Tennessee Valley Authority welcomes you to the

Environmental Investigation Plan Kingston Fossil Plant

COMMUNITY INFORMATION SESSION





EVENT GUIDE

This event is to provide information about the Environmental Investigation Plan (EIP) for the Kingston Fossil Plant. We welcome your feedback and comments on the EIP.

The following acronyms appear frequently on the boards:

- Environmental Investigation Plan (EIP)
- Environmental Assessment Report (EAR)
- Coal Combustion Residuals (CCR)
- Tennessee Valley Authority (TVA)
- Tennessee Department of Environment and Conservation (TDEC)
- Sampling and Analysis Plan (SAP)
- Environmental Protection Agency (EPA)
- Long Term Monitoring Sampling and Analysis Plan (LTM SAP)
- Kingston Recovery Project (KRP)

The information boards are color-coded according to the technical focus area they cover in the EIP. For instance, if they contain general information regarding the EIP process, the information board will be color-coded in blue.

General Information

Below are the main areas of technical focus in the EIP, divided by study area. More information on the activities within each area is available at stations around the room.

The evaluation of existing site data serves as the foundation to support the additional studies planned for each focus area.

Geotechnical	Civil/Mapping Activities	Hydrogeologic	Environmental
 Exploratory Drilling 	 Coal Combustion Residuals Material Quantity 	 Hydrogeologic Investigation 	 Benthic Investigation
 Slope Stability 		 Groundwater Investigation 	 Surface Stream Investigation





KINGSTON FOSSIL PLANT



Facility Overview

- **1951** Kingston Fossil Plant construction began
- **1955** Kingston Fossil Plant construction



completed

9 Coal-fired units (largest coal-burning power plant in the world for over 10 years)

10 billion kilowatt-hours generated annually, enough to power **700,000** homes

14,000 tons of coal burned daily

2008 coal ash spill released5.4 million cubic yards of ash

2015 Ash Recovery Project completed and Ash Landfill capped and closed



TDEC Order CCR Units:

- Interim Ash Staging Area (Closed),
- Sluice Trench and Ballfield East of Sluice Trench (Closure in progress),
- Stilling Pond (Closed)



COAL COMBUSTION RESIDUALS COMPLIANCE ORDER

What is the TDEC Order and why was it put in place?

On August 6, 2015, the Tennessee Department of Environment and Conservation (TDEC) issued Commissioner's Order No. OGC15-0177 to the Tennessee Valley Authority (TVA) for Coal Combustion Residuals (CCR) Compliance pursuant to the provisions of Tennessee's solid waste management and disposal laws.

This order establishes a transparent, comprehensive process to investigate, assess, and remedy any unacceptable risks resulting from the management and disposal of CCR at TVA coal-fired power plants.

What is the EIP?

What it is and why we do it

TDEC has requested certain information about Kingston's CCR management.

What TVA has already done

TVA has ongoing programs and monitoring that can help answer TDEC's questions.

Proposed EIP Activities

The Environmental Investigation Plan (EIP) lays out the proposed investigation TVA will conduct to provide additional information that TDEC has requested.

Did you know...

The plant includes low-sulfur coal in the fuel blend to limit emissions of sulfur dioxide. Other emission-reducing features include selective catalytic reduction systems, which reduce nitrogen oxide emissions by 90%, and two scrubbers, which reduce sulfur dioxide emissions by 95%.



What are coal combustion residuals?

Coal combustion residuals, commonly known as coal ash, are created when power plants burn coal to produce electricity.

These residuals include fly ash, bottom ash, and gypsum, and are collected separately from different areas of the facility.

Fly ash originates from the flue gas electrostatic precipitators, bottom ash from the boilers, and gypsum from the sulfur dioxide scrubbers. Bottom Ash



Gypsum

Fly Ash



BENEFICIAL USE OF GYPSUM AND FLY ASH

Gypsum

Synthetic gypsum **conserves** natural resources by replacing natural mined gypsum.

> Since 2013 more than **188,000 tons** have been **beneficially used** by a ready mix concrete producer in the Knoxville area.

> > In 2019 the **remaining** gypsum will be utilized for wallboard use.

