SITE: TVA Kingston
BREAK: 2.2
OTHER:

SOIL AND ASH SAMPLING RESULTS
KINGSTON FOSSIL FLY ASH RESPONSE
HARRIMAN, ROANE COUNTY, TENNESSEE

Prepared for:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
EMERGENCY RESPONSE AND REMOVAL BRANCH
REGION 4
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INTRODUCTION

The Tetra Tech EM Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) is submitting this report summarizing soil and ash sampling activities conducted at the Kingston Fossil Fly Ash Response in Harriman, Tennessee. This report includes two tables: table 1 provides a figure illustrating the sampling locations; and table 2 provides a summary of the analytical results for the collected samples.

SITUATION

On December 22, 2008, at approximately 0100 hours, the northeastern dike at the TVA Kingston Power Plant, located in Harriman, Roane County, Tennessee, failed. The dike retained one of three cells at the facility used for dewatering fly ash. Subsequently, approximately 5.4 million cubic yards of fly ash were released into two sloughs which flow into the Emory River. The release extended approximately 300 acres outside of the ash storage areas. Local emergency officials first responded to the scene, and then shortly thereafter, began to assist residents affected by the fly ash flows. Three residential homes became condemned as a result of the release.

On December 22, 2008, the National Response Center (NRC), and subsequently the U.S. Environmental Protection Agency (EPA) Region 4, was notified of the incident. An On-Scene Coordinator (OSC) and Tetra Tech START were mobilized to the TVA Kingston Power Plant Facility the same day.

SAMPLING ACTIVITIES

EPA's contractor, Tetra Tech, conducted ash and shoreline soil sampling of impacted and potentially impacted areas. On December 23, 2008, EPA's contractor collected a fly ash sample (grab sample) from a sand bar on the Emory River. On December 27, 2008, EPA's contractor collected two 10-point composite ash samples from the ash pile in staging area C. In the same sampling event, EPA's contractor collected three grab samples of ash that had been deposited along the roadway.

Eleven 5-point composite samples of potentially impacted soil were collected from the shoreline of the rivers. Analyses included: Target Analyte Metals (TAL) (SW846 Method 6010B/7471A), BTEX (gasoline constituents) (SW846 Method 8260B), Silica (SW846 Method 6010B), and Toxicity Characteristic Leaching Procedure (TCLP) Metals (SW846 Method 1311/6010B/7470A).

The sample locations, analyses performed and dates collected are shown in Table 1 below. Sample locations are also provided on the map labeled Figure 1.

Table 1: Ash and Soil Sample Descriptions

Sampling ID	Date	TAL Total Metals	BTEX	Silica	TCLP Metals	Location
TT-SS01	12/23/08	X	X			Fly ash sample collected from a sandbar on the Emory River at mile marker 1.9.
081227-DKC-SS-01	12/27/08	X	X	X	X	Undisturbed sample from top of ash pile located in staging area C.
081227-DKCL-SS-01	12/27/08	X	X	X	X	Disturbed ash sample from staging area C.
081228-KFPRW-01	12/28/08	X	X	X	X	Ash sample from shoulder of Swan Pond Rd, approx 500 ft north of TVA checkpoint.
081228-SPRRW-02	12/28/08	X	X	X	X	Ash sample from shoulder of Swan Pond Rd, near spring drainage way.

Sampling ID	Date	TAL Total Metals	BTEX	Silica	TCLP Metals	Location
081228-SPCRW-03	12/28/08	X	X	X	X	Ash sample from shoulder of Swan Pond Cir, approx 200 ft North of damaged home.
081228-EERBS-SS04	12/28/08	X	X	X	X	Soil sample from staging area on eastern Emory River bank.
081228-ERPL-SS05	12/28/08	X	X	X	X	Soil sample from beneath powerlines on NE bank of Emory River (near Emory River mile marker 1.75).
081228-ERPR-SS06	12/28/08	X	X	X	X	East bank of Emory River next to 346 Peninsula Road.
081228-ERER-SS07	12/28/08	X	X	X	X	East bank of Emory River at 496 Emory River Road.
081228-ERER-SS07-DUP	12/28/08	X	X	X	X	East bank of Emory River located at 496 Emory River Road.
081228-ERER-SS08	12/28/08	X	X	X	X	East bank of Emory River located at 444 Emory River Road.
081228-SGVBR-SS09	12/28/08	X	X	X	X	Sugar Grove Valley Boat ramp, public area.
081228-KCPS-SS10	12/28/08	X	X	X	X	Kingston City Park South boat ramp, public area.
081228-KCP-SS11	12/28/08	X	X	X	X	Kingston City Park public area.

