Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

EXHIBIT 5

Documents submitted:
Offsite Ash Disposal Options Plan
(Revised)
Date submitted
6/ 29/ 2009

Submitted to whom
Leo Francendese, EPA

Concurrence

Received	Not Applicable	TVA
☒	☐	Anda Ray
☒	☐	Mike Scott
☐	☒	Kathryn Copeland
☐	☒	Cynthia Anderson
☐	☒	Dennis Yankee
☐	☒	David Stephenson
☐	☐	
☐	☐	
☐	☐	

Received	Not Applicable	Jacobs
☐	☒	John Moebes
☒	☐	Julie Pfeffer
☐	☒	Jack Howard
☐	☒	Donna Cueroni
☐	☒	Paul Clay
☐	☐	

Approvals

TVA Michael T Scott Date 6/30/09

EPA Leo Francendese Date 7/2/09

Consulted w/ TDEC B. Scott et al.

cc:

- ☒ Anda Ray, TVA
- ☒ Barbara Scott, TDEC
- ☒ Leo Francendese, EPA
- ☒ Mike Scott, TVA
- ☒ Dennis Yankee, TVA
- ☒ Kathryn Copeland, TVA
- ☒ Cynthia Anderson, TVA
- ☐ John Moebes, Jacobs
- ☒ EDM
- ☒ Julie Pfeffer, Jacobs
- ☒ David Stephenson, TVA
- ☒ Michelle Cagley, TVA
- ☒ Greg Signer, TVA
- ☒ KIF Incident Document Control
- ☒ Katie Kline, TVA
- ☒ Gretchen Wahl, Jacobs
- ☒ Barbara Scott, TDEC
- ☒ Dannena Bowman, EPA
- ☒ Jeff Gary, Jacobs

Tennessee Valley Authority, 400 W. Summit Hill Drive, Knoxville, Tennessee 37902

Anda A. Ray
Senior Vice President
Office of Environment and Research

June 30, 2009

Mr. Leo Francendese
U. S. Environmental Protection Agency
Region 4
61 Forsyth Street Southwest
Atlanta, Georgia 30303
francendese.leo@epa.gov

By e-mail

Dear Mr. Francendese:

Please find enclosed the Off-Site Ash Disposal Options Analysis Work Plan. The enclosed work plan fulfills the requirements of Section IX, paragraph 28, item of the Administrative Order and Agreement on Consent. Please contact me if you have any questions.

Sincerely,

Michael T Scott

for Anda A. Ray
Senior Vice President and Environmental Executive
Office of Environment and Research
WT 11A-K

Enclosures

Offsite Ash Disposal Options Analysis

1. Introduction

The Kingston Fossil Plant (KIF) is located at the confluence of the Emory and Clinch Rivers on Watts Bar Reservoir near Kingston, Tennessee. KIF is one of the Tennessee Valley Authority (TVA)'s larger fossil plants. It generates 10 billion kilowatt-hours of electricity a year, enough to supply the needs of about 670,000 homes in the Tennessee Valley. Plant construction began in 1951 and was completed in 1955. KIF has nine coal-fired generating units. The winter net dependable generating capacity is 1,456 megawatts. The plant consumes some 14,000 tons of coal a day.

On Monday, December 22, 2008, just before 1 a.m., a coal fly ash spill occurred at TVA's KIF, allowing a large amount of fly ash to escape into the adjacent waters of the Emory River. Ash, a by-product of a coal-fired power plant, is stored in containment areas. Failure of the dredge cell dike caused about 60 acres of ash in the 84-acre containment area to be displaced. At the time of the slide, the area contained about 9.4 million cubic yards (cy) of ash. The dike failure released about 5.4 million cy of coal ash that now covers about 300 acres, including most of Swan Pond Embayment, the lower Emory River, and reservoir shorelands. Fly ash filled the Swan Pond Embayment on the north side of the KIF property adjacent to the failed dredge cell. A dike has been constructed in the eastern portion of the Swan Pond Embayment to contain the fly ash to the west of the dike until further investigation and disposal options can be evaluated, approved by the regulators, and implemented. Fly ash also entered the channel and overbank areas of the riverine section of the Emory River. TVA is planning to recover the material outside of the Swan Pond Embayment by use of dredging operations.

The fly ash that was released to the Emory River originates from the coal burned in boilers for power production at KIF. The coal, in its natural state, contains various metals that can be retained with the ash after burning. The ash itself is primarily composed of fine silica particles very similar to sand. Trace amounts of arsenic, selenium, cadmium, boron, thallium, and other metals which occur naturally in the coal remain in the ash after coal combustion. These metals are typically bound to the ash.

Dredging is ongoing using hydraulic dredging with mechanical debris removal. The purpose of removing the ash from the river is to limit the potential for future ash migration and to prevent upstream flooding in the event of a large rainfall. The decision for dredging is documented in a Time-Critical Removal Action Memorandum.

In general, dredged material is pumped into a Rim Ditch where solids settle out of the solution which is only about 5% solids initially. Further improvements in dredging efficiency will likely increase percent solids. The water continues flowing through a Sluice Ditch followed by the Ash Pond and then Ash Stilling Pond where further settlement occurs. Settled ash is removed from the ditches through mechanical excavation and windrowed to dry to between 70 and 80% solids. The ash processing area is sufficiently large to allow short-term staging of the ash awaiting transportation and disposal. Ash recovery and processing is discussed in more detail in the currently approved Ash Processing Area Construction and Operation Plan. A subsequent work plan for the time critical removal action will be generated presenting a revised approach to ash recovery and processing. Map 1 below shows the ash recovery areas.