CEMEX Knoxville runs a cement plant near the site that utilizes **Kingston's high quality gypsum** in its ready mix concrete process.

TVA began marketing **Kingston gypsum** to the Georgia Pacific wallboard plant in **August 2018**. The gypsum is a secondary source for the facility that is located adjacent to TVA's **Cumberland Fossil Plant**.

Fly Ash

Fly ash is used in **roads**, **bridges**, **buildings**, airport runways, **dams**, **precast concrete products** and driveways.

More than **75 concrete plants** in Tennessee, Kentucky, Virginia, Georgia, and

Concrete with fly ash is **stronger**, **more durable**, lower cost and **environmentally friendly**.

+100,000 tons of ash were utilized

in 2017.

+234,000 tons of ash have been utilized since 2015.

This ash was utilized in +1.3 million cubic yards of concrete in 2017.

In concrete, every ton of fly ash that replaces Portland cement **reduces** carbon emissions by **1 ton**.

Riverwalk

building

North Carolina use Kingston Class F fly ash.

Kingston Fossil Plant Class F fly ash is **Department of Transportation (DOT) Certified** in Tennessee, Virginia, North Carolina and Georgia. Kingston fly ash was used in **all the concrete** for the...

parking garage in Knoxville









TVA'S ADVANCED TECHNOLOGY FOR IMPOUNDMENT MONITORING CENTER



Automated Instrumentation

TVA's Advanced Technology for Impoundment Monitoring (ATIM) Center

\$2 million

to develop the ATIM center



helps to **identify** and **respond** to any coal ash issues before they become an emergency

More than **11,000** real-time sensors to

monitor ash impoundments send data (24/7/365) to a centralized computer monitoring system

Only facility of its kind in the utility industry in the U.S.

LED wall displays Geographic Information System (GIS) maps, weather, earthquakes, sensor data



ATIM Center

Operations has **real-time data** or can watch what's happening at TVA impoundments via **live video**

System sends **alerts** on any irregularities



ENVIRONMENTAL INVESTIGATION PLAN



ACTIVITIES MATRIX

FOCUS AREA	EXISTING INFORMATION	PROPOSED EIP ACTIVITIES
Exploratory Drilling	 Performed as required for specific projects Over 275 existing borings and over 70 water level instruments 	 Geotechnical drilling and soil sampling Install water level instruments Laboratory Testing
Slope Stability	 Routine visual monitoring and instrumentation monitoring Existing analyses (available for some units) meet industry standards Existing drilling and laboratory data support new analyses 	 Compare existing models to new data If needed, update models and reanalyze New analyses (for some units) for normal and earthquake conditions Compare slope stability results to acceptance criteria
Coal Combustion Residuals (CCR) Material Quantity	 As built/record drawings Aerial surveys performed for specific projects Drilled borings history beginning in 1951 	 Review existing surveys, drawing, and borings Develop three-dimensional models of CCR units Update three-dimensional models with new boring data and water levels Confirm CCR volumes
Hydrogeologic Investigation	 Monitoring well network in place for State permitting requirements and program commitments 	Install 1 background wellsInstall 4 downgradient wellsReport on analytical assessment
Groundwater Investigation	 Groundwater monitoring has been ongoing since 1976 	Bimonthly groundwater sampling for 1 year (6 events)
Water Use Survey	Existing TDEC water well database	 Review existing water supply information and compare to addresses listed for these water sources Perform a door-to-door water use survey Record water use data and GPS locations of identified water sources Conduct one round of sampling and compare to United States Environmental Protection Agency drinking water standards Test for CCR constituents and geochemical parameters

		Report on analytical assessment
Background Soil Investigation	 Background surficial soil samples collected at various shoreline points of Emory and Clinch Rivers 	 Test additional background sampling locations for CCR constituents Review existing data for comparative analysis Report on analytical assessment



ACTIVITIES MATRIX

FOCUS AREA	EXISTING INFORMATION	PROPOSED EIP ACTIVITIES	
Benthic Investigation	 Extensive sampling of remaining ash deposits, submerged sediment, seasonally-exposed sediment, and benthic invertebrates, 2008 to 2017 	 Evaluate and report existing information 	
(sediment, benthic macroinvertebrate and mayfly sampling)	 Baseline Ecological Risk Assessment, 2012 		
	 Long Term Monitoring Sampling and Analysis Plan (LTM SAP) (includes evaluations of sediment quality, benthic invertebrate community composition, and benthic invertebrate bioaccumulation). Biennial and Annual sampling completed from 2013 up to 2017. 		
Surface Stream Investigation	 3,916 surface water samples collected from the Emory, Clinch, and Tennessee Rivers between December 2008 and January 2013 Samples collected on the Emory and Clinch Rivers in response to 24-hour cumulative local rainfalls and/or instantaneous Emory River flows 	 Evaluate and report existing information 	
Fish Investigation	 Spring Sports Fish Surveys completed annually or biennially from 2002 to 2017 Fish community surveys completed biennially from 2001 to 2007 Sampling conducted annually after coal ash release, and additional location added at the area of release and subsequent dredging Sampling reduced again to biennially as part of the LTM SAP in 2013 Fish reproduction studies performed by Oak Ridge National Laboratory (ORNL), 2009 to 2017 Fish bioaccumulation studies performed by ORNL since the coal ash release Fish health studies have been performed by ORNL, since 2009 	Evaluate and report existing information	
Seepage Investigation	 Seep inspections conducted in accordance with Seep Action Plan: Quarterly for potential seepage areas Monthly for active seepage areas until remediated Annual seep inspection report submitted to TDEC 	 Conduct seepage investigation to identify active seeps Collect soil and water samples at identified seeps Analyze samples for CCR constituents Comparative analysis against background soils Report on analytical assessment 	

CCR Material Characteristics

- TVA collected 762 samples that generated 936 analytical results between December 2008 and January 2013
- Ash sample collection and analysis for ash shipments to landfill (began in 2009)
- Leachability report "Kingston Ash Recovery Project Non-Time Critical Removal Action Embayment/Dredge Cell Action Memorandum." EPA-AO-024. (May 2010)
- Comprehensive studies were conducted in 1995, 2002, and 2013 to characterize the CCR ash
- Ash and pore water sample collection and analysis from Stilling Pond (November 2017)

- Collect CCR material samples from borings in units
- Collect pore water samples from temporary wells in units
- Analyze samples for CCR constituents
- Comparative analysis against exiting data
- Report on analytical assessment



2008 COAL ASH RELEASE AND ASH RECOVERY PROJECT (1 OF 2)

1955

Kingston Fossil Plant starts providing power to Tennessee Valley communities



monitoring begins

December 2008

Coal ash release

December



Bioaccumulation

Sampling

Begin time-critical removal actions and habitat restoration

TVA, TDEC, and EPA begin comprehensive sampling of on-site and off-site ash deposits, river water and sediments, biota (fish, benthic invertebrates, birds, turtles, snails, and raccoons), and groundwater.

Between December 2008 and January 2013 more than 12,000 samples were collected, with more than 400,000 analytical results reported.

May

2009



December 2010

2009

TVA's board of directors passes a resolution to phase out wet storage coal byproduct facilities and convert them to dry storage facilities-for all of its 11 coal-fired plants-at a cost of \$1.5 to \$2 billion

ORNL begins Fish Health and Reproduction Studies and Benthic Invertebrate Bioaccumulation Studies

August 2010

Independent medical screening by Oak Ridge Associated Universities concludes that there were no adverse health impacts caused by the coal ash spill. The study concluded that the pre-existing fish consumption advisories should remain in effect.

Time-critical actions and restoration complete

2011 Consistent downward trend noted in concentrations of ash-related constituents in

May

since October 2010

surface water samples from

Emory and Clinch Rivers



2008 COAL ASH RELEASE AND ASH RECOVERY PROJECT (2 OF 2)

2013

Implement Long Term Monitoring Sampling and Analysis Plan (SAP), Includes continuation of previously implemented monitoring:

- Sediment quality
- Fish and benthic invertebrate communities
- Fish and benthic invertebrate bioaccumulation
- Fish health and reproduction
- Sport Fish Surveys
- Tree swallow bioaccumulation and reproduction





2015

Ash Recovery Project completed and Ash Landfill capped and closed

TVA completed ecological restoration efforts beyond cleanup requirements. This included reforestation, restoration of the shoreline and wetland habitat, and reclamation of other disturbed areas. About 15 acres have been reforested, using over 40 types of trees.



