UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

MAY 18 2010

MEMORANDUM

SUBJECT: Request for Approval of Action Memorandum for Non-Time Critical Removal Action Embayment/Dredge Cell; TVA Kingston Fossil Fuel Plant Release Site; Roane County, Tennessee.

FROM: Craig Zeller, P.E.
Remedial Project Manager

TO: Franklin E. Hill, Director
Superfund Division
U.S. EPA Region 4

The purpose of this memorandum is to formally request your approval of the Action Memorandum for the Non-Time Critical Removal Action for the Embayment/Dredge Cell at the TVA Kingston Fossil Fuel Plant (KIF) Release Site in Roane County, Tennessee.

In accordance with the May 11, 2009 Administrative Order and Agreement on Consent (AOC) with EPA, TVA prepared an Engineering Evaluation/Cost Analysis (EE/CA) Work Plan to address coal ash in the embayments and tributaries west of Dike #2; coal ash on upland areas and surface soils; restoration of area waters impacted by the coal ash release per the Jurisdictional Assessment; and proper disposal of all coal ash material recovered during these efforts. Following EPA approval of the EE/CA Work Plan, TVA prepared an EE/CA Report that evaluated, screened, and developed removal action alternatives to address the identified Removal Action Objectives (RAOs). Three alternatives were developed and evaluated in detail in the EE/CA Report, and a 75 day public comment period on the report was conducted from January 19 – April 5, 2010.

TVA has prepared the Action Memorandum for the embayment/dredge cell which also contains the Responsiveness Summary (Appendix B) and the ARARs table (Appendix C). TVA has selected Alternative 3B in the Action Memorandum which involves removal of 2.5 Million cubic yards (CY) of ash from the Swan Pond Embayment, consolidation and on-site disposal of ash in the failed dredge cell and ash pond, installation of an enhanced perimeter containment system around the closed out cell using deep soil-cement mixing techniques, and restoration of the embayment ecosystem to pre-spill conditions. Alternative 3B was selected because it meets the RAOs, complies with ARARs, effectively and safely contains the ash, minimizes off-site transportation and disposal impacts, reduces uncertainty associated with acceptability of off-site disposal, and is the most cost effective.

TDEC officials have reviewed the Action Memorandum prepared by TVA, and based on my consultations, have provided their concurrence on Alternative 3B. EPA Region 4 project staff in the Superfund Division and Office of Environmental Accountability have reviewed and provided comments to TVA on the Action Memorandum, Responsiveness Summary and ARARs table. TVA has revised the Action Memorandum and Appendices to fully address those review comments.

Based on the above, I formally request your approval for Alternative 3B for the Non-Time Critical Removal Action for the Embayment/Dredge Cell at the KIF ash release site in Roane County, Tennessee.

APPROVAL:

Franklin E. Hill, Director
Superfund Division
US EPA Region 4

5/18/2010
DATE

DISAPPROVAL:

Franklin E. Hill, Director
Superfund Division
US EPA Region 4

DATE

Document No. EPA-AO-024

Kingston Ash Recovery Project
Non-Time-Critical Removal Action
Embayment/Dredge Cell
Action Memorandum

Prepared by:
Jacobs
for the Tennessee Valley Authority

Revision	Description	Date
1	Draft AM for TVA Review	02 February 2010
2	Draft AM for EPA/TDEC Review	12 April 2010
3	Final AM for Public Comment	18 May 2010

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ACTION MEMORANDUM

I. PURPOSE

The purpose of this Action Memorandum is to request and document approval of the proposed Tennessee Valley Authority (TVA) non-time-critical removal action for the Swan Pond Embayment and Dredge Cell described herein for the TVA Kingston Fossil Fuel Plant (KIF) Release Site in Roane County, Tennessee. On May 11, 2009, TVA and the U.S. Environmental Protection Agency (EPA) entered into an Administrative Order and Agreement on Consent (AOC) under Sections 104(a), 106(a), and 107 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, pursuant to which TVA will perform the removal action described herein (EPA 2009). Ash in the Emory River and the easternmost portion of the Swan Pond Embayment is currently being removed under a time-critical removal action (TVA 2009a).

This non-time-critical removal action involves the removal, processing, and disposal of the remaining ash material that was released into the Swan Pond Embayment from the KIF. This removal action also involves the closure of the Dredge Cell and adjacent Ash Pond. Under CERCLA, the ash spill constitutes a release, as well as a potential for continued releases of hazardous substances into the environment. The release of hazardous substances at the Site poses a threat to public health and the environment pursuant to Section 104(a) of CERCLA and the conditions at the Site meet the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Section 300.415(b)(2) criteria for removal actions.

II. SITE CONDITIONS AND BACKGROUND

ID Number: TN8640006682

Site Specific ID Number: A4XP

Removal Category: Non-Time-Critical Removal Action

A. SITE DESCRIPTION

This section of the Action Memorandum provides a description of the Site conditions and relevant background information.

1. Removal Site Evaluation

KIF is located at Emory River Mile (ERM) 2.6 and is at the headwaters of Watts Bar Reservoir near the confluence of the Clinch and Emory Rivers. Construction of the plant began in 1951 and was completed in 1955. KIF generates 10 billion kilowatt-hours of electricity a year, enough to supply the needs of more than 700,000 homes in the Tennessee Valley.

On Monday, December 22, 2008, a containment dike surrounding a portion of the Class II landfill for ash from the operation of the power plant failed, releasing about 5.4 million cubic yards (cy) of ash. Ash was released from about 60 acres of the 127-acre Dredge Cell complex. The spilled material covered about 300 acres of adjacent parts of Watts Bar Reservoir, including most of Swan Pond Embayment and reservoir shorelands. Most of the ash which spilled onto land was on property managed by TVA.

Coal, in its natural state, contains various naturally-occurring metals and radionuclides that can be concentrated and retained in the ash after burning the coal for power production. The specific chemical

composition of fly ash depends on the source of the coal. KIF mostly burns eastern bituminous coal but also has used coal from Illinois and blends low-sulfur Western coal to reduce emissions. The principal components of fly ash are those that are typical of rock and soil. Oxides of silicon, aluminum, iron, and calcium, chemically combined in an amorphous form, comprise 95 to 99% of fly ash. Ash also contains variable amounts of magnesium, titanium, sulfur, sodium, and potassium (TVA 2001). Although the main chemical constituent of ash is silicon dioxide, the material may contain trace amounts of constituents that occur naturally in coal (TVA 2009a). The ash has therefore been tested for naturally-occurring metals and radionuclides. The constituents of interest in fly ash include arsenic, chromium, copper, lead, mercury, nickel, selenium, thallium, vanadium, zinc, and the naturally-occurring radionuclides, specifically isotopes of potassium, radium, thorium, uranium, and their short-lived daughter products. The fly ash contains cenospheres, which are inert, hollow balls of sand-like material.

