Session 3b/4b: Emerging Contaminants
February 11, 2009

Assessment of exposure of fish to emerging contaminants in the Eagle Creek Watershed

David C. Bencic[1] US EPA-ORD Cincinnati

Al Alwan[2], John Dorkin[2], Adam D. Biales[1], Robert W. Flick[1], Angela Batt[1], Lenore Tedesco[3], and James M. Lazorchak[1]
[1]USEPA/ORD/NERL/EERD/MIRB, Cincinnati, OH 45268, [2]USEPA/Region 5/Water Division/Water Quality Branch, Chicago, IL 60604-3590, [3]Department of Earth Sciences/
Center for Earth and Environmental Science, Indiana/Purdue University at Indianapolis, Indianapolis, IN 46202

The Eagle Creek Watershed (ECW) encompasses 162 square miles in central Indiana upstream of the Eagle Creek Reservoir, a public drinking water source for the city of Indianapolis. The dominant land-cover is agriculture, although some portions are undergoing urbanization, with three major wastewater treatment plants (WWTPs) and numerous chemical plants and animal feedlot operations in the watershed. Water quality monitoring data collected over the last 20 years indicate that both the reservoir and much of the watershed have not met their designated use criteria. Local organizations such as the Eagle Creek Watershed Alliance have made significant advances in identifying and implementing solutions to problems within the watershed. However, despite the extensive chemical sampling, the problems that have been identified to date do not fully explain the fair to poor fish and benthic community assessments. Therefore, it was hypothesized that previously undetected/undetermined emerging contaminants from point and/or nonpoint sources may be significant contributors to the poor water quality and reduced fish and benthic community assessments of the watershed. The objective of this research was to use biological (molecular indicators) and chemical (analytical chemistry) endpoints to assess the extent of emerging contaminants in ECW and determine the potential exposure to aquatic life. Adult male fathead minnows (*Pimephales promelas*; FHMs) were deployed for 7 days in small submerged cages at five sites (n=8 FHMs at each site) within ECW. Two consecutive, but independent week-long deployments occurred during high water-flow (May/June 2008) and again at the same sites during low water-flow (September 2008). Liver, brain, and testis tissues were collected from each fish following deployment, as well as from 8 time zero control fish. Site- and seasonal-specific responses to biologically-available environmental estrogens were identified using a quantitative, real-time PCR (QPCR) assay for vitellogenin (vtg) gene expression. Unique liver protein profiles were identified in FHMs from selected sites examined from the spring deployment using two-dimensional polyacrylamide gel electrophoresis (2-D PAGE). For chemical analysis, one liter water samples were collected at each site before and after each deployment and examined for the presence of 54 prioritized human and veterinary pharmaceuticals, with up to half of the tested pharmaceuticals present at selected sites. By identifying previously unknown stressors, these molecular and chemical data promise to aid in targeting source reduction efforts and improving biological diversity.

Notes: