Tennessee Valley Authority welcomes you to

Gallatin Fossil Plant Public Open House





GALLATIN FOSSIL PLANT

Units

- Bottom Ash Pond
- Middle Pond A
- Ash Pond A
- Ash Pond E
- Stilling Ponds
- Non-Registered Site (NRS) (closed)



 North Rail Loop (NRL) Landfill (lined CCR landfill)

Legend



NOTE: Aerial image dated February 2017



Facility Overview

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1956-1959	Date of commissioning	
1,950	Facility size (acres)	
13,767,000	Cubic yards of coal combustion residuals (CCR)	
976	Megawatts of output	
565,000	Number of homes powered	
70	Acres of CCR units closed	
435	Acres of CCR units to be closed	



COAL COMBUSTION RESIDUALS

What are coal combustion residuals?

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

At Gallatin these residuals include fly ash, bottom ash, and dry FGD scrubber material which are collected separately from different areas of the facility.

Bottom ash and fly ash are generated in the boiler. Fly ash is collected in a baghouse, while bottom ash is collected from the boiler. Dry FGD scrubber material is generated by the dry FGD scrubber air quality controls completed in 2015. As of 2019, all CCR generated at Gallatin are disposed of in a lined landfill that began operation in 2016.



Dry FGD Scrubber Material



Bottom Ash/Slag



Fly Ash



COAL COMBUSTION RESIDUALS ENVIRONMENTAL INVESTIGATION

What is the Environmental Investigation Plan?

The State of Tennessee (State), the Tennessee Department of Environment and Conservation (TDEC) and the Tennessee Valley Authority (TVA) agreed for TVA to conduct an environmental investigation at Gallatin, which began on July 18, 2016. The environmental investigation includes:

- A hydrogeologic characterization informed by surface geophysical surveys
- Development of current conditions groundwater elevation maps
- Development of groundwater elevation maps for anticipated future conditions
 A private water well survey and water supply well sampling
- Establish a permanent groundwater monitoring network including background wells
- A characterization of native soils
- An evaluation of seeps
- An evaluation of impoundment slope stability
- An assessment of coal combustion residuals material quantity
- An assessment of coal combustion residuals chemical and physical properties
- An evaluation of the Cumberland River sediment and benthic invertebrates
- An evaluation of the Cumberland River water quality
- An evaluation of the Cumberland River fish community and bioaccumulation
- An evaluation of groundwater discharge to the Cumberland River
- An inventory of karst features
- A dye trace study
- A hydrogeologic water balance for the ash ponds
- An evaluation of potential off-site sources of groundwater contamination

At the conclusion of the environmental investigation, TVA will submit a final Environmental Assessment Report (EAR) to TDEC. This report will present the results of the investigation, including the extent to which coal combustion residuals have contaminated the soil, surface water, and groundwater at GAF. The report will also support development of an appropriate corrective action plan at GAF if corrective actions are necessary. TVA has already submitted a draft report on the results of the environmental investigations conducted so far, and TVA will produce a final version of the report when the additional environmental investigation activities conclude.

What TVA is doing independent of the Environmental Investigation

Gallatin has on-going environmental studies independent of the Environmental Investigation. To learn more, please visit the following link:

https://www.tva.gov/Energy/Our-Power-System/Coal/Gallatin-Fossil-Plant



ENVIRONMENTAL INVESTIGATION PROCESS



Additional EIP Studies

Began December 2017

Implement Corrective Action



ENVIRONMENTAL INVESTIGATIONS

FOCUS AREA	EXISTING INFORMATION	EIP ACTIVITIES
Slope Stability	 Routine visual monitoring and instrumentation monitoring Existing analyses meet industry standards Existing drilling and laboratory data support new analyses 	 New analyses (for some units) for normal and earthquake conditions Compared existing models to new data If needed, updated models and reanalyzed Compared 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 1953 	 Reviewed existing surveys, drawings, and borings Developed three-dimensional models of CCR units Updated three-dimensional models with new boring data and water levels Confirmed CCR volumes
CCR Chemcial and Physical Properties	 Chemical characterization previously completed in 2013 and 2016 Physical characterization previously completed in 2012 	 Collected CCR material samples from borings in units Collected pore water samples from temporary wells in units Analyzed samples for CCR constituents Analyzed samples for physical properties
Hydrogeologic Investigation	 Monitoring well network in place for CCR Rule and state permitting requirements 	 Completed a hydrogeologic characterization of the GAF Drilled borings, performed borehole geophysics and reviewed tests; wells located with surface geophysics Installed monitoring wells Developed geologic cross sections Developed current conditions groundwater elevation maps Developed groundwater elevation maps for anticipated future conditions based on groundwater flow modeling
Groundwater Investigation	 Groundwater monitoring has been ongoing since 1987 	 Establish permanent network of groundwater monitoring wells based on hydrogeologic investigation, private water well survey, surface geophysics, groundwater elevation map, and groundwater flow modeling for closure conditions Identify proposed background wells for GAF to establish background groundwater quality
Private Water Well Survey	 No existing data available 	 Visited 235 properties within survey area Completed survey form with owner If well present, requested access to sample well Sampled private water supply wells