Map 1

The decision to process, transport, and dispose of the ash recovered as part of the dredging is also documented in a Time-Critical Removal Action Memorandum. Two transportation methods were discussed in the action memorandum, trucking and rail. Under the Environmental Protection Agency (EPA) and TVA Administrative Order and Agreement on Consent, acceptable disposal locations are described as follows. "TVA shall not permanently dispose of any Waste Material at an off-Site facility, or in a new landfill on-Site, unless that facility or landfill is operating in compliance with RCRA Subtitle D permitting requirements for operation and disposal of industrial wastes which, at a minimum, shall include the use of a synthetic liner, leachate collection system, groundwater monitoring, financial assurance, and closure and post-closure care."

The purpose of this disposal evaluation is to consider acceptable offsite disposal locations and recommend one or more for the disposal of dredged ash material produced during the time critical removal phase of the cleanup along with processed ash. Some ash may remain onsite in the

short-term as part of the stockpile in the ash processing area or as part of a dredge cell embankment test. Because of the quantity of ash material that will be generated during the time-critical removal and the need for prompt action to address the spill, most of the ash generated during the time critical removal action will be transported and disposed of offsite. Other on-site and off-site disposal options will continue to be evaluated as work progresses.

There is also ash generated during current plant operations that is being discharged to the same ash processing system as the dredged ash. Therefore, the ash generated during implementation of the time critical removal action, roughly a year's worth, is being commingled with the recovered ash and will also be included in this disposal decision.

This decision does not include ash that is currently in the failed dredge cell or in the embayment, west of Dike #2. Cleanup and disposal decisions regarding this material will be evaluated as part of the Engineering Evaluation/Cost Analysis performed during the non-time critical removal action. Table 1 illustrates the various sources of ash from KIF and what is included in this evaluation and recommendation for disposal.

Table 1. Ash Quantities and Disposal Method

Sources of Ash	Estimated Ash Quantity	Pre-Spill Disposal Method	Post-Spill Handling /Disposal Method
Current Plant Operations			
Fly Ash	~ 390,000 dry tons/yr ~ 360,000 cy/year	Dredged from main Ash Pond, pumped to upper dredge cells	Wet sluiced from the plant to the processing area, dried and prepared for off-site disposal.
Bottom Ash	~ 95,000 dry tons/yr ~ 88,000 cy/year	Bottom ash is retrieved in the bottom ash sluice channel and used to construct the raised dredge cell dikes, which are made of bottom ash, fly ash and clay.	Wet sluiced from the plant to the processing area, dried and prepared for off-site disposal.
Released Ash – Emory River	2.5 M cy	N/A	Dredged and pumped to the drying area, dried and prepared for off-site disposal.
Released Ash – Swan Pond Embayment, East of Dike 2	0.5 M cy	N/A	Dry ash transported to processing area for offsite disposal or used in onsite tests. Wet ash dredge as above.
Released Ash – Swan Pond Embayment, West of Dike 2	2.4 M cy	N/A	Part of a future decision
Ash Remaining in the Dredge Cell	3.5 M cy	Dredge Cell was the Disposal site	Part of a future decision

The total volume of ash that may be disposed of as part of this decision in the next year is approximately 3 million cy. TVA proposes to transfer about 9,000 cy or approximately 7500 tons of ash off-site each day for disposal. Sometimes the load may be higher as material is brought in from east of Dike #2. This amount of material would require about 85 to 90 rail cars or approximately 500 truck loads leaving the site each day. Material could be moved off-site 24 hours per day, 7 days per week. Expected improvements in dredging productivity could create a dredge production rate of up to 15,000 cy per day. A supplement to this workplan will be issued to address the higher production rate.

Ash samples, as well as a control sample of soil, were taken on December 29 and 30, 2008 in the Kingston area and analyzed for radioactivity. The results indicate the ash contains small amounts of naturally occurring radioactive material found in the earth and coal. Burning of the coal releases heat energy and reduces the amount of material in which the radioactive material remains. Though this does not increase the amount of radioactive material present, its relative concentration is greater than it is in the earth and coal. This material is not required to be managed as a low level radioactive waste.

Moreover, the ash is not considered a Resource Conservation and Recovery Act (RCRA) hazardous waste. The U.S. Environmental Protection Agency (EPA) Toxicity Characteristic Leaching Procedure (TCLP) uses acid digestion (pH of less than 2) to provide a screening-level indication of the potential for leaching of metals. The TCLP test is performed to determine whether the material is hazardous or non-hazardous for the purpose of regulated landfill disposal (40 Code of Federal Regulation [CFR] 261.24). Based on screening, ash samples did not exceed hazardous waste concentrations for any of the metals in the TCLP test.

Because one of the landfills being considered for offsite disposal is located in Alabama, TVA evaluated Alabama regulations governing the disposal of the material. Fly ash and bottom ash is specifically excluded as a solid waste and is called out as a special waste under ADEM Admin Code rules 335-13-4-.21(1)(c). To dispose of a special waste at a commercial solid waste disposal facility in Alabama a "Solid Waste Profile Sheet" is submitted with a hazardous waste determination in accordance with ADEM Admin Code 335-14-2.