2. Physical Location

The Site is located just off of Swan Pond Road in Roane County, Tennessee. Roane County had a total population of 53,399 in 2007. The county is primarily rural with about 60% of the population outside of incorporated cities and towns. Most of the 300 acres directly affected by the release was TVA property, although 40 non-TVA owned properties, constituting a total of 8 acres, were affected. TVA has since purchased 156 of the properties affected by the release or that may be affected by the response actions.

Drinking water in the immediate area has historically been primarily by residential groundwater wells. Over 400 wells were tested by the Tennessee Department of Environment and Conservation (TDEC) immediately after the event and were found to be within required drinking water limits (TVA 2009b). TVA is currently installing a new water distribution system to provide City of Kingston water to area residents.

3. Site Characteristics

Failure of the Dredge Cell filled most of the Swan Pond Embayment. The ash deposits are typically 20 to 40 ft thick, although thicker piles of ash have been constructed in the embayment area during time-critical removal actions. Residual ash in the Emory, Clinch, and Tennessee River system following the time-critical dredging activities will be addressed under a separate non-time-critical removal action. Further sampling and analysis of biotic and abiotic media is planned for the river system, which will be used to assess potential human health and ecological risks associated with the river system.

4. Release or Threatened Release into the Environment of a Hazardous Substance, Pollutant or Contaminant

The ash material at the Site contains naturally-occurring metals such as arsenic, chromium, copper, lead, mercury, nickel, selenium, thallium, vanadium, and zinc, which are hazardous substances as defined by CERCLA Section 101(14). The ash material also contains naturally-occurring radionuclides, which are also hazardous substances as defined by CERCLA Section 101(14).

More than 50 samples of the ash have been collected and analyzed for metals (excluding mercury); 11 samples have been analyzed for organic chemicals, mercury, and radionuclides. Metals, primarily arsenic, have been the focus of this monitoring. Arsenic is present in the ash at an average concentration of approximately 65 milligrams per kilogram (mg/kg), which is above EPA's residential Regional Screening Level (RSL) of 0.39 mg/kg and above EPA's industrial RSL of 1.6 mg/kg for the hazardous substance.

The EPA Toxicity Characteristic Leaching Procedure (TCLP) uses acid digestion to provide an indication of the potential for leaching metals and is used to define if a material will be considered a hazardous waste under the Resource Conservation and Recovery Act (RCRA). Several ash samples collected during the time-critical removal action were sent for TCLP analysis and all indicate that the ash is not considered a hazardous waste under RCRA.

Surface water samples have been collected from clean water ditches and settling basins constructed within the embayment area. More than 170 samples have been collected and analyzed by TVA since the clean water ditches were completed. As of March 11, 2010, the total arsenic concentration in surface water from the embayment area has averaged approximately 0.0278 milligrams per liter (mg/L), which is greater than TDEC's Ambient Water Quality Criterion (AWQC) of 0.010 mg/L. In addition, several concentrations of antimony and selenium have also exceeded water quality criteria.

Groundwater samples have been collected semiannually from monitoring wells surrounding the Dredge Cell in accordance with its industrial waste landfill permit requirements. Wells have been routinely analyzed for 16 metals and flouride. Currently, 6 wells are present in the Dredge Cell area. Arsenic was detected at concentrations exceeding the TDEC Water Quality Criteria for Domestic Water Supplies maximum contaminant level (MCL) of 0.010 mg/L in 2 out of 40 samples from these 6 wells since the ash release. Arsenic was detected in June 2009 at a maximum of 0.0297 mg/L in well AD-2. Results of subsequent monthly sampling through March 8, 2010, indicate that arsenic concentrations in well AD-2 have dropped to 0.00254 mg/L, below its MCL. Historically, arsenic concentrations in well 6A have remained less than 0.014 mg/L, which slightly exceeds its MCL; concentrations do not indicate either an increasing or decreasing trend. Arsenic concentrations in other wells have not exceeded the MCL. Historically, silver has occasionally been detected in one well (6A) at concentrations that exceed its MCL of 0.10 mg/L. However, in 2007 TDEC granted a site-specific standard of 0.18 mg/L for silver in recognition of the fact that silver is present in natural soil and groundwater sources, but is absent in ash.

5. NPL Status

The Site is not on the National Priority List, although, pursuant to the AOC, a preliminary assessment will be conducted at the Site at the completion of removal activities.

6. Maps, Pictures, and Other Graphic Representations

All removal file information, including maps and aerial photos of the Site, will be maintained by TVA and the EPA On-Scene Coordinator and released to the EPA record center, and the Administrative Record for inclusion in the Site files. A figure showing the key features of the Site is attached (Figure 1 in Attachment A).

B. OTHER ACTIONS TO DATE

1. Previous Actions

Immediately following the ash spill, an Incident Command Center was established and emergency measures were implemented to ensure safety of people in the area, contain and evaluate the damage, and plan for recovery of the ash. Several environmental monitoring programs were put in place to monitor river water, drinking water, and air quality. Road, railroads, and utilities were repaired and replaced. Dikes and weirs, both on land and in the water, were constructed to control the ash movement; Dike 2 was constructed to contain ash within the Swan Pond Embayment to the west. Dust control activities were implemented and are ongoing. Storm water management systems, such as clean water diversion ditches and ash water collection and settling basins, were constructed.

On August 4, 2009, an Action Memorandum was approved for removing ash from the river east of Dike 2 under a time-critical removal action (TVA 2009c). The decision was made to remove ash from the river using hydraulic or mechanical dredging and from dry land areas east of Dike 2 using land-based equipment and then process, transport, and dispose of the ash recovered. The purpose of removing the ash from the river and from dry land areas east of Dike 2 was to limit the potential for future ash migration and to prevent upstream flooding in the event of a large rainfall.

2. Current Actions

The time-critical removal action is ongoing; ash removal east of Dike 2 is anticipated to be complete in May 2010 and offsite ash disposal is anticipated to be complete in November 2010. As part of the time-critical removal action, ash recovered from the river near the site of the release through mechanical dredging or land-based equipment is being transported to one of several onsite ash storage areas. Hydraulically-dredged material is being pumped into a Rim Ditch where solids settle out of the solution. The water continues flowing through the Sluice Trench into the Ash Pond and then into the Stilling Pond where further settlement occurs (Figure 1). Settled ash is removed from the ditches through mechanical excavation and windrowed to dry in an ash processing area. Processed ash is loaded into railcars, and is transported to the Perry County Associates (Arrowhead) Landfill in Alabama, for final disposal. Cenospheres and entrained river debris are also being removed from downstream coves and disposed with the processed ash. As of May 4, 2010, nearly 3.1 million cy of material have been removed from the river system and 2.0 million tons (approximately 1.5 million cy) of that material have been shipped offsite for final disposal.

