Attachment A – Sensitive Natural Resource Areas

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Figure A-1. Designated Sensitive Natural Resource Areas

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Attachment B – Flow Patterns of the Clinch River and Emory River at Kingston Fossil Plant

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Description of Emory and Clinch River Flow Patterns at Kingston Fossil Plant (KIF)

Depending on inflows and the time of year, there can be several different dominating flow patterns affecting the KIF intake. The KIF intake channel is located at Emory River Mile (ERM) 2. Emory River flows are measured at Oakdale, at ERM 18.0. The drainage area at Oakdale is 764 square miles, which encompasses about 85 percent of the Emory drainage basin. Watts Bar Reservoir extends up to Harriman, past ERM 12.

During high-flow periods, Emory River water flows at KIF are flowing downstream and into both the Clinch River and the KIF intake, which withdraws about 2,100 cubic feet per second (cfs) for circulating water needs (see Figure B-1).

Figure B-1. Emory River Downstream Flow Pattern

For this flow pattern to be occurring, the Emory River must have flows greater than the KIF intake flow of 2,100 cfs. According to stream gauge records, this only occurs about 18 percent of the time. This flow pattern is more likely to occur during the winter flood season of December through March.

A second flow pattern that can occur happens during the spring filling period (or during a spring flood event) when inflows into Watts Bar Reservoir are raising the pool elevation in the reservoir. This increase in elevation can cause the Emory River to actually flow backward as the increasing headwater is filling the Emory River embayment area with water from dam releases and other local inflows (see Figure B-2). The red arrows show the flow path, with the Emory River flowing backward as the reservoir fills with water.

Figure B-2. Emory River Upstream Flow Pattern

A third flow pattern occurs when KIF intake flows are dominating the flow patterns around the plant and Emory River inflows and water from the Clinch River (Watts Bar Reservoir) is being pulled into the KIF intake. There is not sufficient flow in the Emory to provide the KIF intake water so additional water is pulled upstream from the Clinch River portion of Watts Bar Reservoir (see Figure B-3).

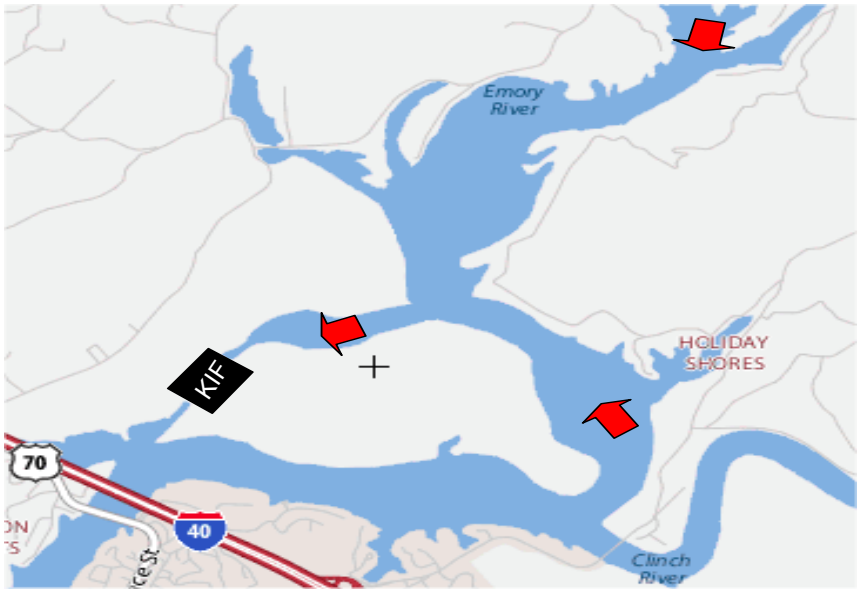

Figure B-3. Clinch and Emory River Flows Toward Kingston Fossil Plant

This is a common occurrence and can even be more complicated during the summer months, when Watts Bar Reservoir is stratified. During summer stratified conditions, cold water from the Clinch River would be flowing under the KIF skimmer wall and into the plant, while the warm Emory River waters are flowing downstream and above the cold Clinch River waters, see Figure B-4.

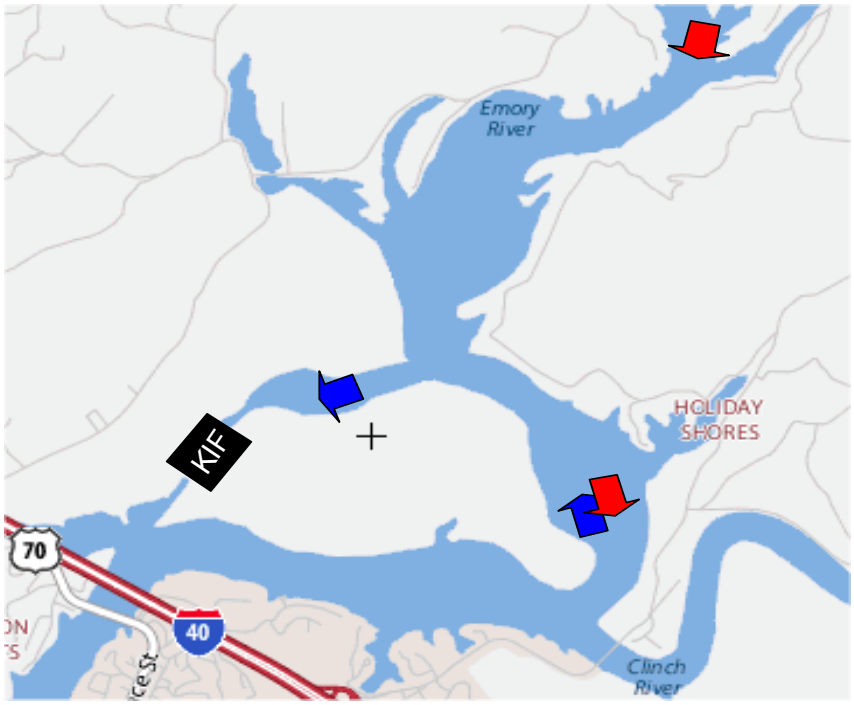

Figure B-4. Clinch Flows into Kingston and Emory Flows Into Clinch

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Attachment C – Aquatic Animals Tables

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Table C-1. Species Collected, Trophic Level, Native and Tolerance Classification, Catch Per Effort During Electrofishing and Gill Netting at Areas Downstream of Kingston Fossil Plant Discharge, Autumn 2007

Common Name	Scientific Name	Trophic Level	Sunfish Species	Native Species	Tolerance	Electrofishing Catch Rate per Run	Electrofishing Catch Rate per Hour	Total Fish EF	Gill Netting Catch Rate per Net Night	Total Gill Net Fish	Total Fish Combined
Longnose gar	Lepisosteus osseus	TC	.	X	TOL	.	.	.	1.10	11	11
Gizzard shad	Dorosoma cepedianum	OM	.	X	TOL	11.67	59.12	175	1.10	11	186
Common carp	Cyprinus carpio	OM	.	.	TOL	0.33	1.69	5	0.20	2	7
Spotfin shiner	Cyprinella spiloptera	IN	.	X	TOL	1.40	7.09	21	.	.	21
Bluntnose minnow	Pimephales notatus	OM	.	X	TOL	0.07	0.34	1	.	.	1
Redbreast sunfish	Lepomis auritus	IN	X	X	TOL	0.07	0.34	1	.	.	1
Green sunfish	Lepomis cyanellus	IN	X	X	TOL	1.07	5.41	16	.	.	16
Bluegill	Lepomis macrochirus	IN	X	X	TOL	24.00	121.62	360	0.40	4	364
Largemouth bass	Micropterus salmoides	TC	.	X	TOL	1.33	6.76	20	0.10	1	21
Longear sunfish	Lepomis megalotis	IN	X	X	INT	7.07	35.81	106	.	.	106
Smallmouth bass	Micropterus dolomieu	TC	.	X	INT	0.07	0.34	1	.	.	1
Brook silverside	Labidesthes sicculus	IN	.	X	INT	0.73	3.72	11	.	.	11
Paddlefish	Polyodon spathula	PK	.	X	.	.	.	.	0.10	1	1
Spotted gar	Lepisosteus oculatus	TC	.	X	.	0.07	0.34	1	.	.	1
Smallmouth buffalo	Ictiobus bubalus	OM	.	X	.	0.33	1.69	5	0.60	6	11
Golden redhorse	Moxostoma erythrurum	BI	.	X	.	.	.	.	0.10	1	1
Blue catfish	Ictalurus furcatus	OM	.	X	.	.	.	.	0.70	7	7
Channel catfish	Ictalurus punctatus	OM	.	X	.	0.27	1.35	4	0.40	4	8
Flathead catfish	Pylodictis olivaris	TC	.	X	.	0.07	0.34	1	0.70	7	8
White bass	Morone chrysops	TC	.	X	.	.	.	.	0.10	1	1
Yellow bass	Morone mississippiensis	TC	.	X	.	.	.	.	0.50	5	5
Striped bass	Morone saxatilis	TC	.	.	.	.	.	.	0.80	8	8
Redear sunfish	Lepomis microlophus	IN	X	X	.	3.00	15.20	45	0.20	2	47
Spotted bass	Micropterus punctulatus	TC	.	X	.	0.07	0.34	1	.	.	1
Black crappie	Pomoxis nigromaculatus	TC	X	X	.	.	.	.	0.20	2	2
Walleye	Stizostedion vitreum	TC	.	X	.	.	.	.	0.10	1	1
Freshwater drum	Aplodinotus grunniens	BI	.	X	.	0.33	1.69	5	0.30	3	8
Inland silverside	Menidia beryllina	IN	.	.	.	0.13	0.68	2	.	.	2
Total						52.08	263.87	781	7.70	77	858
Number Samples						15			10		
Species Collected						19			18		

BI = Benthic Insectivore
EF = Electrofishing
IN = Insectivore
INT = Intolerant
OM = Omnivore
PK = Planktivore
TC = Top Carnivore
TOL = Tolerant

Table C-2. Species Collected, Trophic Level, Native and Tolerance Classification, Catch Per Effort During Electrofishing and Gill Netting at Areas Upstream of Kingston Fossil Plant Discharge, Autumn 2007

Common Name	Scientific Name	Trophic Level	Sunfish Species	Native Species	Tolerance	Electrofishing Catch Rate Per Run	Electrofishing Catch Rate Per Hour	Total Fish EF	Gill Netting Catch Rate per Net Night	Total Gill Net Fish	Total Fish Combined
Longnose gar	Lepisosteus osseus	TC	.	X	TOL	.	.	.	0.10	1	1
Gizzard shad	Dorosoma cepedianum	OM	.	X	TOL	11.20	55.08	168	2.00	20	188
Common carp	Cyprinus carpio	OM	.	.	TOL	0.53	2.62	8	0.50	5	13
Golden shiner	Notemigonus crysoleucas	OM	.	X	TOL	0.07	0.33	1	.	.	1
Spotfin shiner	Cyprinella spiloptera	IN	.	X	TOL	1.33	6.56	20	.	.	20
Bluntnose minnow	Pimephales notatus	OM	.	X	TOL	0.13	0.66	2	.	.	2
Green sunfish	Lepomis cyanellus	IN	X	X	TOL	0.07	0.33	1	.	.	1
Bluegill	Lepomis macrochirus	IN	X	X	TOL	20.27	99.67	304	0.10	1	305
Largemouth bass	Micropterus salmoides	TC	.	X	TOL	1.80	8.85	27	.	.	27
Spotted sucker	Minytrema melanops	BI	.	X	INT	0.53	2.62	8	0.70	7	15
Black redhorse	Moxostoma duquesnei	BI	.	X	INT	.	.	.	0.10	1	1
Longear sunfish	Lepomis megalotis	IN	X	X	INT	2.67	13.11	40	.	.	40
Smallmouth bass	Micropterus dolomieu	TC	.	X	INT	0.33	1.64	5	.	.	5
Brook silverside	Labidesthes sicculus	IN	.	X	INT	0.93	4.59	14	.	.	14
Threadfin shad	Dorosoma petenense	PK	.	X	.	0.33	1.64	5	.	.	5
Bullhead minnow	Pimephales vigilax	IN	.	X	.	0.07	0.33	1	.	.	1
Smallmouth buffalo	Ictiobus bubalus	OM	.	X	.	0.13	0.66	2	0.10	1	3
Golden redhorse	Moxostoma erythrurum	BI	.	X	.	.	.	.	0.20	2	2
Blue catfish	Ictalurus furcatus	OM	.	X	.	.	.	.	1.30	13	13
Channel catfish	Ictalurus punctatus	OM	.	X	.	0.67	3.28	10	0.30	3	13
Flathead catfish	Pylodictis olivaris	TC	.	X	.	0.07	0.33	1	0.20	2	3
White bass	Morone chrysops	TC	.	X	.	.	.	.	0.30	3	3
Yellow bass	Morone mississippiensis	TC	.	X	.	0.07	0.33	1	0.70	7	8
Striped bass	Morone saxatilis	TC	.	.	.	.	.	.	0.90	9	9
Redear sunfish	Lepomis microlophus	IN	X	X	.	2.20	10.82	33	0.20	2	35
Spotted bass	Micropterus punctulatus	TC	.	X	.	0.20	0.98	3	0.10	1	4
Yellow perch	Perca flavescens	IN	.	.	.	0.07	0.33	1	.	.	1
Logperch	Percina caprodes	BI	.	X	.	0.07	0.33	1	.	.	1
Sauger	Stizostedion canadense	TC	.	X	.	.	.	.	0.50	5	5
Walleye	Stizostedion vitreum	TC	.	X	.	.		.	0.20	2	2
Freshwater drum	Aplodinotus grunniens	BI	.	X	.	0.20	0.98	3	0.70	7	10
Inland silverside	Menidia beryllina	IN	.	.	.	1.60	7.87	24	.	.	24
Total						45.54	223.94	683	9.20	92	775
Number Samples						15			10		
Species Collected						19			18		

BI = Benthic Insectivore
EF = Electrofishing
IN = Insectivore
OM = Omnivore
PK = Planktivore
TC = Top Carnivore

Table C-3. List of Fish Species by Family, Scientific, and Common Name Including Numbers Collected in Impingement Samples During 2004-2006 at TVA's Kingston Fossil Plant

Family	Scientific Name	Common Name	Total Number Impinged	
			Year One	Year Two
Petromyzontidae	*Ichthyomyzon castaneus*	Chestnut lamprey	2	0
Clupeidae	*Alosa pseudoharengus*	Alewife	65	36
	Dorosoma cepedianum	Gizzard shad	514	308
	Alosa chrysochloris	Skipjack herring	2	68
	Dorosoma petenense	Threadfin shad	25,320	30,491
	D. petenense x *D. cepedianum*	Hybrid shad	1	0
Cyprinidae	*Pimephales notatus*	Bluntnose minnow	1	6
	Pimephales vigilax	Bullhead minnow	0	3
	Pimephales promelas	Fathead minnow	1	0
	Cyprinella spiloptera	Spotfin shiner	0	1
	Campostoma oligolepis	Largescale stoneroller	1	0
	Notropis atherinoides	Emerald shiner	0	3
	Notropis photogenis	Silver shiner	1	0
Catostomidae	*Hypentelium nigricans*	Northern hogsucker	5	3
	Minytrema melanops	Spotted sucker	1	0
Ictaluridae	*Ictalurus furcatus*	Blue catfish	13	38
	Ictalurus punctatus	Channel catfish	210	137
	Pylodictis olivaris	Flathead catfish	26	5
	Ameiurus natalis	Yellow bullhead	3	0
Atherinidae	*Labidesthes sicculus*	Brook silverside	0	1
Moronidae	*Morone saxatilis*	Striped bass	18	29
	Morone chrysops	White bass	0	3
	Morone mississippiensis	Yellow bass	58	129
Centrarchidae	*Lepomis cyanellus*	Green sunfish	4	0
	Lepomis macrochirus	Bluegill	61	211
	Lepomis gulosus	Warmouth	0	3
	Lepomis megalotis	Longear sunfish	0	5
	Lepomis auritus	Redbreast sunfish	2	7
	Lepomis microlophus	Redear sunfish	0	1

Table C-4. State- and Federally Listed Aquatic Animals Historically Reported From, but No Longer Believed to Occur in, Roane County

Common Name	Scientific Name	State Status or Rank	Federal Status
Spectaclecase	*Cumberlandia monodonta*	-	C
Orange-foot Pimpleback	*Plethobasus cooperianus*	END	LE
Purple Bean	*Villosa perpurpurea*	END	LE
Shiny Pigtoe Pearlymussel	*Fusconaia cor*	END	LE
Fine-rayed Pigtoe	*Fusconaia cuneolus*	END	LE
Turgid Blossom Pearlymussel	*Epioblasma turgidula*	EXTI	LE
Alabama Lampmussel	*Lampsilis virescens*	END	LE
Spiny Riversnail	*Io fluvialis*	S2	-
Ornate Rocksnail	*Lithasia geniculata*	S3	-

- = Not applicable

Federal status abbreviations:

C = Candidate for federal listing
LE = Listed Endangered

State status abbreviations:

END = Endangered
EXTI = Extirpated

State rank abbreviations:

S2 = Imperiled with six to 20 occurrences
S3 = Rare or uncommon with 21 to 100 occurrences

Attachment D – Agency Comments and Responses

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TENNESSEE WILDLIFE RESOURCES AGENCY

ELLINGTON AGRICULTURAL CENTER
P. O. BOX 40747
NASHVILLE, TENNESSEE 37204

To: **Helen Rucker, TVA**
From: **David McKinney, TWRA**
Date: **March 9, 2009**
Subject: **TVA Draft Emergency Dredging Environmental Assessment (EA)**

Ms. Rucker:

TWRA offers the following comments and recommendations regarding the Draft EA provided March 6, 2009.

- TWRA will serve as a co-operating agency for National Environmental Policy Act (NEPA) related activities in response to the Kingston fly ash release.

  TVA Response: TVA has included TWRA as a cooperating agency in the EA.

- To date, TWRA comments and recommendations are incorporated into the Dredge Monitoring Plan and the Draft EA.

  TVA Response: Comment noted.

- During our co-ordination meetings in Cookeville and Chattanooga, there was discussion of the worst case scenario for significant dispersal of fly ash as presently located in the Emory River channel adjacent to Swan Pond embayment. The fly ash material currently in the Emory River channel causes flow to be re-routed toward the left descending bank of the river. The worst case scenario could occur when instream dredging has removed a portion of the existing fly ash "plug", sufficient to return flow to the traditional river channel, and a storm event increases flow in the Emory River, as measured by the gauge at Oakdale, above 10,000 cubic feet per second (CFS), while the surface elevation of Watts Bar Reservoir is at or near winter pool. We recommend discussion of this possibility in the EA.

  TVA Response: The EA has been revised to include a scenario discussion of the potential for increased flow in the Emory River resulting from a storm event on page 33.

- Recognizing the challenges associated with removal of fly ash from the Emory River, TWRA fully supports recapture of this material by dredging.

  TVA Response: Comment noted.

USFWS NEPA COMMENTS ON THE TVA DRAFT EA *FOR* "EMERGENCY DREDGING FOR THE KINGSTON FOSSIL PLANT ASH DIKE FAILURE"

Fly Ash and Bottom Ash Characterization (pg. 5 – 7)

USFWS Comment

Trace Amounts, Trace Metals, and Trace Elements appear to be used interchangeable in this section and throughout the document. Due to exceedences of water quality criteria, sediment quality guidelines, and ecological soil screening values, we suggest revising the narrative language and respective table headers to metals only. Additional analyses related to metal speciation are needed.

> **TVA Response**
>
> TVA has revised this section of the EA (pages 5-9) and now uses trace constituents instead of tract amounts, trace metals and trace elements. Most of these parameters are metals, but there is one non-metal (selenium) and two metalloids (arsenic and antimony). TVA has also added bottom ash characteristics and typical concentrations in regional surface soil to Table 2.

Monitoring Plan (pg. 13)

USFWS Comment

If this NEPA document is released prior to consensus between the agencies on the specifics of a monitoring plan for the Phase 1 Dredging Operation, language in this section should be revised.

> **TVA Response**
>
> TVA is coordinating a final sampling plan with the interagencies. TVA would not issue the FONSI until the final sampling plan has been accepted.

Water Quality (pg. 24 – 27)

USFWS Comment

This section could include a broader discussion of legacy contaminant issues in Watts Bar reservoir including the recent sediment data collected by the Department of Energy. The tables that include maximum and minimum values in this section should be revised to reflect the recent TVA AFA data for fly ash and geoprobe samples.

> **TVA Response**
>
> This section has been revised to add a discussion of the interagency agreement TVA entered into in 1991 to establish a procedure for interagency coordination and review of permitting and other use authorizations that could result in the disturbance

of legacy sediment. The table including the recent data collected by the Department of Energy has been revised with information that is more current.