RESULTS

Tables 2 – 4 contain unvalidated summary analytical data for all EPA collected data, sorted by date. For comparison, each table includes the EPA Region 4 Removal Action Levels (RALs) for residential and industrial soil. RALs identify contaminant levels at which response actions may be required (exposure pathway analysis must be included with the RAL to determine appropriate course of action). Arsenic was the only constituent detected above the RALs.

Arsenic values of the ash ranged from 44.8 mg/kg to 81.3 mg/kg. Data from both sample sets indicates that Kingston Fossil Plant ash exceeds the residential EPA Region 4 Removal Action Level (RAL), but not the industrial RAL, for arsenic. EPA's contractor collected two 10-pt composite samples (DKC-SS-01 and DKCL-SS-02) from the ash cell, one undisturbed and one disturbed. These samples measured 45.8 and 59.9 mg/kg, respectively. Three ash samples were collected on the roadway along Swan Pond Road and Swan Pond Circle Road. These three samples (KFPRW-01, SPRRW-02, and SPCRW-03) measured arsenic levels at 54.2 mg/kg, 81.3 mg/kg, and 69.8 mg/kg, respectively. The sample collected on December 23, 2008 from the deposited ash in the Emory River (TT-SS01) measured 44.8 mg/kg, which exceeds the Region 4 residential RAL for arsenic (39 mg/kg).

See Figure 1 for sample locations.

All shoreline soil sample concentrations were below the RALs for all constituents, including arsenic. See the data tables for the complete data set. TDEC has provided a background analysis of native soils, available at:
http://www.osti.gov/bridge/servlets/purl/1012023782LVNC/webviewable/10120237.PDF.

From December 27-29, 2008, TVA sampled the affected portions of seven residential properties. TVA collected background soil samples from areas above the high-water levels on each property. One additional residence was sampled on January 2, 2008. TVA analyzed the soil and ash for total metals, BTEX (gasoline constituents), and silica.

CONCLUSION

The results of the sampling reveal an elevated amount of arsenic in the ash. Sampling results of shoreline soils near the site did not exceed the RALs; however, a limited number of properties have been sampled to date. Sampling of off-site properties potentially impacted by the release is necessary.

MAP SOURCE: USDA NAIP, 2007.

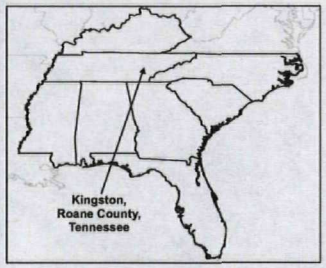
LEGEND

EPA SOIL

Ash

N
W E
S

0 2,000 4,000 6,000 Feet



United States Environmental Protection Agency

KINGSTON FOSSIL PLANT FLY ASH RESPONSE KINGSTON, ROANE COUNTY, TENNESSEE TDD: TTEMI-05-001-0084

TVA KINGSTON FOSSIL PLANT SITE

FIGURE 1

EPA ASH AND SOIL SAMPLING LOCATIONS

TETRA TECH

T N & Associates, Inc. EPA Region 4 START

2009-01-04 Y:\Kingston_TVA\GIS\MXD\Soil_Sampling_Locations_123008.mxd TTEMI-NV jodyhunter TNA4 dennis.bowman

TABLE 2
EPA UNVALIDATED ASH SAMPLING RESULTS
SAMPLES COLLECTED DECEMBER 23, 2008

Sample Designation:	**RAL**	**RAL**	**TT-SS01**
Sample Collection Date:	**Residential**	**Industrial**	**12/23/2008**
Field Quality Control:			
Percent Moisture (percent)			
Percent Moisture	NL	NL	27.7
BTEX (µg/kg, dry weight)			
Benzene	113	626	1.3 U
Ethylbenzene	574	3180	1.3 U
m,p-Xylenes	13800	64400	1.3 U
o-Xylene	16300	76100	1.3 U
Toluene	35400	155000	1.3 U
Total Metals (mg/kg, dry weight)			
Aluminum	76000	3290000	26400
Antimony	329	1360	1.27 J
Arsenic	39	177	**44.8**
Barium	164000	681000	864
Beryllium	1610	6700	6.25
Cadmium	729	2700	*0.577 J*
Calcium	NL	NL	18300
Chromium	27600	154000	41.3
Cobalt	244	1010	17.7
Copper	NL	NL	59.9
Iron	575000	2380000	12000
Lead	400	800	20.3
Magnesium	NL	NL	3900
Manganese	NL	NL	66.9
Mercury	20	93	0.0879 J
Nickel	16400	68100	29.4
Potassium	NL	NL	3280
Selenium	4110	17000	3.13 J
Silver	4110	17000	2.81 U
Sodium	NL	NL	672
Thallium	53	221	4.36 J
Vanadium	4140	17200	107
Zinc	246000	1020000	55.6
TCLP Metals (mg/L)*	(40CFR 261.24)		
Arsenic	5.0		NA
Barium	100.0		NA
Cadmium	1.0		NA
Chromium	5.0		NA
Lead	5.0		NA
Mercury	0.2		NA
Selenium	1.0		NA
Silver	5.0		NA