2. Offsite Disposal Alternatives

On February 23, 2009 TVA issued a request for proposals (RFP) to identify off-site disposal options for consideration. Options requested for proposal included appropriately permitted facilities immediately available to receive and dispose/store the Kingston ash material and that are accessible by barge, truck and/or rail. Responses to the RFP included options for disposal of the material in Subtitle D, Class I landfills or Class II industrial landfills and beneficial reuse/structural fill of the ash in mine or quarry reclamation projects. TVA received about 25 proposals that were screened based on cost and technical and operational criteria. As a result of the procurement process, three sites accessible by rail and four additional landfill sites accessible by truck were identified as being immediately available for ash disposal.

The following alternatives were considered but determined not to be feasible at this time or they did not meet TVA's purpose and need, or the AOC disposal requirements. Consequently, they were eliminated from further evaluation.

- Use of Roane County Landfill as a monofill for coal ash. The Roane County landfill is a permitted Subtitle D, Class I Municipal Solid Waste facility consisting of two phases. Phase I is filled, closed and under post-closure care. Phase II was used as a soil borrow source in the development of Phase I, but has not been developed. Rather than develop Phase II, the county contracted with the landfill in Dayton, TN to receive its municipal waste. Standards of landfill design and permitting have changed since 1989 when this site was first permitted, and the county will have to resubmit their permit in order to develop Phase II as an ash monofill. The capacity of Phase II would be about 2.5 million cy and the haul distance is less than five miles. Because of the time frame required to resolve various technical issues and to complete permit requirement this site was eliminated from consideration as a site immediately available for the disposal of ash being dredged from the Emory River.

- Crab Orchard Quarry is a 17-18 acre active quarry located about 22 miles from KIF. Active mining is occurring on about 10 acres of the property with the rock being supplied to the Kingston Scrubber Project. This site could be permitted as a Class II ash monofill or as a Permit-by-Rule Solid Waste Facility for beneficial reuse. Because of the need for an approved site immediately available to receive ash, this site was eliminated from consideration.
- Crossville Coal Mine was developed to provide coal to TVA. The coal seam that was feasible to mine played out in 2006. The property comprises about 1,200 acres with about 200 acres disturbed by mining operations involving mountain top removal/strip mining. The site is now being reclaimed under a permit with the Office of Surface Mining. The City of Crossville has adopted the provisions of the state of Tennessee's Jackson Law that would require approval from the governing body of the municipality or city before applying for a permit. Because local approval is likely to be controversial and the time it would take for permitting and approval would likely be protracted, TVA does not consider this site to be immediately available for ash disposal.
- Energy Solutions operates a landfill in Utah. This landfill has sufficient volume to accept all of the TVA ash. However, the landfill is 1700 miles from KIF by rail resulting in very high transportation costs and a greater chance for schedule impacts due to rail or weather issues along with a greater chance for accidents. The distance is nearly 5 times as far as the closer rail sites. This landfill was eliminated from further evaluation because of the long distance for rail travel.
- Other alternative locations for Subtitle D, Class II landfills were considered, including use of existing TVA property. However, because of the time requirement to permit those facilities, TVA has eliminated them from consideration at this time.

The landfill disposal sites being considered include state and local approved Subtitle Class I landfills. As part of the permitting process, Class I Landfills must be located, designed constructed, operated and maintained such that the fill areas meet minimum buffer zone standards relative to property lines, residences, down gradient wells, and water bodies. Additionally, Class I landfills must have state-approved management plans to address storm water and erosion control; leachate collection, disposal, and monitoring for those parameters listed in the TCLP; wastes screening; and monitoring including groundwater, surface water, and leachates. Other requirements include dust control, litter control, flood protection as needed, fire safety, and a landfill gas management system.

The three sites with rail access which are immediately available to receive Kingston ash are described below and in Table 2.

Table 2. Disposal Sites with Rail Access

Operator	Phillips and Jordan, Inc.	Veolia Environmental Services	Hazleton Creek Properties, LLC
Facility	Arrowhead Landfill	Veolia-Taylor County Landfill	Hazleton Mine Reclamation Project
Type	Class 1, Subtitle D Landfill	Class 1, Subtitle D Landfill	Beneficial Reuse/Structural fill,

			abandoned coal mine
State	Alabama	Georgia	Pennsylvania
Rail Distance	327 miles	340 miles	660 miles
Total Ash Capacity (cy)	11,000,000	48,000,000	5,000,000
Max. Daily Capacity (cy)	Currently 6,500; 13,800 by mid July, 2009	Unlimited	8,000

Arrowhead Landfill is located in Perry County, near Uniontown, AL. It is a Subtitle D, Class I landfill served directly by Norfolk Southern rail line. The distance by rail from KIF to the Arrowhead Landfill is 327 miles. The site has 11 million cy of storage capacity and has currently developed capacity to immediately receive 1.5 million cy of KIF material. The State of Alabama has approved the placement of KIF coal ash in the Arrowhead landfill. The site has more than sufficient capacity to accommodate the total volume of ash to be removed from the Emory River. It has existing rail spurs that can accommodate 200 to 250 rail cars. At the site, ash would be off-loaded from the rail cars by hydraulic excavators and loaded into 40 ton trucks for transfer about 1.5 miles to the working landfill face where the TVA ash would be placed.