C. STATE AND LOCAL AUTHORITIES' ROLE

1. State and Local Actions to Date

On January 12, 2009, the TDEC issued TVA a Commissioner's Order (TDEC 2009) which directed TVA to undertake numerous response activities at the Site including, but not limited to:

- Implement measures to prevent the movement of contaminated materials and minimize further downstream migration of contaminated sediments;
- Fully cooperate and support TDEC's review of all TVA fly ash impoundments located in the State;
- Submit all existing studies, reports, and memoranda that are potentially relevant to explaining or analyzing the cause of the catastrophic failure of the containment structures;
- Fully cooperate and provide support for TDEC's initial assessment of the impact of the ash release on all waters of the State;
- Prepare and submit a Corrective Action Plan (CAP) within 45 days after receipt of the Commissioner's Order, to include:
    - i. A plan for the assessment of soil, surface water and groundwater; remediation of impacted media; and restoration of all natural resources damaged as a result of the release;
    - ii. A plan for monitoring the air and water in the area during the cleanup process;
    - iii. A plan to ensure that public and private water supplies are protected and that alternative water supplies are provided if contamination is detected;

iv. A plan for addressing both the short-term and long-term management of fly ash at the Site, including remediation and stabilization of the failed ash waste cells, proper management of the recovered ash, and a revised closure plan for the Class II ash disposal facility; and

v. A plan to address any health and safety hazards posed by the ash to workers and the public.

On March 2, 2009, TVA submitted a draft CAP to EPA and TDEC for agency review and approval (TVA 2009a). Since the release, EPA, the State, and TVA have conducted extensive sampling of air, water, and ash material.

2. Potential for Continued State and Local Response

TDEC will continue to play a large role in the response activities at the Site and will continue to oversee activities under the Commissioner's Order that are not addressed by the AOC. In addition, the State will continue to be involved in sampling surrounding water bodies and air, and will be responsible for approving the long-term ash management decisions at KIF, including closure of the Dredge Cell and Ash Pond. It will also have responsibility for approving any off-site disposal locations in the State of Tennessee.

EPA will coordinate with the State to ensure they are apprised of all progress made under the AOC.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

The conditions resulting from the ash release at KIF present a threat to the public health or welfare and the environment if not properly managed and meet the criteria for a non-time-critical removal action as provided for in the NCP Section 300.415(b)(2). The primary criteria include:

- **Section 300.415(b)(2)(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants:**

The area where the ash spilled is temporarily devoid of benthic life. The benthic invertebrates were smothered during the ash spill. This minimizes the food available to aquatic life, impacting the health of the aquatic environment in the area. The presence of naturally-occurring metal and radiological constituents in the ash, if and when resuspended in the water column, can also have an impact on the human receptors or the aquatic environment. Ash is exposed at the ground surface. Results of the human health risk assessment (Jacobs 2010) indicate that there is no unacceptable cancer risk or noncancer hazard to current human receptors; however, cancer risks could exceed the target risk range and noncancer hazards (toxic effects) could exceed the target threshold for future exposure scenarios if actions were not taken. Results of the screening-level ecological risk assessment (Jacobs 2010) indicate that based on the available evidence, the possibility of adverse risks for terrestrial and aquatic ecological receptors potentially exposed to inorganic constituents in ash as soil or as sediment cannot be excluded.

- **Section 300.415(b)(2)(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems:**

There is no identified groundwater contamination or groundwater plume associated with the former Dredge Cell or Ash Pond. Sensitive aquatic ecosystems that existed in the Swan Pond Embayment prior to the ash release (approximately 2.58 acres of wetlands) were virtually eliminated by the release. Wetland areas were typically associated with the shoreline margins, floodplain, small islands, and coves

at the head of the embayment. These wetlands included a mix of forested shrub/scrub and emergent wetlands. The ash release eliminated these wetlands.

- **Section 300.415(b)(2)(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released and,**
- **Section 300.415(b)(2)(viii) Other situations or factors that may pose threats to public health or welfare of the United States or the environment:**

Although several steps have been taken to contain the ash in the Swan Pond Embayment (namely, Dike 2, clean water ditches, and settling basins), stormwater runoff during high precipitation or flooding events may exceed system capacity, resulting in potential migration of the ash into the Emory River. Direct contact between ash material in the embayment and water flowing through the embayment area into Watts Bar Reservoir may cause hazardous substances to migrate or be released into the Emory River. Similarly, erosion of ash and its constituents from the embayment or Dredge Cell into affected waters may occur during such times.

IV. PROPOSED ACTION

A. PROPOSED ACTIONS

The proposed actions listed below have been developed in coordination with the TDEC and EPA. These actions are designed to remove the remaining ash in the Swan Pond Embayment and permanently close the failed Dredge Cell and Ash Pond (including the Lateral Expansion area). These actions will minimize the potential for direct contact with human or ecological receptors exposed to the ash, direct contact with water flowing through the embayment, or migration from the embayment due to erosion. Material placed in the Dredge Cell for the test embankment will remain in the Dredge Cell. An Engineering Evaluation/Cost Analysis (EE/CA) has been prepared that evaluated alternative response actions with respect to their effectiveness, implementability, and cost (Jacobs 2010). The proposed action is to implement Alternative 3b, as evaluated in the EE/CA. Figure 2 presents a layout and cross-sectional sketch showing the end-state of the proposed action. A removal action work plan will be developed to implement the actions described below.

1. Proposed Action Description

Infrastructure. Ash from two outlying areas in the north embayment will be consolidated to a more centralized area where it can be dried and graded. Ash outside of the dirty water ditch along the western border of the north embayment will be excavated to isolate freshwater springs that flow into the ditch. A steel and concrete bridge will be constructed on Swan Pond Circle Road to allow trucks hauling ash to pass beneath the road; this will allow construction-related traffic to pass between the north and middle embayment areas without crossing Swan Pond Circle Road. A new haul road will be constructed from Swan Pond Circle Road across the middle embayment to the current East/West Haul Road.

Excavate the Swan Pond Embayment. Much of the ash in the Swan Pond Embayment is expected to be retrievable with excavators, dozers, and trucks. Admixtures, such as lime or other proprietary materials, may be used to help dry the ash so that it is retrievable. The ash will be piled, dewatered (dried) if needed, and when dry enough, transported to the onsite disposal areas. Trees that are retrieved either within the ash or that are removed will be chipped and either used onsite to stabilize the surface of the ash to support trucks or sent offsite for disposal. Periodically, disturbed ash will be sprayed with a component like Flexterra® to control dust.

Ash that is too wet to remove with traditional land-based equipment may be dredged from the embayment using a small dredge. The dredged material will be piped to the existing Rim Ditch, where the same processing system as used during the time-critical removal action will be used (Rim Ditch, Sluice Trench, Ash Pond, Stilling Pond). Discharges from the Stilling Pond will comply with the existing National Pollutant Discharge Elimination System (NPDES) permit. Any dredged ash will be recovered from the Rim Ditch/Sluice Trench, then processed on the Ash Processing Area ("Ball Field") to allow it to dry sufficiently before being trucked back to the onsite disposal areas.

