and ground water. Studies of such sites in other areas of the country have demonstrated that citizens often have concerns about their lack of involvement in decision-making processes and health and safety issues regarding wastewater reuse; therefore, survey data obtained from a Community Involvement Group (CIG) provides us with information on local perceptions and values regarding current, non-traditional wastewater use and risks, as well as options for alternative water reuse in the future. Overall, the CIG will work together with the project's leadership team to formulate appropriate strategies to communicate project findings to the broader public.

412 Potable Reuse and Microbial Risks – a Critical Review and Comparison of Risks between Planned and De Facto Reuse Scenarios

J. Soller, Soller Environmental, LLC; S. Eftim, ICF; S. Nappier, USEPA

There is an increasing interest in recycling water for potable reuse purposes which makes it important to understand the associated microbial risks. To better understand these risks, we conduct numerical simulation analyses to compare risks from a series of representative *de facto* reuse, indirect potable reuse (IPR) and direct potable reuse (DPR) scenarios using a previously published QMRA methodology and literature review results. Variables in the analyses included: (for *de facto* reuse) the percent wastewater contribution in surface water and the environmental residence time in days; (for IPR) advanced water treatment facility (AWTF) treatment train choice, the percent AWTF contribution to the source water, and time between blending and drinking water treatment in days; and (for DPR) AWTF treatment train and relative level of disinfection for DPR. Additionally, the *de facto* reuse simulation results were compared to a *Cryptosporidium* spp. database collected for the Long Term 2 Enhanced Surface Water Treatment Rule's Information Collection Rule (ICR) and to a systematic literature search of norovirus (NoV) densities in ambient surface waters. The *de facto* simulation comparison revealed that a wastewater contribution of 1% in surface waters and a residence time of 90-days most closely match the ICR dataset. These conditions were then modeled for IPR simulations. Additionally, the simulation comparisons suggest that use of NoV data collected from ambient waters may overestimate microbial risks, in contrast to the use of NoV data from raw sewage. Overall, the simulated predicted risks from IPR and DPR scenarios were consistently lower than those for the *de facto* reuse scenarios. Collectively the analyses provide additional insight about the microbial risks associated with various potable reuse scenarios and highlight the need to carefully consider drinking water treatment choices when wastewater is a component of any drinking water supply (whether *de facto*, IPR, or DPR).

413 Flow cytometry for rapid detection, enumeration, and characterization of waterborne viruses

H. Safford, University of California, Davis / Civil and Environmental Engineering; H. Bischel, EPFL – Swiss Federal Institute of Technology / Civil and Environmental Engineering

The ability to reliably monitor waterborne viruses is essential to ensuring safe water treatment, recycling, and reuse. Waterborne viruses pose significant direct health risks. Moreover, because removal requirements are higher for viruses than for other waterborne pathogens, monitoring virus removal is a conservative approach to assessing the effectiveness of water-treatment processes. Unfortunately, conventional methods of virus monitoring are limited by low sensitivity, extended time needed to obtain results, and numerous other factors. Flow cytometry (FCM)—the analysis of particles based on how they scatter light and fluoresce when passing through a laser beam—offers an alternative approach. Recent advances in FCM have made it a viable tool for water-quality monitoring. Numerous researchers have demonstrated the value of FCM for analysis of waterborne bacteria. This study examines applications of FCM for rapid detection, enumeration, and characterization of waterborne viruses (also known as flow virometry). Specifically, we optimize protocols of FCM-based analysis of four strains of indicator bacteriophages (T4, x174, 6, and MS2) representing a range of sizes, morphologies, and nucleic-acid structures. We then test the optimized protocols on spiked samples of environmental waters (tap water, river water, rainwater, and wastewater taken from three treatment stages). The results build the case for incorporating FCM as a routine monitoring approach in a variety of water treatment and reuse scenarios, including direct potable reuse.

Fate and Effects of Chemicals from Diffuse Sources and Stormwater – Part 1

414 Science-based regulatory approaches for addressing stormwater pollution from diffuse sources

K. Moran, TDC Environmental, LLC

Traditional water pollution regulatory approaches, such as those embodied in the US Clean Water Act, stem from the assumption that pollution comes from large facilities like major industries. Due in part to the success of traditional regulatory programs – and in part to the increased use of specialty chemicals in ordinary products – the main sources of water pollution have shifted to "diffuse sources" like consumer products and pesticides. These shifts demand a shift in water quality regulatory approach. Government agencies in the state of California are responding to this challenge through three major regulatory programs. Scientific research provides key data for these programs by identifying pollutant sources, demonstrating linkages between pollutant sources and surface waters, and detailing the environmental impacts of diffuse pollutants. California Department of Toxic Substances Control's (DTSC's) Safer Consumer Products Regulatory Program is currently piloting its authorities to protect aquatic ecosystems. In May 2018, California municipalities petitioned DTSC to address zinc in vehicle tires (one of two major zinc sources in urban runoff). These California agency efforts are informed by the practical experience and the science behind the first major US regulatory program to address a diffuse water pollution source (copper in vehicle brake pads). Using science linking pesticides application methods to urban runoff loads, California Department of Pesticide Regulation's Surface Water Protection Program has adopted regulations addressing urban runoff pesticides pollution and has expanded scientific review of new pesticide registration applications. California State Water Resources Control Board's Strategy to Optimize Resource Management of Storm Water proposes to integrate California and Federal pesticides regulatory authorities into its urban runoff Clean Water Act compliance program. This change could speed cleanup of pesticides water pollution while saving California state and local governments millions of dollars. Ultimately, better informed product design could avoid water pollution. Many major corporations now voluntarily integrate chemicals safety screening into the early phases of product design. Current screening methods have limited capacity to address diffuse urban runoff pollution. Additional scientific information – and better predictive modeling tools – have the power to inform a clean water future.

415 Roads to ruin: The threats of urbanization to conservation of a sentinel species

B. Feist, NOAA Fisheries – Northwest Fisheries Science Center; E. Buhle, Northwest Fisheries Science Center NMFS; D.H. Baldwin, NOAA Fisheries / Northwest Fisheries Science Center; J.A. Spromberg, Northwest Fisheries Science Center – NMFS / Northwest Fisheries Science Center; S. Damm, US Fish & Wildlife Service; J. Davis, US Fish & Wildlife Service / Division of Environmental Assessment and Restoration; N. Scholz, NOAA Fisheries / Northwest Fisheries Science Center

Since the late 1990s, coho salmon adults returning to their natal urban streams in Puget Sound experience high rates (e.g., 40-90% of run) of spawner mortality syndrome. Evidence suggests that urban stormwater runoff is the likely causative agent and that this high mortality may threaten wild coho populations, particularly in urbanizing basins. The ability to identify basins currently at risk for this syndrome is critical to conservation efforts. We looked at the relationship between the mortality syndrome (time series of coho spawner survey data from 51 streams