Veolia-Taylor County Landfill is located near Mauk, GA. It is a Subtitle D, Class I landfill served directly by CSX rail line via Norfolk Southern rail line out of Kingston. The distance by rail from KIF to the site is about 340 miles. At the site, ash would be off-loaded from the rail cars by 30 ton excavators and loaded into 40 ton trucks for transport one half mile to the working face of the landfill. The Veolia landfill has 48 million cy of available storage capacity which could accommodate more than the maximum volume of ash from the KIF site. The facility has an existing rail spur which could accommodate 120 rail cars.

Hazleton Mine Reclamation Site is located within the City of Hazleton, Luzerne County, PA. The site is served directly by Norfolk Southern rail line. The distance by rail from KIF to the Hazelton site is about 660 miles. The property covers about 330 acres and has been impacted by surface and deep mining and land filling. The site has a permit to receive 5 million cy of coal ash for beneficial reuse and has storage capacity to accommodate the total volume of ash from the KIF dredging operations. Currently, there is an existing rail spur on site which could accommodate 40 rail cars. Additional rail car storage is near the existing rail spur. At the site, ash would be off-loaded from the rail cars by a material handler with an elevated cab and hydraulic clam shell bucket into off- road trucks that would transfer the material to designated abandoned mine pits.

TVA has eliminated the Hazleton Site from consideration, as they are unable to commit to installing a liner for placement of KIF material.

Several Subtitle D Class I landfills had been identified for ash transport by truck for disposal. At the Class I landfills, material would be mixed with other waste material, except for Chestnut Ridge, or used as layering material. At Chestnut Ridge, the material would be managed separately. Nearby landfills include:

- Meadow Branch Landfill, Athens, Tennessee
- Chestnut Ridge Landfill, Heiskell, Anderson County, Tennessee

- Volunteer Regional Landfill, Oneida, Tennessee
- Rhea County Landfill in Dayton, Tennessee

Table 3 contains the characteristics of the local landfills with truck access.

Table 3. Local Disposal Sites with Truck Access

Operator	Waste Connections	Waste Management	Waste Connections	Santek Environmental
Facility	Meadow Branch Landfill	Chestnut Ridge Landfill	Volunteer Regional Landfill	Rhea County Landfill
Type	Class 1, Subtitle D landfill	Class 1, Subtitle D landfill	Class 1, Subtitle D landfill	Class 1, Subtitle D landfill
State	Tennessee	Tennessee	Tennessee	Tennessee
Road Distance	57 miles	50 miles	58 miles	37 miles
Total Ash Capacity (cy)	2,000,000	Up to 5,000,000 with volume guarantee	5,000,000	7,125,000
Max. Daily Capacity (cy)	500	8500 tons	500	500

For most of these landfills, TVA would have to use two or more of landfills simultaneously because of limited storage capacity and to reduce the number of vehicles traveling a particular route, thus mitigating potential traffic congestion, noise and diesel emissions. Note that only the Chestnut Ridge Landfill can accept all the dredged ash at the necessary daily rate.

If used, the Anderson County location (Chestnut Ridge Landfill) would be accessed by I-40 E to I-640 E/I-75 N to exit 117, State Highway 170, and right on Fleenor Mill Road. This route is approximately 50 miles in length one way and most of this is interstate highway. The Meadow Branch Landfill in Athens, TN would be accessed by I-40 E to I-75 S to exit 49, TN-30 (Decatur Pike), to right on TN 750, Piney Grove Road. This route is approximately 65 miles one way. The Rhea County Landfill in Dayton, TN would be accessed by I-40 W to exit 347, US 27 toward Harriman/Rockwood to Smyrna Road. This route is approximately 36 miles one way. The Volunteer Regional Landfill in Oneida, TN would be accessed by Ruitan Road, TN-29, to US 27 to Bear Creek Road. This route is approximately 62 miles one way.

Based on most permit requirements for disposal at Subtitle D, Class I landfills, TVA is required to sample and characterize the ash based on waste acceptance criteria determined for each facility. The required tests include TCLP, total metals and paint filters. Following the tests, TVA would notify respective states of its intent to dispose of ash in their landfill(s) and request approval and a letter of certification that the material is acceptable as fill. The ash to be shipped

would be tested periodically to verify that the material continues to meet the waste acceptance criteria. To be transported to the sites, the material must also meet the Department of Transportation's (DOT) standards for a solid waste with moisture content of less than 30 percent and packaging requirements.

Additionally, for selected disposal site(s), TVA would submit an EPA identification number as well as the necessary contact information to acquire a Comprehensive Environment Response, Compensation, and Liability Act (CERCLA) off-site disposal clearance. Proper notifications would be made to the appropriate personnel at the EPA and the Tennessee Department of Environment and Conservation (TDEC) before removal of ash from KIF property.

3. Evaluation of Options

This analysis evaluates the impacts of transporting ash material by trucks or rail cars. It is based on the proposed removal of approximately 9,000 cy of ash per day at an estimated 20 percent moisture content. The ash quantity estimate represents the amount of material being removed from the river each day operating 24 hours per day, 7 days per week.

The concern with using entirely trucks is the increased traffic on local roads from sending over 500 trucks per day from KIF to one or several local landfills as well as an increased risk from accidents. There is known local community concern over the use of trucks. As ash trucks are moving, additional trucks will at times be entering the site carrying gravel and rock for other construction activities. When KIF was bringing nearly 500 trucks of rock onto the site earlier in the project, local roads were impacted and had to be resurfaced. Resurfacing would need to occur multiple times if trucks were used. In addition when comparing rail versus truck, Arizona State University sites that in terms of fuel efficiency, measured in ton miles per gallon, rail is 400 ton-miles per gallon and truck is 130 ton-miles per gallon. Therefore rail is approximately three times more fuel efficient which results in a smaller carbon footprint.