Notes:

Highlighted results exceeded the Region 4 Residential RALs
BTEX = Benzene, toluene, ethylbenzene, and xylenes
J = The analyte was positively identified; the associated value is the ap concentration of the analyte in the sample.
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
NL = Not listed

* = Comparison values are TCLP thresholds and not Region IX Preliminary Remediation Goals.
RAL= Region 4 Removal Action Level
TCLP = Toxicity characteristic leaching procedure
U = The analyte was analyzed for, but was not detected at or above the associated value.
µg/kg = Micrograms per kilogram

TABLE 3
EPA UNVALIDATED ASH SAMPLING RESULTS
SAMPLES COLLECTED DECEMBER 27-29, 2008

Sample Designation:	RAL	RAL	081227-DKC-SS-01	081227-DKCL-SS-02	081228-KFPRW-01	081228-SPRRW-02	081228-SPCRW-03
Sample Collection Date:	**Residential**	**Industrial**	**12/27/2008**	**12/27/2008**	**12/28/2008**	**12/28/2008**	**12/28/2008**
Field Quality Control:							
Percent Moisture (percent)							
Percent Moisture	NL	NL	31.0	21.3	22.2	26.1	29.9
BTEX (µg/kg, dry weight)							
Benzene	113	626	1.3 U	1.1 U	1.2 U	1.3 U	1.2 U
Ethylbenzene	574	3180	1.3 U	1.1 U	1.2 U	1.3 U	1.2 U
m,p-Xylenes	13800	64400	1.3 U	1.1 U	1.6	1.3 U	1.2 U
o-Xylene	16300	76100	1.3 U	1.1 U	1.2 U	1.3 U	1.2 U
Toluene	35400	155000	1.3 U	1.1 U	1.2 U	1.3 U	1.2 U
Total Metals (mg/kg, dry weight)							
Aluminum	76000	3290000	28900	10500	11000	18600	14900
Antimony	329	1360	1.16 J	1.06 J	1.06 J	1.63 J	1.38 J
Arsenic	39	177	**45.8**	**59.9**	**54.2**	**81.3**	**69.8**
Barium	164000	681000	825	204	188	248	208
Beryllium	1610	6700	1.89 J	0.460 J	0.553 J	0.782 J	1.04 J
Cadmium	729	2700	0.800 J	0.765 J	0.737 J	1.23 J	1.06 J
Calcium	NL	NL	19500	2710	2190	3070	2570
Chromium	27600	154000	38.1	20.0	18.2	30.4	27.4
Cobalt	244	1010	18.7	8.50	8.58	11.4	11.7
Copper	NL	NL	69.4	29.9	34.5	49.2	58.5
Iron	575000	2380000	14100	19300	11800	13900	9590
Lead	400	800	24.9	20.0	15.3	23.2	56.9
Magnesium	NL	NL	4300	873	713	1210	979
Manganese	NL	NL	67.5	231	48.3	56.8	45.7
Mercury	20	93	0.111 J	0.0755 J	0.0563 J	0.0973 J	0.0664 J
Nickel	16400	68100	32.3	17.1	19.3	25.3	27.0
Potassium	NL	NL	2840	1340	1770	3050	2250
Selenium	4110	17000	6.63 J	5.15 J	6.36	6.37 J	7.15
Silver	4110	17000	3.38 U	2.91 U	3.00 U	3.20 U	3.38 U
Sodium	NL	NL	725	147	174	298	224
Thallium	53	221	67.7 U	5.82 U	5.99 U	6.40 U	6.75 U
Vanadium	4140	17200	121	45.6	44.6	71.0	72.9
Zinc	246000	1020000	54.9	28.7	24.3	42.7	36.9
TCLP Metals (mg/L)*	(40CFR 261.24)						
Arsenic	5.0		0.25 U	0.25 U	0.25 U	0.0862 J	0.0984 J
Barium	100.0		4.71	0.766	0.801	1.06	0.747
Cadmium	1.0		0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
Chromium	5.0		0.0540	0.05 U	0.05 U	0.05 U	0.05 U
Lead	5.0		0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Mercury	0.2		0.00266 J	0.004 U	0.004 U	0.00234 J	0.004 U
Selenium	1.0		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Silver	5.0		0.025 U	0.025 U	0.025 U	0.025 U	0.025 U

Notes:

Highlighted results exceeded the EPA Region 4 Residental RALs.