Environmental Consequences (pg. 30)

USFWS Comment

The discussion in this section appears to discount the potential for adverse impacts to aquatic organisms. We believe it is prudent to not discount the potential until all monitoring, data collection, and analyses are completed.

TVA Response

TVA has revised pages 30 and 31 to address this comment.

Aquatic Life (pg. 34)

USFWS Comment

The discussion on fisheries should include an acknowledgement of the potential of the **nanoscale** fly ash particles to cause gill/fin erosion, hyperplasia, and sensory perception impairment to vertebrate and invertebrate species. There is also more recent, post release fisheries data from the Emory River and Clinch River collected by TVA that could be discussed here or included in the appendices.

TVA Response

There are a number of issues that will likely require more detailed study by external research universities and organizations. Examining the potential for nanoscale particle impacts on aquatic life will be one of those issues. TVA is organizing a research consortium that will be able to conduct these types of studies and provide data to support TVA cleanup efforts and to provide scientific input related to the environmental impact of fly ash in general. This consortium will work with nationally recognized researchers to study these issues and provide peer reviewed results that can be used to determine short- and long-term impacts and potential remedies.

USFWS Comment

We suggest acknowledgement of the evaluation of the fly ash samples conducted for the FWS by the Corps of Engineers, Environmental Research Development Center, which demonstrated toxicity to *Hyalella azteca* (report attached). There is discussion related to potential fisheries impacts in the previous water quality and environmental consequences sections that should also be revised.

TVA Response

TVA has revised the EA to include evaluation of the fly ash samples that demonstrated toxicity to *Hyalella azteca* in the Surface Water/Water Quality section of the EA on pages 29-31.

Terrestrial Ecology (pg. 36)

USFWS Comment

The discussion on potential terrestrial species in the KIF area should be expanded to include bald eagle (*Haliaeetus leucocephalus*), gadwall (*Anas strepera*), hooded merganser (*Lophodytes cucullatus*), bufflehead (*Bucephala albeola*), mallard (*Anas platyrhynchos*), and various gull species. We have observed these species utilizing the sluice ponds or flying over active ash stabilization/removal operations during our on-site inspections. There should be a discussion of the attractiveness/utilization of the existing sluice ponds (warm water, abundant prey items) by diving and dabbling duck species. As we have previously discussed, it would be prudent to have a bird-hazing plan in place, in case hazing becomes necessary.

There should be some discussion of the potential for various terrestrial receptors to be exposed to metals and other contaminants in the fly ash from normal feeding/foraging behaviors. This could result from the bioaccumulation of site-related contaminants in prey species and/or through direct ingestion or inhalation of fly ash and/or sediments. A table could be inserted in this section that references existing ecological soil screening levels.

TVA Response

TVA has added the species identified to the Terrestrial Ecology Section of EA, page 38. Additional text related to the bald eagle was added to the Endangered and Threatened Section, page 40.

The potential use of the wildlife decoys or harassment measures is discussed in the Environmental Consequences Section, page 40.

TVA concurs with the need to investigate the potential for the transfer of trace elements and other contaminants, and the bioaccumulation of these materials through various wildlife trophic levels. A detailed analysis of this process and the assessment of impacts to wildlife resources at KIF and surrounding areas would be discussed in subsequent environmental review analyses related to long-term monitoring plans developed in conjunction with regulatory cooperators, page 39.

USFWS Comment

Since the mammalian/avian reproductive/nesting season is beginning, we also believe it is important to recognize the necessity of an evaluation of the potential risks to these receptors from exposure to site-related contaminants.

TVA Response

The text within the Terrestrial Ecology section notes that various species regularly forage and rest in the settling ponds. We have modified our text to include more input regarding the use of the ash ponds by resident and migratory wildlife, pages 40 and 57.

<u>Environmental Monitoring (pg. 53)</u>

USFWS Comment

Note comments above.

TVA Response

Comment noted.

Wildlife and Plants Mitigative Measures (pg. 54)

USFWS Comment

A commitment by TVA to evaluate exposures and the potential for lethal and sub-lethal effects to terrestrial receptors would substantially strengthen this section. As noted above, a contingency bird hazing plan for the ash processing area and discharge locations appears warranted.

> **TVA Response**
>
> TVA concurs with the need to investigate the potential for the transfer of trace elements and other contaminants, and the bioaccumulation of these materials through various wildlife trophic levels. A detailed analysis of this process and the assessment of impacts to wildlife resources at KIF and surrounding areas would be discussed in subsequent environmental review analyses related to long-term monitoring plans developed in conjunction with regulatory cooperators. Additionally, if warranted, a bird hazing plan to keep wildlife from certain areas would be used, page 60.

Other Comments

USFWS Comment

TVA should include a section on relevant regulations and statutes that will influence future activities at the Kingston Fossil Plant. These include the Clean Water Act (86 Stat. 816, as amended: 33 U.S.C 1251 et seq.), Endangered Species Act (87 Stat. 884, as amended: 16 U.S.C. 1531 et seq.), Migratory Bird Treaty Act (16 U.S.C. 703-711), Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), and the Bald and Golden Eagle Protection Act (54 Stat. 250, as amended: 16 U.S.C 668-668d).

> **TVA Response**
>
> A new section identifying the above relevant regulations and statues as been added to the EA on page 10. However, the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) is not included in the document because TVA is exempt.

EPA NEPA COMMENTS ON THE TVA DRAFT EA *FOR* "EMERGENCY DREDGING FOR THE KINGSTON FOSSIL PLANT ASH DIKE FAILURE"

EPA Comment

As requested, the U.S. Environmental Protection Agency (EPA) has received the TVA draft Environmental Assessment (DEA) on "emergency dredging" at the Kingston Fossil Plant (KIF) in Roane County, Tennessee relative to the coal ash spill on December 22, 2008. We had previously reviewed TVA's "initial emergency EA available on the TVA website (Initial Emergency Response Actions for the Kingston Fossil Plant Ash Dike Failure). Although we understand, the initial EA is an emergency EA, our overall impression of that initial EA was that the impact assessment was generally qualitative in nature and offered no wetland impacts (acreage) or mitigation.

> **TVA Response:** The scope of these initial EAs is focused on the potential impacts of TVA's actions since the slide occurred. The baseline conditions used for this assessment are post-slide conditions. The No Action scenario would be if TVA did not take corrective actions for the ash slide. Impacts to wetlands essentially occurred during the event; therefore, there would be no additional impact as a result of TVA's actions to stabilize the slide. A description of the pre-slide wetlands has been added to the EA. The long-term recovery plan, damage assessment, and subsequent environmental review will address pre-slide conditions and identify the appropriate mitigation needed.

EPA Comment

The DEA indicates (pg. 25) that 5.4M cubic yards (cy) of ash was spilled together with 327M gallons of water. The spill affected 300 acres of land adjacent to KIF and in the Emory River receiving waters. Before the spill (pg. 28), the existing river bottom sediment could already have been contaminated with background levels of PCBs, chlordane and mercury.

> **TVA Response:** The water quality section of the EA describes pre-slide conditions. The Emory River arm of Watts Bar Reservoir is on the state 303(d) list (TDEC 2008) because of sediments contaminated with polychlorinated biphenyls (PCBs) and chlordane from industrial point sources. The section of the Emory above the influence of the Watts Bar impoundment is listed because of mercury from atmospheric deposition. The Emory River may have elevated metal levels because several upstream tributaries are listed for manganese, iron, and pH from historic coal mining activities. Furthermore, a few of the upstream tributaries are also impacted by sediment or other causes from agriculture or development. In 1991, TVA entered an interagency agreement with the U.S. Corps of Engineers, U.S. Department of Energy, U.S. Environmental Protection Agency and the Tennessee Department of Heath and Environment to establish a procedure for interagency coordination and review of permitting and other use authorizations which could result in the disturbance, resuspension, removal and/or disposal of contaminated or potentially contaminated sediment in the Watts Bar Reservoir. Based on information gathered during the implementation of this agreement, the contaminants

of interest have been narrowed to 137 cesium and mercury. Projects are reviewed to determine whether the sediment contains 137 cesium or mercury contamination at levels which when disturbed or removed constitute environmental risk or require special handling techniques or equipment to protect human health and the environment from injury or harm. TVA and Oak Ridge National Laboratory (ORNL) will conduct sediment sampling for these and other constituents prior to conducting activities that could disturb the underlying sediments.

EPA Comment

We understand (pg. 1) that the DEA primarily addresses the proposed removal of spilled coal ash (slurry) and other debris from the Emory River between RM 1.5 and 3.5. In addition, dewatering and drying of the dredged material and temporary on-site and off-site storage options are discussed. Long-term restoration of the area was deferred to future TVA NEPA documentation. Implementation of the current EA is expected within 90 days.

TVA response: TVA anticipates for dredging to begin no later than March 20, 2009. A Pilot program to identify appropriate turbidity control measures during dredging and upland during ash processing would be conducted during the first 60 days or less. Dredging activities including all 3 phases of dredging are estimated to last until January 2010.

EPA Comment

Based on our expedited review of the current emergency dredging DEA, we offer the following preliminary comments. A more detailed review on the final EA (FEA) may follow. To the extent feasible in the short review timeframe, these comments reflect a consolidation of EPA Region 4 programs.

Ash Metal Concentrations (pg. 7) - Table 2 lists the "trace element analysis of TVA pond ash" including heavy metals such as arsenic, cadmium, mercury and lead. The data reflect the concentrations from various ash pond samples. For comparison, we suggest that this table in the FEA also provide ambient concentrations of area soils. The locations of the ambient sample sites should also be disclosed with a rationale as to why these stations are considered representative of ambient conditions. Although we note that metal concentrations do not exceed hazardous waste screening concentrations (pg. 7), metals that could nevertheless be bioavailable and bioaccumulate (mercury, arsenic, selenium, etc.) in fish and other aquatic life should also be emphasized in the requested comparison to ambient soil concentrations.

TVA response: TVA has revised this section of the EA and now uses trace constituents, since some parameters are non-metals and metalloids. TVA has also added bottom ash characteristics and typical concentrations in regional surface soil to Table 2 in the EA (page 10).

EPA Comment

Project Start-up (pg. 8) - We note that the dredging is expected to begin within the next 90 days. While we understand the various contractual, legal and NEPA requirements for this dredging project, we suggest that this project - once fully coordinated - be expedited to start before the 90 days if possible. An expedited start-up may benefit the environment to minimize any additional downstream transport of the ash, the uncertainty of the ecological

effects of the ash constituents, the possibility of downstream flooding due to the loss of flood storage and other considerations.

> **TVA response:** TVA anticipates for dredging to begin no later than March 20, 2009. A Pilot program to identify appropriate control measures during dredging and upland during ash processing would be conducted during the first 60 days or less. TVA and other agencies consulted agree that an expedited start-up would benefit the environment. TVA would use adaptive management during Pilot dredging to determine the most likely place for plumes and locate monitors that will collect field data including turbidity when collecting TSS and TDS samples.

EPA Comment

KIF Discharge Canal (pg. 9) - The figures provided in the DEA are of excellent quality. For the Figure 5 aerial, we recommend that it also indicate (mark in red) KIF's discharge canal (or that the text explain that KIF uses a closed cooling system) and discuss if this discharge flow would exacerbate the downstream transport of the spilled ash at this time and during the proposed dredging.

> **TVA response**: TVA has revised this figure (now Figure 6) to indicate the plant's discharge. The KIF Ash Pond discharges in the KIF Plant Intake Channel shown on Figure 6. Water from the plant intake is used in a closed cooling system and discharge via the Plant Discharge Channel at Clinch River mile 2.9. Discharge from the Ash Pond would not effect transportation of spilled ash prior to or during the proposed dredging activities.

EPA Comment

Dredging (pgs 11, 14 & 16) - From an impact perspective relative to flood protection (flood storage is less), water quality (chemical effects of the ash is not fully known), and ecological (effects on benthos, fish, wetlands and other aquatics), we agree with the dredge removal of the spilled ash and debris from the Emory River. We also agree with the use of a hydraulic dredge for ash removal to minimize turbidity, and a mechanical dredge for debris removal. We also support a Pilot dredging program (pg. 11) which should be monitored for turbidity (pg. 1 l), with adaptive management (pg. 14) being applied to the process to minimize dredging water quality impacts (to improve BMPs).

> **TVA response**: Comment noted.

EPA Comment

Ash Storage (pg. 16) - We assume the existing onsite "Operational Ash Temporary Storage Area" is proposed for temporary ash storage. However, unless this is an approved or permitted site (or can be modified as such), we suggest that existing permitted landfill options (pg. 11, 44, & 45) be considered for ash disposal to reduce the risk of an additional dike failure or associated water quality problems. These landfills should be as local as possible and preferably accessible by rail (versus trucks) to limit diesel emissions (additional comments provided below). Any dike construction of new temporary or permanent onsite ash ponds should be upgraded in terms of construction materials (rock vs. soils) and include competency monitoring to help prevent additional breaching under rain events and other weather conditions.

TVA response: TVA is conducting engineering studies including stability analysis on the temporary storage areas. These areas will be reviewed and approved by TDEC and EPA prior to stacking any material to ensure the risks of additional dike failure or associated water quality problems are adequately addressed. The four landfills identified in the EA are the closest in proximity to KIF with adequate storage space for the ash to reduce impacts and costs associated with transportation.

EPA Comment

Debris Storage (pg. 16) -Debris storage could presumably be located onsite since the amount of ash would be limited. However, the debris wash water (containing ash particulates) would need to be properly handled.

TVA response: Debris will be washed if possible using river water on the debris barge back in the area of dredging before it is taken to an onsite location. The debris will be water washed to remove ash prior to chipping activities. The wash water will be controlled to prevent ash from being deposited in the onsite location.

EPA Comment

Turbidity near the dredging is to be monitored to be within 200 NTUs of the background turbidity. The FEA should include the ambient level (or a range) in NTUs that might be expected for such background levels, based on ambient data. In addition, the basis for using a +200 NTU tolerance between the turbidity plume and ambient levels should be provided in the FEA (e.g., TVA policy or TDEC standard).

TVA response: Below is ambient turbidity data that has been collected in the Emory River to date.

Emory River Mile (ERM)	Non Rain Event			Post Rain Event*		
	Min	Average	Max	Min	Average	Max
ERM 0.1	3.1	8.28	14.7	7.8	18.5	33.9
ERM 1.75	1.4	8.05	12.5	10.3	16.525	25.7
ERM 2.1	3	8.31	18.4	9.7	23.325	50.6
ERM 4.0	2.1	5.97	12.2	3.9	10.175	15.7
ERM 12.2	0.6	6.34	30.5	3.9	5.175	9.8

*Post rain events are the first time samples were taken after a ≥0.5" rainfall over a 24 hour period. Data is from January 12 - March 13, 2009.

In discussions with TDEC, TVA worked to identify a turbidity trigger that would limit impacts downstream without being too restrictive of dredging operations. TVA believes 200 NTU is an appropriate level to trigger operational management decisions. Turbidity will be monitored with real-time readings. Best Management Practices (BMP) will be implemented when the upstream/downstream turbidity difference is 200 NTU or greater. If field observations and/or water quality data

trends indicate that the 200 NTU trigger is not going to be protective enough of downstream water uses, TVA will consult with TDEC and EPA regarding implementation of more protective mitigation methods.

EPA Comment

Dredged Material (PE. 13) - We assume (pg. 53) that dredging for this emergency project will not intentionally remove river bottom sediments in addition to the spilled ash along the river channel. That is, will the emergency dredging be limited to ash and debris or will the project include any maintenance dredging that may be needed along the navigational river channel? The latter may change the NEPA documentation of this project, its emergency nature, and its review timeframe. We appreciate that controls to prevent accidental over-dredging (ash plus underlying sediment) would be applied through the use of background bathymetry information.

TVA response: At this point, TVA cannot determine if maintenance dredging of the channel would be needed. TVA is proposing a phased approach to dredging in which the disturbance to the underlying sediments would be minimized. Phase 1 dredging will be to limited depth to avoid disturbance of river sediment. A safety buffer of between 5 to 10 feet of ash will be left in the river channel during this phase of dredging. TVA will conduct sediment sampling between the phases of dredging to determine potential impacts and mitigation measures needed for sediment disturbance due to pre-existing contaminant issues. Later dredging phases will address maintenance of the navigation channel and removal of ash down to the sediments. Throughout the dredging process, TVA would coordinate with the US Army Corps of Engineers and other regulatory agencies to determine if maintenance dredging would be needed. If needed, a plan for that activity would be developed for review and approval along with the necessary NEPA review.

EPA Comment

Fugitive Dust (pg. 16) -The chemistry of the crusting agent that is proposed for binding ash storage piles to reduce ash fugitive dust should be identified. Depending on the potential environmental effects, if any, of this binder and its water quality toxicity, it should only be used if water truck spraying does not adequately control fugitive dust. Conversely, water should also not be over-sprayed to prevent the generation of runoff unless these waste streams are contained.

TVA response: Dust at active work areas along Swan Pond Road and elsewhere on the site is being controlled by spraying with water, a method that has been used at KIF for years in the ash pond area. The crusting agent (TM-06-515 MINCRYL X50™) is a water-soluble vinyl acrylic emulsion, a nontoxic liquid dust suppression agent that TVA has previously used at KIF and other fossil plants. TVA minimizes the use of chemicals to the extent practicable to reduce operating costs.

EPA Comment

Discharge Water (pg. 17) - It is stated that "[discharge water from the dredging and dewatering operations will be returned to the existing ash pond using pumps and solid piping". It is further stated (pg. 35) that "[decanted water would pass through the existing ash ponds and exit via the existing NPDES permitted outfall." While this would appear to be consistent with the NPDES permit, intuitively there would seem to be ash metal

contaminants left in the wash water being discharged back into (presumably) the Emory River. We recommend that the State NPDES permitting agency (TDEC) with EPA oversight verify this approach or modify it as necessary to maintain river water quality. The FEA should provide confirmation or a verified alternate approach.

> **TVA response**: The ash pond is permitted to discharge into the Plant Intake Channel per the NPDES permit. The intake channel water is pumped into the plant and used in the closed cooling water system before discharge to the Clinch River at mile 2.9. There is no discharge to the Emory River from the Ash Pond. TVA has had discussions with TDEC and agreed to monitor specific metals at the Ash Pond discharge as part of the project. TVA also calculated a mass balance for the ash pond during dredging operations (see Table 6, page 41).

EPA Comment

Reservoir Ecological Quality (pg. 25) - TVA periodically assesses the ecological quality of its reservoirs. Figure 10 provides such data for the Watts Bar Reservoir (interconnected with the Emory River) for 1994-2006 on a two-year cycle. If the 2008 data are available, the FEA should include them since 2006 data may now be dated.

> **TVA response**: The 2008 data has been incorporated into the water quality section of the final EA (page 32).

EPA Comment

Bioavailability (p a. 26) - As suggested above and discussed in the DEA (pg. 26), metals from the ash such as arsenic, mercury and selenium may disassociate from the ash and become bioavailable. We understand that the timeframe for assessing such chronic effects may be longer termed than this emergency EA. However, the prospective TVA EIS regarding the ash spill at Kingston should address such long-term impacts on fish, benthos and other aquatics (e.g., chronic exposure, bioaccumulation, sublethal effects) as well as the ecological recovery (notably sessile benthic macroinvertebrates) of the affected reach of the Emory River. Human fish consumption concerns, if any, should also be addressed.

> **TVA response**: TVA plans to address these in the long-term recovery and remediation review.

EPA Comment

TEC & PEC Risks (pg. 27) - Although bioavailability may be a chronic concern, Table 5 indicates that ash concentrations for arsenic and copper already exceed the Threshold Effect Concentration (TEC) and Probable Effect Concentration (PEC) levels for sediments. Aquatic organisms may therefore be at risk for these metals. As indicated in the DEA (pg. 27), "[these results indicate that further testing is warranted." We assume this implies additional sediment sampling for results verification and bioassays on any acute animal effects.

> **TVA response**: TVA is proceeding with establishing an interagency working group to address these issues and further testing. This group along with the public and other key stakeholder groups would provide input in determining the scopes of

studies and evaluations needed. These would be incorporated into the overall environmental review for the remediation and recovery actions.

EPA Comment

Flocculents (pg. 29) - The introduction of flocculents in the river to control suspended sediments during dredging should only be considered if permitted by the NPDES permit (pg. 29) and if they have been demonstrated not to be toxic to aquatic life and do not bioaccumulate. Page 53 suggests this to be proposed by TVA. Overall, the use of mechanical means such as silt fences is preferred over chemical additives of an already impacted area whenever flow rates permit.