Complete a comprehensive risk assessment for coal ash related impacts on human health and 20 local species of flora and fauna





32-acre Lakeshore Community Park

opens



More than \$10 million invested in recreational and ecological enhancements in the Swan Pond area, including providing property for the purpose of a Roane County sports complex, Roane County's new Emergency Response Center, and a volunteer fire station for the Swan Pond community

With \$43 million in TVA funding, the Roane County Economic Development Foundation built new public schools and a wastewater treatment plant for the City of Kingston, and rehabilitated the historic Princess Theatre in Harriman.

TVA receives Environmental Protection Agency Region 4's Excellence in Site Reuse Award



\$750 million has been spent in the effort to phase out wet storage coal byproduct facilities and convert them to dry storage facilities (resolution established in 2009)







Annual monitoring of the river system will continue for up to 30 years to confirm that risks associated with the residual ash remain low and that ash-related concentrations of metals decline with time.

Groundwater monitoring and maintenance of the Ash Landfill will also be conducted over the long term.









OGC15-0177 (Commissioner's Order) August 6, 2015

Order Has Two Purposes

- 1. Establish transparent and comprehensive process for the Investigation, assessment, and remediation of unacceptable risks, resulting from the management and disposal of coal combustion residuals (CCR) at the TVA's coal-fired power plants in Tennessee.
- 2. Coordination of Implementation of the federal CCR rule to insure compliance with Tennessee laws and regulations that govern the management and disposal of CCR.

TN Department of Environment & Conservation

Environmental Investigation Plan (EIP)

- The Order requires TVA to develop an EIP for each site that, when implemented, shall provide the information necessary to *"fully identify the extent of soil, surface water, and ground water contamination by CCR"*
- EIP development is an iterative process requiring review and input from TDEC



• TDEC approved EIP will be presented at the AIP and issued for public comment



Objectives of the EIP

- Define background conditions:
 - soil
 - surface water, sediment, and aquatic life
 - groundwater
 - pre-construction site conditions (topography, hydrology)
- Determine how each unit was constructed and modified during lifetime
- Develop a thorough understanding of the geology at the • site
- Define groundwater flow and chemistry at the site
- Delineate potential impacts to groundwater, soil, surface water, sediment, and aquatic life

Environment & Conservation

Objectives of the EIP

- Characterize CCR material
 - quantity
 - chemistry
 - physical characteristics (geotechnical)
 - saturation levels



Data generated will be used to develop a final Environmental Assessment Report (EAR) and ultimately, an appropriate selection of remedy for each site



Sampling and Analysis Plans (SAPs)

- TVA has worked with TDEC to develop and execute SAPs to develop new data where needed
- The SAPs provide detailed plans for conducting those studies to obtain new data and will describe how it will be used to respond to specific information requests
- The SAPs are structured as independent documents that guide the work of the SAP execution teams
- Included as Appendices to the EIP



TVA KIF SAPs

- Background Soil SAP
- Exploratory Drilling SAP
- Material Quantity SAP
- CCR Material Characteristics SAP
- Hydrogeological Investigation SAP
- Groundwater Investigation SAP
- Stability SAP
- Water Use Survey SAP
- Seep SAP



Additional Data Included in the EIP

- Appendix B Regulatory Correspondence
- Appendix E Exhibits
- Appendix K NPDES Outfall Data
- Appendix L Evaluation of Existing Geotechnical Data
- Appendix N Groundwater Monitoring
- Appendix O Well 22 Records
- Appendix Q Historic Seep Summary
- Appendix T Public Comments



EXPLORATORY DRILLING

(1 of 2)

What it is and why we do it

Exploratory drilling helps us better understand what is in and under each CCR unit.

