

SCCWRP #1477

Evaluating the Effectiveness of Street Sweeping for Reducing Toxicity of Urban Runoff

Victoria McGruer¹, Georg Braun², Danhui Xin¹, Beate I. Escher^{2,3}, Elizabeth Fassman-Beck¹, Alvine C. Mehinto¹

¹*Southern California Coastal Water Research Project, Costa Mesa, CA*

²*Department of Cell Toxicology, Helmholtz Centre for Environmental Research – Ufz, Leipzig, Germany*

³*Environmental Toxicology, Department of Geosciences, Eberhard Karls University Tübingen, Tübingen, Germany*

ABSTRACT

Urban stormwater runoff contains mixtures of contaminants that may impact ecological and human health. Traditional monitoring focuses on a limited set of regulated pollutants (bacteria, nutrients, metals) and may overlook other drivers of toxicity. Here, we assessed the effectiveness of street sweeping as a stormwater management practice in removing toxic contaminants using cell bioassays and analytical chemistry. A rainfall generator was used to simulate three storm events on a heavily trafficked parking lot in Long Beach, California, where one side of the pavement was swept and the other side remained unswept. Cell bioassay screening indicated activation of xenobiotic metabolism, oxidative stress, and neurotoxicity in all swept and unswept runoff samples. Similarly, chemicals, such as pesticides and polycyclic aromatic hydrocarbons, were detected in all runoff samples. Street sweeping reduced cell bioassay responses and contaminant levels, but these reductions were variable and not statistically significant. Iceberg modeling indicated that targeted analytes accounted for a small part of the observed biological responses (3–27% for xenobiotic metabolism, 0.05–0.09% for oxidative stress, and <0.0002% for neurotoxicity), suggesting the presence of other bioactive contaminants. These findings underscore the need to incorporate effect-based methods in water quality evaluations to ensure that treatment processes yield biologically meaningful improvements.

Due to distribution restrictions, the full-text version of this article is available by request only.

Please contact pubrequest@sccwrp.org to request a copy