Two spurs with approximately 3575 feet of track along with signalization and appurtenances have been designed and are currently being constructed to accommodate off-site disposal using rail. Currently served by Norfolk Southern Railroad, the rail spurs will meet Norfolk Southern standards and specifications and TVA requirements. The spurs will connect directly to the existing Norfolk Southern branch line coming into KIF. Each spur will hold about 24 rail cars. Each day a unit train consisting of 85 to 110 loaded cars would leave KIF. Upon returning to the KIF site, empty cars would be staged and moved into position for loading as needed. These trains would be in addition to coal, ammonia, and limestone trains entering the site each day. Train traffic and impact to traffic on Swan Pond Road would increase greatly over that seen in the last few months.

Two primary public impacts to the use of rail transportation are 1) grade crossing delays to highway vehicles and 2) the comparative rail transportation rate to each location.

Grade crossing delay can be separated into two categories; the movement between the plant and the mainline junction along the branch line and the movement along the mainline. It can be estimated that an 85 car train (5500 linear feet) moving on a branch line at 15 miles per hour requires 4.3 minutes for the train to pass the grade crossing. An examination of aerial

photographs of the branch line route between the mainline junction and the plant indicate that there are five independent grade crossings. The cumulative impact to all grade crossings for the inbound empty and outbound loaded trains would be 43 minutes per day.

The mainline railroad grade crossing delay to motor vehicles is insignificant since the trains are moving under normal railroad operations at speeds exceeding 35 miles per hour.

An economic evaluation of the total costs for the disposal options considered favors rail transportation sites. The rail sites are located in other states while the closer trucking sites are located in Tennessee. The total disposal costs for rail served sites plus fewer trucks on the local roads meant that a rail site is preferred for the majority of the material requiring disposal.

4. Results of Loading Test

A series of pre-qualified loading vendors were invited to participate in a rail car loading test which began the week of May 4, 2009. Based on the concern over potential community opposition to trucks and the potential for accidents by trucks, only rail vendors were invited to participate in the test. Based on these evaluations, loading and disposal criteria have been established for the future loading, transportation, and disposal operations at the KIF Ash Recovery Project site. Trucks may be tested in the future.

4.1 Participating Contractors

The following contractors were pre-qualified for the ash loading and disposal contract. Each of the participating contractors participated in some aspect of the loading test:

Name	Role
Phillips & Jordan, Inc.	Loading & Disposal
MACTEC	Loading
Veolia Environmental Services	Disposal
Norfolk Southern	Railcar Provision & Transport

4.2 Loading Process

Each loading contractor performed their loading operations in the KIF Rail Yard along Track 16 just south of the contractor trailers. Each contractor was required to load a total of 15 railcars to near capacity (approximately 90 tons each) with pre-specified but varying lining systems. Both loaders had wet weather to handle. Heavy rains occurred during loading operations or shortly thereafter.

Phillips and Jordan. Phillips and Jordan (P&J) elected to load all of its railcars with a hydraulic excavator equipped with a smooth-lipped bucket. Because of the excavator's cab elevation, an aggregate ramp was constructed for the excavator to work atop. The loading area was fixed so Norfolk Southern provided a tug to move the cars in and out of position during loading. The working area was protected from ash spillage with the use of a plastic liner encompassing the entire loading area.

The ash was brought to the loading area by tandem dump trucks and dumped into a large rock box for the excavator to remove material from. Each railcar took approximately 30 to 35 minutes to fill and position for the next load.

MACTEC. MACTEC elected to load its 15 railcars with the use of two front end loaders equipped with a 5 cubic yard bucket. The front end loaders removed material from a secondary stockpile in the Ash Storage Area and operated along Track 16 to their desired railcar. Ash containment was achieved by placing a plastic liner along the loading side and opposite side of the railcar.

Each railcar was loaded in approximately 45 to 50 minutes. The longer loading time for each railcar can be attributed to the distance the loaders had to travel from stockpile to railcar (approximately 1/8 mile average) and the difficulty the larger loader bucket had in loading the narrow railcar opening.

4.3 Lining Systems

Prior to loading operations, a breakdown of the desired lining type was given to each contractor. The breakdown is listed below:

- (1 car) 6 mil thickness Flap Liner or "Burrito Liner"
- (2 cars) 10 mil thickness Flap Liner
- (1 car) 20 mil thickness Flap Liner
- (2 cars) 10 mil thickness zipper type liner
- (1 car) 13 mil thickness zipper type liner
- (8 cars) Soiltac© spray liner system

Both the burrito and zipper liners were easily installed, reasonably easy to close, and kept out water well. The zipper liner was the more efficient of the two to close. The zipper liner could be quickly closed with the use of a single laborer. The burrito liners were more difficult to close and often required at least two laborers to do so.

While installing and closing, the 6 mil liner tended to damage or tear too easily. The 20 mil liner was very cumbersome during placement into the railcar and also during closing. The lining process was most efficient with the use of the 10 and 13 mil liners. They also were sufficient in resisting tears and abrasions and were light enough to work with.