BTEX = Benzene, toluene, ethylbenzene, and xylenes

J = The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample.

mg/kg = Milligrams per kilogram

mg/L = Milligrams per liter

NL = Not listed

* = Comparison values are TCLP thresholds and not Region IX Preliminary Remediation Goals.

RAL= Region 4 Removal Action Level

TCLP = Toxicity characteristic leaching procedure

U = The analyte was analyzed for, but was not detected at or above the associated value.

µg/kg = Micrograms per kilogram

TA. 4

EPA SOIL SAMPLING RESULTS

SAMPLES COLLECTED DECEMBER 28, 2008

Sample Designation:	RAL	RAL	081228-EERBS-SS04	081228-ERPL-SS05	081228-ERPR-SS06	081228-ERER-SS07	081228-ERER-SS07-DUP
Sample Collection Date:	Residential	Industrial	12/28/2008	12/28/2008	12/28/2008	12/28/2008	12/28/2008
Field Quality Control:							Field Duplicate
Percent Moisture (percent)							
Percent Moisture	NL	NL	22.5	25.8	24.7	18.3	22.0
BTEX (µg/kg, dry weight)							
Benzene	113	626	0.92 U	1.1 U	1.0 U	0.98 U	0.88 U
Ethylbenzene	574	3180	0.92 U	1.1 U	1.0 U	0.98 U	0.88 U
m,p-Xylenes	13800	64400	0.92 U	1.1 U	1.0 U	0.98 U	0.88 U
o-Xylene	16300	76100	0.92 U	1.1 U	1.0 U	0.98 U	0.88 U
Toluene	35400	155000	0.92 U	1.1 U	1.0 U	0.98 U	0.88 U
Total Metals (mg/kg, dry weight)							
Aluminum	76000	3290000	13100	12500	14400	9580	10100
Antimony	329	1360	0.461 J	1.10 J	0.567 J	1.24 J	1.87 J
Arsenic	39	177	1.34 J	27.9	3.29 J	19.1	19.1
Barium	164000	681000	76.5	28.2	118	68.2	174
Beryllium	1610	6700	0.497 J	0.0646 J	0.685 J	0.535 J	0.618 J
Cadmium	729	2700	3.12 U	0.273 J	3.08 U	0.141 J	0.211 J
Calcium	NL	NL	1510	976	2140	1030	1120
Chromium	27600	154000	21.0	27.7	26.0	54.4	86.7
Cobalt	244	1010	8.49	4.04	18.0	33.7	30.8
Copper	NL	NL	12.8	21.0	15.6	10.9	11.3
Iron	575000	2380000	19100	36700	24800	28000	30100
Lead	400	800	10.1	45.4	18.2	71.8	61.2
Magnesium	NL	NL	2530	458	2410	635	688
Manganese	NL	NL	268	228	1150	1410	4160
Mercury	20	93	0.127 U	0.127 J	0.129 U	0.0280 J	0.0293 J
Nickel	16400	68100	23.5	11.7	18.8	11.6	12.9
Potassium	NL	NL	1840	350	2260	577	534
Selenium	4110	17000	2.12 J	2.64 J	3.37 J	2.86 J	4.29 J
Silver	4110	17000	3.12 U	3.11 U	3.08 U	3.02 U	0.375 J
Sodium	NL	NL	52.2 J	33.7 J	57.9 J	25.2 J	22.5 J
Thallium	53	221	6.23 U	6.21 U	6.17 U	6.04 U	60.4 U
Vanadium	4140	17200	20.3	81.5	28.5	41.0	43.0
Zinc	246000	1020000	44.7	26.3	35.4	31.8	35.6
TCLP Metals (mg/L)*	**(40CFR 261.24)**						
Arsenic	5.0		0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Barium	100.0		0.303 J	0.188 J	0.327 J	0.319 J	0.346 J
Cadmium	1.0		0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
Chromium	5.0		0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Lead	5.0		0.05 U	0.0116 J	0.05 U	0.05 U	0.05 U
Mercury	0.2		0.004 U	0.000456 J	0.000301 J	0.000298 J	0.000291 J
Selenium	1.0		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Silver	5.0		0.025 U	0.025 U	0.025 U	0.025 U	0.025 U

Notes:

Highlighted results exceeded the Region 4 Residental RALs.

