

Selenium Dynamics in Mining-Influenced Headwater Streams of Central Appalachia¹

K.M. Whitmore*, S.H. Schoenholtz, C.E. Zipper, D.J. Soucek²

Surface coal-mining is a source of selenium (Se) contamination in streams of the Appalachian coalfields. Selenium dynamics in aquatic systems are complex and largely controlled by site-specific factors, but have been understudied in Appalachian headwater streams. In this study, we evaluated the degree and dynamics of Se enrichment and bioaccumulation in headwater streams influenced by coal-mining. Based on Se concentrations in macroinvertebrates collected from 23 headwater streams, nine sites were selected for further study: three reference streams with no history of coal-mining, and six streams influenced by coal mining. Mining-influenced streams were further separated into “high-Se” and “low-Se” streams based on macroinvertebrate tissue Se concentrations. Water-column, sediment, biofilm, leaf detritus, and prey and predator macroinvertebrates were collected and analyzed for Se concentration during two sample periods, Sept. - Oct. 2015 and Feb.-March 2016. Selenium concentrations in all media were found to be elevated in mining-influenced over reference streams and in high-Se over low-Se streams. Selenium dynamics, enrichment in particulate media (sediment, biofilm and leaf detritus) and trophic transfer of Se to prey from particulate media and to predators from prey, did not exhibit major differences among streams of differing Se levels. Water column Se concentrations were predicative of Se concentrations in macroinvertebrate tissues. Findings from this study indicate headwater streams influenced by coal-mining play a significant role in the introduction of elevated Se concentrations into the aquatic food-chain.

Additional Key Words: macroinvertebrates, trace element, enrichment, bioaccumulation

¹ Abstract submitted to 2017 Joint Conference of the WV Mine Drainage Task Force, American Society for Mining and Reclamation (ASMR), and the Appalachian Regional Reforestation Initiative (ARRI). April 9-13. Morgantown WV.

² Kriddie M Whitmore, Graduate Student, Department of Forest Resources and Environmental Conservation; Stephen H. Schoenholtz, Director, Virginia Water Resources Research Center; and Carl E. Zipper, Professor, Department of Crop and Soil Environmental Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, and David J. Soucek, Ecotoxicologist, Illinois Natural History Survey, Champaign, IL 61820.