



Charles R. Hoppin, Chair and Members
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814

Dr. Jörg E. Drewes
Professor and Director of Research
Civil and Environmental Engineering
1500 Illinois Street
Golden, Colorado 80401-1887
Telephone: 303.273.3401
Mobile: 303.884.9746
E-mail: jdrewes@mines.edu
www.urbanwatererc.org



June 28, 2012

RE: Comments on Draft Amendment “Requirements for Monitoring Constituents of Emerging Concern for Recycled Water”

Dear Sirs,

As the former Chair of the Scientific Advisory Panel convened by the State Water Resources Control Board in accordance with provision 10b of the Water Recycling Policy, I am offering some clarifications in references to statements provided in the draft amendment. The Panel had an opportunity to review the draft amendment and clarifications provided in this letter are endorsed by all panel members.

If you have any questions, please do not hesitate to contact me at 303-273-3401 or via E-mail at jdrewes@mines.edu.

On behalf of the Water Recycling SAP,

Dr. Jörg E. Drewes
Professor of Civil and Environmental Engineering
Director of Research (NSF ERC ReNUWIt)

Comments provided on behalf of the Science Advisory Panel on the Draft Amendment to the Recycled Water Policy “Requirements for Monitoring Constituents of Emerging Concern for Recycled Water”

The Science Advisory Panel (SAP) applauds the State Water Resources Control Board for adopting a science-based approach to amend the State’s Recycled Water Policy and considering the key recommendations and the monitoring framework as described in the Panel’s final report published in June 2010¹. The SAP reviewed the draft amendment (Attachment A) and offers the following clarifications to address some issues identified in the draft document:

Attachment A, Footnote 5, pg. 2 and Table 6, pg. 16: *“For evaluating removal of CECs, the treatment zone for soil aquifer treatment is from the surface of the application area through the unsaturated zone to groundwater, including groundwater within a two-week travel time distance through an aquifer downgradient of the surface application area.”*

Panel Comment:

This footnote and table appear to reflect information provided in Table 8.2 of the SAP report (see pg. 66) that presents expected removals for soil aquifer treatment (SAT) based on the work by Drewes et al. (2008).² These specific removals occurred based on a two-week travel time and no dilution. It is important to recognize that an effective and safe groundwater recharge project could have actual removal rates that differ from these percentages if the conditions of the project differ from those experimental conditions considered by Drewes et al. (2008). First, reporting a removal percentage will depend on the assumed indicator concentration in the recycled water applied to a groundwater recharge project. For example, if the influent concentration of a CEC was lower, the removal rate would be lower. Secondly, depending on the recycled water quality (i.e., partially nitrified, fully nitrified/denitrified) and the extent of the vadose zone of a given SAT site, oxic or anoxic conditions might prevail affecting the removal efficiency (kinetics) of CEC attenuation. As described on page 67 of the SAP report, performance is initially defined during an individual project’s piloting/start-up phase in parallel with an occurrence study to confirm the presence of the proposed performance indicator CECs in the feed water of each unit process (in the case of a surface spreading facility, recycled water prior to and after soil aquifer treatment). Table 8.2 in the SAP report was intended to provide some example benchmark values regarding SAT performance considering field monitoring data reported by Drewes et al. (2008) from sites with similar conditions. Although Amendment A provides a qualification (p. 14) by stating “The expected removal differentials provided shall not be used as compliance requirements”, we would suggest that the sample collection point for SAT performance for a given project should be established based on consultation with California Department of Public Health (CDPH) in conformance with the CDPH groundwater regulations. The draft regulations have been used for over 30 years to permit groundwater recharge projects with monitoring programs developed on a project-specific basis. This approach will continue even when the final regulations are adopted.

¹ Drewes, J.E., Anderson, P., Denslow, N., Olivieri, A., Schlenk, D., and Snyder, S. (2010) Final Report Monitoring Strategies for Chemicals of Emerging Concern (CECs) in Recycled Water Recommendations of a Science Advisory Panel, SWRCB, Sacramento, CA, June 25, 2010.

² Drewes, J. E., D. Sedlak, S. Snyder and E. Dickenson (2008). *Development of Indicators and Surrogates for Chemical Contaminant Removal during Wastewater Treatment and Reclamation* (WRF-03-014), Alexandria, VA, WaterReuse Research Foundation.

It is noteworthy, that the November 2011 draft CDPH groundwater recharge regulations also establish SAT performance monitoring, but did not establish the point of monitoring at two weeks. The draft regulations require testing “prior to the soil treatment process and the water after the soil treatment process, but at a point no farther than 30 days downgradient of the treatment process.”

Therefore, we recommend that the footnote be revised as follows:

“For evaluating removal of CECs, the treatment zone for soil aquifer treatment is from the surface of the application area through the unsaturated zone to groundwater, including groundwater after SAT and within a 30-day ~~two-week~~ travel time distance through an aquifer downgradient of the surface application area.”