TVA response: TVA has investigated the use of polymers for a variety of applications related to the ash release. The use for the ash pond would be to control the amount of additional solids sent to the ash pond through the processing area, and possibly to aid in settling the material in the ash pond. The other potential application is to control turbidity in the river. TVA would do that only as a last resort, and will need an NPDES permit specifically for that application. If TVA proposes to use in-river polymers over a long period of time, we will evaluate possible aquatic bioaccumulation. For use in the ash recovery process or in the ash pond, TVA will request approval from TDEC beforehand.

Initially, the processing area would be operated without polymers to determine the efficiency of solids settling and removal in the process ditch. The polymers would only be used as needed. The request for proposals sent to certain water treatment vendors resulted in three effective polymer products that have passed acute and chronic toxicity testing. The liquid polymer was selected as the primary choice due to ease of application. The two dry polymers would be considered as backups. A separate request will be submitted to TDEC providing information on the specific polymers that TVA has investigated and requesting approval of one or more for use in the recovery operation.

Two of the three polymers are from Kemira Water Solutions, and the third is from GE Betz, Inc. Kemira PAX-XL 19 is the preferred product because it is a liquid, which makes it easier to use. The other two are dry polymers. For the most likely application of helping settle TSS in the ash recovery area or in the ash pond, TVA would apply it through a manifold system somewhere along the lower end of the rim ditch, or possibly at the point where that water flows over a weir to the bottom ash/fly ash ditch, or in the worst case, at the discharge from that ditch to the ash pond.

EPA Comment

Monitoring (PE. 30) - We agree with the use of proposed continuous water quality monitoring stations to determine levels of turbidity during dredging. We understand that TDS and TSS will be analyzed and supplemented by crew visual observations. It is unclear, however, how the visual observations gauge the level of turbidity (e.g., individual judgment by eye, secchi disk, helicopter, etc.)? More importantly, what changes will be made if turbidity levels are determined to be too elevated? We assume dredging will be slowed or

suspended for a time. Would someone have stop-work authority in the field and what would be the threshold used (+200 NTUs above ambient?)?

> **TVA response**: Visual observation will be used to determine the presence and size of an objectionable color plume during dredging operations. This is a purely subjective method that will be used in conjunction with real-time turbidity monitoring to determine appropriate changes in dredging activities as needed. Field personnel would relay their information to the Project Manager who has work-stop authority if needed. The threshold for work-stop is the inability to control turbidity through dredging operational modifications and physical BMPs. TVA will also collect field parameters, including turbidity, when collecting TSS and TDS samples.

EPA Comment

Aquatic Life (pg. 34) - Sessile bottom-dwelling benthos were smothered by the ash slide. Mobile fish may have escaped unless stranded by the ash. We appreciate that the DEA qualifies the kinds of fish, mussels, and other aquatics in the area and the quality (TVA rating) of the ecological conditions of the interconnected Watts Bar Reservoir (pg. 25). However, the FEA should attempt to provide more of an inventory of the reach of the Emory River impacted. While such baseline data may or may not be available for benthic inhabitants, it is difficult to assess the impacts of the spill on the benthos – and mitigate for them - without such an inventory.

> **TVA response**: In order to compile a more accurate estimate of mussel and snail communities that were affected by the slide, TWRA and TVA will cooperate in spring mussel and snail surveys in an Emory River embayment and mainstem Emory River and Clinch River habitats that were unaffected physically (i.e., covered by fly ash) by the slide. Existing fish and benthic data from previous surveys and the upcoming mollusk survey data would be used to estimate the composition and abundance of fish, mollusks and other species that comprised the aquatic communities in Swan Pond Creek embayment and in the mainstem Emory River at the time of the slide.
>
> TVA is forming an Interagency Team that would consist of personnel from involved and interested federal, state, and local agencies. The team would scope the decisions to be made related to remediation actions, including dredging, and would help identify necessary modifications to data collection activities, or research needed. It has also been suggested that TVA enter into a Natural Resource Damage Assessment and Restoration (NRDAR) process, with all appropriate state and federal trustees, to characterize and evaluate the potential and extent of damage or injury to natural resources, to design long-term monitoring needs related to the event, and to determine adequate compensation and/or restoration for damaged or injured natural resources, including lost uses. Some preliminary meetings of biologists and toxicologists from appropriate state and federal agencies have taken place. Participants in these meetings discussed appropriate studies for characterizing the potential pathways that contamination related to the spill might enter the food web. In addition to a damage assessment, long-term monitoring and assessment plans are a likely result of this process.

EPA Comment

Waters of the US (pg. 36) - Affected waters of the US such as wetlands were discussed in general terms on page 36. Waters of the US included those associated with shoreline

margins, tributary streams, three small islands, and reservoir coves. Types included forested, shrub-scrub and herbaceous. The National Wetlands Inventory (NWI) maps showed waters of the US along shorelines and island fringes as well as the proposed onsite ash storage area. Some of these areas were heavily used by waterfowl and shorebirds. Based on post-spill aerials, waters of the US were eliminated by inundation. Overall, EPA believes that primarily waters of the US in the form of several acres of water (river mud bottoms) below ordinary high water were affected more than waters of the US in the form of wetlands.

> **TVA response**: Comment noted.

EPA Comment

As suggested above for aquatics, the FEA should attempt to establish a reasonable waters of the US pre-spill inventory. This background inventory should try to quantify the waters of the US acreage lost by the spill using recent pre-spill aerials, NWI maps, and other background river information. Mitigation should be discussed with the US Army Corps of Engineers (COE), EPA and US Fish and Wildlife Service (FWS).

> **TVA response**: The scope of these initial EAs is focused on the potential impacts of TVA's actions since the slide occurred. The baseline conditions used for this assessment are post-slide conditions. The no action scenario would be if TVA did not take corrective actions for the ash slide. Future environmental reviews would assess the effects of the ash slide on the human, physical, and biological environment including a natural resource damage assessment. This would include inventories for all pre-slide conditions including waters of the US. Alternatives for clean-up methods, clean-up levels, remediation, monitoring, and mitigation for the entire event will be considered.

EPA Comment

Endangered Species (pg. 38) - EPA will defer to the FWS and their state counterparts in regard to endangered species and affected shorebird and waterfowl common species.

> **TVA response**: Comment noted.

EPA Comment

Offsite Landfills (pg. 42) - We appreciate that the impacts of delivering (by truck) the recovered and dewatered ash to nearby permitted landfills was assessed. Four local landfills located 36, 50, 62 and 65 roadway miles from KIF were analyzed. As indicated above, if the proposed onsite disposal site is not permitted or cannot be modified to be approvable (to prevent any additional dike failure or water quality problems), one or more of these permitted landfills should be considered. However, environmental impacts of these routes should also be considered since truck hauling is predicted to involve many truck trips per day (510 trucks per day and therefore presumably 1020 round trips), worsen the LOS rating for two roadway segments, and increase overall congestion and noise.

> **TVA response**: TVA is working with TDEC to resolve concerns regarding temporarily on-site storage. TVA proposes to use two or more of the four identified permitted landfills simultaneously for ash disposal/storage in order to reduce the

number of vehicles traveling a particular route and therefore mitigate traffic congestion, noise and diesel emissions. Additionally, truck routes identified in the EA were selected to avoid schools, historic districts and downtown areas to the extent possible. Operations requiring truck hauling are projected to be short-term.

Currently, TVA has focused primarily on truck hauling because of the need for immediate action and also because no rail or barge transport is reasonably available for the four landfills sites identified in this EA. However, TVA has issued a request for proposals that would identify alternative disposal sites in addition to those covered by the EA. Should additional sites be considered which could be reasonably served by either barge or rail along with other methods of conveyance such as trucks and conveyor systems, TVA would evaluate the effects of using those sites and transportation alternatives short-term as a supplement to this EA or long-term as part of an overall environmental review in implementing its Corrective Action Plan.

EPA Comment

The FEA should therefore discuss the acceptability of the onsite temporary ash pond area and also discuss any rail options to local landfills, and then justify TVA's preferred disposal alternative (including environmental considerations). Rail options would reduce fuel use and diesel emissions.

TVA response: TVA is still evaluating through geotechnical studies how much temporary on-site storage, including Phase II of the gypsum storage area, is available during the dredging process. TVA is also still evaluating rail options through proposals being received through a TVA request for proposal (RFP). Due to the urgency to begin dredging and the limited availability of information regarding rail and barge, TVA would address these alternatives in either a supplement to this EA or another environmental review covering short-term actions for clean-up.

Through an additional RFP, TVA is evaluating the use of Class I landfill airspace to meet any immediate need for disposal. For any location or transportation method under consideration, selection of the preferred disposal alternative would be dependant upon many factors including costs, tipping fees, timing of availability to receive the dredge material, and potential environmental impacts. Four active Class I landfills lie within a 50-mile radius of Kingston in Dayton, Anderson County, Oneida, and Athens. None of the facilities have in place the infrastructure to accept ash by rail. Each of these sites offers relatively good highway access and minor impacts to roadways for a short-term duration project based on single dredge output. Due to fuel costs, haul route time, and impacts to more roadway surfaces, closer disposal locations are generally preferred, but, if two or three dredges are implemented, consideration would be given to trucking the material to two or more landfills as previously stated. The transport impact is only a portion of the landfill consideration. Other equally as important issues, such as available space in each landfill (e.g. should we use up all the space at a landfill and force a community to then have to truck their material elsewhere) , the scarcity and high value of permitted Class I capacity in the state, the ability of each landfill to receive ash at the rates necessary to consistently manage the output of the ash stockpile at

Kingston, and the total cost for the disposal at each of the landfills (transportation cost plus tipping fee).

EPA Comment

If one or more off-site landfills with truck delivery is selected, all trucks should be tuned and equipped to minimize air and noise emissions, and preferably used ultra-low sulfur diesel fuel and minimize idling times.

TVA response: TVA's request for proposals (RFP) for off-site roadway ash transport requires potential bidders to take the impact of its activities upon the environment into consideration. Contractor shall take into account such factors as, among other things, air pollution, erosion control, noise control, solid waste disposal, and wastewater disposal. The contract would require that truck owners are to properly maintain trucks, including tune-ups and the use of low sulfur diesel fuel. Minimizing idling time would be required in the contract.

EPA Comment

We agree with page 48 that "...two or more available landfills should be used simultaneously to somewhat mitigate the effects on roadways." Such effects would include air and noise quality to roadside residents.

TVA response: Comment noted.

EPA Comment

If possible, routes should minimize populated areas, especially any routes that substantially affect minority and low-income populations. The FEA should discuss environmental justice aspects along the potential routes to the landfills using 2000 census data.

TVA response: The proposed routes were selected with the use of main roadways in mind. Where possible, interstate highways and divided highways are used to minimize the impact on local traffic and residents while providing direct routes to the various landfills. Consideration, where logistically practical, and feasible, will be to route truck traffic through plant roads and out the middle or back gates to minimize the length of truck travel on Swan Pond Road. Logistics considerations include coordination with ongoing scrubber construction activities, any planned plant modification work, as well as regular rail deliveries of coal, limestone, and ammonia. TVA has added Environmental Justice analysis to the EA.

EPA Comment

Noise (OR. 48) - In addition to ensuring that trucks and other construction equipment have mufflers and engine housings consistent with their manufacturer's specifications, we suggest that shielding (e.g., hush-houses) might be tried for stationary equipment such as pumps (dredges?) to attenuate noise for any nearby residents and operators. Modem technology would also minimize noise levels at the source (source reduction). A timeframe (days, months) for overall construction should also be provided in the FEA in order to gauge the magnitude of construction impacts.

TVA response: Dredging operations and associated activities are estimated to last through January 2010. Activities would be conducted 24 hours per day and 7 days a week. In the EA and FONSI, TVA is committing to noise shielding and lighting modification to minimize impact to local residents.

EPA Comment

Air Quality (pg. 50) - We note (pg. 50) that TVA's monitoring of fine particulates (PM-2.5) relative to fugitive dust from ash piles showed that "...daily averages are well below the 24-hr NAAQS, the level that EPA considers safe". We note, however, that the first data set shown on Figure 17 was not until 1/2/09 - some 10 days after the ash slide event (12122108). In contrast, the PM-10 measurements on Figure 16 were started earlier (12128108). The FEA should discuss this.

TVA response: Hand-held real-time PM10 monitoring began on December 28, 2009 using battery-operated industrial hygiene instruments. Stationary continuous air quality monitoring did not begin until January 2, 2009 due to the necessity to install power at the monitoring site.

EPA Comment

Cumulative Impacts (pg. 52) -This section (pg. 52) states that "TVA is not aware of any currently proposed activities in the vicinity of the proposed Emory River dredge area that would affect the same resources potentially impacted by the dredging." It should be noted, however, that TVA is currently in the NEPA process (FEIS stage) of finalizing its Watts Bar Reservoir Land Management Plan that is interconnected with the Emory River ash spill. To the extent that TVA can avoid land allotments for industrial sites along the shorelines of its reservoirs (unless they require water access), industrial accidents such as the Kingston ash slide could be minimized (i.e., would not be associated with waterways).

TVA response: TVA is not aware of any currently proposed activities in the vicinity of the proposed Emory River dredge area that would affect the same resources potentially impacted by the dredging. Other than KIF, none of the alternatives of the proposed Watts Bar Reservoir Land Plan have existing activities involving the river bottom or propose any in the vicinity of the dredge area (TVA 2009b). Future proposals for major water based projects are unlikely in the immediate dredge area given the lack of potential industrial or developed recreation sites and TVA's current land policy which considers disposal of reservoir lands for industrial purposes or other businesses, if the property is located in an existing industrial park or the land is designated for such purposes in a reservoir land management plan.

EPA Comment

Mitigation Measures (pg. 52) - We generally support the mitigation measures offered in this section. Some of our concerns are addressed by these measures. The FEA should, however, provide a commitment to implement these measures (subject to agency review and comment). Additional detail and cross-referencing with relevant sections of the FEA is also recommended. For example, how will TVA control river flows considering natural/seasonal changes in flows, river flow reversals in direction, discharges from KIF, and other variables?

TVA response: The Mitigation Measures will be included as commitments in the FONSI. TVA would continue to manage flows to the extent possible of the Clinch and Tennessee rivers in the Kingston area by controlling the releases from Melton Hill, Fort Loudoun, and Watts Bar dams, provided it does not conflict with meeting the flows and water levels established in the *TVA River Operations Study* (TVA 2004). This flow management is designed to minimize the downstream movement of spilled ash and to prevent backflow of potentially ash-laden water from the Clinch River into the Tennessee River

EPA Comment

Summary - Overall, the DEA provides a reasonable basis for the proposed dredging, particularly given the emergency of the event and response. However, we request that our preliminary comments be considered in the development of the FEA. Notably absent in this DEA and the previous "initial EA, however, is a pre-spill baseline for waters of the US and aquatic life in the affected project area. That is, there is no quantification for the waters of the US acreage lost (inundated) by the spill or an estimate of the smothered benthic assemblages potentially inhabiting the portions of the river bottom that were inundated. The FEA should therefore attempt to quantify the waters of the US acreage lost (e.g., using NWI maps, recent aerials or other background river data) and the affected acreage that can be expected to have been inhabited by benthic macroinvertebrates (e.g., based on water quality, water depth, sediment type, historic sediment contamination, and perhaps TVA's 2008 ecological rating of Watts Bar Reservoir). Such baseline data would be useful for outlining mitigation for waters of the US, benthic and other environmental losses due to the spill. Future TVA NEPA documents on this ash spill should address area recovery and ecological effects such as acute PEC/TEC effects and chronic bioavailability and bioaccumulation of ash metals.

TVA response: The scope of these initial EAs is focused on the potential impacts of TVA's actions since the slide occurred. The baseline conditions used for this assessment are post-slide conditions. The no action scenario would be if TVA did not take corrective actions for the ash slide. The long-term recovery plan, damage assessment, and subsequent NEPA review would address pre-slide conditions and identify the appropriate mitigation needed. TVA has revised the EA to include the latest aquatic ecology information.

EPA Comment

In regard to the proposed dredging, we recommend the use of all reasonable methods to reduce turbidity in the water column. These include continuous monitoring at upstream and downstream water quality stations, river flow rate and KIF discharge controls, NPDES permit compliance, use of silt screens, reductions in the rate of dredging or even work stoppages, turbidity plume monitoring, use of accepted thresholds for turbidity tolerances above ambient levels, continued coordination with state and federal agencies, and various other methods. Storage of recovered ash should be located at an onsite approved permitted ash pond or offsite permitted landfill(s).

TVA response: All of the above methods are already part of TVA's proposed dredging operations. We agree to implement them fully during the dredging process.

EPA Comment

We also recommend that the FEA address ways that TVA is pursuing to prevent dike failure at this and other TVA facilities (e.g., frequent inspections, more in-depth inspections, engineering/structural changes, increased use of alternatives to coal power plants to generate electricity, etc.). Finally, the FEA should clarify if the current dredging EA is being developed using CEQ regulations for emergency procedures (40 CFR 1506.1 1) or simply TVA's own emergency procedures in terms of timeframes for NEPA reviews and project implementation.

> **TVA Response**: TVA is using the CEQ guidance for Preparing Focused, Concise and Timely Environmental Assessments. Because in this situation, there is no statutory exemption from NEPA requirements, no categorical exclusion is available, the proposed recovery/response actions are not covered in an existing NEPA analysis (EA or EIS), and the expected environmental impacts of the proposed recovery/response action is not considered to be significant; TVA is preparing a concise and focused environmental assessment in a short time. TVA has consulted with CEQ on this approach.

Tennessee Valley Authority, 400 West Summit Hill Drive, Knoxville, Tennessee 37902-1499

February 26, 2009

Mr. E. Patrick McIntyre, Jr.
Executive Director
Tennessee Historical Commission
2941 Lebanon Road
Nashville, Tennessee 37243-0442

Dear Mr. McIntyre:

As TVA has notified you in earlier correspondence, on December 22, 2008, a dike at an ash pond failed at TVA's Kingston Fossil Plant (KIF) in Roane County, Tennessee. KIF is located on the Emory River close to the confluence of the Clinch and Tennessee Rivers near Kingston, Tennessee (Figure 1). The dike failure at TVA's KIF released about 5.4 million cubic yards of coal ash that now covers approximately 300 acres (Figure 2). The dike failure resulted in ash being displaced from about 60 acres of the 84-acre ash pond.

Pursuant to 36 CFR § 800.12(d), TVA has been coordinating with your office actions undertaken as an essential and immediate response to the incident, such as the construction of Weir #1 and Dike #2 (Figure 3) to restrict the flow of ash into the Emory River and the downstream watershed (Clinch and Tennessee Rivers).

TVA is now proposing to dredge ash out of the Emory River at locations east of Dike #2. It is estimated that approximately 2.4 million cubic yards of ash have been displaced east of Dike #2 into the Emory River, including the Lakeshore Slough (Figure 3). The ash and debris in the channel continues to erode downstream due to the flow of the Emory River. Weir #1 has slowed the movement of ash down the Emory River to the Clinch and Tennessee Rivers, but has not halted it. Immediate action is necessary to minimize the movement of ash in the channel further downstream to maintain the water quality and aquatic ecology areas downstream. TVA proposes to remove (dredge) debris and ash from the Emory River between River Miles 1.5 and 3.5 (Figure 1).

The proposed dredging will take place in three phases.

- Phase 1 would focus on restoring flow in the original Emory River channel to the pre-incident level. Currently, part of the river channel is blocked by ash and the river is diverting around the blockage. First, the river channel will be dredged to an elevation of 710 feet msl utilizing a 10-inch Ellicott 370 machine. This hydraulic dredge is capable of pumping ash up to 6,000 linear feet with the in-line booster pump. Bathometric surveys of the Emory River before the incident indicate that this depth will restore flow without disturbing the pre-incident river sediments. Dredge material will be removed in approximately 10-foot segments. As part of Phase 1, the recently constructed underwater weir (Weir #1) will be lowered incrementally. Mechanical dredging (clam shell) will only be used to remove large debris such as trees and lumber that blocks the hydraulic dredge. One goal of this phase is to not disturb pre-incident sediments in the Emory River. Some ash will remain above these sediments at the conclusion of Phase 1. This phase of dredging is projected to last through May 2009.

- Phase 2 would focus on removing any remaining ash with the goal of returning the river channel back to its original depths while minimizing the disturbance of legacy, native sediments. This would be achieved by using river bathymetry and Global Positioning System (GPS) controls onboard a 10-inch Ellicott 370 dredging machine with a 50-foot maximum cutting depth. Weir #1 would be removed at the end of this phase.

- Phase 3 would focus on removal of ash deposits that are outside of the Emory River channel (for example Lakeshore Slough). This operation would utilize bathymetry derived from the 1940 pre-impoundment topographic maps unless more recent information is available.

