

Kingston Ash Recovery Project Workplan
Ash Migration Investigation Using Sub-bottom Profiler

Background

Downstream movement of ash from the KIF ash release into the river has been a primary concern since the day of the release. Several actions were taken in the first month following the spill to reduce the potential for ash movement. Potential redistribution of ash downstream by high flows has been a driving force in expediting dredging to remove the ash from the river. A high-flow event occurred May 4 that moved a significant amount of ash; subsequent efforts to characterize the amount and extent of ash movement have been only partially successful. TVA has purchased a sub-bottom profiler that will provide more timely and more accurate information on the depth and extent of ash deposits in this river system.

Objectives

The objectives of this investigation are to:

1. Identify the current areal extent of ash migration.
2. Characterize the depth of ash throughout the ash deposition area.
3. Develop easily understandable maps depicting both the areal extent of ash and the depths of ash within that range.

Approach

Objective 1 will be addressed during the last week of July and the first week of August, 2009 (Phase 1).

A field crew trained in use of the sub-bottom profiler will collect digital profiles of ash depths in the following river reaches:

1. Clinch River 5.0 and upstream until no ash deposits are observed.
2. Emory River 4.0 and upstream until no ash deposits are observed.
3. Tennessee River 568.0 and upstream until no ash deposits are observed.
4. Tennessee River 563.5 and downstream until no ash deposits are observed.

The general approach will be that the field crew will go to these areas and use the sub-bottom profiler to acquire data on transects, working their way upstream in the first three areas and downstream in the last area to identify where the end of the ash "drape" over the native sediment occurs. To supplement the bottom profile images and assist their interpretation of those images, periodically the crew will collect bottom samples using either a box corer or gravity corer.

The material collected in the corer will be examined visually to identify the presence of ash, recording the depth of ash at each location and correlating it with the sub-bottom profile image for that location. If there are questions whether the material collected is actually ash, a composite sample through depth representative of the suspect ash layer will be collected for laboratory analysis for selected metals characteristic of fly ash and possible polarized light microscopy. The composite will be composed of enough aliquots to allow for analysis.

Results of the combination of digital sub-bottom profiling and visual confirmation of ash depth will be used to create, by August 21, a 2-D map of the extent of ash present on the bottom of the river system. In addition to identifying the boundaries of the ash deposits, this map will identify specific locations where box corer samples have been collected within the last month to measure ash depths and will present that information for each location. This map will be updated with the data described below in Phase 2 to present ash depth information as isopleths or as areas color-coded for observed ash depths.

Objective 2 will be accomplished between August 7 and August 31, 2009. (Phase 2)

The field crew will collect digital sub-bottom profile cross-section data at 100-meter intervals along the thalweg of each river. The crews may adjust the spacing if necessary to obtain sufficient data in the allotted time to develop higher-resolution maps of ash depth. If time permits and there appears to be a need for more detailed information, the spacing between transects may be reduced to 50-meters. If it appears that collecting data at 100-meter intervals for the whole system will require more than the allotted time, the field crew will increase the spacing to 200-meters or more, then return later and fill in the gaps.

Bottom samples also will be collected as deemed necessary by the field crews to confirm ash depths and correlate with digital imagery using either a box corer or gravity corer. Cores will be photographed and documented in accordance with SOP.

Objective 3 will be accomplished partly during Phase 1 and partly following Phase 2 sampling.

Two-dimensional maps will be prepared by October 2, with evaluation of 3-D surface maps occurring during the same time.

If it appears that 3-D maps will provide additional value and that they can be produced from the data with a relatively small increase in effort, those maps will be developed by October 15.

Additional investigations

Depending on the results of this investigation and the type of high-flow events that occur between September, 2009 and March 2010, one or more portions of this investigation may be repeated to assess additional ash movement resulting from future high-flow events. Criteria for determining whether to repeat all or parts of this investigation will be developed cooperatively by TVA and ASU staffs in cooperation with EPA.

Collaboration

A cooperative agreement will be executed with Appalachian State University (ASU) to obtain support from staff associated with a concurrent research investigation funded by the National Science Foundation (NSF). ASU staff and ASU-contracted staff will provide professional consultation on field interpretation of digital sub-bottom profile imagery, and will collaborate with TVA staff in post-processing the data and generating the maps described above.

In addition, the Principal Investigator (PI) on the NSF research from Appalachian State University will provide consultation on interpretation of results to better characterize ash movement, and to evaluate the results of separately-funded modeling of Total Suspended Solids transport by high-flow events. He also will utilize the data collected to augment the NSF-funded research, and will develop and submit for publication in peer-reviewed journals appropriate scientific papers describing the results of these and the NSF investigations. For more detail on the role of the PI, please see the NSF grant proposal.