ENVIRONMENTAL INVESTIGATIONS

FOCUS AREA	EXISTING INFORMATION	EIP ACTIVITIES
Karst Inventory / Dye Trace Study	 Historical maps of karst features 	 Desktop study completed Performed field reconnaissance (TVA & private properties) to develop inventory map of karst features Injected dye into karst features, helped characterize subsurface groundwater flow paths Dye trace study Phase 2 in planning stage
Water Balance	 We had NPDES Permit 	 Compared measurements of inputs and outputs to the ash pond system

Seepage Investigation	 Conducted 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 	 Conducted seepage investigation to identify active seeps Collected soil and water samples at identified seeps Analyzed samples for CCR constituents Comparative analysis against background soils Implement Corrective Action Plan if needed
River Sediments and Benthic Invertebrates	 No previous sediment data available TVA benthic community data available 2010-2018 No previous benthic bioaccumulation data available 	 Collected sediment cores, segmented into layers, analyzed for % ash and CCR-related chemical constituents Collected bottom-dwelling organisms (benthic invertebrates) from coves adjacent to GAF, upstream, and downstream Compared community structure adjacent vs. upstream / downstream Measured bioaccumulation of CCR-related constituents
River Water Quality	 Limited USACE data available, but none near GAF 	 Collected river water samples from multiple locations in the Cumberland River upstream, adjacent, and downstream of GAF Analyzed samples for general water quality parameters

		and CCR-related constituents
Fish Community and Bioaccumulation	 Fish community data available 2001-2018 Minimal previous fish bioaccumulation data available 	 Caught (via electroshocking and netting), counted (by species), and released all species of fish present at locations upstream, adjacent, and downstream of GAF Collected 6-fish composite samples of fish from locations upstream, adjacent, and downstream of GAF Analyzed fish tissues for CCR-related constituents
Near-bottom Temperature and Conductivity	 TVA data on heated water discharge, but nothing available to identify smaller thermal anomalies 	 Slowly cruised along parallel paths that track the river bank from near-shore to mid-channel, continuously monitored water temperature, conductivity, and pH at one half-meter above bottom
Aerial Imagery	 No previous aerial infared imagery available 	 Collected aerial infrared imagery of the Cumberland River under summer and winter conditions



HISTORIC TIMELINE

1953 Construction begins on Gallatin Fossil Plant (GAF).

1970

Ash ponds open.



1997–1998 NRS is closed.

1956–1959

GAF begins producing power with all four units on-line by 1959. The Non-Registered Site (NRS) receives ash produced by GAF.





2009

TVA commits up to \$2 billion to convert coal ash storage at all plants to dry storage.

2016



2013-2015

At GAF, TVA invested \$1 billion on the flue gas desulfurization (FGD) scrubber system, selective catalytic reduction (SCR) system, and baghouse installation.

More than \$5.4 billion has been spent so far in updating all of TVA's fossil fuel plants to produce *cleaner energy*.

North Rail Loop Landfill (NRL) is constructed to receive dry FGD scrubber CCR.

2019

GAF stops sending CCR and process flows to ash ponds.

2016

TVA begins environmental investigations at Gallatin.





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

Only facility of

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

More than **16,000** real-time sensors to

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

its kind in the utility industry in the U.S.



ATIM Center

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

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

System sends **alerts** on any irregularities



SLOPE STABILITY

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.

Example of existing slope stability analysis



What TVA had already done

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

Outputs: Factor of safety against sliding

Required analyses to satisfy EIP requirements

Unit	Normal	Earthquake
Bottom Ash Pond	E	E
Middle Pond A	Ε	E
Ash Pond A	Ε	Ε
Ash Pond E	Ε	Ε
Stilling Ponds	Ε	С
NRS	С	С

E = Existing analysis C = Completed analysis for EIP

Additional EIP Activities

• Completed new analyses (for some units) for normal and earthquake conditions

• Compared slope stability results to acceptance criteria



COAL COMBUSTION RESIDUALS MATERIAL QUANTITY

What it is and why we do it

Recent surveys of the site track the location and quantity of coal combustion residuals (CCR) to aid overall site management.

