

## **Diversion of Flow Augmentation to Reduce Mercury Input to East Fork Poplar Creek at the Y-12 National Security Complex**



East Fork Poplar Creek at the Y-12 National Security Complex after flow diversion

### ***Challenges***

East Fork Poplar Creek (EFPC) in Oak Ridge, TN has been posted with a fish consumption advisory as a result of contamination arising from historical losses of mercury at the DOE's Y-12 National Security Complex (NSC). Remedial actions at Y-12 have reduced mercury inputs to the creek by more than 90%, but streamwater and fish remain contaminated. In a negotiated agreement with the Tennessee Department of Environmental and Conservation, a flow augmentation system was emplaced in upper East Fork Poplar Creek in 1996 to maintain stream water levels typical of the late 1980's and improve ecological conditions in the stream. Increased mobilization of mercury from localized streambed contamination was an unintended consequence of that action. The challenge at this site is to reduce or eliminate mercury inputs associated with flow augmentation while retaining its ecological benefits.

### ***Solutions***

A Technical Working Group convened at Oak Ridge National Laboratory in January 2008 recommended several innovative approaches for reducing mercury contamination in fish in EFPC. One of those recommendations was to eliminate or reduce flow augmentation in the reach of stream where subsurface deposits of metallic mercury were present. The underlying hypothesis was that penetration of surface water into the

contaminated streambed was proportional to flow, and flow reduction would generate a commensurate decrease in mercury added to the stream across that reach. Staff of the ORNL Environmental Sciences Division initiated efforts in June 2008 to field test the reduction and diversion of flow augmentation and to evaluate the impact on mercury levels in EFPC surface water with assistance from the Y-12 NSC Department of Environmental Compliance.

### ***Technical Accomplishments***

In July and August 2008, 50% of the flow augmentation water entering the uppermost section of EFPC was diverted to a site 2.5 km downstream near the point where the minimum stream flow requirement was stipulated. Total waterborne mercury concentrations were measured daily at six locations along the length of EFPC for two weeks prior to the diversion, during the two week diversion, and for two weeks after flow was restored to its prior configuration. Preliminary results of the short-term test were promising. Mercury flux to the surface flow within the source reach was estimated at 1.1 gram per day prior to diversion and 0.5 gram per day when flow was reduced. Heavy rainfall and development of a large leak in the flow diversion system during the experiment period made comparisons problematic in quantitative terms, nevertheless, reduction in mercury flux from the stream bed source is clearly measurable in the field test. Additional chemical and hydraulic data are being analyzed to provide more concrete interpretation of the changes in mercury fluxes observed in the field pilot study.

### ***Potential Impacts***

Mean daily export of mercury from the Y-12 site via EFPC was ~8 gram per day over the past five years. Recent actions to further reduce mercury inputs have proved to be expensive to build and operate. The most recent action, a multi-million dollar project to treat a contaminated spring water source that added 2–4 gram per day of mercury, was completed in 2005. Diversion of 50% or more of the flow augmentation input to the downstream addition point has the potential to eliminate up to 20% of the remaining mercury input to EFPC from the Y-12 site at essentially no cost. Future demonstration that the observed reduction in mercury flux persists over the long term is needed, but successful implementation of the actions tested in this project has the potential to move EFPC closer to achieving compliance with its designated uses under the Clean Water Act: recreation and the propagation of fish and wildlife.