Porewater Arsenic Investigations Summary

TVA and Duke University researchers sampled porewater from ash and sediment at various locations associated with the Kingston ash release on several occasions from 2009 through 2011. Sampling and handling methods varied depending on the objectives of the different investigations. This document very briefly summarizes the methods and results.

Locations and sampling methods

A. Ash Storage Cell Saturation Zone

TVA used a truck-mounted Geoprobe™ to sample in situ porewater in the top meter of saturated ash in the relic ash cell (the portion that did not fail) and nearby locations. After inserting a probe and screen, a peristaltic pump and inert tubing was used to sample the interstitial groundwater, which was filtered through a 0.45-micron filter and considered to be a sample of the porewater in saturated 100% ash.

B. River Sediments Open to Atmosphere

Box Corer Samples – Homogenization Open to the Atmosphere

Duke University researchers used a box corer device to collect sediments from sediment depths up to 20 centimeters at various locations in the Emory and Clinch Rivers (Ruhl et al. 2010). Samples were lifted to the surface, manually mixed in clean polymer tubs, and the homogenized sediments were vacuum-filtered through 0.45-micron filters while still at each sampling location to obtain porewater samples.

TVA collected co-located samples in each location sampled by Duke University following the same collection and extraction methods. Results for both sets of samples are presented in the figure at the end of this summary.

VibeCore™ Samples - Homogenization Open to the Atmosphere

Duke University researchers also used a lined VibeCore™ sampler to collect a 109 cm core at ERM 2.0. That sample was divided into two equal-length segments which were homogenized and filtered in a similar manner as the box corer samples described above.

C. River Sediment - Capped Four-Inch Cores Maintained in an Inert Atmosphere

TVA researchers used a technique to collect sediment samples and extract porewater in an inert atmosphere more representative of conditions at the bottom of the reservoir which also protected the sediments from atmospheric oxidation during handling. A sediment sample with overlying water was collected using a box corer. Immediately following collection, 1.5-inch diameter by 4-inch long acrylic sample tubes with vented caps were pressed vertically into the intact sediments in the box corer, allowing the overlying water to escape through the cap until the tube was inserted to the top of the sediment. After all tubes were inserted, the vent hole was temporarily sealed using a gloved finger as each tube was slowly pulled from the box corer. The bottom of each tube was quickly capped and the vented cap at the top was sealed with electrical tape. This extraction minimized sediment exposure to the atmosphere, and resulted in undisturbed sediment core samples with minimal overlying water. The sealed samples were stored upright on wet ice, with porewater extraction by centrifugation under an inert atmosphere within 24 hours at a contract laboratory.

Results

Arsenic concentrations ranged from 339 to 915 µg/L in the upper meter of saturated 100% ash from the relic cell and nearby areas. Porewater arsenic concentrations from box corer samples were roughly
proportional to percent ash starting at 40 percent ash (see figure below—the $r^2$ value of 0.52 shown on the figure is only for box core samples with >40 % ash). One TVA box corer sample collected at ERM 4.0 yielded arsenic at higher concentrations than was observed in the top meter of water in the relic cell. The two Duke University VibeCore™ samples at ERM 2.0 also yielded higher values of arsenic.

This preliminary evaluation of porewater results is undergoing additional analysis. It is expected to be published in a more complete form later, along with results for other analytes.