Remove Clean Water Ditches. A series of clean water ditches were installed during the time-critical removal action to bypass upgradient surface water around the ash. Nearly 5,900 linear ft of ditches, 4-ft deep and 16 to 20 ft across were constructed through the north and middle portions of the Swan Pond Embayment. At least one side of the ditch is made of ash and is covered in rock. This portion of the ditch, including the overlying rock, will be removed so as to remove the underlying ash. The rock will be disposed onsite with the ash, or cleaned and re-used onsite.

Remove Dike 2 and Settling Basins. Dike 2 is a temporary rock dike comprised of shot rock, riprap, and smaller-sized rock saturated with ash. The dike is approximately 1,400-ft long with an average height of 12 ft and average width of 30 ft at the top. The dike has served as a barrier to prevent ash from moving into the Emory River from the embayment and to serve as a haul road. Immediately adjacent to Dike 2 are several settling basins that serve as a treatment system for water that migrates over ash. Roughly 5 acres are used for the basins, which are lined with rock.

Both the dike and the settling basins must remain in service until the last of the ash is removed west of Dike 2. At that time, the rock and any accumulated sediment will be removed and transported to the onsite disposal area. Some of the larger rock may be washed of ash so that the clean rock may be used for onsite drainage and erosion control.

Restore Embayment Ecosystem. Following the removal of ash from the areas west of Dike 2, the embayment ecosystem will be restored to pre-spill conditions, as best determined from a jurisdictional assessment based on analysis of existing data and site observations, data collected from surrounding reference communities in a similar geomorphic position, and best professional judgment. The requirements for a jurisdictional assessment include maps of the site prior to the spill and following the non-time-critical removal action, areas/species/habitat impacted, habitat created or revegetated with selected species, channel slopes, and similar elements. The pre-spill topography of the embayment shoreline and surrounding areas will be reconstructed to an elevation that supports native plant communities. Restoration will incorporate the following actions:

- Achieving suitable elevations within the floodplain necessary to support the restoration of a complex mosaic of forested, scrub-shrub, and emergent wetland plant communities. This includes the restoration of floodplain microtopography and wetland hydrology (i.e., constructed vernal pools) that historically provided important off-channel, seasonal, aquatic habitat for amphibians, birds, and other semi-aquatic species.

- Restoring the island that was historically located on the northern perimeter of the middle embayment. The island was likely an aquatic habitat feature important to fish and other aquatic species. Restoration will include filling and/or regrading to establish pre-spill topography.

- Characterizing the bottom sediments exposed by excavation/dredging or filling/regrading for organic content and moisture retention capacities to determine if soil amendments will be necessary to support the restoration of native plant communities. Hydric soils were identified in the wetland

ecosystems surrounding the embayment. Given that the embayment appears subject to high sediment deposition, the bottom substrate of the embayment is expected to reestablish naturally.

The final planting will restore a complex mosaic of forested, scrub-shrub, and emergent wetland plants. Figure 3 presents a conceptual cross-section of the restored embayment, with reference to different native plant communities. Species composition and densities of restored plant communities will be based upon previously collected data within the embayment area, as well as data collected from surrounding reference communities in a similar geomorphic position.

Install Perimeter Containment. The foundation beneath the perimeter berms will be stabilized by constructing a grid of soil/cement columns that are installed using deep soil mixing techniques. Figure 4 presents a conceptual cross-section and plan view of the stabilized foundation zone. Selected foundation zones will be stabilized by mechanically mixing in-situ soil materials with a cement grout slurry using a hollow-stem paddle mixer. Auger drilling equipment will be used to create a soil/cement column. Successive columns will then be installed to create a contiguous subsurface "wall" of soil/cement. These walls will then be configured into the required grid pattern. The conceptual foundation zones, to be refined during final design, are anticipated to vary from 15-ft to 130-ft wide. A working platform, consisting of layers of geogrid, sand, and stone, will be built along the perimeter berm prior to stabilizing the underlying foundation material. A ditch will be constructed around the perimeter of the Dredge Cell and Ash Pond to divert surface drainage away from the site and to control runoff from the site.

Construct Working Platform/Stack Ash. A working platform, consisting of layers of geogrid, sand, and stone, will be constructed across the Dredge Cell and Ash Pond before dry ash is stacked to serve as a capillary break, and to provide a stable working base for construction equipment. Dried ash (near optimum moisture content) will be placed in relatively thin lifts, and each lift will be compacted.

Grade Dredge Cell. The former Dredge Cell will be regraded to a peak elevation of approximately 790 ft mean sea level (msl). The regrading will occur over time and will be coordinated with the construction of the working platform for the new perimeter berm and closure of the Ash Pond.

Cover Dredge Cell and Ash Pond. A soil cover will be placed to control erosion, control dust generation, promote runoff and evapotranspiration, limit infiltration, and provide a surface for vegetative growth. A layer of clay and then topsoil will be placed over the entire area and contoured. Other low-permeability caps, such as a composite clay liner system, may also be used. Once the cover reaches final grade, it will be seeded and mulched.

Monitoring. Because ash will remain in the Dredge Cell and Ash Pond area, the groundwater underneath the cell and surface water flowing from the cell will be monitored quarterly for at least one year or until the results indicate stable conditions. Once stable conditions are confirmed for four quarters, the monitoring will be reduced to semi-annually for the 30-year post-closure monitoring. A permanent network of groundwater wells will be installed and monitored for metals and radionuclides. The containment system as well as the drainage systems will be periodically inspected. Monitoring and inspection results will be documented in a five-year review report to ensure the remedy remains effective and adequately protective of human health and the environment over the long-term. Air and surface water monitoring will be conducted during implementation of the removal action.

Institutional Controls. The Dredge Cell and Ash Pond area will be maintained as a disposal location for the foreseeable future. Under Tennessee solid waste regulations, access to the cell will be controlled. Institutional controls in the form of restrictive covenants will be recorded on the property in order to prohibit exposure to the contents of the Dredge Cell and Ash Pond disposal areas and to protect the integrity of the perimeter containment, cover, and other components of the remedy. Institutional controls

will also include a "Notice in Deed to Property" that will be recorded on the property pursuant to TDEC 1200-1-07-.04(8)(f) for the purpose of notifying persons that the property has been used as a disposal facility and its use is restricted in accordance with an approved closure/post-closure plan.

In addition the following existing plans will be revised to make them applicable to non-time-critical removal activities:

- Site Health and Safety Plan,
- Site Storm Water Management Plan,
- Site Dust Control and Air Monitoring Plan, and
- Surface Water Monitoring Plan for the Emory, Clinch, and Tennessee Rivers.