It tells us:

- What is there: material types (CCR, soil, rock) and properties (strength, permeability, etc.)
- Where it is (material locations)
- Where the water levels are (material saturation)

What TVA has already done

The EIP includes an evaluation of existing

geotechnical data. This includes a review of design and construction records, inspection records, field data (including 275+ borings and 70+ water level instruments), laboratory data, and engineering analyses.

Each piece of information has been evaluated to confirm that it was properly collected and analyzed in the past. These existing data are very valuable in understanding CCR unit conditions.





The drilling inspector will prepare boring logs to describe the recovered samples.

Proposed EIP Activities

- Additional borings within the interior of the CCR units
- Install temporary wells in CCR material
- Laboratory testing
- Share data with the hydrogeological, environmental, and civil/mapping discipline teams



EXPLORATORY DRILLING

(2 of 2)

Where will the drilling be done?



Sluice Trench and Ballfield East of Sluice Trench

2 Borings with temporary wells

NOTE: This imagery does not show the current condition of the Stilling Pond. The Stilling Pond has been closed since the imagery was collected.

Legend



What are Water Level Instruments/Piezometers?

Sensors that measure water



pressures in CCR, soil, rock





Slotted S well screen to

Surface protection for top of well

PVC pipe with slots that allow water to enter at a selected depth in the boring



SLOPE STABILITY

(1 of 2)

What it is and why we do it

These analyses tell us if the slopes of the CCR units are stable. Multiple locations around each CCR unit are checked for stability.

Normal (long-term) conditions and earthquake conditions are evaluated.

What TVA has already done

Slope stability has been analyzed many times over the years, for various conditions and at multiple units.

The existing analyses were reviewed as part of the evaluation of existing geotechnical data.

Each analysis was reviewed for adequate documentation, appropriate methods, and representative conditions.

Example of existing slope stability analysis



Inputs: Surface and subsurface geometry/zones, engineering properties, water levels/pressures, external loads

Outputs: Factor of safety against sliding

Existing and proposed analyses satisfy **EIP** requirements

CCR Unit	Normal	Earthquake
Interim Ash Staging Area (Closed Condition)	NR	NR
Sluice Trench and Ballfield East of Sluice Trench (Closed Condition)	E/P	Ρ
Stilling Pond (Closed Condition)	Е	Е

E = Existing analysis P = Proposed analysis NR = Not Required

Proposed EIP Activities

O Compare existing models to new data from the Exploratory Drilling Sampling and Analysis Plan

- If models are representative, no changes
- If not, update models and reanalyze
- New analyses (for some units) for normal and earthquake conditions
- Compare slope stability results to acceptance criteria



SLOPE STABILITY

(2 of 2)

What it is and why we do it

Slope stability is influenced by water levels and pressures (among other factors).

Monitoring water levels also supports the hydrogeologic investigation and the CCR material quantity estimate (saturated vs. unsaturated material).

What TVA has already done

TVA has multiple types of water level instruments on site, as well as a number of monitoring wells, to track water levels in many areas. These instruments have been installed over many years, for various purposes. More than 15 water level instruments (including piezometers) are currently installed.

TVA has operated an Instrumentation Monitoring Program since 2012 that includes automated and manual readings of select piezometers. These monitoring instruments will send warnings to site personnel if water levels rise enough to start affecting slope stability.

Existing instrumentation



NOTE: This imagery does not show the current condition of the Stilling Pond. The Stilling Pond has been closed since the imagery was collected.

Legend



Water Level Instrumentation

- New instruments are added:
 - due to the Exploratory Drilling Sampling and Analysis Plan
 - due to the Hydrogeological Investigation
 Sampling and Analysis Plan (monitoring wells)

Data are routinely assessed and correlated to rainfall, river levels, etc.



CLOSURE AND CAP

What it is and why we do it

CCR Units are closed and capped with a liner system to promote surface runoff and reduce infiltration.