What TVA had

CCR Map (Location/Depth)



already done

- Pre-development topographic maps
- As built/record drawings
- Aerial surveys performed for specific projects
- Drilled borings history beginning in 1953

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 is typically updated annually as well as any time significant changes are 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 that are stored on site. These mapping updates are for both inventory management as well as site management, ensuring that the CCR units are used to their best potential.



- Reviewed existing surveys, drawing, and borings
- Developed three-dimensional models of CCR units
- Updated three-dimensional models with new boring data and water levels
- Confirmed CCR volumes



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

Proposed Temporary Wells



water in the CCR units.

What TVA had done

Comprehensive studies were conducted in 2012, 2013, and 2016 to characterize the CCR.

The ash material sampled included: Fly Ash and Bottom Ash.

Each sample is tested for physical and chemical characteristics, including leachability and total metals.

Legend

- Historical Boring Location
- Proposed DPT Location
- Proposed DPT/Temporary Monitoring Well Location
- Geophysical Survey Line Used for Selection of Drilling Location Temporary Road Estimated Pond Extents
- NRS Boundary Cell Dividers 2000' Grid TVA Gallatin Boundary

Additional EIP Activities

• Collected CCR material samples from borings in units

- Collected pore water samples from temporary wells in units
- Analyzed samples for CCR constituents
- Analyzed samples for physical properties
- Report the analytical results in the Environmental Assessment Report (EAR)



NORTH RAIL LOOP LANDFILL

What it is and why we do it

The North Rail Loop Landfill was permitted with TDEC in 2014 as a new landfill with a bottom liner and leachate collection system.

A landfill bottom liner is a low permeable barrier consisting of compacted clay, geosynthetic clay liner, and a geomembrane to separate the CCR materials from the groundwater. A leachate collection system consists of pipes, geocomposite drainage layers and drainage aggregates to collect rainwater that flows to the bottom of the CCR landfill. Bottom liner and leachate collection system for the Gallatin North Rail Loop Landfill



Making the bottom liner and leachate collection system



Place geologic buffer and compacted clay liner

Place geosynthetic clay liner over compacted clay liner

Install geomembrane over geosynthetic clay liner

Install geocomposite drainage layer over geomembrane



Install protective ash cover layer and perforated leachate collection pipe

Aerial photo of landfill



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.

Groundwater Monitoring Well



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

What TVA had already done

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



What is a groundwater monitoring well? A well specially designed and installed to obtain representative groundwater quality samples and hydrogeologic information.



- Additional monitoring wells and piezometers installed to supplement current groundwater monitoring well networks to further investigate groundwater quality and flow direction:
 - A total of 163 monitoring wells exist today (on-site and on private property)
 - Water levels are gauged monthly



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.

Monitoring Well Locations



What TVA had already done

Groundwater monitoring has been occurring on the Gallatin Plant since 1987 and currently consists of 2 programs:

- State permit monitoring:
 - North Rail Loop (NRL) Landfill (lined CCR landfill)
 - Non-Registered Site (NRS) (Closed)
- Federal Coal Combustion Residuals (CCR) Rule monitoring:
 - Bottom Ash Pond, Middle Pond A, Ash Pond A, Ash Pond E

Legend

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- Monitoring Well Location
- North Rail Loop Landfill
- Non-TVA Monitoring Well Location Stilling Ponds TVA Gallatin Fossil Plant Property Cumberland River Direction of Flow Boundary (Approximate) **CCR Management Units** North Rail Loop (NRL) Landfill

Glover's Pond

- Groundwater samples collected from background and downgradient locations 0
- Groundwater samples collected per Environmental Investigation Plan (EIP) schedule, Federal 0 Coal Combustion Residuals (CCR) rule requirements, and state compliance requirements
- Analytical results to be reported in the Environmental Assessment Report (EAR)



PRIVATE WATER WELL SURVEY

What it is and why we do it

A water use survey is a search for private water supplies (e.g. wells, springs) located within a 1-mile radius north of the Gallatin Fossil Plant. It is used to evaluate the quality of groundwater used in these private wells.