BTEX = Benzene, toluene, ethylbenzene, and xylenes

J = The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample.

mg/kg = Milligrams per kilogram

mg/L = Milligrams per liter

NL = Not listed

RAL= Removal Action Level

* = Comparison values are TCLP thresholds and not Region IX Preliminary Remediation Goals.

RAL= Region 4 Removal Action Level

TCLP = Toxicity characteristic leaching procedure

U = The analyte was analyzed for, but was not detected at or above the associated value.

µg/kg = Micrograms per kilogram

TA. .4
EPA SOIL SAMPLING RESULTS
SAMPLES COLLECTED DECEMBER 28, 2008

Sample Designation:	RAL	RAL	081228-ERER-SS08	081228-SGUBR-SS09	081228-KCPS-SS10	081228-KCP-SS11
Sample Collection Date:	Residential	Industrial	12/28/2008	12/28/2008	12/28/2008	12/28/2008
Field Quality Control:						
Percent Moisture (percent)						
Percent Moisture	NL	NL	22.6	25.2	27.4	23.1
BTEX (µg/kg, dry weight)						
Benzene	113	626	0.92 U	0.89 U	1.1 U	0.92 U
Ethylbenzene	574	3180	0.92 U	0.89 U	1.1 U	0.92 U
m,p-Xylenes	13800	64400	0.92 U	0.89 U	1.1 U	0.92 U
o-Xylene	16300	76100	0.92 U	0.89 U	1.1 U	0.92 U
Toluene	35400	155000	0.92 U	0.89 U	1.1 U	0.92 U
Total Metals (mg/kg, dry weight)						
Aluminum	76000	3290000	13700	16200	22600	8140
Antimony	329	1360	0.664 J	1.06 J	1.11 J	0.418 J
Arsenic	39	177	3.99 J	34.5	19.1	6.07 J
Barium	164000	681000	44.3	47.0	24.5	17.8
Beryllium	1610	6700	0.117 J	0.346 J	0.351 J	0.109 J
Cadmium	729	2700	2.94 U	0.333 J	0.178 J	0.0423 J
Calcium	NL	NL	1420	2180	1620	647
Chromium	27600	154000	18.7	19.5	34.2	11.7
Cobalt	244	1010	4.39	6.46	2.34 J	2.69 J
Copper	NL	NL	8.74	35.6	21.8	10.7
Iron	575000	2380000	23100	40700	40800	17900
Lead	400	800	13.8	55.5	24.7	15.3
Magnesium	NL	NL	874	873	1020	379
Manganese	NL	NL	180	313	143	112
Mercury	20	93	0.0649 J	0.212	0.160	0.129 U
Nickel	16400	68100	6.68	18.8	12.2	5.62 J
Potassium	NL	NL	659	581	840	416
Selenium	4110	17000	2.60 J	3.23 J	3.86 J	2.01 J
Silica	NL	NL				
Silver	4110	17000	2.94 U	3.32 U	3.43 U	3.04 U
Sodium	NL	NL	48.2 J	30.7 J	29.7 J	22.2 J
Thallium	53	221	5.88 U	6.63 U	6.85 U	6.08 U
Vanadium	4140	17200	23.2	69.3	66.1	18.8
Zinc	246000	1020000	31.1	66.4	84.5	22.9
TCLP Metals (mg/L)*	**(40CFR 261.24)**					
Arsenic	5.0		0.25 U	0.25 U	0.25 U	0.25 U
Barium	100.0		0.178 J	0.288 J	0.149 J	0.145 J
Cadmium	1.0		0.025 U	0.025 U	0.025 U	0.025 U
Chromium	5.0		0.05 U	0.05 U	0.05 U	0.05 U
Lead	5.0		0.05 U	0.05 U	0.05 U	0.0188 J
Mercury	0.2		0.00413	0.004 U	0.00132 J	0.00183 J
Selenium	1.0		0.1 U	0.1 U	0.1 U	0.1 U
Silver	5.0		0.025 U	0.025 U	0.025 U	0.025 U

Notes:
Highlighted results exceeded the Region 4 Residental RALs.
BTEX = Benzene, toluene, ethylbenzene, and xylenes
J = The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample.
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
NL = Not listed
RAL= Removal Action Level
* = Comparison values are TCLP thresholds and not Region IX Preliminary Remediation Goals.
RAL = Region 4 Removal Action Level
TCLP = Toxicity characteristic leaching procedure
U = The analyte was analyzed for, but was not detected at or above the associated value.
µg/kg = Micrograms per kilogram