The following CCR units have been capped and closed:

Stilling Pond closure cap liner system



Making the Stilling Pond closure cap





Remove freestanding water

Site preparation

Place structural fill

Install flexible membrane liner over structural fill



Install geocomposite drainage layer over flexible membrane

Place clay cover soil and top soil

oil Place vegetation (sod)

Stilling Pond closed and capped



COAL COMBUSTION RESIDUALS MATERIAL QUANTITY

What it is and why we do it

Frequent surveys of the site track the location and quantity of coal combustion residuals (CCR).

This aids in overall site management and will inform other EIP activities.

What TVA has already done

- Pre-development Topographic Maps
- Aerial Surveys
- As-built /Record Drawings
- Drilled Borings

Even before construction began, the facility had been extensively mapped. These site topographic maps, aerial surveys, and construction updates are used for site management.

Site mapping was typically updated annually, as well as at any time significant changes were made to the layout of the site—whether that means a shift of operations from one area to another or an increase/decrease in the volumes of materials stored on site. These mapping updates were for both inventory management as well as site management, ensuring that the CCR units are used to their best potential.





Example of a 3-dimensional model developed and used to calculate volumes

Proposed EIP Activities

- Review existing surveys, drawings, and borings
- Develop 3-dimensional models of CCR units
- Incorporate data from new EIP soil and rock boring and monitoring wells into the model
- Confirm CCR volumes



HYDROGEOLOGIC INVESTIGATION

What it is and why we do it

Hydrogeologic investigations help us better understand how groundwater moves in a particular area, as well as its interaction with the surrounding soils and rocks.

These investigations consist of installing groundwater monitoring wells to collect information about groundwater.

Background (i.e., unaffected by the Kingston Plant) and downgradient wells are used to study water quality changes.

What TVA has already done

Several hydrogeologic investigations have been conducted at the Kingston Plant to monitor groundwater quality and flow direction to determine compliance with state regulations and program commitments.



Groundwater Monitoring Well



What is a groundwater monitoring well?

A well specially designed and installed to obtain representative groundwater quality samples and hydrogeologic information.

Proposed EIP Activities

• Additional monitoring wells will be installed to supplement current groundwater monitoring well networks to further investigate groundwater quality and flow direction:

- 1 background monitoring well
- 4 downgradient monitoring wells

• Report the analytical results in the Environmental Assessment Report (EAR)



GROUNDWATER INVESTIGATION

What it is and why we do it

Groundwater samples are collected frequently to test for a number of quality measures. By testing groundwater regularly, TVA can track compliance with regulatory permits and requirements.

What TVA has already done

Groundwater has been monitored at the Kingston site since 1986. Monitoring currently consists of state-permit compliance sampling at the KRP Ash Landfill and program commitments at the Interim Ash Staging Area.

Proposed groundwater wells



NOTE: This imagery does not show the current condition of the Stilling Pond. The Stilling Pond has been closed since the imagery was collected.

Legend



Proposed EIP Activities

• Bimonthly groundwater monitoring for 1 year (6 events)

• Sample 5 new wells

• Groundwater samples will be collected from background and downgradient locations

• Conduct an investigation to understand the movement of groundwater

• Investigate how the ash storage units affect groundwater movement and quality



WATER USE SURVEY

What it is and why we do it

A water use survey is a search for private water supplies (e.g., wells, springs) within a ½-mile radius of the Kingston Plant. It is used to evaluate the quality of groundwater used in these private wells.

What TVA has already done

A survey of this type has not been conducted in recent history. The purpose of the water use survey is to understand local groundwater quality and measure if CCR are influencing the local groundwater supply.

Facility 1/2-mile buffer



NOTE: This imagery does not show the current condition of the Stilling Pond. The Stilling Pond has been closed since the imagery was collected. Legend

TVA Property 1/2 Mile Buffer

Proposed EIP Activities

- Review existing information on private water wells and springs
- Perform a door-to-door water use survey
- Record water use data and GPS locations of identified water wells and springs
- Conduct sampling for CCR parameters and compare to United States Environmental Protection Agency drinking water standards
- Test water for potential impacts from CCR constituents
- Report the analytical results in the Environmental Assessment Report (EAR)



BACKGROUND SOIL INVESTIGATION

What it is and why we do it

The constituents found in CCR are also found in nature. This investigation would detect CCR constituent levels in background soils.