2. Rationale for Selection of the Proposed Action

TVA has selected the proposed action based on careful consideration of multiple factors, as evaluated in the EE/CA. The proposed action, which consists of the removal of ash from the embayment with onsite disposal in the Dredge Cell and Ash Pond, offers the best tradeoff of effectiveness, implementability, and cost remedy evaluation criteria. The following summarizes the key considerations in selecting this action.

a. **The proposed action is effective in meeting each of the removal action objectives (RAOs).** RAOs have been identified in the EE/CA to mitigate the threat or potential threat to the public or the environment as a result of the spilled ash in the Swan Pond Embayment. These threats or potential threats, as listed in Section III of this Action Memorandum, were evaluated in the screening-level human health and ecological risk assessments in the EE/CA, which indicated potential risk to human and ecological receptors due to exposure to naturally-occurring metals and radionuclides in the ash. The RAOs also reflect the mid-term strategic objectives of the site as defined in the AOC. The following describe how the proposed action meets each of the RAOs.

   i. ***Minimize direct contact between ash material in the embayment and water flowing through the embayment area into Watts Bar Reservoir.*** By removing the ash from the embayment, direct contact between ash and water is eliminated, which effectively eliminates further migration of ash-laden sediment or surface runoff into the reservoir. Ash removal by both mechanical excavation and dredging has been shown to be effective during the time-critical removal action in the eastern embayment (east of Dike 2), based on results of visual observations of the excavation surface and examination of soil/sediment cores using polarized light microscopy.

   ii. ***Minimize migration of ash and its constituents from the embayment, Dredge Cell, or Ash Pond into affected waters due to erosion.*** By removing ash from the embayment and capping of the ash during closure of the Dredge Cell and Ash Pond, erosion and transport of ash-laden runoff is eliminated, which effectively eliminates further migration of ash-laden sediment or surface runoff to the reservoir. The final 36-inch thick clay, soil, and vegetative cover over the ash will be graded and will have drainage facilities that will be effective in minimizing erosion of cover material, optimizing drainage, and are consistent with drainage in the surrounding area.

   iii. ***Minimize direct contact exposure by human or ecological receptors to ash on the ground.*** By removing the ash from the embayment and capping the ash in the Dredge Cell and Ash Pond, direct contact by both human and ecological receptors is eliminated. The cover will be effective in eliminating direct contact exposure, and will provide sufficient thickness against dust generation or burrowing.

iv. ***Restore the embayment to pre-spill conditions.*** By removing the ash from the embayment, and reestablishing pre-spill topography, plant communities, and habitat for fish, semi-aquatic amphibians, and bird species, the embayment will be restored to pre-spill conditions. The restoration of a complex mosaic of forested, scrub-shrub, and emergent wetlands along the embayment shorelines will be effective in establishing a riparian zone that will encourage natural repopulation of native faunal groups.

v. ***Close the former Dredge Cell in accordance with Tennessee Solid Waste Rule 1200-1-7.*** The proposed action includes closure of both the Dredge Cell and adjacent Ash Pond in accordance with TDEC solid waste regulations. The proposed action will be in full compliance with these applicable or relevant and appropriate requirements (ARARs). Furthermore, the former Dredge Cell and Ash Pond will be closed by installing a safe and structurally-sound perimeter containment system, as described below, to prevent any future release of ash from the closed facility.

vi. ***Dispose of waste streams from the removal action in accordance with ARARs.*** By disposing of the ash from the embayment in the on-site Dredge Cell and Ash Pond, waste streams will be disposed in accordance with TDEC regulations. Dry stacking of the ash in compacted lifts will be effective in providing a safe, stable fill with suitable shear strength and limited long-term settlement. Construction activities will be effectively implemented onsite to control fugitive dust emissions, erosion, and sedimentation in compliance with TDEC 1200-3-8 and TDEC 1200-4-10. Excavated ash will be characterized, managed, and disposed in compliance with 40 CFR 262.11 and TDEC 1200-1-11. As indicated above, closure will be in accordance with TDEC 1200-1-7.

Public comments on the EE/CA indicated a concern over groundwater remediation if ash were to be disposed onsite (see the Responsiveness Summary in Attachment B). However, groundwater remediation was specifically not identified as an RAO for the following reasons:

- There is no identified groundwater plume. As described in Section II above, groundwater samples have been collected at least semiannually from monitoring wells surrounding the Dredge Cell and routinely analyzed for 16 metals and flouride. Since the ash release, 2 out of 40 samples exceeded the MCL for arsenic; those two samples were from well AD-2 at the south end of the Ball Field in June and July 2009. However, subsequent monthly sampling of well AD-2 over the past 7 months has shown that arsenic does not exceed the MCL in that well. Historically (over the past 10 years), arsenic concentrations in one well (6A) exceeded its MCL 6 out of 27 times; however the highest historical concentration (0.014 mg/L in December 2004) only slightly exceeded the MCL in that one well and since the spill, arsenic has not exceeded the MCL. Arsenic concentrations in other wells have not exceeded the MCL. Concentrations do not indicate either an increasing or decreasing trend. Historically, silver has occasionally been detected in one well (6A) at concentrations that exceed its MCL of 0.10 mg/L. However, in 2007 TDEC granted a site-specific standard of 0.18 mg/L for silver in recognition of the fact that silver is present in natural soil and groundwater sources, but is absent in ash. Therefore there is no identified groundwater contamination or groundwater plume associated with the former Dredge Cell or Ash Pond.

- Metals in the ash do not leach readily under site-specific conditions. Several lines of evidence support this conclusion. First, groundwater quality does not exceed drinking water standards after more than 50 years of the ash being in contact with groundwater. This overall evidence, which integrates the effects of site-specific geochemical,

hydrostratigraphic, and leaching characteristics, demonstrates that ash does not leach readily. Second, an EPA Science Panel review of potential selenium issues after the ash spill concluded that metals are not readily leaching off the ash particles spilled into the river, based on available surface water monitoring data. None of the downstream median concentrations of dissolved metals were found to be above the water quality criteria benchmarks for protection of aquatic life. Third, the U.S. Army Engineer Research and Development Center (ERDC) tested samples of ash taken from the Dredge Cell, Emory River, and Stilling Pond using sequential extraction procedures designed to remove metals from the ash with increasingly more "aggressive" solvents. Results of that study demonstrated that site-specific metals (such as arsenic and selenium) would not easily become mobile in normal aqueous environments, that is, they do not readily leach from the ash. Fourth, results of Toxicity Characteristic Leaching Procedure (TCLP) testing of ash samples for waste characterization purposes have shown that the TCLP leachate does not exceed threshold limits and that the ash is not a hazardous waste. This provides indirect evidence that the ash does not readily leach metals. Public comments on the EE/CA (see the Responsiveness Summary in Attachment B) suggest that alternate leaching procedures developed in EPA research studies could result in greater leaching of metals. However, such alternate procedures subject the ash to harsh pH conditions that are not representative of site-specific pH and redox conditions.