During Phase 1, the dredge spoil would be pumped to a dredge sluice channel in the ash recovery area (Figure 5) to be constructed beside the existing plant fly ash and bottom ash channel. The dredge spoil will be dewatered in this area. The dewatering and processing areas will be sloped to drain into the existing plant ash pond. In addition, some dredge spoil could be pumped into geo-fabric tubes (Figure 4) that allow water to escape while retaining the ash and debris. These tubes would be temporarily stored in an existing area at KIF (Figure 5) until they are relatively dry. This area was an ash storage pond that has been landscaped and modified for other uses. There are no historic properties in the dewatering and temporary storage area.

TVA is currently assessing several long-term options for dealing with the ash and debris removed from the river. The impact of any long-term options on historic properties will be addressed in a future consultation.

TVA has completed several cultural resource surveys in this portion of Watts Bar reservoir (Cannon 1986, Ahlman et al. 2000; Franklin and Frankenberg 2000). The only archaeological site that is recorded in the area affected by these dredging, dewatering and storing (temporary) activities is 40Re46 (Figure 6). This site, identified near the confluence of Swan Pond Creek and the Emory River, was recorded as a prehistoric artifact scatter in 1941. The recorded location of 40RE46 was re-investigated in 1986 by Cannon (Figure 7) and in 2000 by Ahlman et al. The site was not relocated in either survey, possibly due to permanent inundation, an error in mapping or the low density of artifacts. The site is depicted partially within the original river channel which suggests that the site boundary is questionable. The Tennessee archaeological site form for 40Re46 (Figure 8) indicates that it was identified by C.H. Nash. A search by personnel of the McClung Museum of all records attributed to C.H. Nash has failed to find any additional information on this site.

The current location of the ash and debris prevents TVA from safely relocating and evaluating 40Re46. TVA believes that the aforementioned Phase 1 dredging method will have no effect on the integrity of the site because one of the goals of this dredging is to leave the underlying sediments undisturbed. Our office will continue to notify you of the additional dredging phases as they develop or if revisions are necessary.

Pursuant to 36 CFR § 800.12(b)(2), TVA seeks your comments regarding the impact of Phase 1 dredging activities on historic properties. Because this activity is essential to contain the immediate impacts of the incident, we respectfully request your comments within **seven calendar days** of receipt of this letter. If you have any questions contact Tom Maher at 865-632-7452 or 865-228-1374 (cell) or tomaher@tva.gov.

Sincerely,

Original signed by Thomas O. Maher

Thomas O. Maher, Ph.D.
Manager
Cultural Resources

TOM:IKS
Enclosures
cc: Ms. Jennifer Barnett
Department of Environment and Conservation
Division of Archaeology
1216 Foster Avenue
Nashville, Tennessee 37210

EDMS, WT 11D-K

Citations

Ahlman, Todd M., Susan R. Frankenberg and Nicholas P. Herrmann
2000 *Archaeological Reconnaissance Survey of Tennessee Valley Authority Land on the Watts Bar Reservoir*. University of Tennessee. Submitted to TVA.

Cannon, Kenneth P.
1986 *Assessment of the Archaeological Resources of the Watts Bar Reservoir, East Tennessee*. University of Tennessee. Submitted to TVA.

Franklin, Jay D. and Susan R. Frankenberg, Ph.D.
2000 *Archaeological Reconnaissance Survey and Limited Deep Testing of the Proposed Kingston Fossil Plant Rail Spur Corridor*. University of Tennessee. Submitted to TVA.

TENNESSEE HISTORICAL COMMISSION
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
2941 LEBANON ROAD
NASHVILLE, TN 37243-0442
(615) 532-1550

March 3, 2009

Dr. Thomas Maher
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

RE: TVA, FOSSIL PLANT ASH CLEANUP PHASE I, HARRIMAN, ROANE COUNTY

Dear Dr. Maher:

The Tennessee State Historic Preservation Office has reviewed the above-referenced undertaking received on Friday, February 27, 2009 for compliance by the participating federal agency or applicant for federal assistance with Section 106 of the National Historic Preservation Act. The Procedures for implementing Section 106 of the Act are codified at 36 CFR 800 (Federal Register, December 12, 2000, 77698-77739).

After considering the documentation submitted, we concur that there are no National Register of Historic Places listed or eligible properties affected by this undertaking. This determination is made either because of the location, scope and/or nature of the undertaking, and/or because of the size of the area of potential effect; or because no listed or eligible properties exist in the area of potential effect; or because the undertaking will not alter any characteristics of an identified eligible or listed property that qualify the property for listing in the National Register or alter such property's location, setting or use. Therefore, this office has no objections to your proceeding with the project.

If your agency proposes any modifications in current project plans or discovers any archaeological remains during the ground disturbance or construction phase, please contact this office to determine what further action, if any, will be necessary to comply with Section 106 of the National Historic Preservation Act. You may direct questions or comments to Jennifer M. Barnett (615) 741-1588, ext. 105. This office appreciates your cooperation.

Sincerely,

E. Patrick McIntyre, Jr.
Executive Director and
State Historic Preservation Officer

EPM/jmb

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Appendix A – Sampling Plan

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TENNESSEE VALLEY AUTHORITY
Office of Environment & Research
Environmental Resources and Services

KINGSTON FOSSIL PLANT

FLY ASH RECOVERY PROJECT

SAMPLING PLAN FOR PHASE 1 DREDGING OPERATIONS

Kingston, Tennessee
March 2009

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Attachment 1 – Kingston Fossil Plant Fly Ash Pond Incident Environment Sampling Plan

Attachment 2 – Standard Operating Procedure for Surface Water Sampling TVA-KIF-SOP-01

Attachment 3 – Kingston Fossil Plant Fly Ash Recovery Project – Ash Pond Management Plan

Attachment 4 – TVA Remediation Ambient Air Monitoring Plan

I. Introduction

This sampling plan and the supporting documents incorporated either by reference or as appendices describe the physical, chemical, and toxicological sampling and monitoring of water, ash, and sediments TVA will perform in conjunction with the Phase 1 dredging of ash from the Emory River. It supersedes the descriptions of monitoring activities in Sections 4.3 and 5.0 of the Phase 1 Emory River Dredging Plan, Kingston Fossil Plant Ash Recovery Project submitted to the Tennessee Department of Environment and Conservation (TDEC) and the U.S. Environmental Protection Agency (EPA) on February 25, 2009.

II. Water Quality Chemical Monitoring Overview

Several different water quality monitoring activities will be associated with the Phase 1 dredging of ash from the Emory River. These are described in more detail in the following sections; in brief form they include:

1. Continuous monitoring of temperature, dissolved oxygen, conductivity, pH, and turbidity by Hydrolab® instruments deployed from five floating platforms in the river and intake channel;
2. Daily field monitoring via boat using Hydrolab® instruments to locate turbidity plumes, with subsequent sampling of the most turbid portions of identified plumes for total and dissolved metals, total and dissolved mercury, alkalinity, total hardness, total suspended solids, and dissolved solids;
3. Continued routine fixed-station monitoring via boat of the same field variables and analyses as in items 1 and 2 at the five fixed station locations on the Emory River, four locations on the Clinch River, and one (or two) locations on the Tennessee River that have been routinely monitored three times/week since the week of December 22, 2008.
4. Analysis of water samples associated with ash pond management, sediment elutriates and whole sediment toxicity tests.

A. <u>Continuous Monitoring</u>

Floating turbidity monitoring systems will be established upstream and downstream of the Phase 1 dredging area to monitor potential water quality impacts. Five continuous monitoring stations will be deployed at ERM 0.5, ERM 4.0, at locations approximately ¼ mile north and south of dredging operations, and in the KIF intake channel (Table 1). Data from these stations will be obtained at 15-minute intervals and transmitted to a server located at KIF, where it will be processed automatically and monitored to detect significant changes.

Table 1 Continuous Hydrolab® Fixed Monitoring Stations		
Identifier	**Location**	**Turbidity Difference between Upstream and Downstream**
Emory River Station 1 (ERS1)	ERM 0.5	If Emory River is flowing toward Clinch River: ERS1-ERS2, ERS3-ERS2
Emory River Station 2 (ERS2)	1/4 mile upstream north of dredging	Background Station
Emory River Station 3 (ERS3)	1/4 mile upstream south of dredging	Background Station
Emory River Station 4 (ERS4)	ERM 4.0	If Emory River is flowing away from Clinch River: ERS4-ERS3, ERS2-ERS3
Emory River Station 5 (ERS5)	KIF Intake Channel	If all flow is towards KIF intake channel: ERS5-ERS2 or ERS5-ERS3; ERS3-ERS2 or ERS2-ERS3

Emory River flows sometimes reverse direction as a result of TVA reservoir operations, Kingston Fossil Plant operations, or when the Emory River flow is less than the KIF intake flow. At times the downstream direction of flow is toward the Clinch River, at other times it is toward the plant intake, and at other times it can be back towards Harriman. A complicating factor is that beginning about mid-May Watts Bar Reservoir stratifies thermally into a warm upper layer that is somewhat isolated from the deeper, cooler water. After stratification has become established, it is possible to have Emory river water flowing in a normal downstream direction at the surface, while cooler Clinch River water is flowing upstream toward the KIF cooling water intake, having been diverted by an underwater weir in the Clinch River just downstream of the Emory River confluence.

The two floating stations approximately ¼ mile either direction from the dredging operations will be moved as dredging progresses. The floating stations at ERM 0.5 and 4.0 are equipped with velocity meters to determine the direction of flow past the dredging operation. Initially the Hydrolabs® will be deployed at a depth of six feet. This depth will be adjusted as the depth of dredging increases, as thermal stratification develops, and if results from the turbidity plume monitoring indicate a different depth is more representative.

Based on the flow direction and velocity data, the station located approximately ¼ mile from the dredging operations determined to be upstream of dredging will be considered as the background station for each set of data measurements. The two downstream monitoring stations (approximately ¼ mile downstream and either the intake channel or one of the other two Emory River Stations—ERM 4.0 or ERM 0.5) will be compared to the background station to evaluate water quality changes. The measured 15-minute interval turbidity values for the background and downstream stations will be used to calculate a rolling 24-hour moving average turbidity change associated with dredging.

If the 24-hour moving average turbidity change exceeds 200 NTU, dredging operations and BMPs will be evaluated and data from the further downstream station will be reviewed. If the 24-hour moving average between the upstream station and both downstream stations exceeds 200 NTU, dredge production would be decreased, cutting depth would be modified, and/or other operational controls would be utilized to mitigate the turbidity. Other BMPs, such as the use of turbidity curtains or possible use of a non-toxic flocculent polymer, also would be considered and utilized as needed. Such a situation also would trigger additional field monitoring (visual observation and Hydrolab® monitoring) and sample collection to better define the extent of the turbidity plume. If field observations and/or water quality data trends indicate that the 200 NTU trigger is not sufficiently protective of downstream water uses, TVA will consult with TDEC about more protective mitigation measures.

B. Daily Monitoring Via Boat

During the first two weeks of dredging, field crews will be deployed in boats during daylight hours to monitor turbidity plumes and to define the three-dimensional boundaries of any observed plumes. The crews will identify turbidity plumes visually, and then will use a combination of visual observations and turbidity measurements via Hydrolabs® to identify the horizontal and vertical boundaries of the plume.

After locating the most turbid part of the plume (depth and horizontal location), a water sample will be collected using a peristaltic pump following the procedure in the Standard Operating Procedure for Surface Water Sampling (TVA-KIF-SOP 01). Samples will be analyzed for the variables listed in Table 2. Twenty-four-hour turnaround will be requested for total suspended solids (TSS) analyses. If turbidity levels in the plume seem excessive, then real-time turbidity measurements from the floating monitors will be checked and dredging operations and BMPs will be modified as needed.

Data collected will be continuously evaluated during the first two weeks to determine the effectiveness of this approach and appropriate refinements to improve the approach, as well as the appropriate frequency needed for the duration of phase 1 dredging.

Table 2. Analytes, Methods, and Target Reporting Limits: Water, Elutriate, and Dilution Water		
Test Parameter	**Test Method**	**Reporting Limit**
Basic Water Chemistry		
pH	150.2	0.1 pH Units
Alkalinity	310.2/SM 2310B	10 mg/L
Total Hardness	200.7/200.8/SM 2340B	1 mg/L
Total Suspended Solids (TSS)	160.2/SM2540D	1.0 mg/L
Total Dissolved Solids (TDS)	SM 2540C	1.0 mg/L
Metals—Total and Dissolved		
Aluminum	6010B/6020/200.7/200.8	100 μg/L
Antimony	6010B/6020/200.7/200.8	2 μg/L
Arsenic	6010B/6020/200.7/200.8	2 μg/L
Barium	6010B/6020/200.7/200.8	200 μg/L
Beryllium	6010B/6020/200.7/200.8	2 μg/L
Boron	6010B/6020/200.7/200.8	200 μg/L
Cadmium	6010B/6020/200.7/200.8	1 μg/L
Calcium	6010B/6020/200.7/200.8	100 μg/L
Chromium	6010B/6020/200.7/200.8	2 μg/L
Cobalt	6010B/6020/200.7/200.8	10 μg/L
Copper	6010B/6020/200.7/200.8	5 μg/L
Iron	6010B/6020/200.7/200.8	100 μg/L
Lead	6010B/6020/200.7/200.8	2 μg/L
Magnesium	6010B/6020/200.7/200.8	1000 μg/L
Manganese	6010B/6020/200.7/200.8	10 μg/L
Mercury	7470/245.1	0.2 μg/L
Molybdenum	6010B/6020/200.7/200.8	40 μg/L
Nickel	6010B/6020/200.7/200.8	5 μg/L
Potassium	6010B/6020/200.7/200.8	1000 μg/L
Selenium	6010B/6020/200.7/200.8	2 μg/L
Silver	6010B/6020/200.7/200.8	2 μg/L
Sodium	6010B/6020/200.7/200.8	1000 μg/L
Thallium	6010B/6020/200.7/200.8	2 μg/L
Vanadium	6010B/6020/200.7/200.8	4 μg/L
Zinc	6010B/6020/200.7/200.8	50 μg/L

Laboratory reporting limits for each analyte listed in Table 2 are based on the TDEC Required Method Detection Levels (RDL), applicable water quality criteria and maximum contaminant levels (TDEC Rules 1200-4-3-.03 and 1200-5-1-.12), and on reporting limits achievable by the certified laboratories contracted by TVA.

This list of analytes will be reviewed over the course of the first month's dredging and modified as appropriate, in consultation with TDEC, to eliminate analyses that are providing little or no useful information.

C. Continued Fixed-station Monitoring

During dredging operations TVA will continue routine sampling of surface water three times per week and after rain events exceeding 0.5" total over 24 hours at five locations on the Emory River, four locations on the Clinch River, and one (or two) locations on the Tennessee River (Table 3). Samples will be analyzed for the variables listed in Table 2. The frequency of routine surface water sampling will be reviewed over the course of the first month's dredging, and periodically thereafter. Frequency will be modified as appropriate, in consultation with TDEC.

Sampling will be performed following the procedures outlined in the Kingston Fossil Plant Fly Ash Pond Incident Environmental Sampling Plan (TVA-KIF-ESP) dated February 2009, and described in more detail in the Standard Operating Procedure for Surface Water Sampling (TVA-KIF-SOP) dated March 2009. In summary, those procedures require using an approved peristaltic pump or approved hand-held sampler, sample bottles and preservatives appropriate for each type of analysis, and placing collected samples into cooler(s) with ice. Duplicate turbidity, temperature, dissolved oxygen, conductivity, and pH field samples will be conducted on a 1/10 sample frequency. Duplicate samples will also be collected on a 1/10 frequency for TSS, total dissolved solids, total metals, dissolved metals, total hardness, dissolved silica, and alkalinity. Additionally, a matrix spike/matrix spike duplicate sample (MS/MSDS) will be taken on a 1/10 frequency and submitted to the lab.

Table 3
Routine Surface Water Sampling Locations

Sample Number	Location	RM	Site Label	Sample Type	Latitude	Longitude
1	Clinch River	0.0	KIF-CRM0.0-Date	Grab	N35.86364	W84.53181
2	Clinch River	2.0	KIF-CRM2.0-Date	Grab	N35.88621	W84.52778
3	Clinch River	4.0	KIF-CRM4.0-Date	Grab	N35.88956	W84.49892
4	Clinch River	5.5	KIF-CRM5.5-Date	Grab	N35.89274	W84.48142
5	Emory River	0.1	KIF-ERM0.1-Date	Grab	N35.88986	W84.48778
6	Emory River	1.75	KIF-ERM1.75-Date	Grab	N35.90305	W84.49708
7	Emory River	2.1	KIF-ERM2.1-Date	Grab	N35.90925	W84.50055
8	Emory River	4.0	KIF-ERM4.0-Date	Grab	N35.92416	W84.48255
9	Emory River	12.2	KIF-ERM12.2-Date	Grab	N35.92899	W84.55450
10	Tennessee River	563.5	KIF-TRM563.5-Date	Grab	N35.83941	W84.58283
11	Tennessee River	568.5	KIF-TRM568.5-Date	Grab	N35.85539	W84.53068

Field measurement of turbidity at Clinch River mile 0.0 will be used as a trigger for sampling at Tennessee River mile 563.5. If the turbidity reading at CRM 0.0 exceeds 20 NTU, crews will collect samples at TRM 563.5.

Samples will be collected from the water column fifteen feet below surface or at mid-depth (if total depth is <15'). As thermal stratification becomes established, TVA will review the sufficiency of collecting these samples at one depth and will modify the sampling depth(s) as appropriate, in consultation with TDEC.

Water quality data from both the fixed station samples and the plume samples will be compared to TDEC Fish and Aquatic Life Use Classification and Recreation Use Classification (water and organisms) criteria. TVA will consult with TDEC to determine the format and frequency of reporting of water quality data. Any exceedences will be reported immediately and will initiate consultation with TDEC about additional mitigation measures.

D. Water Analyses Supporting Ash Pond Management, Toxicity Tests, Bioaccumulation, and Special Studies
Water samples will be collected and analyzed in support of the Ash Pond Management Plan as specified in that plan. In addition, each time TVA collects river water to be used in sediment tests (whole and elutriate), samples will be collected for metals analyses. Water used in some of the toxicity tests also will be analyzed post-exposure to evaluate the partitioning of metals from the ash to the overlying water. Finally, additional samples will be collected as other opportunities are identified to obtain water quality information that will address specific concerns. One such example is the March 16, 2009, collection of water and sediment samples for selenium analysis from the location near Dike 2 where work is underway to install stormwater containment basins. There undoubtedly will be additional situations identified that will require mobilization and collection of samples to address specific issues.

III. River Ash and Sediments Chemical Monitoring Overview

TVA has conducted a significant amount of sampling to characterize the chemical composition and particle size distribution of ash in the remaining part of the dredge cell and in ash spilled into the embayment. Similarly, TVA and DOE, at TVA's request, have performed sediment sampling in both the Emory and Clinch Rivers, including locations well upstream and downstream of the spill area. The initial ash sampling and resulting data were summarized in the Corrective Action Plan; analysis of data received to date for the more recent sediment sampling is partially complete, as are the chemical analyses. Reports on those results will be prepared as that work is completed.

TVA has done much less sampling of the ash deposited in the river than of the ash in the remaining dredge cell and embayment. Initial expectations were that the material that was easily accessible in the embayment and material remaining in the dredge cell would be representative of material in the river. To some extent, that expectation has held up, but given the relatively small amount of data that has been developed, in preparation for beginning dredging TVA is obtaining additional samples of the material in the river for a variety of analyses and purposes. River ash samples are being or have been collected for the following purposes:

1. Chemical analysis for total metals;
2. Particle size analysis;
3. Acid-Volatile Sulfides/Simultaneously Extractable Metals (AVS/SEM) analyses for evaluating bioavailability of metals;
4. Standard whole sediment toxicity analyses (*Hyallella azteca* and freshwater juvenile mussels);
5. Standard whole-sediment bioaccumulation tests (*Lumbriculus variegates* & *Corbicula fluminea);*
6. Standard whole sediment elutriate chemistry and toxicity (*C. dubia, P. promelas & juvenile mussels*); and
7. Possible long-term exposure analyses.

A. Sampling locations and sample preparation

For the analyses for chemical composition, particle size, AVS/SEM, and the various toxicity bioassays and bioaccumulation tests (items 1—7 above), two sets of composite samples of ash will be collected prior to the start of dredging in the Emory River at locations just upstream and just downstream of the most impacted area. GPS coordinates will be obtained for each of these sets of samples. Samples will be collected in successive 10-foot sections using a 3" Vibracore® sampler deployed from a boat. The upper 10' section will be representative of the first two 5' dredging cuts, the second 10' section will be of material to be dredged in the third and fourth dredging cuts, and the last section will be of the remaining ash in the bottom of the channel down to the pre-event channel bottom.