The level of naturally occurring constituents within the background soils can be compared to other soil samples to assess any impacts from the CCR constituents.

What TVA has already done

Background surficial soil samples were collected at various shoreline points of Emory and Clinch Rivers. These data will be reviewed for inclusion with the set of data gathered during implementation of the Investigation.

Proposed soil sampling locations



Legend

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- Existing Background Monitoring Well Location
- Proposed Groundwater Well Location
 Proposed Background Soil Sample Location
- CCR Unit Area (Approximate)
- Engineered Wetlands Area (Approximate)
- KIF Study Area Boundary

NOTE: This imagery does not show the current condition of the Stilling Pond. The Stilling Pond has been closed since the imagery was collected.

Proposed EIP Activities

• Identify a minimum of 12 sampling locations for representative background soils

- Use a drill rig to collect soil samples
- Collect background soil samples and submit to analytical laboratory for analysis of CCR constituent levels
- Report the analytical results in the Environmental Assessment Report (EAR)



HISTORIC BENTHIC INVESTIGATION-SEDIMENT AND BIOLOGICAL STUDIES

What it is and why we do it

The Emory and Clinch Rivers are evaluated to compare the health of aquatic wildlife upstream and downstream of the plant.

These evaluations have two parts:

- Testing snails and mayfly adults and nymphs to see if CCR constituents are in their tissues
- Counting the types and numbers of different benthic macroinvertebrates in rivers and streams adjacent to site

Sediment samples are taken from the river bottom to determine whether CCR material and/or constituents have migrated from the site to Emory, Clinch, and Tennessee Rivers.

What TVA has already done

- January 2009 to July 2012, extensive sampling of remaining ash deposits, submerged sediment, seasonally-exposed sediment, and benthic invertebrates
- August 2012 Baseline Ecological Risk Assessment evaluated potential ecological effects on biota from ash residuals in the river system
- 2013, Implemented Long Term Monitoring Sampling and Analysis Plan (LTM SAP), which includes evaluations of sediment quality, benthic invertebrate community composition, and benthic invertebrate bioaccumulation. Biennial and Annual sampling completed from 2013 up to 2017.

What are benthic macroinvertebrates?

Aquatic organisms that live in and on the sediment substrate.

Why do we study them?

They are an important part of the local food chain, and are good indicators of changes in the environment.



Examples of benthic macroinvertebrates



Nymphs are immature mayflies found in the sediment.

Ongoing Activities

 Continue to document the effectiveness of the approved remedial action (i.e., Monitored Natural Recovery (MNR) of the river system)

Proposed EIP Activities

- O Using existing sediment data, develop a map identifying the location of remaining CCR material on the streambed and the depth of the remaining CCR material on the streambed
- Evaluate and present existing benthic and sediment data in the Environmental Assessment Report (EAR)



HISTORIC BENTHIC INVESTIGATION-SEDIMENT AND BIOLOGICAL STUDIES

Where has the sampling been done?

Historic sediment and benthic invertebrate sample locations





Legend

KIF Study Area Boundary



KIF Study Area Boundary

Sampling Reach Location



Clinch River



Emory River



Intake Channel/Impoundment



Tennessee River





HISTORIC SURFACE STREAM INVESTIGATION

What it is and why we do it

Surface stream sampling is performed both upstream and downstream to determine if CCR materials and/or constituents are affecting adjacent water bodies.

What TVA has already done

From December 2008 through January 2013 TVA collected nearly 4,000 water samples from the Emory, Clinch, and Tennessee Rivers and the embayments adjacent to Kingston, with more than 202,000 analytical results reported. These included samples from throughout the year, with almost 200 samples collected during high river flows following storm events.

Historic surface water sample locations



Legend KIF Study Area Boundary Sampling Reach Location Emory River Clean Water Ditch Intake Channel/Imp Clinch River Tennessee River

Ongoing Activities

 Based on the numerous surface stream samples collected in the vicinity of the Kingston Fossil Plant since the coal ash spill and the lack of evidence of impacts from the release on surface streams, no additional

sampling is proposed.