- Hydrostratigraphic conditions at the site mitigate transport (migration) of metals from the Dredge Cell to groundwater discharging at the river. A silty clay layer underlies the ash that has a thickness of approximately 10 ft and a hydraulic conductivity of approximately 1.9×10^{-6} cm/sec, which acts as a barrier to metal migration. Shallow groundwater movement is generally from upland areas toward the river, resulting in upward hydraulic gradients beneath the Dredge Cell, which impedes downward metal migration. It should be noted that the conceptual design for the Dredge Cell closure includes installation of a soil-cement perimeter foundation treatment zone that will impede lateral groundwater flow. The conceptual design for the Dredge Cell also includes a low-permeability clay cap over the ash, which will reduce infiltration of precipitation through the ash by an order of magnitude (14 inches/yr to 1.4 inches/yr) and reduce the rate of leachate generation.

For these reasons, groundwater remediation has not been identified as an RAO. Several public comments on the EE/CA (see the Responsiveness Summary in Attachment B) suggest that a liner and/or leachate collection system should be included in the closure design. However, because there is no identified groundwater contamination or groundwater plume associated with the former Dredge Cell or Ash Pond, metals do not readily leach from the ash, and hydrostratigraphic conditions impede metal migration, no liner or leachate collection system is warranted to protect human health or the environment. It should be noted, that up to 40 ft of ash will remain below grade, beneath the groundwater table, so that ash will remain in contact with the groundwater as it has for the past 50 years. It is unnecessary to install a synthetic liner beneath that ash and it would be ineffective to install a synthetic liner on top of that ash, prior to dry ash stacking. For these reasons, neither a liner nor a leachate collection system are included in the conceptual closure design.

It should be noted that the river system will be addressed in a separate EE/CA and Action Memorandum following additional investigation to confirm geochemical conditions and leaching characteristics for modeling fate and transport of metals and radionuclides to the river. Future sampling and analysis plans for characterization of the river system include additional leaching tests, hydraulic conductivity tests, geochemical and geotechnical tests, additional wells, and

sampling of groundwater at the shoreline, in sediment porewater and in epibenthic water immediately above the bottom of the river. This investigation will be used in quantitative fate and transport modeling to evaluate the flux of constituents to the river and to assess risks to human and ecological receptors. .

b. **The proposed action is effective in safely containing the ash**. The perimeter berm, foundation stabilization system, and ash fill will be effective and stable over the long term, so that the closed Dredge Cell will not present a threat of future release. Analysis of the conceptual berm stability under static loading conditions resulted in safety factors greater than 1.5, which are indicative of stable conditions. The conceptual berm configuration and foundation design effectively address the four contributing factors cited by AECOM in their root cause analysis of the former dike failure:

   i. ***Fill Geometry.*** The former failed dike was constructed using small dikes stacked progressively up slope on top of nearly 80 feet of sluiced ash and a sensitive silt ("slimes") layer. Total height of the dikes that surrounded the former Dredge Cell prior to its failure was elevation 820 ft msl. The proposed action will reconstruct the perimeter containment using a single compacted earthen berm placed on a crushed rock working platform. The perimeter berm will be built to a height of 765 ft msl; the Dredge Cell will be built to a maximum elevation of approximately 790 ft msl, which is 30 ft lower than the former Dredge Cell prior to its failure.

   ii. ***Fill Rates.*** The elevation of the ash in the former Dredge Cell prior to failure was increasing at a rate of about 6 ft/yr, more rapidly compared to earlier years, which added load to the wet ash beneath the dikes. In particular, filling resulted in loose, wet ash saturated throughout its depth, which led to high porewater pressures at depth and low strength in the sluiced ash materials. The proposed action will reconstruct the cell fill by dry stacking using dewatered ash, compacted in thin lifts. Results of the test embankment have shown that such construction methods do not result in excess porewater pressures in the foundation ash materials under a controlled and monitored rate of filling.

   iii. ***Foundation Soils.*** Creep deformations within the submerged loose slimes was occurring under the load of loose wet ash in the former Dredge Cell, which caused a reduction in the strength of the slimes and led to deep-seated failure of the dike. The proposed action will reinforce the perimeter berm foundation with soil-cement columns that will not rely on the strength of the soft foundation soil layer for stability, but will instead transfer the load substantially to the soil-cement columns. The foundation ash/soil layers beneath the perimeter berm will be mixed in-place with cement grout, to achieve a specified strength. The foundation improvements will be designed to support the internal pressures from the landfilled ash, even if a strong earthquake were to liquefy the saturated ash/soil layers beneath the ash fill.

   iv. ***Ash Fill.*** The original sluiced ash was deposited under water, resulting in a high void ratio (very loose ash) that did not consolidate or densify under the surcharge weight of ash placed above it. As a result, the loose wet ash had a low undrained shear strength with a very sensitive structure. The proposed action will reconstruct the cell fill above current grades using dewatered ash, compacted in thin lifts on top of a constructed working platform that serves as a capillary break. Results of the test embankment study have shown that the shear strength of the compacted dry ash is much greater than loose

wet ash. The moisture content of the dry ash will be at the optimum level to achieve a specified shear strength.

The test embankment program was successful in demonstrating that stable embankments can be constructed across the Dredge Cell subgrade. The results verified key design parameters, including settlements, horizontal displacements, porepressures, strength, and drainage from the ash fill. The results also verified key construction methodology, including control of moisture content, compaction, daily lift thickness and filling rates, and erosion control. Successful completion of the test embankment program was primarily attributed to use of a working platform, geotechnical instrumentation and evaluation, moisture conditioning, embankment geometry and surface runoff, and erosion control. The test embankment results will be used as a basis for embankment design and construction.