If possible, the first 20' depth of ash in this area will be sampled on the same day, sectioning the cores into the two 10' sections. If that proves not to be possible, cores will be obtained prior to beginning dredging and following completion of the second and fourth cuts. In most places the remaining depth of ash following the fourth dredge cut will be less than 10'. The cores collected during that sampling event will, where possible, penetrate into the pre-event river channel bottom sediments. Those cores will be sectioned at that level, and the native sediments will be retained for analysis along with the overlying ash.

Each 10' core will contain approximately 12 liters of ash. A sufficient number of cores will be collected at each location to provide enough ash to perform all the analyses listed in items 1-7 above. The material collected will be composited into an appropriate container and will be gently homogenized by manually tumbling the container before split samples are removed for the various analyses.

B. Chemical Analyses

1. The composited ash samples will be analyzed for the constituents listed in Table 4 by TVA's contract chemical analysis laboratory.
2. Particle size analysis will be performed by a contract laboratory certified for that analysis.
3. Samples for AVS/SEM analysis will be shipped to a contract laboratory with demonstrated specialized capability to perform this analysis.
4. The various toxicity analyses and bioaccumulation tests will be performed by contract laboratories described further in Section IV, below.
5. The list of analytes for the native sediment samples will be slightly different from those listed in Table 2. The native sediments samples will be analyzed for legacy contaminants, including PCBs and chlordane, as well as for other analytes. The list of analytes for those samples will be submitted to TDEC for approval prior to conducting laboratory analyses.

Table 4. Analytes, Methods, and Target Reporting Limits: Ash and Sediment Samples

Test Parameter	Test Method	Reporting Limit*
Ammonia	EPA 350.1	5 mg/kg
Sulfides	SW-846 9030	5 mg/kg
Total Organic Carbon	SW-846 9060 modified	100 mg/kg
Aluminum	SW-846 6010B	40 mg/kg
Antimony	SW-846 6010B	6.0 mg/kg
Arsenic	SW-846 6010B	2.0 mg/kg
Barium	SW-846 6010B	1.0 mg/kg
Beryllium	SW-846 6010B	1.0 mg/kg
Boron	SW-846 6010B	20 mg/kg
Cadmium	SW-846 6010B	0.5 mg/kg
Calcium	SW-846 6010B	500 mg/kg
Chromium	SW-846 6010B	1.5 mg/kg
Cobalt	SW-846 6010B	5.0 mg/kg
Copper	SW-846 6010B	2.5 mg/kg
Iron	SW-846 6010B	20 mg/kg
Lead	SW-846 6010B	1.5 mg/kg
Magnesium	SW-846 6010B	500 mg/kg
Manganese	SW-846 6010B	1.5 mg/kg
Molybdenum	SW-846 6010B	4.0 mg/kg
Nickel	SW-846 6010B	4.0 mg/kg
Potassium	SW-846 6010B	500 mg/kg
Selenium	SW-846 6010B	1.5 mg/kg
Silver	SW-846 6010B	3.0 mg/kg
Sodium	SW-846 6010B	500 mg/kg
Thallium	SW-846 6010B	3.5 mg/kg
Vanadium	SW-846 6010B	2.5 mg/kg
Zinc	SW-846 6010B	6.0 mg/kg
Mercury	SW-846 7471	0.02 mg/kg
SEM Cadmium	EPA 821-R-91-100	0.001112 umoles/g
SEM Copper	EPA 821-R-91-100	0.009835 umoles/g
SEM Lead	EPA 821-R-91-100	0.0007239 umoles/g
SEM Mercury	EPA 821-R-91-100	0.00006232 umoles/g
SEM Nickel	EPA 821-R-91-100	0.01704 umoles/g
SEM Zinc	EPA 821-R-91-100	0.03823 umoles/g
Acid Volatile Sulfide	EPA 821-R-91-100	0.499 umoles/g
Grain Size	ASTM D422	1.0%
Total Solids	ASTM D2216	1.0 %
Specific Gravity of Soils	ASTM D-854-00	0.01 mg/L

*Reporting limits assume dry-weight material (100% solids); sample-specific reporting limits will be higher based on sample volume and percent moisture. Sample results will be reported on a dry-weight basis.

C. Reference Station(s)

A reference control station or reference sediment material is required for comparison purposes for the whole sediment toxicity and bioaccumulation tests. This is problematic because the characteristics of the ash are dissimilar to those of native sediments. It is unlikely that an unaffected Emory River sediment sample is appropriate since the physicochemical nature of ash is so different. TVA is consulting with the contract toxicity laboratory about the feasibility of developing and using a formulated sediment that mimics the physicochemical characteristics of the ash material in the river, per section 7.2 of the EPA (2000) methods manual. Developing and using such a sediment on all future whole sediment toxicity tests during this project may make it possible to discern effects that are attributable to the physical constituents of the test material versus the chemical contaminant constituents.

Although it would bear no relationship to the chemical composition of the ash spill, if a formulated sediment is used, the same chemical analyses for total chemical constituents would be performed on that material as on the ash used in the whole sediment bioassays.

IV. Toxicological Monitoring

A. Whole Sediment Toxicity Evaluation

This Section of the dredge monitoring plan describes procedures for testing freshwater organisms in the laboratory to evaluate the potential toxicity or bioaccumulation of chemicals in whole sediments (ash). All whole sediment toxicity tests will be performed by the University of Maryland – Wye Research and Education Center aquatic toxicity laboratory in Queenstown, Maryland. All 10' homogenized core sections collected as described previously in this plan will be tested once only.

1. Whole Sediment Samples

Aliquots from homogenized samples described in Section III will be used in all whole sediment toxicity tests within 8 weeks of sample collection. These are the same samples that will undergo chemical analyses as described in Section III. Emory River water from upstream of the dredge operations impact zone will be used as overlying water in these tests within 14 days of sample collection. Because toxicity of certain metals is inversely related to water hardness and because hardness in the Emory River is lower than in the downstream Clinch and Tennessee Rivers, using Emory River water in the whole sediment toxicity tests will ensure the toxicity evaluation is conservative.

2. Test Methods

a. *Hyalella azteca* 10-day Survival and Growth Test for Sediments

A 10-day toxicity test will be conducted with whole sediment (ash), formulated sediment, and negative control sediment using 7- to 14-day old animals (1- to 2-day range in age) to evaluate potential toxicity to sediment-dwelling organisms in the impacted area of Emory River. The tests will be conducted in accordance to Test Method 100.1 of EPA 600/R-99/064 (EPA 2000). The following table contains a summary of test conditions and test acceptability criteria for this method:

1. Test type:	Whole sediment toxicity test with renewal of overlying water
2. Test duration:	10 d
3. Temperature:	23 ± 1º C
4. Light Quality:	Wide-spectrum fluorescent lighting
5. Light Intensity:	About 100 – 1000 lux
6. Photoperiod:	16 h light, 8 h dark
7. Test chamber size:	300 mL high-form lipless beaker
8. Sediment volume:	100 mL
9. Overlying water volume:	175 mL
10. Renewal of overlying water:	2 volume additions/d; continuous or intermittent (e.g., 1 volume addition every 12 h)
11. Age of test organisms:	7- 14-d (1- to 2-d range in age)
12. No. organisms per test chamber:	10
13. No. of replicate chambers:	8 (recommended for routine tests)
14. No. organisms per test conc.	80
15. Feeding regime:	YCT food, fed 1.0 mL daily (1800 mg/L stock) to each test chamber
16. Aeration:	None, unless DO drops below 2.5 mg/L
17. Overlying water:	Unaffected Emory River water
18. Test chamber cleaning:	If screens become clogged during test, gently brush the outside of the screen
19. Overlying water quality:	Hardness, alkalinity, conductivity, and pH at beginning and end of a test. Temperature, DO, and ammonia daily.
20. Endpoints:	Survival and growth (dry weight)
21. Test acceptability criteria:	Minimum control survival of 80% and measurable growth of test organisms in the negative control sediment
22. Post-exposure water metals:	No analysis

b. Five-day Freshwater Juvenile Mussel Survival Test for Sediments

An acute 5-day toxicity test will be conducted with whole sediment (ash), formulated sediment, and negative control sediment samples using <8-day old juvenile freshwater mussels (species to be selected based on availability) to determine if ash and its associated contaminants (e.g., toxic metals) pose an acute (short-term) risk to Emory River mussel communities. Test design/conditions will adhere to the following:

1.	Test type	Static, non-renewal, screening
2.	Exposure duration	5 days
3.	Dilution series	N/A
4.	Species tested	Representative mussel species TBD based on availability
5.	Procedure for obtaining juveniles	Fish host
6.	Age / culturing of test organisms	<8 days / fed daily in clean sediment (see below)
7.	Temperature	24 ±1 °C
8.	Photoperiod	24 h dark
9.	Test chamber	Mussels contained in 5 cm-diam. glass cylinders closed on the lower end with 100 μm Nitex© mesh screen and positioned in 250 ml crystallizing dishes (or similar) to be in contact with test sediments (ash, control, reference) and overlying water. (Note: Extend top of each cylinder above the water to ensure juvenile mussels remain contained.)
10.	Sediment volume (test, reference, and control)	20 ml, sufficient to completely cover (~0.5 cm) bottom of the crystallizing dish.
11.	Overlying water volume	200 ml
12.	No. organisms/chamber	10
13.	No. replicate chambers	5
14.	Renewal	Only if necessary to eliminate experimental artifacts (e.g., ammonia)
15.	Feeding	6 ml algal concentrate, fed on days 0 and 3
16.	Aeration	None, unless dissolved oxygen in overlying water drops below 5.0 mg/L
17.	Overlying water:	Unaffected Emory River water
18.	Test chamber cleaning	Toxicity cleaned glassware initially with no cleaning during testing
19.	Water quality (Initial / Final)	DO, pH, hardness, alkalinity, conductivity, ammonia, temperature

20. Endpoints	Survival (foot movement/ciliary action)
21. Survival determinations/ information	Daily live-dead counts / including recorded observations of behavior (number with active pedal locomotion, number immobile with "gaped" shells and/or foot/cilia action only, etc.). Contained mussels are examined by retrieving mesh-enclosed cylinders, rinsing away ash/sediment particulates, placing the bottom of rinsed cylinders in a small amount of control water (i.e., in an open Petri dish), counting/observing live/dead mussels, and returning them to the test chambers and ash/sediment.
22. Test acceptability criterion	$\geq$ 90% survival in controls
23. Follow-up observations (survival)	5 days post exposure in clean (control) sediment and fed (see above)
24. Post-exposure water metals:	Yes

c. Ten-day Freshwater Juvenile Mussel Survival Test for Sediments

Concurrent with the 5-day test described in Section III.A.2.b, .a 10-day toxicity test will be conducted on whole sediment (ash) using <8-day old juvenile freshwater mussels (species to be selected based on availability) to determine if ash and its associated contaminants (e.g., metals) pose a longer-term acute risk to Emory River mussel communities. Testing will generally follow test conditions and test acceptability criteria for the paper pondshell freshwater mussel (or appropriate other similar species to be selected based on availability) as set forth in Appendix E, pages 29-30, of the EPA/COE Inland Testing Manual (EPA 1998). Those test conditions with appropriate modifications are as follows:

1. Test type	Static renewal, screening
2. Exposure duration	10 days
3. Dilution series	N/A
4. Species tested	Representative mussel species TBD based on availability
5. Procedure for obtaining juveniles	Fish host
6. Age / culturing of test organisms	<8 days / fed daily in clean sediment (see below)
7. Temperature	24 $\pm$1 °C

8. Photoperiod	24 h dark
9. Test chamber	Mussels contained in 5 cm-diam. glass cylinders closed on the lower end with 100 μm Nitex© mesh screen and positioned in 250 ml crystallizing dishes (or similar) to be in contact with test sediments (ash, control, reference) and overlying water. (Note: Extend top of each cylinder above the water to ensure juvenile mussels remain contained.)
10. Sediment volume (test, reference, and control)	20 ml, sufficient to completely cover (~0.5 cm) bottom of the crystallizing dish.
11. Overlying water volume	200 ml
12. No. organisms/chamber	10
13. No. replicate chambers	5
14. Renewal	Both sediments and overlying water initially and on day 6; for overlying water only, more frequently if necessary for eliminating experimental artifacts (e.g., ammonia)
15. Feeding	6 ml algal concentrate, fed on days 0, 3, 6 and 9
16. Aeration	None, unless dissolved oxygen in overlying water drops below 5.0 mg/L
17. Overlying water:	Unaffected Emory River water
17. Test chamber cleaning	Toxicity cleaned glassware initially with no cleaning during testing
18. Water quality (Initial/Renewal/Final)	DO, pH, hardness, alkalinity, conductivity, ammonia, temperature
19. Endpoints	Survival (foot movement/ciliary action)
20. Survival determinations / information	Daily live-dead counts / including recorded observations of behavior (number with active pedal locomotion, number immobile with “gaped” shells and/or foot/cilia action only, etc.) Contained mussels are examined by retrieving mesh-enclosed cylinders, rinsing away ash/sediment particulates, placing the bottom of rinsed cylinders in a small amount of control water (i.e., in an open Petri dish), counting/observing live/dead mussels, and returning them to the test chambers and ash/sediment.
21. Test acceptability criterion	≥ 90% survival in controls
22. Follow-up observations (survival)	10 days post exposure in clean silt and fed (see above)
23. Post-exposure water metals:	Yes

d. *Lumbriculus variegatus* and *Corbicula fluminea* Bioaccumulation Tests for Sediments

A 28-day bioaccumulation test will be conducted with whole sediment (ash), formulated sediment, and negative control sediment using adult *L. variegatus* and *C. fluminea* to evaluate the potential for bioaccumulation of chemicals in sediments (ash) of Emory River. The tests will be conducted in accordance to Test Method 100.3 of EPA 600/R-99/064 (EPA 2000). The following table contains a summary of test conditions and test acceptability criteria for this method:

1. Test type:	Whole sediment toxicity test with renewal of overlying water
2. Test duration:	28 d
3. Temperature:	23 ± 1º C
4. Light Quality:	Wide-spectrum fluorescent lighting
5. Light Intensity:	About 100 – 1000 lux
6. Photoperiod:	16 h light, 8 h dark
7. Test chamber size:	4- to 6-L aquaria with stainless screens or glass standpipes
8. Sediment volume:	1 L or more depending on TOC
9. Overlying water volume:	1 L or more depending on TOC
10. Renewal of overlying water:	2 volume additions/d; continuous or intermittent (e.g., 1 volume addition every 12 h)
11. Age of test organisms:	Adults
12. No. organisms per test chamber:	Ratio of TOC in sediment to organism dry weight should be no less than 50:1. Minimum of 1 g/replicate; preferably 5 g/replicate
13. No. of replicate chambers:	5 (recommended for routine tests)
14. No. organisms per test conc.	40
15. Feeding regime:	None
16. Aeration:	None, unless DO drops below 2.5 mg/L
17. Overlying water:	Unaffected Emory River water
18. Test chamber cleaning:	If screens become clogged during test, gently brush the outside of the screen

19. Overlying water quality:	Hardness, alkalinity, conductivity, and pH at beginning and end of a test. Temperature, DO, and ammonia daily.
20. Endpoint:	Bioaccumulation
21. Test acceptability criteria:	Performance-based criteria outlined in Table 13.4 (page 67) of EPA/600/R-99/064
22. Post-exposure water metals:	No analysis

The following table provides information on the chemical analyses to be performed on tissue samples.

Table 5. Analytes, Methods, and Target Reporting Limits: Tissue Samples

Test Parameter	Test Method	Reporting Limit*
Aluminum	SW-846 6020	25 mg/kg
Antimony	SW-846 6020	0.1 mg/kg
Arsenic	SW-846 6020	0.1 mg/kg
Barium	SW-846 6020	0.1 mg/kg
Beryllium	SW-846 6020	0.1 mg/kg
Boron	SW-846 6020	0.5 mg/kg
Cadmium	SW-846 6020	0.1 mg/kg
Calcium	SW-846 6020	100 mg/kg
Chromium	SW-846 6020	0.1 mg/kg
Cobalt	SW-846 6020	0.1 mg/kg
Copper	SW-846 6020	0.5 mg/kg
Iron	SW-846 6020	25 mg/kg
Lead	SW-846 6020	0.1 mg/kg
Magnesium	SW-846 6020	100 mg/kg
Manganese	SW-846 6020	0.5 mg/kg
Molybdenum	SW-846 6020	1.0 mg/kg
Nickel	SW-846 6020	0.1 mg/kg
Potassium	SW-846 6020	100 mg/kg
Selenium	SW-846 6020	0.2 mg/kg
Silver	SW-846 6020	0.05 mg/kg
Sodium	SW-846 6020	100 mg/kg
Thallium	SW-846 6020	0.1 mg/kg
Vanadium	SW-846 6020	0.2 mg/kg
Zinc	SW-846 6020	2 mg/kg
Mercury	SW-846 6020	0.02 mg/kg
Mercury	SW-846 7471	0.01 mg/kg

* Reporting limits for tissue samples are presented on a wet-weight basis.

B. Elutriate Toxicity Evaluation

This Section of the dredge monitoring plan describes procedures for testing freshwater organisms in the laboratory to evaluate the potential acute toxicity resulting from exposures to chemical contaminants that may be released to the water column through dredge activities. All elutriate toxicity tests will be performed by the University of Maryland – Wye Research and Education Center aquatic toxicity laboratory in Queenstown, Maryland. All 10' homogenized core sections collected as described previously in this plan will be tested once only.

1. Elutriate Preparation

Aliquots from homogenized samples described in Section III will be used within 8 weeks of sample collection along with upstream Emory River water (<14-day holding time) unaffected by dredging operations to prepare elutriate solutions in the laboratory. Chemical analyses for both of these media were described previously in this dredge monitoring plan.

Briefly, elutriates will be prepared by combining a sediment-to-water volumetric ratio of 1:4, stirred vigorously for 30 minutes, and allowed to settle for one hour. The supernatant will then be decanted and split into two aliquots. One aliquot will be serially diluted and used for one set of exposures. The other aliquot will be clarified by centrifugation and this supernatant will be used in concurrent exposures undiluted.

2. Test Methods

a. *Ceriodaphnia dubia* 96-hour Survival Test

Elutriates prepared as above will be used in 48-hour exposures using <24-hour old *C. dubia* to evaluate potential toxicity to water column organisms in the Emory River area influenced by re-suspended ash during dredge operations. The tests will be conducted in accordance to the Inland Testing Manual (EPA 1998) and EPA-821-R-02-012 (EPA 2002a). The following table contains a summary of test conditions and test acceptability criteria for this method:

1. Test type:	Static, non-renewal aqueous toxicity test
2. Test duration:	96 h
3. Temperature:	25 ± 1º C
4. Light Quality:	Wide-spectrum fluorescent lighting
5. Light Intensity:	50-100 ft-c
6. Photoperiod:	16 h light, 8 h dark
7. Test chamber size:	30 mL (recommended minimum)
8. Elutriate volume:	15 mL (recommended minimum)
9. Renewal of elutriate:	None
11. Age of test organisms:	< 24 h
12. No. organisms per test chamber:	5
13. No. of replicate chambers:	5
14. No. organisms per test conc.	25
15. Feeding regime:	Feed YCT and *Selenastrum* while holding prior to the test and at 48 h; newly-released young should have food available a minimum of 2 h prior to use in a test
16. Aeration:	None
17. Dilution water:	Unaffected Emory River water
18. Test chamber cleaning:	None
19. Water quality:	Hardness, alkalinity, conductivity, and pH at beginning and end of a test. Temperature, DO, and ammonia daily.
20. Test Concentrations:	Non-centrifuged: 100, 50, 25, 12.5, 6.25, 0% (river control), MHSW (negative control) Centrifuged: 100%, 0% (river control), MHSW (negative control)
21. Supernatant holding time:	≤ 24 h
22. Endpoints:	Survival
23. Test acceptability criteria:	≥ 90% survival in river control and negative control
24. Post-exposure water metals:	No analysis

b. *Pimephales promelas* 96-hour Survival test

Elutriates prepared as above will be used in 48-hour exposures using <24-hour old *P. promelas* to evaluate potential toxicity to water column organisms in the Emory River area influenced by re-suspended ash during dredge operations. The tests will be conducted in accordance to the Inland Testing Manual (EPA 1998) and EPA-821-R-02-012 (EPA 2002a). The following table contains a summary of test conditions and test acceptability criteria for this method:

1. Test type:	Static, non-renewal aqueous toxicity test
2. Test duration:	96 h
3. Temperature:	25 ± 1º C
4. Light Quality:	Wide-spectrum fluorescent lighting
5. Light Intensity:	50-100 ft-c
6. Photoperiod:	16 h light, 8 h dark
7. Test chamber size:	250 mL (recommended minimum)
8. Elutriate volume:	200 mL (recommended minimum)
9. Renewal of elutriate:	None
11. Age of test organisms:	< 24 h
12. No. organisms per test chamber:	10
13. No. of replicate chambers:	5
14. No. organisms per test conc.	50
15. Feeding regime:	*Artemia* nauplii are made available while holding prior to the test and at 48 h
16. Aeration:	None, unless DO concentration falls below 4.0 mg/L; rate should not exceed 100 bubbles/min (recommended)
17. Dilution water:	Unaffected Emory River water
18. Test chamber cleaning:	None
19. Water quality:	Hardness, alkalinity, conductivity, and pH at beginning and end of a test. Temperature, DO, and ammonia daily.
20. Test Concentrations:	Non-centrifuged: 100, 50, 25, 12.5, 6.25, 0% (river control), MHSW (negative control) Centrifuged: 100%, 0% (river control), MHSW (negative control)
21. Supernatant holding time:	≤ 24 h

22. Endpoints:	Survival
23. Test acceptability criteria:	≥ 90% survival in river control and negative control
24. Post-exposure water metals:	No analysis

c. Mussels

Ash is not sediment and, therefore, may be both chemically and physically inhospitable to mussels and other sediment-dwelling organisms. Without an appropriate reference sediment of similar grain size, compatibility, organic content, and/or composition, including characteristic fine, or coarse, or abrasive materials—and free of toxic constituents--it will be difficult to distinguish survival or growth effects (reductions) demonstrated during a toxicity exposure from physical and toxic causes, or both. For this reason, evaluating freshwater mussels' response to elutriate samples that contain the dissolved (bioavailable) ash contaminants is important.