Proposed EIP Activities

• Evaluate and present existing surface stream data in the Environmental Assessment Report (EAR)



FISH INVESTIGATION

What it is and why we do it

Fish are captured using electrofishing and gill netting, and tissue samples are taken.

They are used to test the levels of CCR constituents in fish.

What TVA has already done

- Spring Sports Fish Surveys were completed annually or biennially at the Kingston Plant from 2002 to 2017.
- Fish community surveys were completed biennially from 2001 to 2007 upstream and downstream of the Kingston Plant using TVA's Reservoir Fish Assemblage Index (RFAI) methodology.
- After the coal ash release, sampling was conducted annually, and an additional location was added at the area of the release and subsequent dredging. After 2013, the sampling was reduced again to biennially as part of the Long Term Monitoring Sampling and Analysis Plan (LTM SAP).
- Fish reproduction studies have been performed by the Oak Ridge National Laboratory (ORNL) in the vicinity of the Kingston Plant since the first breeding season (spring 2009) after the coal ash release to 2017.
- Fish bioaccumulation studies have been performed by ORNL at the Kingston Plant since the coal ash release.

Historic fish sampling locations



Legend

- Fish Reproduction Study
 Oak Ridge National Labortory. 2009-2010
- Evaluation of Fish Community TVA 2001-2010
- Spring Sport Fish Survey TVA 2002-2017
 - rvey
- Data Analysis and Temporal Trend Evaluations in Biota ARCADIS 2009-2015
- Data Analysis and Temporal Trend Evaluations in Biota ARCADIS 2009-2014
- KIF Study Area Boundary

Ongoing Activities

- Based on the numerous fish studies completed at the Kingston Plant since the coal ash release, the lack of evidence of
- Fish health studies have been performed by ORNL at the Kingston Plant since 2009.

impacts from the release on the fish, and ongoing fish studies being conducted by TVA and ORNL annually or biennially, additional fish sampling is not being proposed.

Proposed EIP Activities

• Evaluate and present existing fish sampling data in the Environmental Assessment Report (EAR)



SEEPAGE INVESTIGATION

What it is and why we do it

Dikes on the property are checked frequently to identify active seeps.

What TVA has already done

- Conduct seep inspections in accordance with Seep Action Plan:
 - Quarterly for potential seepage areas
 - Monthly for active seepage areas until remediated
- Annual seep inspection report submitted to TDEC

Historic seep locations



Legend



NOTE: This imagery does not show the current condition of the Stilling Pond. The Stilling Pond has been closed since the imagery was collected.

Proposed EIP Activities

- Conduct seepage investigation to identify active seeps
- Collect soil and water samples at identified seeps
- Analyze samples for CCR constituents
- Comparative analysis against background soils
- Report the analytical results in the Environmental Assessment Report (EAR)



COAL COMBUSTION RESIDUALS MATERIAL CHARACTERISTICS

What it is and why we do it

The different CCR materials on site are tested for levels and types of chemical constituents. This helps us understand whether they leach from (or leave) the ash and enter the water in the CCR units.

What TVA has already done

- Between December 2008 and January 2013 TVA collected 762 samples that generated 9,236 analytical results
- Ash sample collection and analysis for ash shipments to landfill (began in 2009)
- Leachability report "Kingston Ash Recovery Project Non-Time Critical Removal Action Embayment/Dredge Cell Action Memorandum." EPA-AO-024 (May 2010)
- Comprehensive studies were conducted in 1995, 2002, 2013, and 2016 (chemical only) to characterize the CCR ash
- Ash and pore water sample collection and analysis from Stilling Pond (November 2017)

Proposed temporary wells



NOTE: This imagery does not show the current condition of the Stilling Pond. The Stilling Pond has been closed since the imagery was collected.

Legend

- Proposed Temporary Well (Screened Interval)
- CCR Unit Area (Approximate)
- Engineered Wetlands (Approximate)
- Polishing Pond (Approximate)

Proposed EIP Activities

- Collect CCR material samples from borings in units
- Collect pore water samples from temporary wells in units
- Analyze samples for CCR constituents
- Comparative analysis against existing data
- Report the analytical results in the Environmental Assessment Report (EAR)