For these reasons, the perimeter berm, foundation stabilization system, and ash fill will be effective and stable over the long term.

c. **The proposed action minimizes offsite transportation and disposal impacts**. By disposing of the ash onsite, the proposed action will virtually eliminate inherent short-term risks associated with shipment of ash over public roadways or railways and will eliminate uncertainties in implementing offsite disposal. The following describe the reasons why onsite disposal is preferred over offsite disposal.

   i. ***Transportation risks.*** If ash were to be shipped offsite, short-term risks of railroad incidents or rail-vehicle intersection accidents would be proportionate to the number of trip-miles. Offsite transport of more than 2.8 million cy of ash would result in nearly 125,000 trip-miles by rail alone. Transportation risk calculations presented in the EE/CA indicate that an estimated 1 rail accident, 0.8 rail injuries, and 0.4 rail fatalities could occur. Hauling a portion of the ash by truck would reduce potential rail transportation risks, but increase the truck transportation risks accordingly. Offsite shipment of ash would involve more than 380 trains hauling for 19 months, which would result in continued disruption of local traffic and inconvenience to local residents. Greater volumes of offsite shipment would result in even higher transportation risks. Offsite shipments implemented during the time-critical removal action have received considerable objection from local residents. Several public comments on the EE/CA (see the Responsiveness Summary in Attachment B) expressed concern regarding truck hauling due to the increased danger of traffic and potential damage to area roadways. Onsite disposal will minimize these transportation risks.

   ii. ***Acceptability of offsite disposal.*** Public opposition to use of a particular permitted disposal facility would complicate implementability of offsite disposal. Several public comments on the EE/CA (see the Responsiveness Summary in Attachment B) expressed concern over continued offsite disposal at the Arrowhead Landfill. Environmental Justice concerns were raised as to the public health, socioeconomic, and equity implications of continuing to dispose of ash from the non-time-critical action in a low-income and minority community. Landfill operation concerns were raised as to the ability of offsite landfills accepting coal ash to handle the specific regulatory and management controls needed. Operational concerns included control of air quality and fugitive dust, leachate treatment, surface water quality, and groundwater quality. These concerns and public opposition regarding the Arrowhead Landfill would likely be present if other permitted offsite disposal facilities were to be used. TVA does not have the ability to control the waste management practices at commercial offsite disposal

facilities. Onsite disposal will eliminate these concerns regarding acceptability of offsite disposal.

Several public comments on the EE/CA (see the Responsiveness Summary in Attachment B) expressed a preference that all ash be removed from the area, not only the ash from the embayment, but all the ash remaining on the site, so as to achieve a vision for the site that is entirely free of ash. However, offsite disposal of such large quantities of material would have even greater negative impacts to the community due to long-term shipments, and would further compound the problems discussed above regarding transportation risks, disposal capacity, and acceptability. Onsite disposal will protect the health of local residents and persons that use the river and avoid significant offsite transportation and disposal risks.

d. **The proposed action results in comparable time to achieve RAOs.** The proposed action is expected to be complete in less than 5 years, including final closure of both the Dredge Cell and Ash Pond. Closure will occur in phases, and must be carefully coordinated with the dry ash conversion project, dredged ash dewatering operations, and long-term wastewater management facilities needed to support the operating power plant. The time to complete the action is not substantially different from other alternatives that were considered. Although offsite disposal could likely be completed in less than 4 years, TVA does not consider the difference in these duration estimates to outweigh the disadvantages of offsite transportation and disposal.

e. **The proposed action is the most cost-effective.** The proposed action is estimated to cost the least of the alternatives considered, primarily due to the high cost of offsite transportation and disposal associated with the other alternatives. Long-term operation and maintenance costs are expected to be the same for all alternatives. This lower estimated cost, combined with the lower transportation and disposal risk and the effectiveness in meeting RAOs and safely containing the ash, provides the best tradeoff of effectiveness, implementability, safety, time, and cost among the alternatives considered. Several public comments on the EE/CA (see the Responsiveness Summary in Attachment B) expressed a preference for a lower cost approach that would have the least impact on electric rate payers in the region.

3. Contribution to Remedial Performance

The proposed removal action will address the threats discussed in Section III, in accordance with the removal criteria of NCP Section 300.415(b)(2). The removal action contemplated in this Action Memorandum is consistent with future remedial actions that are anticipated at the Site. A Preliminary Assessment will be conducted at the completion of the removal work to address whether additional assessment or remedial work is necessary to address any residual contamination remaining at the Site, predominantly within the river system.

4. Description of Alternative Technologies

The use of alternative technologies is not anticipated at this time. For low-level threat waste found at metals-in-soil sites, the EPA presumptive remedy is containment, although excavation with disposal and other institutional controls have also been used. The proposed removal action will use a combination of these presumptive remedy technologies.

The EE/CA presented an evaluation of alternative technologies for the embayment/Dredge Cell, including phytoremediation, separation by screening or sieving, electrokinetic separation, soil washing, chemical extraction, immobilization, and vitrification. These other technologies are not considered cost-effective nor implementable at this site.

The EE/CA also presented an evaluation of other alternatives for the embayment/Dredge Cell. One alternative would have excavated the ash and other materials in the embayment and disposed of this material offsite. A berm would have been installed to keep ash in the Dredge Cell from entering the embayment in the future and the Dredge Cell would have been graded for drainage. The height of the closed cell would have been approximately 790 ft msl. The embayment would have been restored to an aquatic and riparian environment. The actions under this alternative would have been designed to avoid returning any spilled ash back into the Dredge Cell and to close the remainder of the Dredge Cell in place. This alternative was not selected because of the large volume of material (more than 2.8 million cy) that would have been transported by rail and/or truck offsite, corresponding transportation risks, and uncertainties in acceptability of the final disposal site. This alternative would not have provided any greater environmental protectiveness, yet would have resulted in capital costs that are 60% higher than the selected action.

Another alternative would have excavated the ash and other materials in the embayment, plus enough ash from the Dredge Cell to limit long-term reliance on a dike between the cell and the embayment, yet would have left enough ash to provide buttressing for the remaining dikes. The removed material would have been disposed offsite. The Dredge Cell would have been graded to a gradual slope, with a maximum height of the closed cell of approximately 780 ft msl at its highest point, although most of the Dredge Cell would have been below elevation 765 ft msl. The embayment would have been restored to an aquatic and riparian environment. The actions under this alternative would have been designed to minimize long-term reliance on a dike containment system by removing much of the ash from the Dredge Cell above the surrounding ground level. This alternative was not selected because of the very large volume of material (more than 6.8 million cy) that would have been transported offsite, primarily by rail, corresponding very high transportation risks, and high uncertainties in the acceptability of the final disposal site. This alternative would not have provided any greater environmental protectiveness, yet would have resulted in capital costs that are 160% higher than the selected action.

Another alternative, similar to the selected action, would have excavated the ash and other materials in the embayment and placed them fully in the Dredge Cell, which would have been closed as part of the removal action. The adjoining Ash Pond would have been closed at a later date, which would have avoided complications in project phasing needed to coordinate closure of the Ash Pond with completion of dredging and with the KIF dry ash conversion project. This alternative was not selected because closing the two areas separately would have resulted in greater time and cost, primarily due to closing the Ash Pond at a later date and increasing the foundation stabilization needed for perimeter berm construction. This alternative would have resulted in capital costs that are 15% higher than the selected action.

Several other options were considered, but not retained as alternatives, as explained in the EE/CA. Those options included leaving all materials within the embayment and either covering them in-place or placing a liner beneath them; excavating all ash from the embayment and replacing with clean fill dirt; excavating all ash from the embayment and placing them in a new onsite lined landfill, and excavating all ash from both the embayment and the entire Dredge Cell.

