Public Hearing (12/15/10)
CEC – Recycled Water
Deadline: 1/10/11 by 12 noon

Science Advisory Panel Comments to Staff Report

Prepared by Jörg E. Drewes on behalf of the Science Advisory Panel

This document summarizes comments of the Science Advisory Panel (Panel) on the report entitled "Constituents of Emerging Concern (CEC) Monitoring for Recycled Water" prepared by State Water Resources Control Board (State Water Board) staff. The Staff Report was provided to the Panel on November 18, 2010 with the request to review.

The Panel clarifies that in the selection process to derive a monitoring list for recycled water, all chemicals were considered CECs that are currently not regulated by the US EPA and/or the State of California. Thus, chemicals that appear on California Unregulated Contaminant Monitoring List for Drinking Water and CDPH's notification level lists were considered CECs. For these chemicals, the Panel assessed their viability as potential indicator compounds, depending upon whether measured environmental concentration (MEC) information was available. For chemicals currently appearing on the two lists mentioned above, MEC information was available for chlorate, NDMA, NDEA, NDPA, vanadium, sec-butyl benzene, carbon disulfide, dichlorodifluoromethane, 1,4-dioxane, formaldeyde, isopropylbenzene, and methyl isobutyl ketone. Of these chemicals, only NDMA exceeded a MEC/MTL ratio of "1".

The Panel notes that the State Water Board adopted recommendations for monitoring of CECs provided by the California Department of Public Health (CDPH) (via written correspondence dated September 13, 2010). While CDPH's recommendations were limited to surface spreading groundwater recharge projects, the Panel supports the State Water Board's decision to apply additional monitoring requirements to both surface spreading and direct injection projects with the following suggestions. In the final report, the Panel provided a transparent framework to derive a list of chemicals for monitoring of various reuse applications that are either human health- or treatment performance-based indicators. Thus, the Panel suggests that the State Board maintains this transparency and provide the reasoning why additional chemicals were added for monitoring in recycled water (i.e., note in Table 1 for each chemical whether it is health or performance-based). Following this logic, we offer the following observations and suggestions:

- Boron, chlorate, 1,4-dioxane, NDMA, NDEA, NDPA, 1,2,3-trichloropropane, naphthalene, and vanadium are currently listed on CDPH's notification list. Boron, 1,2,3-trichloropropane, and vanadium are also listed on California's unregulated contaminant list. Thus, these chemicals are considered "health-based indicators".

- Chromium-6 is listed on California's unregulated contaminant list. Diazinon appears on CDPH's Archived Advisory Levels List for Drinking Water. NPYR appears on CDPH's List of Relevant Nitrosamines (http://www.cdph.ca.gov/certlic/drinkingwater/Pages/NDMA.aspx) with a 10^{-6} risk level of 15 ng/L. No particular risk level was specified for N-nitrosodiphenylamine. Thus, these chemicals are also considered "health-based indicators".

- Of the compounds CDPH suggested for yearly monitoring (bisphenyl A, carbamazepine, and TCEP [tris(2-carboxylethyl)phosphate]) listed on p. 3 and Table 1, the Panel notes that as written, two of the three chemicals listed don't exist. However, the Panel assumes that CDPH intended to recommend bisphenol A (BPA) and TCEP [tris (2-chloroethyl) phosphate]. The Panel considered all three chemicals in its CEC monitoring

selection process. MEC information for all three chemicals was available for California and the MEC/MTL for BPA, carbamazepine, and TCEP were determined to be $8*10^{-5}$, 0.4, and 0.28, respectively. Since the MEC/MTL ratios were lower than 1, the Panel did not select any of these three chemicals as an appropriate indicator chemical based on health relevance. However, all three chemicals were considered as potential performance indicators. Given the high analytical uncertainty associated with BPA (ubiquitous occurrence leads to false positives), the Panel did not consider BPA as a viable performance indicator. Carbamazepine and TCEP are relatively persistent chemicals frequently occurring in recycled water. However, occurrence of these chemicals is highly variable which can limit determining "percent removal" through a given treatment train. Instead, the Panel favored sucralose as a more suitable performance indicator compound given that sucralose occurs at higher concentrations in recycled water, exhibits less variability, has a large detection frequency, and based on its physicochemical properties, represents the properties of an ideal conservative tracer.
As the State Board agreed to follow the recommended framework as developed by the Panel (see p. 1), the Panel suggests removing the three additional performance indicators (BPA, carbamazepine, and TCEP) from Table 1 because they have been subject to an assessment following the proposed framework and were not considered as performance indicators given the reasons stated above.

- Considering the classification provided above, the Panel suggests adding a designation ("health" or "performance") for additional chemicals listed in Table 1.

- P. 3, last paragraph, second sentence "...UVA absorption, turbidity, chloride residual, and total coliform". Please correct to "...UV absorbance, turbidity, chlorine residual, or total coliform" (*highlighted in red to indicate proposed changes*).

- P. 5, Application of Performance-based Indicator CECs and Surrogates
  The concept of performance based indicators and surrogates requires that the operational conditions of a given treatment process stay constant (e.g., flux and recovery for RO; CT for disinfection). Thus, the Panel recommends modification of the first sentence in this section to read: "The effectiveness of a wastewater treatment process in removing CECs can be evaluated using performance-based indicator CECs and surrogate parameters and constituents providing the operational boundary conditions (e.g., flux, CT) stay constant".
  Add a sentence at the end of the first paragraph on p. 6 to read: "...monitoring phase. For both phases, record the operational conditions and demonstrate that these stay constant during the time period of monitoring."
  Modify the last sentence of the fourth paragraph on p. 6 to read: "...to the effluent for a given set of operational conditions."

- p. 11, Table 2 lists the surrogate parameter "UVA Absorption". This is incorrect. The Panel suggests correcting to UV absorbance (UVA). Please also correct footnote #5 to read "ultraviolet absorbance (UVA)".

- For clarity and consistency, the Panel suggests adding another column to Table 1 listing the proposed detection frequency for each parameter matching recommendations suggested by CDPH.

The Panel supports the State Water Board's recommendation to develop bioanalytical techniques as a primary research focus. The Panel emphasizes that the basis of deriving MEC information for the Panel's assessment was based on a survey that was neither comprehensive nor targeted enough to pool available occurrence information of CECs (as measured today) in recycled water in California. The Panel believes that a targeted and comprehensive review of peer-reviewed literature and occurrence studies of CECs outside California can significantly improve the assumptions and coverage of CECs as reported in the Panel Report.

We appreciate the opportunity to provide comments to the Staff Report. Please feel free to contact us (jdrewes@mines.edu) if you have any questions or concerns.

Sincerely,

Jörg E. Drewes (Chair)
(on behalf of Paul Anderson, Nancy Denslow, Adam Olivieri, Dan Schlenk, and Shane Snyder)