Addressing Groundwater/Surface Water Interactions at Contaminated Sediment Sites: Getting Risk Reduction Right

Frank S. Dillon (Frank.Dillon@jacobs.com) (Jacobs, Detroit, MI, USA)
Dan Lavoie (Jacobs, Washington DC, USA)
Jeffrey Johnson (Jacobs, Denver, CO, USA)
Steven S. Brown (The Dow Chemical Company, Midland, MI, USA)
Allen Burton (University of Michigan, Ann Arbor, MI, USA)

Background/Objectives. Regulatory attention on assessing environmental impacts from the discharge of contaminated groundwater to a surface water body has increased significantly in recent years, particularly as the scientific community has determined that adverse ecological effects tend to be associated with contaminant concentrations in sediment porewater rather than those in bulk sediment. Even if contaminant concentrations in the receiving surface water body itself are below levels of concern, the potential impacts to biota living in and near the sediment in the groundwater–surface water transition zone are increasingly the target of investigation. This groundwater-to-surface water interface (GSI) pathway complicates the management of contaminated sediment sites and sites where contaminated groundwater may intersect with an adjacent water body. There are both regulatory and practical/methodological challenges in addressing this pathway. Assessing the ecologically relevant exposure environment is a particular challenge. The presentation will utilize two case studies to illustrate practical solutions for some of these challenges.

Approach/Activities. Historical investigations at two industrial facilities in the Eastern United States identified elevated contamination in site groundwater venting to adjacent water bodies. In one case, site-related groundwater data were evaluated to determine whether volatile organic compounds (VOCs) associated with a groundwater plume may be venting to an adjacent river where ecological receptors might be exposed at the GSI. Multiple porewater investigations were conducted to identify and map VOC venting zones and determine if VOC concentrations in sediment porewater posed unacceptable ecological risks to aquatic biota. The second case was associated with a facility that produced and stored salt and operated wastewater settling ponds located adjacent to a river and lake. Elevated concentrations of chloride and TDS were observed in groundwater immediately adjacent to the settling ponds, and investigations were conducted to define the horizontal and vertical extent of venting groundwater, determine any interaction between the groundwater and adjacent waterbodies, and measure contaminant concentrations in groundwater and porewater. Fine-scale vertical profiling techniques were tested and deployed in areas between the settling ponds and the waterways in order to measure porewater contaminant concentrations and assess potential ecological risks at the GSI.

Results/Lessons Learned. For the first case, the porewater data were used to evaluate potential ecological risks to the benthic macroinvertebrate community, inform onshore site characterization activities, and support risk management decisions. The results supported a monitored natural recovery decision for sediment coupled with an upland source control component. For the second case, the fine-scale porewater data were used to identify areas where the benthic community may be at risk from venting groundwater. Subsequent ecological studies were completed to determine if the venting groundwater posed an actual risk to the benthic community. The data were then used as a line of evidence in conjunction with the exposure data to identify areas of likely impact from venting groundwater and to focus remedial actions in order to achieve risk reduction.