The Soiltac© spray liner was the least effective of all three methods of containment. While Soiltac© maybe a very effective application for normal soil types, it did not develop a cohesive bond with the processed ash. The Soiltac© had a tendency to roll off the surface of the ash during application and settle in the corners of the railcar and in other craters or low spots.

4.4 Transportation

Prior to leaving the site, all railcars were inspected for leaks and residual ash. Each railcar was placarded with the proper waste identifier (UN 3077).

Phillips and Jordan (P&J) Railcars. Of the 15 P&J railcars destined for departure, there were only 7 that were approved to leave the site. All of the railcars with the Soiltac© application were rejected for transport by Norfolk Southern. Most of the Soiltac© cars were rejected due to visible water leakage, which appeared gray in color on two cars. The others were rejected because Norfolk Southern representatives did not have faith that the remaining Soiltac© cars would resist leaking in transit.

The Soiltac© mixture was not successful in coagulating with the processed ash and forming the protective seal it was intended to do. Because of this, water from storm events was able to seep into the ash and elevate its moisture content. An attempt was made to salvage these cars for transport by placing a protective 20-mil tarp over each car, but ultimately none of the P&J Soiltac© railcars were allowed to leave the site.

All of the railcars utilizing the flap "burrito" liners and zipper liners were approved for departure by Norfolk Southern. Some of the railcars did show signs of water leakage, but none of the water appeared gray in color which indicated it was water purged during loading that was present in the car before loading (in between the liner and railcar surface). No moisture from the ash could have escaped the car since it was completely contained within the liner.

MACTEC Railcars. Given lessons learned from the P&J loading procedures, Norfolk Southern provided railcars in better overall condition and an emphasis was made to more effectively seal the railcar joints with sealing compound. TVA/Jacobs directed that eight, instead of the planned seven, rail cars would be prepared and loaded utilizing burrito liners with the additional car liner being a 10-mil burrito liner. TVA/Jacobs directed five of the remaining seven cars to use Soiltac© would be lined with 6-mil polyethylene plastic in the bottom and sides of cars first. The two of the seven cars in the best condition were not lined. All seven cars that received the Soiltac© application were tarped immediately with 20-ml tarps after loading to prevent the intrusion of rainwater. Because of these precautions, all but one of the railcars were permitted to leave the site by Norfolk Southern. The lone railcar that did not leave the site was an unlined, Soiltac© railcar. It showed small traces of leakage of gray water in one of its corners.

4.5 Unloading and Disposal

Prior to site disposal unloading operations, representatives from TVA, Jacobs, Norfolk Southern, liner vendors, loader contractors, and, in Georgia the state regulators were present to witness unloading operations and to inspect the landfills. Both landfills were capable of handling the processed ash and cleaning of the railcars for return to site. Each waste handler effectively unloaded the railcars and designated a disposal area separate from its other municipal waste so the ash could be easily located in the future with the use of a global positioning system.

Perry County "Arrowhead" Landfill, Uniontown, Ala. (P&Jordan Loader). Unloading operations at the Perry County Landfill were performed with a clamshell specifically designed for railcar contents removal. The clamshell was able to remove about 98% of the ash and the remaining ash was removed by sweeping, shoveling, vacuum truck and pressure washer.

Veolia-Taylor County Landfill, Mauk, Georgia (MACTEC Loader). Unloading operations at the Veolia-Taylor County Landfill were done with a hydraulic excavator with a one yard bucket being used for the test only. Residual ash was then removed by sweeping, shoveling, and using a vacuum truck and pressure washer. The unloading procedure at Veolia was effective, but was slower than the Perry County, due to the small bucket size of the unloading equipment bucket. Veolia plans to increase the size of their bucket in this operation, if they are awarded the contract. Pressure washing was discontinued after seven cars and cleaning was completed to the satisfaction of Norfolk Southern representatives with sweeping, shoveling, and vacuuming. The only time pressure washing will be utilized in the cleaning process is when cars will be returned to Norfolk Southern general service.

4.6 Recommendations

As a result of the loading test, the following recommendations have been developed for full scale application.

- All rail cars will have some form of a liner material between the car and the ash material. Rail cars will be either lined and tarped or they will have a 10-mil burrito bag liner installed.
- Rail cars must be in good condition and capable of holding a minimum of 100-tons of ash material.
- Rail car dimensions must be known in order to acquire the correct tarps to prevent intrusion on car safety devices, allow installation efficiently and ensure multiple uses.
- Use of the burrito bag liners is preferred during rain events and tarps/lining can be used for dry weather loading operations
- Complete cleaning of used rail cars using pressure washing will only be needed when the cars are being returned to the rail company for general service.

The lessons learned from this test were used by the various vendors to improve their bid estimates for TVA.

5 Summary of Preferred Option

TVA proposes to use rail cars as the primary transportation means to transport ash being dredged from the Emory River and the ash settling ponds (as well as plant-produced ash in the interim) to a Subtitle D Class I landfill. Management and placement of the Kingston ash in the disposal sites would be in accordance with the facilities' operating procedures and all applicable federal, state, and local permit requirements and regulations.

TVA proposes to (1) design and construct two rail spurs adjacent to the processing area (underway); (2) load fly ash, bottom ash, and minor quantities of other small recovered debris into burrito lined gondola rail cars and/or tarped gondola rail cars with fitted liners; (3) move materials by rail to a selected permitted disposal site; (4) off-load material into trucks, as needed; and (5) transfer the material by truck and place it in a Subtitle D Class I landfill site. The empty rail cars would be cleaned inside and out to remove any residual ash before being returned to KIF for reuse. This alternative eliminates the traffic congestion and reduces air impacts, fugitive dust, cost and maintenance for road repair, and other public safety concerns related to trucking the majority of the material.

