Assessing Biological and Chemical Quality of Harvested Rainwater in Arizona: Can In-Line Carbon Filters Decrease Health Risks?

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The project addresses harvested rainwater as an increasingly utilized residential water source in the western U.S. The benefits of rainwater harvesting can include reduced demand on potable water supplies, decreased erosion, and interception of low quality "first flush" runoff water in the landscape, preventing it from entering the storm water system. Current drought conditions have stimulated municipal investment in rainwater harvesting, and the City of Tucson has experienced unprecedented response to their new rainwater harvesting incentives/rebate program. Since the inception of this program in 2011, the City has trained hundreds of Tucson residents on construction and use of harvesting systems, and has provided many thousands of dollars in rebates following installation. Harvested water is most often used for garden and landscape irrigation, yet no water quality standards exist regarding the use of harvested rainwater and the risk that harmful constituents collected within the water tanks may present to human health. A comprehensive study conducted in 2004 identified lead (Pb) and microorganisms as a health concern in harvested rainwater; this work will extend the earlier study to include more temporally intensive water analyses of two established harvesting cisterns along a rainfall/temperature gradient in Southern Arizona. In addition, low-cost carbon filters will be tested for their efficacy in removal of microbial and chemical contaminants in water leaving the tanks. Results of the study will be incorporated into a risk assessment to identify and quantify human health concerns, and will be useful to utilities and municipalities throughout the western U.S. in drafting plans for safe use of harvested rainwater.

Work will be conducted using two existing rainwater harvesting systems located at: (1) the University of Arizona Water Resources Research Center (Tucson, Arizona) and (2) the Biosphere2 Center (Oracle, Arizona). Prior to sample collection, the cistern interiors will be flushed with a dilute (0.5%) bleach solution to dislodge existing biofilms and sediments. Water samples will be collected over six months following each rainfall exceeding 5 mm, and thereafter every 2 weeks until the tanks become dry. On each visit, two water samples will be collected from each tank: first, an un-filtered sample will be collected from the tank tap; a second sample will be collected following the installation of a low cost, in-line activated carbon filter. Water samples will be analyzed for microbial contaminants (total and fecal coliforms, *Enterococcus*, and *Pseudomonas*); and a suite of heavy metals (arsenic, cadmium, lead) and perfluorooctane sulfonic acid (PFOS). Each of the target chemicals is potentially airborne and contained in the EPA Candidate Contaminant-3 (EPA CCL-3) list. The final dataset will be incorporated into risk assessment models to identify safe (from a human health perspective) usage for harvested rainwater, and will assess the potential for in-line carbon filters to remove biological and chemical contaminants and reduce risk.