A 10-day acute exposure (as opposed to 5 days) will add additional conservatism to the evaluation. Test methods will generally follow test conditions and test acceptability criteria for the paper pondshell freshwater mussel (or appropriate other similar species to be selected based on availability) from the Inland Testing Manual (EPA 1998) as indicated in the 10-day whole sediment freshwater juvenile mussel test design above—except, clean sediment instead of ash will be utilized as a substrate while exposing mussels to elutriates. Those test conditions with appropriate modifications are to be as follows:

1. Test type	Static renewal, definitive
2. Exposure duration	10 days
3. Dilution series	0.5 (test @ 100, 50, 25, 12.5, and 6.25 percent elutriates) for non-centrifuged elutriates, no dilutions for centrifuged elutriates
4. Species tested	Representative mussel species TBD based on availability
5. Procedure for obtaining juveniles	Fish host
6 Age / culturing of test organisms	<8 days / fed daily in clean sediment (see below)
7. Temperature	24 ±1 °C
8. Photo period	24 h dark

9. Test chamber	Mussels contained in 5 cm-diam. glass cylinders closed on the lower end with 100 μm Nitex© mesh screen and positioned in 250 ml crystallizing dishes (or similar) to be in contact with test sediments (ash, control, reference) and overlying water. (Note: Extend top of each cylinder above the water to ensure juvenile mussels remain contained.)
10. Sediment volume (test, reference, and control)	20 ml, sufficient to completely cover (~0.5 cm) bottom of the crystallizing dish.
11. Elutriate water volume	200 ml
12. No. organisms/chamber	10
13. No. replicate chambers	5
14. Renewal	Both sediments and overlying water initially and on day 6; for overlying water only, more frequently as necessary for eliminating experimental artifacts (e.g., ammonia)
15. Feeding	6 ml algal concentrate, fed on days 0, 3, 6 and 9
16. Aeration	None
17. Overlying water:	Unaffected Emory River water
17. Water quality (Initial/Renewal/Final)	DO, pH, hardness, alkalinity, conductivity, ammonia, temperature
18. Endpoints	Survival (foot movement/ciliary action)
19. Control survival	≥ 90%
20. Survival determinations/ information	Daily live-dead counts / including recorded observations of behavior (number with active pedal locomotion, number immobile with "gaped" shells and/or foot/cilia action only, etc.) Contained mussels are examined by retrieving mesh-enclosed cylinders, rinsing away sediment particulates, placing the bottom of rinsed cylinders in a small amount of control water (i.e., in an open Petri dish), counting/observing live/dead mussels, and returning them to the test chambers and sediment.
21. Test acceptability criterion	≥ 90% survival in controls
22. Follow-up observations (survival)	10 days post exposure in clean silt and fed (see above)
23. Sampling and sample holding requirements	<8 wk (ash); <14 days (elutriate)

C. Plume Toxicity Evaluation

This Section of the dredge monitoring plan describes procedures for testing freshwater organisms in the laboratory to evaluate the potential chronic toxicity resulting from exposures to chemical contaminants that may have been released in plumes to the Emory River water column through dredge activities. All plume toxicity tests will be performed by the University of Maryland – Wye Research and Education Center aquatic toxicity laboratory in Queenstown, Maryland. These tests will be conducted on a monthly basis unless it is determined that results are consistently indicating no risks to aquatic biota, which would call for a decrease in frequency of this monitoring.

1. Plume Water Samples

Aliquots from plume samples described in Section II will be used in all plume water toxicity tests within 36 hours of sample collection. These are the same samples that will undergo chemical analyses as described in Section II. Unaffected Emory River water from upstream of dredge operations will be used as positive control/dilution water in these tests within 36 h of sample collection.

2. Test Methods

a. Daphnid, *Ceriodaphnia dubia* Survival and Reproduction Test (EPA Method 1002.0). ***Note***: This test may not be appropriate if the turbidity of the plume water is too high for observing the test organisms. If this is the case, a 10-day survival and growth test (water-only) with *H. azteca* will be conducted instead.

Plume water will be used in exposure durations sufficient to produce 3 broods in river water controls initiated with <24-hour old *C. dubia* to evaluate potential chronic toxicity to water column organisms in the Emory River area influenced by re-suspended ash during dredge operations. The tests will be conducted in accordance to EPA-821-R-02-013 (EPA 2002b). Initially, these tests will be screening level only (100% plume water plus a river water control and MHSW negative control). If results from continual testing indicate that the plume is toxic, a definitive test design (with dilutions) will be implemented. The following table contains a summary of test conditions and test acceptability criteria for this method:

1. Test type:	Static renewal aqueous toxicity test
2. Temperature:	25 ± 1º C
3. Light Quality:	Wide-spectrum fluorescent lighting
4. Light Intensity:	50-100 ft-c
5. Photoperiod:	16 h light, 8 h dark
6. Test chamber size:	30 mL (recommended minimum)
7. Exposure volume:	15 mL (recommended minimum)
9. Renewal of plume water:	Daily (required)
11. Age of test organisms:	< 24 h; and all released within a 8-h period (required)

12. No. organisms per test chamber:	1 Assigned using blocking by known parentage
13. No. of replicate chambers:	10 (required minimum)
14. No. neonates per test conc.	10 (required minimum)
15. Feeding regime:	Feed 0.1 mL each of YCT and algal suspension per test chamber daily (recommended)
16. Aeration:	None
17. Dilution water:	Unaffected Emory River water (if dilutions are required)
18. Test chamber cleaning:	None
19. Water quality:	Hardness and alkalinity for each sample used in test; Temperature, DO, pH, conductivity, and ammonia daily
20. Test Concentrations:	Initial monitoring: 100, 0% (river control), MHSW (negative control) If toxicity persists: 100, 50, 25, 12.5, 6.25, 0% (river control), MHSW (negative control)
21. Test duration:	Until 60% or more of surviving control females have three broods (maximum test duration 8 days) (required)
22. Endpoints:	Survival and reproduction
23. Test acceptability criteria:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods (required)
24. Post-exposure water metals:	No analysis

b. Fathead Minnow, *Pimephales promelas*, Larval Survival and Growth Test (EPA Method 1000.0)

Plume water will be used in 7-day exposure durations with <24-hour old *P. promelas* to evaluate potential chronic toxicity to water column organisms in the Emory River area influenced by re-suspended ash during dredge operations. The tests will be conducted in accordance to EPA-821-R-02-013 (EPA 2002b). Initially, these tests will be screening level only (100% plume water plus a river water control and MHSW negative control). If results from continual testing indicate that the plume is toxic, a definitive test design (with dilutions) will be implemented. The following table contains a summary of test conditions and test acceptability criteria for this method:

1. Test type:	Static renewal aqueous toxicity test
2. Temperature:	25 ± 1º C
3. Light Quality:	Wide-spectrum fluorescent lighting
4. Light Intensity:	50-100 ft-c
5. Photoperiod:	16 h light, 8 h dark
6. Test chamber size:	500 mL (recommended minimum)
7. Exposure volume:	250 mL (recommended minimum)
9. Renewal of plume water:	Daily (required)
11. Age of test organisms:	Newly hatched larvae less than 24 h old. If shipped, not more than 48 h old, 24 h range in age (required)
12. No. organisms per test chamber:	10 (recommended)
13. No. of replicate chambers:	4 (required minimum)
14. No. neonates per test conc.	10 (required minimum)
15. Source of food:	Newly hatched *Artemia* nauplii (less than 24 h old) (required)
16. Feeding regime:	On days 0-6, feed 0.1 g newly hatched (less than 24-h old) brine shrimp nauplii three times daily at 4-h intervals or, as a minimum, 0.15 g twice daily at 6-h intervals (at the beginning of the work day prior to renewal, and at the end of the work day following renewal). Sufficient nauplii are added to provide an excess.
16. Aeration:	None, unless DO concentration falls below 4.0 mg/L. Rate should not exceed 100 bubbles/minimum (recommended)
17. Dilution water:	Unaffected Emory River water (if dilutions are required)
18. Test chamber cleaning:	None
19. Water quality:	Hardness and alkalinity for each sample used in test; Temperature, DO, pH, conductivity, and ammonia daily
20. Test Concentrations:	Initial monitoring: 100, 0% (river control), MHSW (negative control) If toxicity persists: 100, 50, 25, 12.5, 6.25, 0% (river control), MHSW (negative control)
21. Test duration:	7 d

22. Endpoints:	Survival and growth
23. Test acceptability criteria:	80% or greater survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.25 mg (required)
24. Post-exposure water metals:	No analysis

c. Mussels

Plume impacts on water-column species will not include toxicity assessment of bottom dwellers such as freshwater mussels. Impacts of any "settled" plume constituents will be adequately assessed using conclusions from the whole sediment mussel tests (above), the elutriate analysis in the previous Section, and results from long-term monitoring and toxicological analysis following completion of Phase 1 dredging.

D. Polymer Toxicity Evaluation

The use of polymers to aid in the separation of water from solids from dredge material is being considered by TVA. In this effort, TVA is designing tests on a product-by-product basis to decide on their efficacy and toxicity to water column species (*C. dubia* and *P. promelas*). TVA is using various test protocols (acute and chronic) to evaluate potential toxicity that may be caused by the use of these products, and toxicity risk decisions that are being made rely finally upon the results of chronic test methods identified above for plume toxicity.

Once final decisions are made with regard to polymers that might be used, and their use is implemented, the ash pond effluent will be monitored periodically using *C. dubia* and *P. promelas* chronic methods above to ensure that discharges from the ash pond will not pose unacceptable risks to receiving stream organisms.

E. Long-term Exposure Analyses

TVA acknowledges the requests by USFWS and TWRA to consider long-term exposures and effects that might occur as the result of dredge operations. Specifically, we are investigating possible methods and species that could answer questions regarding sublethal effects to species other than *P. promelas* and mussels, and we have already engaged in conversations with UMD – WREC in this regard. One specific request is that TVA conduct a 90-day freshwater juvenile mussel test. This test is not being proposed as part of the Phase 1 dredge plan; however, it will be considered as part of a long-term assessment of ash impacts to river sediment-dwelling organisms. The likely test design will evaluate long-term survival and growth of juvenile mussels in 100 percent ash and serial dilutions of ash mixed with clean river sediment. Because of the limited experience in conducting juvenile mussel toxicity tests of this duration and lack of standardized methods, this should be considered in an important but experimental evaluation for understanding long-term implications of this ash spill.

V. Dust Monitoring & Control Overview

TVA has permanent air monitoring stations strategically located in the community near KIF to continuously monitor air quality off-site (Attachment 4; Ambient Air Monitoring Plan). In addition approximately 10% of site workers are routinely selected to wear personal air monitors to ensure worker safety. However, those methods do not provide the real-time monitoring necessary to immediately implement controls when dusting occurs. For on-site monitoring of dust development, site workers are instructed to continuously observe the ash recovery and processing area for visible dust as a normal course of their daily duties. In addition, designated individuals have specific responsibilities to monitor for fugitive dust.

Any time dusting conditions associated with the Phase 1 dredging and ash recovery develop, TVA will implement appropriate control measures operations such as truck watering, application of chemical dust suppressants, or modifications to work activities. Water trucks with spray bars will be used to control dust on unpaved roads. Fugitive dust from active ash storage areas will be controlled through the use of both water trucks with spray bars and water cannons. If an area of the stockpile is expected to be inactive for a week or more, or water spray appears to be ineffective, TVA will apply a crusting agent (binder) to the surface of the stockpile.

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ATTACHMENT 1

KINGSTON FOSSIL PLANT FLY ASH POND INCIDENT ENVIRONMENTAL SAMPLING PLAN

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KINGSTON FOSSIL PLANT FLY ASH POND INCIDENT ENVIRONMENTAL SAMPLING PLAN

TVA-KIF-ESP

Prepared by

Office of Environment and Research
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February 2009

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1.0 PURPOSE

This Environmental Sampling Plan (ESP) documents the initial sampling efforts and provides guidance and standard sampling and quality assurance (QA) procedures to guide the interim environmental sampling of air, water, and solid materials collected in areas affected by the Kingston Fossil Plant (KIF) fly ash pond release incident. This sampling plan is designed to capture environmental data necessary to comply with pertinent federal and state regulations; to document the extent, degree, and nature of environmental impacts resulting from this incident; and to guide recovery and remediation efforts at the affected areas.

2.0 SCOPE

This ESP applies to solids, water, and air sampling activities undertaken at the KIF site and areas affected, or believed to be affected, by the fly ash pond release. It is designed for the short-term period following the incident. Subsequent Quality Documents including a Field Sampling Plan (FSP), specific standard operating procedures (TVA-KIF-SOPs), and a site-wide quality assurance project plan (QAPP) will be issued to guide recovery and long-term monitoring of the affected sites.

3.0 BACKGROUND

On Monday, December 22, 2008, a dike failed at the Tennessee Valley Authority's (TVA's) KIF plant releasing approximately 5.4 million cubic yards of coal ash that now covers about 300 acres. No injuries occurred, but three homes were severely damaged and were rendered uninhabitable. Portions of the rail line and Swan Pond Road were covered with ash, and utilities were interrupted including water, power and gas. TVA and Roane County Office of Emergency Management and Homeland Security (EMHS) responded immediately, and the response and recovery continues. TVA activated an Incident Command System response organization to manage the recovery project. Members include U.S. EPA Region 4, the Tennessee Department of Environment and Conservation (TDEC), the Roane County Office of EMHS, and TVA.

4.0 STANDARD PROCEDURES

Field sampling activities will be conducted in accordance with the site Health and Safety Plan (HASP). A pre-job safety plan will be developed and documented prior to field work. Field team members will be briefed and sign-off on the pre-job safety plan. A copy of this signed plan will be given to the Environmental Sampling Lead at the end of each day.

The following are general requirements to be followed during future sampling activities.

- Sampling conducted by water craft will include a crew of at least two persons, and relevant safety procedures will be enforced.

- Global positioning system (GPS) location data will be collected at sampling locations and will conform to spatial guidelines listed in the Quality Documents.
- Sampling will be guided by and conform to the Quality Documents including FSP, SOPs, and a site-wide QAPP. Frequent field audits will be performed and appropriately documented.
- Any raw water (intake) samples collected at municipal water treatment plants will have a corresponding finished water sample collected during the same event.
- Off-site ash or debris samples will have a corresponding native soil sample taken for comparison where possible.
- Samples should be evaluated to the lowest detection limit routinely available from the analytical laboratory. Lower detection limits may be mandated at various phases of dredging and recovery.
- During sampling, field data sheets will be utilized to record field observations.
- Copies of the field data sheets will be given to the Environmental Sampling Lead at the end of each sampling day. Environmental Sampling Lead will forward field data sheets to Incident Documentation.
- Standard sampling nomenclature as described in the Quality Documents will be used for environmental samples.

5.0 SOIL/ASH SAMPLING

During the second and third weeks of January 2009, TVA employees and contractors began collecting samples of ash from areas that were safely accessible and began analyzing those samples for metals concentrations and radioactivity. These initial radiochemical surveys were performed by TVA's Western Area Radiological Laboratories.

The analysis of metals in the solid samples continues to the present. Solid samples collected included five surface samples to a depth of approximately thirty inches (30") and a continuous vertical core sample to a depth of approximately fifty-two feet (52') below the containment area surface. Twenty-eight laboratory analyses were performed on the individual surface samples and on the material in the core sample at approximately two-foot (2') intervals.

Future soil/ash sampling will be conducted on an as-needed basis. Surface samples will be collected as composite samples typically consisting of aliquots from several locations. Surface samples will be analyzed for total metals (Method 6010B and 7471) and may include Toxicity Characteristic Leaching Procedure (TCLP) extraction (Method 1311), and TCLP metals analysis. Off-site ash or debris samples will be accompanied by a corresponding native soil (*e.g.,* soil that has been determined to have been unaffected by the ash release) sample where possible.

The field sampling team will conduct the soil sampling program in accordance with the FSP, SOPs, and the site-wide QAPP. At a minimum, these documents will assist the field team in managing the field tasks including sample collection, equipment decontamination, sample handling/labeling/shipping, and field documentation. Quality control (QC) samples will be collected throughout the soil sampling program as specified in the site-wide QAPP.

5.1 Residential Soil Sampling of TVA-Residential Properties Affected by Fly Ash

The purpose of this sampling is to identify and characterize areas affected by this incident. Ultimately, these data will be used to assess potential short-term threats posed to the public and to guide remediation activities.

Prior to field collection activities, field teams must be granted access by the property owner. It is preferable to obtain a signed access agreement from the resident prior to entering the property to perform sampling. If a resident refuses to sign an access form, verbal access is acceptable, but should be formally documented by the field team.

Samples will be collected from approximately 15 impacted properties. Sampling design will conform to the U.S. EPA SW-846 manual. Sampling plans will be designed so that sampling density will be representative and based on statistical techniques and will include at least four samples per parcel in accordance with the EPA SW-846 manual.

Due to a variety of site-specific variables which may be encountered during sampling, the field sampling team may alter the sampling design on a case-by-case basis. The reasons for variations from the sampling plan will be fully documented.

To assure proper randomness is applied to the sampling efforts, a grid of the appropriate density will be overlain on the parcel map and a random-number table will be used to select the appropriate number of sample sites. It is believed the deposited ash is randomly heterogeneous with regard to its chemical characteristics and that random chemical heterogeneity will remain constant from batch to batch. Therefore, it is reasonable to assume that sample representativeness will be achieved by simple random sampling. Analytical techniques will conform to the SW-846 analytical methods with quality enhancements stipulated in the site-wide QAPP and FSP. These referenced documents ensure chemical measurements are of known data quality and usable for ascertaining reliable estimates of the targeted chemical characteristics of the ash.

In order to include proper representation of background samples, TVA sampling teams will also collect two surface samples (one from the upper level and one from the lower level) from Dike C to provide a comparative analysis to the surface soil samples collected from the residential properties potentially affected by the fly ash. Each of these surface samples will be composed of ten aliquots, whenever possible.

5.2 Residential Soil Sampling of Adjacent Properties

The adjacent properties will be visually inspected to determine if material has deposited on the property. Residents have been instructed to call the Public Information Line (865-717-4006) if ash deposition is observed on their property. If material is visually observed on an adjacent property, samples will be collected using the procedures described above. If ash material is not visually apparent, samples will not be collected.

5.3 Background Soil Study

A background soil study will also be conducted to provide initial information regarding the native soil conditions in the vicinity of the site. The data will help determine a baseline for possible further studies and/or actions on the affected properties. The purpose of the plan is to identify areas that require additional investigation to fully understand the need for remediation.

6.0 RIVER SEDIMENT SAMPLING

During early February 2009, sediments in the immediate area of the discharge into the Emory River and background sediments upstream of the ash slide were sampled in order to compare the typical analytical characteristics of the ash as sediment to those of the sediments upstream of the spill site. The comparison was also intended to provide insight as to the potential harm from disturbing historical, non-TVA chlordane and polychlorinated biphenyl (PCB) contamination in the sediments from past spills into this section of the Emory River. Sediment samples were analyzed for total metals (including mercury), TCLP metals, chlordane, PCBs, and moisture.