The rail spurs were designed and are being constructed in accordance with Norfolk Southern Railroad standards and specifications and TVA requirements. The design would require three turnouts, approximately 3575 feet of track, and two switches and a cross-over all within the TVA plant area. A 6' wide level surface would be constructed adjacent to each spur to accommodate load-out operations. Ballast for the rail spurs would be taken from a nearby rock quarry(ies). The rail spurs are designed and are being built so that runoff drains to the processing area. Signalization and appurtenances, including flashing lights and gates, are being constructed at the Swan Pond Road crossing. Norfolk Southern will construct one lead track turnout. Construction is expected to be complete by July 2009.

Each spur will hold about 24 cars. Ash would be moved from the processing area to a load-out station adjacent to each of the rail spurs by heavy equipment. Rail cars would be lined and

covered using a burrito wrap to control fugitive dust and leakage during transport. Any ash present on the outside surfaces of the rail cars would be removed before the cars leave the site. The cars would be in a sift-proof condition to satisfy DOT packaging requirements (49 CFR 173.240) and would have a proper hazardous material waybill describing the commodity as: "RQ, Environmental Hazardous Substances, Solid, N.O.S., 9, UN3077, PG III (contains arsenic compounds)". Emergency plans for managing issues occurring during transportation have been developed and fully coordinated with the railroad.

As proposed, one unit train with 85 to 110 loaded rail cars would leave the KIF site each day and proceed to the selected disposal site. Both disposal facilities have existing rail spurs where the rail cars would be stationed for off-loading. One or two excavators will be used to off-load the ash into trucks for transport to the placement site. The excavators are expected to remove 95 to 98 percent of the ash. Any ash remaining in the rail cars would be removed by a vacuum truck. A vacuum truck would also be used to remove any water that accumulates due to settling of the material during transport. At the disposal facility, water would be pumped/vacuumed out prior to unloading the rail car and properly managed along with any water remaining after unloading in the leachate collection system. The rail cars would be cleaned inside and out to remove residual ash before returning to KIF. The receiving facility would place the ash in a designated area encased in a soil barrier, separated from other waste materials and identified using a global positioning system coordinates and elevations. All rail car lining systems would be considered waste and would be disposed of along with the ash at the disposal facility.

The Arrowhead Landfill in Uniontown, AL was selected as the preferred disposal location. The total cost was notably less than the price for transport and disposal in the landfill in Mauk, GA. The Uniontown landfill is direct served by Norfolk Southern, while Mauk, GA landfill is served by CSX, which adds cost for dual service by both rail companies. Since both facilities were determined to be able to compliantly and safely handle the ash material in the quantity and frequency of delivery required, the final decision was based primarily on cost per ton to transport and dispose of the ash material.

The Arrowhead Landfill is a state-of-the-art, Subtitle D Class I facility. The composite liner system consists of 2 feet of 1×10^{-7} cm/sec compacted clay, a 60 mil high density polyethylene geomembrane liner, and a 2 foot thick drainage layer with a leachate collection system and protective cover. The site geology consists of the Selma Group chalks which ranges from 500 to 570 feet thick across the site, with a permeability less than 1×10^{-8} cm/sec. The uppermost groundwater aquifer is located beneath this layer.

Workers at the Arrowhead Landfill will receive various levels of safety and health training. All site workers will be trained in accordance with the their site safety and health plan and receive specific instruction regarding the Job Safety Analysis (JSAs). In accordance with the P&J health and safety plan, P&J will ensure workers are qualified to perform the assigned tasks prior to any work activity being performed. P&J will provide specific instruction as to the material that will be handled along with specific hazards and mitigation measures that will be instituted. A select group of workers, those who will be cleaning out the inside of the railcars, will receive HAZWOPER training. P&J will maintain an aggressive and thorough worker exposure monitoring program (air monitoring) and will continue to make adjustments to the levels of protection as information is obtained. All site workers will begin work in Level D protective equipment, except for those workers who will come in direct contact with the material routinely such as those cleaning out the inside of the rail cars. Those workers will wear protective coveralls (polypropylene or Tyvek) and respiratory protection (specifically designed to protect the worker from particulate matter).

Arrowhead landfill is located 4 to 5 miles from Uniontown, which is the nearest population center. The landfill is in an isolated area, surrounded by large tracts of property, farms, and ranches. The site has a 100 foot buffer that surrounds the entire landfill property. No waste is allowed to be placed in the buffer area. The nearest residence is approximately 250 to300 feet away from the site.

The placement of KIF material at the Arrowhead Landfill will significantly economically benefit Perry County. The Arrowhead landfill is considered by local elected officials as an economic partner in the community, and is a potential major source of revenue both for Uniontown and Perry County. Arrowhead pays Perry County $1.05 for each ton of material disposed, of which 0.5 ¢ goes to roads and the remainder is divided among the police department, fire department, schools, and other county needs. Landfill operators project that local hiring of up to 50 positions will occur. In addition, leachate from the landfill is trucked to the City of Marion for disposal. Arrowhead pays $25.00 per 1000 gallons in leachate disposal fees to the city of Marion, which averages approximately $10,000 per month.