Private Water Well Survey Area



- Performed a door-to-door survey for private water wells (235 properties surveyed)
- Recorded water use data
- O Conducted sampling for CCR constituents and compared to United States Environmental Protection Agency drinking water standards
- Results will be provided in the Environmental Assessment Report (EAR)



KARST INVENTORY / DYE TRACE STUDY

What it is and why we do it

A karst inventory is a search for karst features including sinkholes, swallets, karst windows, caves, springs and sinking creeks or streams on TVA's Gallatin Fossil Plant property and within a 1-mile radius north of the Plant.

Karst Inventory Survey Area



A dye trace study involved the introduction of dye into subsurface drainage pathways and monitoring where the dye flows.

The Phase 1 dye trace study was conducted to identify potential locations of groundwater discharge or springs.

Phase 2 currently being planned.

Phase 1 Dye Injection Locations



- Desktop study completed
- O Performed field reconnaissance (TVA & private properties) to develop inventory map of Karst features
- Dye trace study Phase 1 completed
- Dye trace study Phase 2 in planning stage
- Results will be provided in the Environmental Assessment Report (EAR)



EXAMPLE KARST INVENTORY RESULTS







SEEPAGE INVESTIGATION

What it is and why we do it

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

The soils and water at active seep areas are tested for CCR constituent levels.

Seep Locations



What TVA had 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 in accordance with National Pollutant Discharge Elimination System (NPDES) permit requirements

- Conducted seepage investigation to identify active seeps
- Collected soil and water samples at identified seeps
- Analyzed samples for CCR constituents
- Compared analysis against background soils
- Report the analytical results in the Environmental Assessment Report (EAR)
- Develop Corrective Action Plan if needed



CUMBERLAND RIVER INVESTIGATIONS

INVESTIGATION	ACTIVITIES PERFORMED	PURPOSES
<section-header></section-header>	 Collected sediment cores, segmented into layers, analyzed for % ash & CCR-related chemical constituents Collected bottom-dwelling organisms (benthic invertebrates) from coves adjacent to GAF, upstream, and downstream Compared community structure adjacent vs upstream/downstream Measured bioaccumulation of CCR-related constituents 	 Assess extent of CCR present in river Evaluate whether GAF operations affect benthic ecology Evaluate whether GAF operations affect bioaccumulation and whether levels of constituents are at harmful levels
River Water Quality	 Collected river water samples from multiple locations in the Cumberland River upstream, adjacent, and downstream of GAF Analyzed samples for general water quality parameters and CCR-related constituents 	 Compare with historical data and upstream/ downstream to evaluate whether GAF operations affect Cumberland River water quality
Fish Community and Bioaccumulation	 Caught (via electroshocking and netting), counted (by species), & released all species of fish present at locations upstream, adjacent, and downstream of GAF Collected 6-fish composite samples of fish from locations upstream, adjacent, and downstream of GAF Analyze fish tissues for CCR-related constituents 	 Evaluate whether GAF operations affect fish ecology Evaluate whether GAF operations affect bioaccumulation and whether levels of constituents are at harmful levels
Near-bottom Temperature and Conductivity	 Slowly cruised along parallel paths that tracked the river bank from near-shore to mid-channel, continuously monitoring water temperature, conductivity, and pH at one meter above the bottom 	 Identify any temperature or conductivity anomalies that might be due to submerged seeps or springs
Aerial Imagery	 Collected aerial infrared imagery of the Cumberland River under summer and winter conditions 	 Identify any temperature anomaly "signatures" that reach the water surface



CUMBERLAND RIVER SEDIMENTS SAMPLING LOCATIONS

Sediment Sample Locations



Legend

- Cove 2 Sample Location
- River Sediment Sample Location
- Sample Location in Response to TDEC 10/24/2016 Comments
 - Cumberland River Direction of Flow





SEDIMENT CORE SAMPLE



BENTHIC INVERTEBRATE ORGANISMS

CUMBERLAND RIVER WATER QUALITY SAMPLING LOCATIONS

Surface Water Sample Locations

Legend

- △ River Mile
- Original November 2015 Sampling Locations
- Potential Anomalies
- Surfacewater Sampling at Sediment
 Sampling Locations
- TVA Gallatin Fossil Plant Property Boundary (Approximate)
- CCR Management Units
- North Rail Loop (NRL) Landfill Stilling Ponds

FISH BIOACCUMULATION SAMPLING

Fish Sampling Locations

Legend

Cove

Electroshock Fishing

NEAR-BOTTOM TEMPERATURE AND CONDUCTIVITY

COMMUNITY ACTION GROUP

TVA is creating a Community Action Group (CAG) to help encourage dialogue and communicate the status and plans for activities at the Gallatin site.

