SOCIETY OF ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY. ANNUAL MEETING– November 2014

http://www.setac.org

Laboratory intercomparison of cell bioassays for screening of recycled water quality

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Abstract

Contaminants in water are monitored by targeting individual or groups of chemicals known to occur and for which robust analytical methods exist. With initiatives to identify, prioritize and mitigate the impact of known and unknown chemicals that pose unacceptable risks to ecological and human health, a more efficient strategy is needed to screen for all chemicals that occur (or will occur) in our water resources. In response to increasing pressure on potable water supplies, the State of California adopted a policy in 2010 to increase the production and use of recycled water for recharge of groundwater aquifers. To ensure the safety of recycled water, the policy mandated monitoring of constituents of emerging concern (CECs) that may occur post-treatment. In collaboration with international efforts to develop screening bioassays for water quality monitoring, a multi-investigator study to adapt high throughput in vitro cell based assays for water quality screening was initiated. The initial phases of this study identified endpoints of concern for humans exposed to chemical residuals in recycled/drinking water (e.g. estrogenicity, genotoxicity). Commercially available cell lines were selected and evaluated for performance (i.e. sensitivity, precision) as well as for potential to transfer this technology into routine use by the water resources community. Estrogen, androgen, glucocorticoid and progesterone receptor based cell lines hypothesized to respond to a wide variety of endocrine disrupting compounds at toxicologically relevant (i.e. ng/L range) concentrations were then used to test water samples using standardized protocols. These protocols first screened for cytotoxic effects to further validate receptor specific responses. Twelve water samples representing a range of treated water quality were tested for the five standardized endpoints described above by the 5 project team labs in this round robin exercise. The results of this exercise will be used to further optimize the standardized protocols, and to set the stage for pilot evaluation of this technology for monitoring of recycled water.