TVA Executives have met with six local elected officials, including county commissioners, a Mayor, and a City Council member to discuss the potential use of the Arrowhead facility as a disposal site for the KIF material. These elected officials strongly support the disposal of KIF material at the Arrowhead facility. The common theme among the elected officials was the need for revenue and jobs to improve the economic condition of Perry County. No concerns were expressed about receiving KIF material.

Appendix:

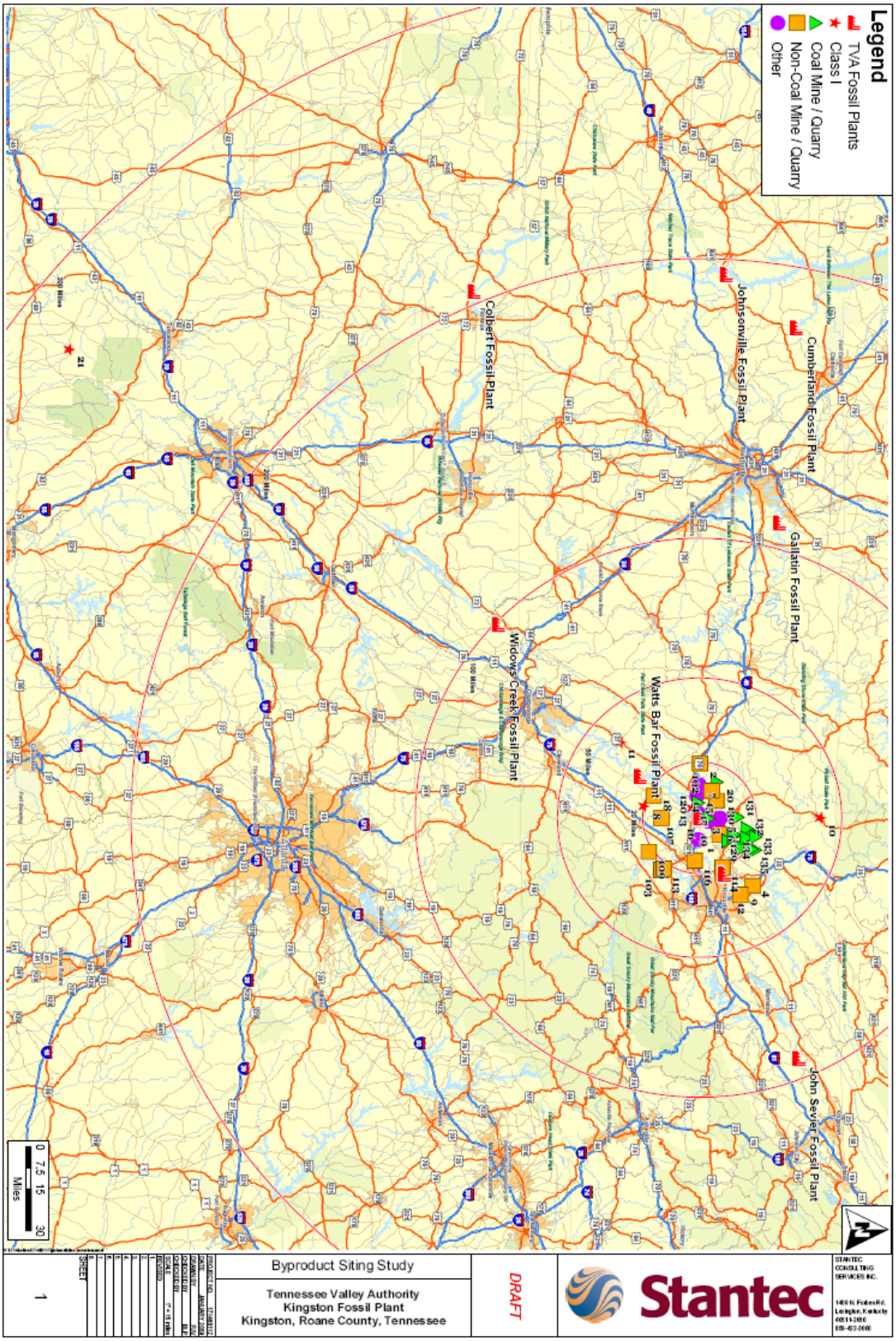
[MAP OF DISPOSAL SITES]

[PHOTO OF RAIL CAR LOADING]

[PHOTO OF ALA LANDFILL SITE]

[PHOTO OF UNLOADING]

[PHOTO OF TRAIN SET]


Legend
TVA Fossil Plants
Class I
Coal Mine / Quarry
Non-Coal Mine / Quarry
Other
Cumberland Fossil Plant
Johnsonville Fossil Plant
Gallatin Fossil Plant
Colbert Fossil Plant
Widows Creek Fossil Plant
Watts Bar Fossil Plant
John Sevier Fossil Plant
0 7.5 15 30
Miles
Byproduct Siting Study
Tennessee Valley Authority
Kingston Fossil Plant
Kingston, Roane County, Tennessee
DRAFT
Stantec
STANTEC CONSULTING SERVICES INC.
1400 N. Fortes Rd.
Lexington, Kentucky
40511-2050
859-422-3000
SHEET
1

Loading rail cars at Kingston.

Active disposal cell at the Arrowhead Landfill in Uniontown, AL

Loaded train. The gondola cars are much lower than standard bottom dump or rotary dump cars.

Unloading cars at Arrowhead Landfill. A water truck was used to simulate unloading during a heavy rain.