5. Engineering Evaluation/Cost Analysis (EE/CA)

The EE/CA for the embayment/Dredge Cell (Jacobs 2010) is available in the Administrative Record, available at the TVA Outreach Center, the Kingston Public Library, the Harriman Public Library, and online at *www.tva.com/kingston* and *www.epakingstontva.com.* The EE/CA was issued for public comment on January 19, 2010. Following a 75-day public comment period, written responses to significant comments on the EE/CA were prepared. The Responsiveness Summary is attached to this Action Memorandum (Attachment B).

6. Applicable or Relevant and Appropriate Requirements (ARARs)

Pursuant to the NCP, removal actions conducted under CERCLA are required to attain ARARs to the extent practicable, considering the exigencies of the situation. Waivers described in 40 CFR 300.430 may also be used for removal actions. This action is being conducted as a non-time-critical removal action. Pursuant to the AOC, restoration of area waters impacted by the coal ash release will be considered a remedial activity for purposes of complying with ARARs. Therefore, ARARs pertaining to such restoration shall be attained unless a waiver has been approved by EPA. A list of ARARs is attached to this Action Memorandum (Attachment C).

Closure of the Dredge Cell will be in accordance with Tennessee Solid Waste Rule 1200-1-7, thereby complying with terms of the TDEC Commissioner's Order. The final cover system will be at least 36 inches thick, consisting of a compacted soil layer at least 24 inches thick which has a permeability no greater than 1×10^{-7} cm/sec, and a second soil layer at least 1-ft thick for the support of vegetative cover. An alternate final cover system may be used provided that it provides equivalent or superior performance in minimizing infiltration. The final surface will be graded and/or have drainage facilities that minimize erosion of cover material, optimize drainage, and are consistent with drainage in the surrounding area.

Restoration of the embayment will restore waters of the state and the associated floodplain and wetland areas impacted by the ash in compliance with TDEC 1200-4-3 and associated ARARs. Removal of the ash will remove the naturally-occurring metals and radionuclides that could produce toxic effects on the health and safety of humans or animals. Water quality will be restored to meet AWQC in surface water within the embayment. Waters will therefore not contain residual pollutants from the ash that may impair the usefulness of the river water as a source of domestic or industrial water supply, recreation, or irrigation, or that may impair the health of fish or aquatic life.

Pursuant to the AOC, TVA agrees that it will comply with Clean Water Act Section 404(b)(1) guidelines to restore waters of the United States to the functional level occurring prior to the ash release. In order to identify the full extent of response activities necessary to meet this ARAR, TVA will conduct a jurisdictional assessment of the Site, to the extent not previously evaluated, which will identify all waters of the United States impacted by the release. The jurisdictional assessment will be performed in accordance with the requirements of the AOC.

Site preparation, construction, and excavation activities will be conducted in compliance with TDEC 1200-3-8 and TDEC 1200-4-10, including precautions to control fugitive dust emissions, erosion, and sedimentation. Dredged material removed from the embayment will not be placed into an aquatic ecosystem, in compliance with 40 CFR 230.10(a).

Excavated ash will be characterized, managed and disposed in compliance with 40 CFR 262.11 and TDEC 1200-1-11. Because ash will be disposed onsite, rules pertaining to offsite disposal or transportation of hazardous materials are not applicable.

B. PROJECT SCHEDULE

The proposed removal action will be implemented within an estimated 4.25 years following design of the removal action. Figure 5 shows a conceptual schedule for construction sequencing. A removal action work plan will be developed to provide more details on the anticipated productivity of the excavation, dredging, foundation stabilization, berm construction, ash stacking, and final cover construction. The schedule is highly dependent on weather and availability of specialty contractors.

C. ESTIMATED COSTS

Capital costs associated with implementing the proposed removal action are estimated at $268.2 million (2009 dollars). Subsequent operation and maintenance costs are estimated at $686,000/year (2009 dollars).

V. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

The timing of the decision on the embayment and Dredge Cell is important. The ongoing time-critical action is scheduled to be completed in spring 2010. Construction and transportation activities will have been underway for over a year to accomplish this goal. The remaining ash in the embayment will have been contained by constructing drainage features to separate clean water runoff from the ash. Although the clean water ditches have been designed for a 25-year recurrence interval, some of the drainage features in the embayment (sediment basins) have been sized for a storm event having only a 2-year recurrence interval; a delay in the decision would increase the risk of future ash releases during greater storm events. Implementation of the proposed removal action scope is needed by spring 2010 to allow for continuation of removal activities and smooth transition from time-critical to non-time critical actions.

VI. OUTSTANDING POLICY ISSUES

There are no outstanding policy issues.

VII. ENFORCEMENT

This action is being undertaken pursuant to an AOC between TVA and EPA. TVA is the lead Federal agency for this action.

VIII. RECOMMENDATION

This Action Memorandum is the decision document that represents the selected removal action for the restoration of the Swan Pond Embayment and closure of the Dredge Cell associated with the TVA KIF Release Site in Roane County, Tennessee. This Action Memorandum has been developed in accordance with CERCLA as amended, and is not inconsistent with the NCP. This decision is based on the Administrative Record for the site, available online at *www.tva.com/kingston* and *www.epakingstontva.com.* The Administrative Record is also available at the following locations:

TVA Outreach Center
509 N. Kentucky Street
Kingston, Tennessee
(865) 632-1700

Kingston Public Library
1004 Bradford Way
Kingston, Tennessee
(865) 376-9905

Harriman Public Library (computer disks)
601 Walden Street
Harriman, Tennessee
(865) 882-3195

IX. REFERENCES

U.S. Environmental Protection Agency (EPA). 2009a (May 11). *Administrative Order and Agreement on Consent, Docket No. CERCLA-04-2009-3766*, Region 4.

Jacobs 2010. (January 15). *Kingston Ash Recovery Project, Non-Time-Critical Removal Action, Embayment/Dredge Cell, Engineering Evaluation/Cost Analysis (EE/CA).*

Tennessee Department of Environment and Conservation (TDEC) 2009 (January 12), *Commissioner's Order, Case No. OGC09-0001*, Division of Water Pollution Control.

Tennessee Valley Authority (TVA) 2001. *Material Safety Data Sheet, Class "F" Fly Ash*, MSDS No. BP-001.

TVA 2009a (March). *Final Environmental Assessment, Emergency Dredging for the Kingston Fossil Plant Ash Dike Failure, Roane County, Tennessee.*

TVA 2009b (March 2). *Corrective Action Plan for the TVA Kingston Fossil Plan Ash Release, Roane County, Tennessee.*

TVA 2009c (August 4). *Action Memorandum: Request for Removal Action at the TVA Kingston Fossil Fuel Plant Release Site, Roane County, Tennessee.*

X. ATTACHMENTS

Attachment A Figures
Attachment B Responsiveness Summary
Attachment C Applicable or Relevant and Appropriate Requirements (ARARs)