicals of Emerging Concern (CECs) in California's Aquatic Ecosystems Recommendations of a Science Advisory Panel D. Schlenk, University of California-Riverside / Department of Environmental Sciences; K.A. Maruya, SCCWRP, Southern California Coastal Water Research Project; P. Anderson, Ohio EPA; N.D. Denslow, University of Florida / Department of Physiological Sciences and Center for Environmental and Human Toxicology; A. Olivieri, EOA Inc.; J. Drewes, Colorado School of Mines / Environmental Science and Engineering; G. Scott, NOAA; S. Snyder, University of Arizona / Chemical and Environmental Engineering. Contaminants of emerging concern (CECs) represent a challenging problem for regulators to address, owing to limited scientific knowledge about their sources, fates, and effects. The State of California convened a panel of experts to provide recommendations on how current knowledge of CECs should influence their regulatory activities, beginning with recycled water applications, and with support from the David and Lucile Packard Foundation, continuing with ambient waters receiving treated wastewater effluent and stormwater discharge. The Panel delivered a risk-based framework and monitoring approach which included a list of priority CECs, appropriate methods and interpretive guidelines for monitoring data. To make future monitoring more relevant and efficient, the Panel recommended the development of bioanalytical tools that integrate the response of high priority CECs.

378 Developing bioanalytical techniques to address water quality N.D. Denslow, University of Florida / Department of Physiological Sciences and Center for Environmental and Human Toxicology; P. Anderson, Ohio EPA; J. Drewes, Colorado School of Mines / Environmental Science and Engineering; A. Olivieri, EOA, Inc.; D. Schlenk, University of California-Riverside / Department of Environmental Sciences; G.I. Scott, National Ocean Services / Center for Coastal Environ. Health & Biomolecular; S.