Samples were collected using an Eckman or Ponar dredge. Nineteen samples were collected from a 32-cell grid near Emory River mile (ERM) 2.1 in the immediate area of the ash slide. Flow in the upstream portion of the Emory River has limited sediment accumulation. Additionally, the river bottom is very rocky in many areas, thereby limiting the ability to collect sediment samples. Eight background sediment samples were collected at roughly one-tenth mile intervals beginning at ERM 6.3 and working upstream.

The sampling device was decontaminated prior to use and after each sample using a mixture of deionized (DI) water and LiquiNox® followed by a triple rinse with DI water. Pre-cleaned, stainless steel bowls and plastic spoons were used to homogenize the samples. Split samples were collected for analytical laboratory comparisons at the rate of 1:4 samples. Chain-of-Custody forms were used to document field sampling activities and sample control. Samples were placed in a cooler with ice following collection.

Field logbooks were used to document the following information:

- Unique sample ID,
- Bottleware and analysis information,
- GPS coordinates,

- Depths of sample,
- Date/Time of sample collection,
- Samplers names,
- Visual observations for samples, and
- Deviations from standard TVA protocols and practices.

Similar sampling was conducted by Bechtel Jacobs for DOE in anticipation of TVA's need to dredge in the area. Analytical results will be shared with all stakeholders including the Watts Bar Interagency Working Group.

Future TVA (or TVA contractor) sediment sampling will be conducted in the same manner described above and will conform with the FSP, SOPs, and the site-wide QAPP.

7.0 SURFACE WATER SAMPLING

Water monitoring in response to the ash spill at KIF began with water quality sampling on the afternoon of December 22, 2008. TVA performed field measurements of water temperature, dissolved oxygen, conductivity, and pH to determine that the Emory and Clinch Rivers were fully mixed. TVA collected water quality samples at roughly mid-depth (15 feet) at one-mile intervals from Clinch River mile (CRM) 0.0 to 4.0 and at ERMs 0.1, 1.0, 1.75, 2.1 and 4.0, as well as from the Tennessee River at approximately Tennessee River mile (TRM) 568, in the immediate vicinity of the Kingston Water Treatment (KWT) Plant intake. Additionally, TVA collected a sample from the intake structure for the Supplemental Condenser Cooling Water at Watts Bar Nuclear (WBN) plant approximately 40 miles downstream on the Tennessee River.

Surface water sampling locations have been established to assess the impacts of the fly ash release on the local river system. Surface water sampling is ongoing (TVA conducts sampling three days per week) on the Tennessee, Clinch, and Emory Rivers. These locations encompass approximately 14 miles of the local river system and establish upstream, point-of-release, and downstream surface water locations.

TVA is sampling surface water for the analysis of total and dissolved metals by EPA Method 200.7 and 245.1, total suspended solids (TSS) by Method SM2540D, total hardness by EPA Method 200.7 (as Ca), and total alkalinity by EPA Method 310.2. There are five sampling locations on the Emory River, four locations on the Clinch River, and two locations on the Tennessee River. Samples are collected three times per week (Monday, Wednesday, and Friday). In addition, the above locations will be sampled after 24-hour total rain events of one-half inch (0.5") or greater on non-routine sampling days for the same analyses described above.

One-time samples were collected from two ponds in the Swan Pond Road area. TDEC has sampled at ERMs 0.1, 1.7, 2.1, 4.0, and 12.1; and at the Clinch River at mile 2.3 (Highway 70 Bridge over the Clinch River) and mile 4.5. These samples were analyzed for metals by EPA

Method 200.7/200.8 and 245.1, TSS by Method SM2540D, total hardness by SM3500D (as Ca), total alkalinity by EPA Method 310.2, and settle-able residue by SM 2540F .

Field parameters are being measured using a multi-analyte programmable data logger (Hydrolab®) at each sample location. Parameters of interest that will be documented include temperature, dissolved oxygen, pH, and conductivity. Details on field instrument calibration for these field parameters are documented in field log books. In addition, field measurements for turbidity are measured at Watts Bar dam as a preliminary indication of total suspended solids concentration utilizing a Hach 2100P Turbidimeter.

Each sample is collected using a peristaltic pump or a Kemmerer® sampler. Samples are collected from the water column 15 feet below surface or mid-point (if it is greater than 15 feet). Appropriate sample bottles, Chain-of-Custody records, and cooler(s) with ice shall be on-hand for use during sampling.

The field sampling team will be observant and document observed aquatic life kills or uncontained cenospheres. Specific personnel (and the associated contact phone numbers) to notify in the event of aquatic life spills or uncontained cenospheres will be named in the Quality Documents.

Water sampling and analysis is being conducted in accordance with EPA Region 4 and TDEC guidance for standard National Pollutant Discharge Elimination System (NPDES) sampling and analysis. This guidance includes EPA Region 4 Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, 40 Code of Federal Regulations (CFR) 136.3 requirements for analyte holding time, preservatives, and analytical methods; TDEC Rules Chapter 1200-4-3 for required detection levels and laboratory certifications; and EPA analytical methods such as Method 200.7 for total and dissolved metals and other EPA/TDEC-approved methods. The field sampling team will conduct the surface water sampling program under the guidance of the FSP, SOPs, and the site-wide QAPP. QA/QC samples will be collected throughout the surface water sampling program as specified in the site-wide QAPP.

8.0 FISH TISSUE SAMPLES

TVA is corroborating with TDEC, Tennessee Wildlife Resources Agency (TWRA), and Oak Ridge National Laboratory (ORNL) to examine contaminants in fish tissue. TWRA began collecting fish for tissue analysis during the week of January 5, 2009, and will compare the data to existing historical data. Tissue samples are split for analysis by State of Tennessee Environmental Laboratory, ORNL, and TVA Central Laboratories for quality assurance. The samples are analyzed for metals, pesticides, and PCBs which are part of routine sampling related to existing human-health consumption advisory. TDEC will post advisories if fish tissue contaminate levels exceed protection criteria.

Additionally, as part of the Vital Signs Monitoring Program, TVA has systematically monitored contaminants in fish tissue at four locations (TRM 532, TRM 560.8, TRM 601, and CRM 22.0) on Watts Bar Reservoir since the early 1990s. TVA will sample fish tissue from these locations again in autumn 2009 and 2010.

In conjunction with the bioaccumulation investigations, ORNL is conducting fish health studies which include measurements that represent short-term responses such as physiological bioindicators and intermediate- and long-term responses such as histopathological and morphological indicators to assess sub-lethal effects as a result of ash exposure.

9.0 DRINKING WATER SUPPLY FROM RIVER

TVA began sampling "raw" water from the KWT Plant intake on December 23, 2008; samples were not collected on December 24, 25, or 27, 2008. On December 26, 2008, a raw water sample was collected. Between December 28 and 31, 2009, samples were collected of both raw and finished water. The samples collected by TVA were analyzed for total and dissolved metals (EPA Method 200.7 and 245.1) and total suspended solids (Method SM2540D).

Subsequently, TDEC took the lead on sampling and reporting water supply information in accordance with TDEC's legislative mandate to ensure the safety of the drinking water supplies for the citizens of Tennessee, and TVA halted sampling at these locations. TDEC began sampling the KWT Plant on December 23, 2008 and added the Rockwood Water Treatment Plant on December 31, 2008.

It is anticipated that TDEC will continue to conduct drinking water supply sampling for the foreseeable future. Currently, TVA does not anticipate conducting future water supply sampling. If, however, such sampling is determined to be necessary, sampling activities will be conducted in accordance with the FSP, SOPs, and the site-wide QAPP.

10.0 RESIDENTIAL POTABLE WATER SOURCE SAMPLING

TVA's long-term groundwater monitoring plans are currently being developed and will be presented in the FSP, SOPs, and the QAPP.

TDEC has been sampling, upon request, wells, springs, and private water supplies within a four-mile radius of the incident site. Samples are collected at an exterior tap prior to water treatment devices. If necessary, special arrangements will be made for wells that do not have functional pumps or wells or springs that have been inundated with ash. Persons wishing to have their wells or springs sampled should make a request by calling TDEC's Knoxville Environmental Field Office at 865-594-6035 or 888-891-8332. No finished drinking water supplies sampled to date have exceeded the drinking water standards.

11.0 AIR MONITORING

Air monitoring began on Sunday, December 28, 2008, with contractor personnel from the Center for Toxicology and Environmental Health (CTEH) performing real-time mobile monitoring for air particulates less than 10 microns diameter (PM10).

In addition to the mobile monitoring using hand-held instruments, CTEH set up five stationary industrial hygiene type sampling pumps strategically located to capture simultaneous up-wind and down-wind data relative to KIF regardless of wind direction. The mobile air monitoring is designed to capture information on potential human exposure to airborne particulates. Contractor personnel travel to random locations in areas proximate to KIF and collect real time data on air quality. In addition to collecting continuous information on airborne particulate concentrations, the stationary samplers also collect 24-hour composite samples of airborne particulate matter. Filters are collected and sent for analysis by a contract laboratory to quantify filter loadings of selected contaminants.

TVA mobilized a mobile air monitoring laboratory which began air monitoring on the plant site on December 31, 2008, for PM10 and air particulates less than 2.5 microns diameter (PM2.5). Metrological data were also collected. The laboratory demobilized on February 4, 2009.

Results of air monitoring have documented generally low concentrations of airborne particulates. None of the daily averages of the more than 10,000 instantaneous measurements approached or exceeded the 24-hour daily National Ambient Air Quality Standard. To date, the several elevated real-time readings have been associated with either residential wood heating or open burning of brush on private lands and were not associated in any way with TVA activities. The standard concentration against which assessments are made is a daily average. While individual readings may have exceeded the standard, no daily averages have approached or exceeded the standard.

To date, analytical results for airborne substances that could potentially impact human health are either below detection limits or below levels of a health concern.

On February 12, 2008, CTEH began operation of federal reference method ambient air monitors at five locations in the nearby community and at one background location in Harriman, Tennessee. This monitoring network will replace the industrial hygiene sampling pump monitoring network described above and is planned to be operated for the foreseeable future.

Data obtained from handheld real-time sampling will be shared with EPA, TDEC, and appropriate public officials following proper QA data review. Sampling and monitoring will include the gathering of accurate geospatial location information using handheld GPS units set to gather data using World Geodetic System (WGS84) datum. GPS location information will be reported in decimal degrees.

ATTACHMENT 2

STANDARD OPERATING PROCEDURE FOR
SURFACE WATER SAMPLING
TVA-KIF-SOP-01

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DRAFT

STANDARD OPERATING PROCEDURE FOR:

SURFACE WATER SAMPLING

TVA-KIF-SOP-01

Prepared by
Environmental Standards, Inc.

for

Tennessee Valley Authority
Office of Environment and Research
Environmental Resources and Services

March 12, 2009

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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe methods that will ensure that representative samples of surface water are collected around Kingston Fossil Plant (KIF), that appropriate documentation is maintained, and that samples are properly preserved.

The procedure is applicable to sampling surface waters in rivers and streams in the areas surrounding KIF.

2.0 GENERAL CONSIDERATIONS

Potential hazards associated with the planned tasks shall be thoroughly evaluated prior to conducting field activities. The site-specific health and safety plan (HASP) provides a description of potential hazards and associated safety and control measures.

Sampling personnel who must enter the water shall remain downstream of the sampling location. The appropriate level of personal protection equipment (PPE) shall be worn at all times when entering the water as defined in the site-specific Health and Safety Plan (HASP). In general, personnel should not wade into flowing water when the product of depth (in feet) and velocity (in feet per second) equals 10 or greater ("rule of thumb" from U.S. Geological Survey [USGS]). If flow data are unavailable, personnel shall not exceed a water depth of knee height. Every attempt shall be made to utilize a sampling device such that personnel entry into the water body is avoided. For sample locations that are a considerable distance from the shoreline, a boat, barge, dock, or bridge may be employed for sampling. Water safety hazards and associated precautions shall be thoroughly considered and understood prior to conducting sampling activities in the vicinity of surface water.

Surface water samples will be collected at locations that are most likely to be impacted based on factors such as source, drainage patterns, and environmental features of concern or as specified in project work control documents. Surface water samples will be collected prior to the collection of sediment, benthic, or fish samples to avoid contamination of the sample by agitation of the bottom sediments. Consideration shall be given to using a container large enough to collect samples for both field and laboratory analysis. Surface water sampling guidance can be found in the Tennessee Department of Environment and Conservation (TCEC) document *Quality System Standard Operating Procedure (SOP) for Chemical and Bacteriological Sampling of Surface Water.*

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Field sampling equipment shall be decontaminated in accordance with the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08) prior to use.

Surface waters generally fall into either of two categories—flowing surface waters or still / stagnant waters. Surface water samples will generally be listed as grab or composite samples. Specific considerations associated with sampling each type of surface water encountered are discussed in the following sections.

The following devices are generally used for surface water sampling:

- Laboratory-cleaned sample bottle,
- Kemmerer depth sampler,
- Water bottle sampler,
- Handheld or portable Global Positioning System (GPS), and
- Automated composite sampler.

3.0 PROCEDURES

The following sections describe the procedures for sampling surface waters. In the event these procedures cannot be performed as written in this SOP, field personnel must contact the immediate supervisor to get approval for the deviation to the procedure prior to conducting sampling activities. If the immediate supervisor cannot rectify the circumstances leading to the deviation, then the immediate supervisor shall contact the Quality Assurance/Quality Control (QA/QC) Lead to-determine if the deviation is acceptable from the standpoint of effecting data reliability. If the deviation is not acceptable to the QA/QC lead, then the field team must cease sampling activities until the issue associated with the deviation is resolved. Documentation of approved deviations will be recorded in the field logbook.

3.1 Pre-Job Preparation

The Field Team Leader will ensure that the following activities have been completed prior to leaving for the water sampling site.

a. Obtain equipment necessary for completing the sampling activities such as Kemmerer depth sampler, peristaltic sampler, automated sampler, or equivalent equipment.

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b. Obtain appropriate sample bottles both for the required sample analyses and the required quality control (QC) sample analyses. In addition, confirm that the analytical laboratory has been contacted and is prepared to receive the samples.

c. If sampling is conducted on personal property, provide the TVA Project Manager with the schedule for sampling and verify that site/sampling area access and legal right-of-entry have been obtained, where required.

d. Review the Field Sampling Plan (FSP), site-specific Quality Assurance Project Plan (QAPP), HASP, and appropriate SOPs with the TVA Project Manager to determine specific sampling requirements. In general, the equipment listed on the Equipment Checklist provided in Table 1 will be adequate for small bodies of water; however, a boat or other specialized sampling equipment may be necessary to obtain samples from large water bodies.

e. Obtain appropriate site maps. If the site maps do not have surface water sampling locations already indicated, review sampling locations with the TVA Project Manager and mark maps appropriately. Identify location and staking requirements.

3.2 Field Preparation

Upon arrival at the site, the Field Team Leader will identify the field team to the property owner, if present.

a. Set up the decontamination area away from potentially contaminated areas (if possible). Decontaminate reusable sampling equipment that will contact the sample matrix prior to use in accordance with *Decontamination of Equipment* SOP (TVA-KIF-SOP-08).

b. If necessary, obtain both potable and deionized (DI) water for decontamination and ensure that sufficient quantities are available to accommodate the work. Record the water source in the field logbook. Obtain approval from the TVA Project Manager for using on-site water for decontamination prior to use.

3.3 Sampling Flowing Surface Waters (Rivers, Streams, or Drainage Ditches)

Project-specific requirements may necessitate a specific sampling location; in general, however, the preferable sampling location of flowing water bodies is where the water is well mixed laterally and vertically. These locations are characterized by fast moving or turbulent waters. Sites immediately below riffle areas are generally representative of the entire flow.

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In the case of calmer waters, the preferred sampling location is the area of highest flow rate.

a. Begin by selecting the farthest downstream sampling location. In general, collect downstream samples first, followed by upstream samples to minimize the disturbance of bottom sediments and potential downstream sample locations.

b. Collect a single sample at mid-depth and the mid-point of the main current, conditions permitting, for most streams where there is good lateral and vertical mixing.

3.3.1 Grab (or Discrete) Sample Collection

When the collection of a discrete sample at a certain depth is required, a Kemmerer sampler or Peristaltic pump should be used. A Kemmerer sampler is comprised of an open tube that is allowed to float between its top and bottom caps. At a desired sample depth, a weighted messenger is sent down the associated towline compressing the top cap into the tube and into the bottom cap, thereby closing the sample tube on both ends. A Peristaltic pump is comprised of a flexible tube fitted inside a circular pump casing (though linear peristaltic pumps have been made). A rotor with a number of "rollers" attached to the external circumference compresses the flexible tube. As the rotor turns, the part of tube under compression closes, thereby forcing the fluid to be pumped to move through the tube.

3.3.1.1 Kemmerer Sampler

a. Lower the Kemmerer sampler to the appropriate depth.

b. Once at the desired depth, use the weighted messenger or similar trigger to close the sampling device.

c. Filter the samples collected for dissolved metals analysis using a 0.45-µ filter.

d. Fill the appropriate certified-clean bottleware.

3.3.1.2 Peristaltic Pump Sampling

a. For inorganic sampling, use new certified-clean disposable Silastic®, Teflon®, Tygon®, or equivalent tubing.

b. Use dedicated tubing and inert weights at each sampling location**.** Change dedicated tubing monthly (<32 days) or when visual indications of stains are observed or there are indications of contamination from equipment blanks.

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c. Lower the weighted Peristaltic pump tubing to the appropriate depth.

d. Once at the desired depth, turn on pump and begin purging for approximately one to two minutes before sampling.

e. Filter the samples collected for dissolved metals analysis using a 0.45-µ filter.

f. Fill the appropriate certified-clean bottleware.

3.3.1.3 Water Bottle Sampler

A water bottle sampler may be used to collect surface water samples at a limited depth or at the surface.

When the laboratory-supplied sample bottle is unpreserved, proceed as follows.

a. Lower the capped unpreserved sample container to the desired depth oriented so that the capped end of the bottle faces downstream to minimize potential entrainment or debris into the sample.

b. Remove the cap allowing the sample container to fill.

c. Replace the cap and remove the container from the water.

When using sample bottles containing preservatives, first fill a separate, clean, unpreserved bottle as defined in steps a through c above, then follow step below.

d. Immediately decant from the clean, unpreserved bottle into the sample bottle containing preservative.

Any of the following field conditions may necessitate the collection of a surface grab sample: when stream velocity is such that penetration to depth is not easily obtained, when surface sheen/film is identified, when low water exists, or when a sample from the upper surface of the water body is required.

Note: If a surface film is suspected (or visible), the surface of the water will be sampled by gently lowering the sample bottle horizontally into the water with the mouth of the bottle directed upstream, taking reasonable measures to avoid suspended/floating debris.

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3.3.2 Composite (or Time-Weighted) Sample Collection

When the collection of a sample will be used to characterize general water-quality bracketing a period of time, an automated composite sampler can be used.

a. Determine total sample time, total sample volume, and time between aliquots (sub-samples) when programming automated composite samplers are used to obtain a representative time-weighted sample.

b. Once all sample aliquots have been collected, combine the water from the individual sub-sample containers into a clean composite container.

c. Decant water from the composite sample container into the laboratory sample container. If a significant amount of time exists between the first and last sub-sample, swirl the composite container lightly prior to sample collection to aid in mixing of stratification that may have occurred.

d. To create composite samples, combine sub-samples collected at varying locations.

e. Filter the samples collected for dissolved metals analysis using a 0.45-µ filter.

f. Fill the appropriate certified-clean bottleware.

3.4 Sampling Still or Stagnant Waters (Ponds)

Project-specific requirements may necessitate a specific sampling location; in general, however, when sampling still or stagnant waters, it is important to collect a "vertical" sample of the water because still waters have a greater tendency to stratify than rivers or streams. A sample will be collected near the bottom of the body of water (without disturbing the sediment).

If the pond is so large that the sample location cannot be reached from the bank, it may be necessary to use a small boat to reach the sampling area. Gentle rowing in a small boat will cause less sediment disturbance than wading through the pond.

3.4.1 Grab (or Discrete) Sample Collection

Grab samples can be collected using a Kemmerer sampler (or similar device) or clean sample bottle. Refer to Section 3.3.1 of this SOP for details on the use of the selected sample device.

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3.4.2 Composite (or Time-Weighted) Sample Collection

Procedures for collecting samples from still/stagnant waters are similar to the procedures for samples collected from flowing surface waters. Composite sample collection methods are described in Section 3.3.2 of this SOP.