Roles of Community Action Group

- Identify community concerns and share them with TVA
- Identify ways in which to communicate to the larger community about CAG efforts and activities
- Communicate opportunities for the public to provide comment and/or input
- Educate their community on how to find information that can answer questions and concerns on the safe management of coal combustion residuals (CCR)

Who can apply

Full-time residents of Sumner and Wilson Counties (must be age 18 years or older)

Terms and Membership

Each Community Action Group will consist of no more than 14 community members

One-year and two-year terms (randomly selected from membership)

Terms are staggered so that there is always a clear link to previous discussions and activities

Volunteer opportunity - compensation for service will not be provided. Certain out-of-pocket expenses can be reimbursed, if requested

Once assembled, the Community Action Group will decide where, when and how often they meet and how they will communicate. Local administrative support will be provided to assist their work

SURFACE IMPOUNDMENT CLOSURE AND RESTORATION EIS

TVA is preparing an Environmental Impact Statement (EIS) to address potential environmental effects associated with several projects to facilitate longterm management of CCR.

Proposed Alternatives

- Alternative A No Action Alternative
- Alternative B Closure of All Surface Impoundments via Closure-by-Removal, the Potential Removal of De Minimis CCR from the Stilling Ponds, and Expansion of the Existing Onsite Landfill. Note that CCR could be removed to either an on-site landfill or to a beneficial reuse facility.

GALLATIN AGREEMENTS

In June 2019, TVA entered into two agreements with TDEC to close the various units at GAF.

Commissioner's Order - Non-Registered Site

- Impacts the Non-Registered Site and known groundwater impacts at the unit
- the concentrations of target metals
- A field demonstration will be performed with the most promising reagents to determine if the remediation approach is effective at the unit
- The Treatability Testing and Field Demonstration Plans will be submitted to TDEC for approval
- The results of this study will inform the final closure of the unit

• TVA plans to conduct a treatability test to evaluate various reagents to adjust the groundwater pH to reduce

GALLATIN AGREEMENTS

In June 2019, TVA entered into two agreements with TDEC to close the various units at GAF.

Consent Order - Ash Ponds

- Impacts the Bottom Ash Pond, Ash Pond A, Ash Pond E, Middle Pond A, and Stilling Ponds
- beneficial reuse
- The NEPA process is underway to address any potential environmental impacts of the closure-by-removal activities and final disposition of CCR

• TVA will excavate and remove CCR from the units and store in a lined landfill and/or process the material for

SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

Gallatin Fossil Plant Bottom Ash Dewatering Facility Permanent Flow Management System

TVA is preparing a Supplemental Environmental Assessment (SEA) to address the potential environmental effects associated with a permanent flow management system to treat process wastewater at the Gallatin Fossil Plant (GAF). The SEA supplements an Environmental Assessment (EA) and subsequent Finding of No Significant Impact (FONSI) that TVA issued in 2017, which evaluated a bottom ash dewatering (BADW) system that is currently under construction.

Proposed Alternatives

- Alternative A No Action
- Alternative B Closure of the Bottom Ash Pond, Construction of Process Water Basin(s) and Permanent Flow Management System

TVA's preferred alternative is Alternative A, under which permanent modifications would be made to the interim flow management system and it would continue to treat process water flows from GAF until the BADW system becomes operational. Under Alternative A, the Bottom Ash Pond would not be closed for the purpose of constructing the process water basin(s) and the process water basin(s) would not be constructed.

Public Comment

TVA will accept comments on the Draft SEA that it receives no later than October 9, 2019. Any comments received, including names and addresses, will become part of the administrative record and will be available for public inspection.

Comments can be submitted online or emailed to <u>arfarless@tva.gov</u>

Comments can also be mailed to: Tennessee Valley Authority ATTN: Ashley Farless, GAF BADW SEA 1101 Market St., BR2C-C Chattanooga, TN 37402

LEGACY CCR AREAS

Non-Registered Site

Ash Ponds

ENVIRONMENTAL STEWARDSHIP

- - Burners
 - Overfired
- Scrubber

Air Quality Improvements

North Rail Loop Landfill

ENVIRONMENTAL STEWARDSHIP

Plant Process Water Treatment

Bottom Ash Dewatering