Regarding Table 6, we recommend to change footnote 2 to read:

“2 – Treatment process: Soil aquifer treatment. The stated expected removal differentials (%) are an example and need to be finalized through during the initial testing phase for a given site.”

Attachment A, Section 2.1.1, (1) and Footnote 8, pg. 6:

“For groundwater recharge reuse projects implementing surface application of recycled water, health-relevant CECs shall be monitored at these locations:

- (1) Following tertiary treatment⁷ prior to discharge to the surface application area;*
- (2) Either in the unsaturated zone or in the uppermost portion of the groundwater⁸ underlying the surface application area; and*
- (3) Within groundwater at a location downgradient of the surface application area and upgradient of the point of extraction for drinking water supply.”*

“⁸ Groundwater monitoring location situated within a two-week travel time (groundwater travel through the aquifer) downgradient of the surface application area.”

Panel Comment:

Given the site-specific conditions of each project, the SAP feels that it might be difficult to establish a groundwater monitoring well that is located “either in the unsaturated zone or in the uppermost portion of the groundwater underlying the surface application area”. The SAP report stated: “The location and monitoring criteria for selection and use of these sampling locations are site-specific and need to be defined on a case-by-case basis. The guidance provided within this report should be used to supplement the monitoring conducted as part of compliance with the draft CDPH regulations” (p. 69). Instead, the Panel suggests coupling the location with minimum travel times. We acknowledge that the SAP report does not provide more detail on this issue, but we would suggest that SAT performance monitoring occurs in recycled water prior to SAT and after SAT, but at no point farther than 30 days downgradient of the treatment process. This would be consistent with the most recent CDPH draft groundwater recharge regulations. The CDPH draft regulations go on to state: “For other CEC monitoring, the draft regulations establish the following minimum monitoring well requirements: (1) at least one well located no less than 2 weeks, but no more than 6 months of travel through the saturated zone of the recharge project; (2) at least 30 days upgradient of the nearest drinking water well; and (3) at least one well located between the recharge project and the nearest downgradient domestic water supply well”. Depending on project specifics and well locations, the first well classification could be used for performance testing.

In addition, the two groundwater points of monitoring (POMs) are not consistent with the SAP guidance. The SAP report suggested that one of the locations would be “wells representing the

underlying groundwater and/or from shallow lysimeter wells” (pg. 69). The Amendment A language requires a well be placed in a spreading basin, which is impractical in many cases and not necessary. We recommend collecting a sample consistent with the panel’s recommendation in a shallow monitoring well that collects representative water as illustrated by some of the existing permitted groundwater recharge projects.

We recommend that the language be revised as follows:

“For groundwater recharge reuse projects implementing surface application of recycled water, health-relevant CECs shall be monitored at these locations:

(1) Following tertiary treatment⁷ prior to ~~discharge application~~ application spreading area; and

(2) At monitoring well locations consistent with CDPH regulations for groundwater recharge projects. ~~Either in the unsaturated zone or in the uppermost portion of the groundwater⁸ underlying the surface application area; and~~

(3) ~~Within groundwater at a location downgradient of the surface application area and upgradient of the point of extraction for drinking water supply.”~~

Footnote 8 should be deleted.

The Panel suggests to adopt the same revised language for **Attachment A, Section 2.2.1, (1), pg. 7**; and the monitoring points in **Table 3, pg. 10, Table 4, pg. 11, and Table 5, pg. 15**.

Attachment A, Section 3.1, (1), pg. 8:

*“The purposes of the initial assessment phase are to (1) identify the occurrence of health-relevant CECs, performance indicator CECs and surrogates in recycled water, the **unsaturated zone**, and groundwater, (2) determine the effectiveness of treatment of the unit processes⁹, and (3) define the project-specific performance indicator CECs and surrogates to monitor during the baseline phase.” [emphasis added]*

Panel Comment:

The SAP recommendations allowed for assessment in the unsaturated zone or groundwater; the language in Amendment A implies all projects would have to assess unsaturated zones, which is not feasible in every project. An additional challenge exists with lysimeter sampling in unsaturated zones since in many cases it is infeasible to collect sufficient sample volume to evaluate all CECs using a lysimeter.

We recommend that this language be revised as follows:

“The purposes of the initial assessment phase are to (1) identify the occurrence of health-relevant CECs, performance indicator CECs and surrogates in recycled water, ~~the unsaturated zone, and groundwater~~, (2) determine the effectiveness of treatment of the unit processes⁹, and (3) define the project-specific performance indicator CECs and surrogates to monitor during the baseline phase, and (4) establish expected removal rates for performance indicator CECs and surrogates.”