3.5 Sample Collection from a Vessel

It will be necessary, in some cases, to use a vessel (boat or barge) to collect surface water samples. Sampling devices used to collect surface water samples from a vessel should be selected by considering the depth of the sample and the flow of water above the sample depth. Usually, manual grab equipment cannot be used for off-shore sampling.

a. Make sure that the sampling vessel is registered for use in the state in which it will enter a body of water.

b. Predetermine sampling locations and reference in project-specific documentation. Record the sampling locations and mark with either a buoy or GPS device.

c. If buoys are used, navigate the sampling vessel to the buoy and tie the vessel to the buoy. (The buoys will be set in a manner that will hold the boat within approximately 10 feet of the sampling location.)

d. When buoys are not used, navigate the sampling vessel to the coordinates stored in the GPS unit. Use an anchor (or spuds if available) in a manner that will hold the sampling vessel within approximately 10 feet of the target coordinates.

e. If anchors or spuds are used, allow five minutes to elapse before commencing sampling to allow any suspended solids to settle downstream.

Note: Field conditions may be such that anchoring or using spuds is not effective (such as rock bottom or high-flow velocity). At these locations, the vessel's engine should be used to maintain position over the sampling location.

3.6 Collection of Field Measured Water-Quality Parameters

Field-measured water-quality parameters (such as temperature, dissolved oxygen, pH, conductivity, or turbidity) may need to be measured. These parameters should be measured in the field, as a grab sample, using a multi-analyte programmable data logger (Hydrolab® or equivalent). There are a variety of water-quality data loggers available that measure the water-quality parameters identified above. It is preferred, but not required, to utilize one water-quality data logger capable of measuring each of the water-quality parameters identified in the work plan (except for turbidity). Turbidity should be measured using a Hach 2100P Turbidimeter or equivalent device. The field personnel should be

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familiar with the data logger and should reference the user's manual of the data logger for familiarity.

a. Calibrate the instruments used to measure water-quality parameters in accordance with the instruments' manufacturer recommendations by following the calibration procedures specified in the instruction manual.

b. Document calibration procedures including calibration solutions used, expiration date(s), lot numbers, and calibration results in the project field logbook.

c. Collect field-measured water quality parameters from the same location and depth as the sample location for laboratory analysis.

d. Collect field measurements *in-situ* by deploying the data logger to the desired sample location (except for turbidity).

e. For turbidity, collect a grab sample using a sampling device described in Section 3.3.1 and transferring that sample to the turbidity vial of the turbidity meter.

f. Allow a one- to two-minute equilibration period following the data logger deployment.

g. Record the measurements in the field logbook.

3.7 Sampling Site Field Location

Each sample collection location must be demarcated in the field using stakes, flagging tape, or GPS for general location and future sampling purposes. The sample collection device shall be placed on the upstream left bank for consistency purposes. If it is deemed not appropriate to field locate the sampling location(s) by GPS, a concise descriptive location and sketch map of the sampling location(s) must be included in the field logbook or site map, as appropriate.

3.8 Field Logbook Documentation

Field logbooks to record daily activities, including sample collection and tracking information, will be maintained by the Field Team Leader. Information will be entered into the field logbook by the appropriate field team member using waterproof ink. In addition to the minimum requirements discussed in the *Field Documentation* SOP (TVA-KIF-SOP-06), the field logbooks should document those sampling characteristics specific to this SOP and as defined in the applicable project work control documents.

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The Field Team Leader will review the field logbook entries on a daily basis for completeness and accuracy and indicate this review by initialing the entries. As specified in the FSP, the Field Team Leader is also responsible for the completion of all required data collection forms.

3.9 Collection of Field Quality Control Samples

Field Quality Control (QC) samples include DI blanks, duplicate samples, and split samples. The purpose of the DI blank is to evaluate the quality of the DI water used during decontamination of the sample collection bottleware and the cleanliness of the laboratory-provided bottleware. The required frequency and protocols for field QC samples are presented in the project QAPP.

3.10 Sample Handling, Packing, and Shipping

Samples will be marked, labeled, packaged, and shipped in accordance with the *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07).

3.11 Decontamination and Waste Management

All sampling equipment will be decontaminated in a manner consistent with the *Decontamination of Equipment* SOP (TVA-KIF-SOP-08). Decontamination procedures shall be documented in the field logbook. Investigation-derived wastes produced during sampling or decontamination will be managed in accordance with *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-17).

4.0 REFERENCES

- Tennessee Department of Environment and Conservation (TDEC), *Quality System Standard Operating Procedure (SOP) for Chemical and Bacteriological Sampling of Surface Water*; Division of Water Pollution Control. 2008
- Tennessee Valley Authority (TVA). *Decontamination of Equipment* SOP (TVA-KIF-SOP-08), February 2009.
- TVA. *Field Documentation* SOP (TVA-KIF-SOP-06), March 2009.
- TVA. *Field Sampling Plan* (FSP), TVA, 2009.
- TVA. *Health and Safety Plan* (HASP), Kingston site-specific plan, 2009.
- TVA. *Management of Investigation-Derived Waste* SOP (TVA-KIF-SOP-17), March 2009.

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- TVA. *Quality Assurance Project Plan* (QAPP), TVA, 2009.
- TVA. *Sample Labeling, Packing, and Shipping* SOP (TVA-KIF-SOP-07), March 2009.
- U.S. Geological Survey. *National Field Manual for the Collection of Water-Quality Data: U.S. Geological Survey Techniques of Water-Resources Investigations*, Book 9, Chapters. A1-A9, variously dated, http://pubs.water.usgs.gov/twri9A.

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Table 1: Surface Water Sampling Equipment and Materials Checklist	
Item Description	**CHECK**
Health & Safety	
Nitrile gloves	
Hard hat	
Steel-toed boots	
Hearing protection	
Field first-aid kit	
Eyewash	
Safety glasses	
Barricades, cones, flashing lights, signs (if sampling from a bridge)	
U.S. Coast Guard-approved flotation device	
Sufficient length of rescue line	
Hip waders	
Life preserver (if sampling from boat/barge)	
Paperwork	
Health & Safety Plan	
Project work control documents	
Location map, field data from previous sampling events	
Field logbook	
Chain-of-custody forms and custody seals	
Equipment/Materials	
Surface water sampling devices: • Kemmerer Depth Sampler • Manual or Composite Sampler (and instruction manual) • Water bottle sampler	
Laboratory-supplied bottleware	
Laboratory-supplied bottleware with preservatives	
Decontamination and Waste Management Equipment	
Deionized water	
Buckets or tubs	

End of Procedure

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ATTACHMENT 3

KINGSTON FOSSIL PLANT
FLY ASH RECOVERY PROJECT – ASH POND MANAGEMENT PLAN

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TENNESSEE VALLEY AUTHORITY
Office of Environment & Research
Environmental Resources and Services

KINGSTON FOSSIL PLANT

FLY ASH RECOVERY PROJECT - ASH POND MANAGEMENT PLAN

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Kingston, Tennessee
March 2009

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INTRODUCTION

Purpose

This document provides various measures for managing the Kingston Fossil Plant ash pond during ash recovery dredging in the Emory River. This plan was developed to address concerns that the discharge from the ash pond could have negative impacts on the receiving stream during dredging.

Scope

This document describes the ash pond monitoring and best management practices that will be or could be employed to manage the ash pond discharge during dredging. TVA will implement various best management practices for the return water from the dredged ash processing area. This processing area will be the primary site for settling dredge material. Return water flow from the dredged material will be directed to the ash sluice channel that flows to the ash pond. This is similar to normal ash sluicing operations. It is expected that most of the dredged ash will settle out in the channels in the ash processing area, while some of the ash will be discharged to the ash pond and settle there. The current NPDES PERMIT No. TN0005452 designates the ash pond as an internal monitoring point (IMP 001). The plant's permitted discharge to Clinch River mile 2.9 is from the condenser cooling water discharge channel (DSN 002).

ASH POND MONITORING - IN-POND AND DISCHARGE

Ash Pond Sampling

TVA will conduct surface water sampling at the ash pond weekly during the dredging operation. Six metals (aluminum, arsenic, mercury, thallium, cadmium, and selenium) have been identified as metals of special interest based on mass balance calculations, TDEC Reasonable Potential evaluation, and aquatic health concerns. All metals will be analyzed using EPA Method 200.8, except for mercury which will be analyzed using EPA Method 245.7. The analytical results will be reported as part of the Ash Recovery Project water quality monitoring. TVA will consult with TDEC to determine the format and frequency of water quality data reporting.

Sampling will be performed following the procedures outlined in the Kingston Fossil Plant Fly Ash Pond Incident Environmental Sampling Plan (TVA-KIF-ESP) dated February 2009, and described in more detail in the Standard Operating Procedure for Surface Water Sampling (TVA-KIF-SOP) dated March 2009. In summary, each sample will be collected using a peristaltic pump, a Kemmer sampler, or equivalent equipment. Samples will be collected from the permitted monitoring location, IMP 001. Appropriate sample bottles and cooler(s) with ice shall be used for proper collection and storage of samples. Crews will collect the samples in one-one liter sample bottle preserved with nitric acid.

Visual Observations and TSS Monitoring

During dredging operations, TVA will increase the frequency of visual observations of the final stilling pond to daily, observing the pond for increased turbidity. This will be included with the Ash Release Program Administrator's (Environmental) or PA(E)'s inspection responsibilities. Objectionable turbidity will be communicated to dredging personnel to investigate and/or consider additional BMPs or modification(s) to the dredge operation. The Ash Release PA(E)'s routine inspections will also include observations about collected cenospheres in the main ash pond and stilling pond. Notification to TVA's By-Products Marketing Staff for increased collection will be made if excessive cenospheres are observed.

The dredge material from the Emory River will discharge to the ash processing area. The processing area then drains to the ash pond system which discharges through IMP 001 to the plant intake channel. The dredged material will be composed of a small percentage of solids and a large percentage of liquids (i.e., water containing suspended solids). The ash pond system is required to reduce the TSS concentration in the water discharged to the ash pond system from a currently unknown concentration to the NPDES permit discharge limit of 90 milligrams per liter (mg/L) maximum and 30 mg/L monthly average.

TSS sampling currently occurs on a monthly basis at the ash pond discharge (IMP 001). During the first two weeks of dredging, TVA will increase TSS monitoring at IMP 001 to daily and require a 24-hour laboratory turnaround. The daily TSS monitoring will be evaluated at the end of the two week period and reduced to weekly if the data supports the change. Weekly monitoring of the TSS will continue for the duration of the dredging operations that provide dredge return water to the ash pond, or until a reliable data trend may be observed that does not violate NPDES permit limitations. The TSS analytical results will be included in Ash Recovery Project reporting as well as in the NPDES monthly Discharge Monitoring Report (DMR).

In addition to visual observations and TSS monitoring, TVA will install and maintain a Hydrolab® DataSonde equipped with a turbidimeter. The turbidimeter will monitor turbidity levels at 15-minute intervals and the data will be reviewed on one-hour intervals. The monitor will be located near the skimmer weirs in the ash stilling pond at a depth of 1 meter which should be representative of what is being discharged. This turbidity data will be used to evaluate the efficiency of settling. The monitor will be installed before the dredging begins to collect background data.

ASH SETTLING AND PARTICLE SIZING

Settleability studies and particle size characterization of the ash are being conducted to help identify and design the best management practices to implement in the ash processing area and in the ash pond for solids control.

Settling Column Tests

Test 1

On March 01-02, 2009, a settling column test was performed to get an initial estimate on the settling velocity of the released ash. An ash sample was taken from the remaining dredge cell, and mixed with Emory River water. The slurry mixture at 5% was introduced to the settling column and turbidity and TSS samples were taken over a 24 hr period. Table 1 shows the turbidity values as measured in-situ using a portable Hach turbidimeter. In addition to turbidity, TSS samples were sent to a third party laboratory for analysis. The TSS data are not available yet.

Table 1 - March 01-02, 2009 Settling Column Test Turbidity Results

Time Interval	Date and Time	Bottom	Turbidity Values (NTU) per Port Height				Top
		1'	2'	3'	4'	5'	6'
Start	3-1-09 1320	>1000	>1000	>1000	>1000	>1000	>1000
15 min	3-1-09 1335	>1000	>1000	>1000	>1000	>1000	>1000
30 min	3-1-09 1350	>1000	>1000	>1000	>1000	>1000	259
45 min	3-1-09 1405	>1000	>1000	>1000	1000	289	130
1 hour	3-1-09 1420	>1000	>1000	528	265	137	131
2 hours	3-1-09 1520	105	99	89.1	82.2	79.5	39.9
3 hours	3-1-09 1620	56.7	53.2	54.9	45.9	30.9	26.6
4 hours	3-1-09 1720	35.7	36.2	32.2	38.9	31.3	20.4
6 hours	3-1-09 1920	22.7	21.5	21.9	21.3	20.7	15.5
8 hours	3-1-09 2120	17	16.5	16.1	15	14.6	10.6
16 hours	3-2-09 0520	10.6	9.75	9.7	8.08	7.77	3.13
24 hours	3-2-09 1324	6.57	7.27	6.5	7.17	6.89	2.01

Test 2

Since the ash was taken from the remaining dredge cell and not from the river where dredging will occur, another settling test was performed. The follow-up test utilized ash taken directly from the river above and below the primary impacted area. The samples were ash surface samples collected by boat. Two settling columns were tested

concurrently at the same 5% solids content to determine rate of settling on ash directly from the river. The results below show that the ash in the river settles more slowly than the ash taken from the remaining dredge cell. Theoretical retention time with 5 dredges operating is 1.25 hours in the ash processing area and 2.29 days in the ash pond.

Table 2 - March 08-12, 2009 Settling Column Test Turbidity Results

Downstream of Ash								
Time Interval	Date and Time	Collect TSS	Bottom	Turbidity Values (NTU) per Port Height				Top
			1'	2'	3'	4'	5'	6'
Start	3/8/09 13:40	Yes	>1000	>1000	>1000	>1000	>1000	>1000
15 min	3/8/09 13:55	No	>1000	>1000	>1000	>1000	>1000	>1000
30 min	3/8/09 14:10	No	>1000	>1000	>1000	>1000	>1000	1000
45 min	3/8/09 14:25	No	>1000	>1000	>1000	>1000	1000	1000
1 hour	3/8/09 14:40	Yes	>1000	>1000	>1000	1000	866	858
2 hours	3/8/09 15:40	Yes	837	612	534	486	480	398
3 hours	3/8/09 16:40	Yes	351	335	338	304	300	252
4 hours	3/8/09 17:40	Yes	271	259	249	238	225	182
6 hours	3/8/09 19:40	No	195	194	180	169	150	127
8 hours	3/8/09 21:40	Yes	150	162	149	127	122	106
16 hours	3/9/09 5:40	Yes	97.3	92	86.6	76.6	91	40.3
24 hours	3/9/09 13:40	Yes	77.2	70.2	67.6	57.9	56.8	33.4
48 hours	3/10/09 13:40	Yes	35	33.9	34.9	31.1	26.7	39.2
72 hours	3/11/09 13:40	Yes	25.9	18.5	18.5	19.3	17.7	n/a
96 hours	3/12/09 13:40	Yes	14.7	12.7	13	13.7	12.5	n/a
Initial River Water Turbidity Reading = 7.51								
Upstream of Ash								
Time Interval	Date and Time	Collect TSS	Bottom	Turbidity Values (NTU) per Port Height				Top
			1'	2'	3'	4'	5'	6'
Start	3/8/09 13:40	Yes	>1000	>1000	>1000	>1000	>1000	>1000
15 min	3/8/09 13:55	No	>1000	>1000	>1000	>1000	>1000	>1000
30 min	3/8/09 14:10	No	>1000	>1000	>1000	>1000	>1000	422
45 min	3/8/09 14:25	No	>1000	>1000	>1000	>1000	576	285
1 hour	3/8/09 14:40	Yes	>1000	>1000	1000	359	240	203
2 hours	3/8/09 15:40	Yes	175	158	130	124	93.3	65.5
3 hours	3/8/09 16:40	Yes	99.1	70	84.2	65.3	61.8	39
4 hours	3/8/09 17:40	Yes	70.7	53.6	56	47.5	40.8	24.7
6 hours	3/8/09 19:40	No	40.4	32.8	36.7	27.9	29.3	26
8 hours	3/8/09 21:40	Yes	26.3	23.2	24.9	21.9	23.2	20.1
16 hours	3/9/09 5:40	Yes	21.5	15.8	18.5	13.9	13.1	7.99
24 hours	3/9/09 13:40	Yes	12.5	9.61	10.9	10.6	10.2	11.4
Initial River Water Turbidity Reading = 5.39								

Based on the settling column tests the turbidity is significantly reduced within a 24-hour period. The TSS data from these tests will be compared to the NPDES discharge limits at IMP 001.

Particle Size Information

Particle size distribution is being performed on the ash samples that were used in the settling column testing. Results are pending, but are expected to be similar to the particle sizing data from the dredge cell. This data will be helpful to correlate the fine particles settling to the polymer dosing rate, if polymers are used for suspended solids control.

SOLIDS CONTROL

Turbidity Curtains

A turbidity curtain has been recently deployed in the main ash pond as a baffle between the lateral expansion cell and the sluice channel discharge to reduce short circuiting and increase retention time. This curtain supplements the curtain that is in the ash stilling pond. The increased retention time will allow more particle settling, which will improve TSS at IMP 001. The curtain in the main ash pond is a partially permeable curtain with a vinyl skirt. The curtain is 7 ft deep and 1000 ft in length. The curtain in the stilling pond is also 7 ft deep and is 1200 ft long, but in impermeable. The stilling pond curtain extends from the surface to the bottom of the pond.

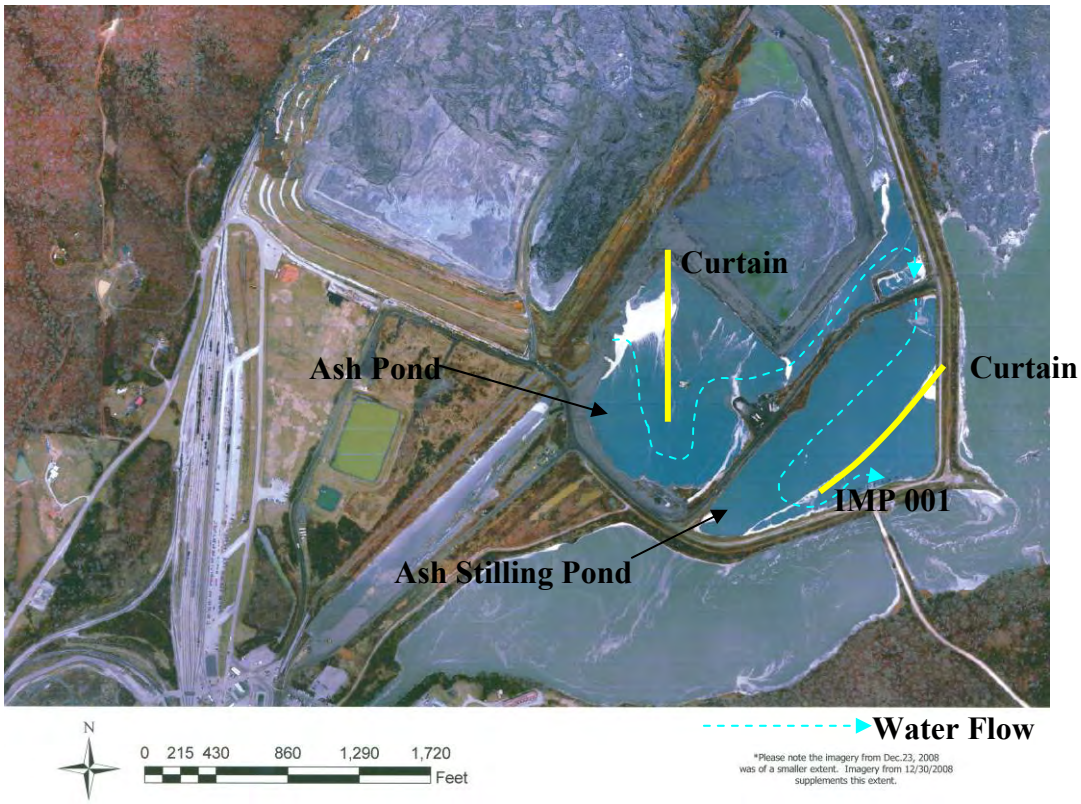

Figure 1 - Turbidity Curtain Location Map

Polymer Injection

TVA has investigated the use of polymers for a variety of applications related to the ash release. The related use for the ash pond will be to control the amount of additional solids sent to the ash pond through the processing area, and possibly to aid in settling the material in the ash pond. Initially, the processing area will operate without polymers to determine the efficiency of solids settling and removal from the process ditch. The polymers will only be used as needed. The request for proposals sent to certain water treatment vendors resulted in three effective polymer products that have passed acute and chronic toxicity testing. The liquid polymer was selected as the primary choice due to ease of application. The two dry polymers will be considered as backups.