

MNR at Onondaga Lake: Good Things Come to Those Who Wait

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Background/Objectives. Monitored natural recovery (MNR) is a significant component of the remedy to address mercury in the profundal zone sediments (area with water depths greater than 9 meters) of Onondaga Lake, in central New York State. Reductions of sources internal and external to the lake, resulting in sedimentation and burial by cleaner sediments, is the primary process resulting in natural recovery in the profundal zone. Site-specific numerical modeling supported by several types of ongoing monitoring data was used during the design phase of this project to understand the likely future effectiveness of MNR. The remedy was predicted to successfully meet the sediment performance criteria of 2.2 milligrams per kilogram (mg/kg) prior to the end of the prescribed MNR period, which is the 10 years following the remediation of upland sources and the littoral zone (the year 2027). Natural recovery monitoring was initiated prior to remediation of the lake bottom and continued throughout the 5-year remediation period. The first year of post-construction monitoring was conducted in 2017. This presentation will summarize the data-based and modeling lines of evidence used to evaluate the MNR remedy and report on the monitoring results.

Approach/Activities. Onondaga Lake post-construction monitoring began in 2017, 1 year after the completion of the dredging and capping in the littoral zone areas of the lake. Monitoring to evaluate the progression of natural recovery and understand the processes that control its rate included collection of sediment cores and analysis for mercury; deployment of sediment traps and measurement of gross deposition flux and concentrations of mercury on depositing sediment; collection of frozen cores for visual observations of mixing; and monitoring of fluorescent microbead markers that marked the mudline elevation to quantify the thickness of material deposited since 2010.

Results/Lessons Learned. Monitoring indicates that natural recovery is progressing faster than model projections. Pre-remediation mercury concentrations in the top 4 centimeters of sediment ranged from 0.8 to 4.5 mg/kg. Modeling predicted that these concentrations would decrease to levels ranging from 0.5 to 0.6 mg/kg at the end of the 10-year MNR period. However, they were measured to be 0.4 to 1.4 mg/kg 1 year following construction. Data collected to assess the mechanisms controlling natural recovery rate (i.e., mixing and burial) were evaluated and compared to assumptions used in the design phase modeling. Visual inspection of frozen cores continues to indicate that mixing of sediment in most areas of the profundal zone is taking place in the top few centimeters only. Mixing is occurring to depths that are less than assumed in the modeling. Sediment trap data indicated sedimentation rates were higher than assumed in the model and the mercury concentrations measured in the material collected in the traps were lower than assumed to occur post-construction in the modeling as well. Cores collected from microbead marker plots in 2017 show the fluorescent microbead marker is clearly visible, consistently at a depth below top of sediment, and is within the range of prior estimates of net sedimentation rates. Thus, the reason that surficial mercury concentrations measured in 2017 were found to be much lower than predicted by the modeling appears to be the use of conservative assumptions in the natural recovery modeling. These results are consistent with natural recovery trends at numerous other sites, where modeling projections of MNR underestimated the actual rate of natural recovery, often by a substantial margin.