

**SURFACE WATER 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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Revision 1**

## **SURFACE WATER SAMPLING RESULTS**

### **TVA KINGSTON FOSSIL PLANT FLY ASH RESPONSE HARRIMAN, ROANE COUNTY, TENNESSEE**

#### **INTRODUCTION**

The Tetra Tech EM Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) is submitting this report summarizing surface water sampling activities conducted at the Kingston Fossil Fly Ash Response in Harriman, Tennessee. EPA tasked Tetra Tech to collect surface water samples from areas within the Clinch, Emory, and Tennessee River systems. The purpose of the investigation was to provide an initial characterization of natural waters which may have been impacted by the release of fly ash into the river. EPA will use the data to determine the risks to public health and the environment. Tetra Tech conducted the investigation using the Field Branches Quality System and Technical Procedures located at <http://www.epa.gov/region4/sesd/fbqstp/>.

This letter report includes an attached figure depicting the sampling locations and tables showing a summary of the data.

#### **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 flow. 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. A Federal On-Scene Coordinator (OSC) and Tetra Tech START contractor were mobilized to the TVA Kingston Power Plant Facility the same day.

#### **SAMPLING ACTIVITIES**

From December 23, 2008 to December 29, 2008, EPA's contractor, Tetra Tech, collected a total of 26 samples of surface water from the Tennessee, Clinch, and Emory Rivers. On December 23, 2008, EPA contractors accompanied TVA personnel in watercraft along an approximately 10-mile long stretch of the rivers. A total of 10 samples were collected and split between the two entities. The samples were analyzed by an independent off-site laboratory for a combination of Target Analyte List (TAL) total and dissolved metals (SW846 Method 6010B/7470A) and total suspended solids (EPA 160.2). On December 29, 2008, EPA contractors and TVA collected duplicate samples from 11 locations (including one quality control duplicate) at similar locations along the same path as that taken on December 23, 2008. The samples were analyzed by an off-site laboratory for TAL total and dissolved metals (SW846 Method 6010B/7470A), total dissolved silica (SW846 Method 6010B).

The following table identifies EPA surface water samples, their location and corresponding analyses:

**Table 1: Surface Water Sampling Descriptions and Locations**

Sample ID	Date Collected	TAL Total Metals	TAL Dissolved Metals	Total Suspended Solids	Total Dissolved Silica	Location
KIF-TRM568.5	12/23/08	X	X	X		Tennessee River mile marker 568.5
KIF-CRM0.0	12/23/08	X	X	X		Clinch River mile marker 0.0
KIF-CRM2.0	12/23/08	X	X	X		Clinch River mile marker 2.0
KIF-CRM4.0	12/23/08	X				Clinch River mile marker 4.0
KIF-CRM5.5	12/23/08	X				Clinch River mile marker 5.5
KIF-ERM0.1	12/23/08	X	X	X		Emory River mile marker 0.1
TT-ERM1.9	12/23/08	X				Emory River mile marker 1.9
TT-ERM1.9-DUP	12/23/08	X				Emory River mile marker 1.9
KIF-ERM2.1	12/23/08	X				Emory River mile marker 2.1
KIF-ERM4.0	12/23/08	X				Emory River mile marker 5.0 surface.
KIF-TRM568.5	12/29/08	X	X		X	Tennessee River mile marker 568.5
KIF-CRM0.0	12/29/08	X	X		X	Clinch River mile marker 0.0
KIF-CRM2.0	12/29/08	X	X		X	Clinch River mile marker 2.0
KIF-CRM2.5	12/29/08	X	X		X	Clinch River mile marker 2.5
KIF-CRM4.0	12/29/08	X	X		X	Clinch River mile marker 4.0
KIF-CRM5.5	12/29/08	X	X		X	Clinch River mile marker 5.5
KIF-ERM0.1	12/29/08	X	X		X	Emory River mile marker 0.1
KIF-ERM1.75	12/29/08	X	X		X	Emory River mile marker 1.75
KIF-ERM2.0	12/29/08	X	X		X	Emory River mile marker 2.0
KIF-ERM2.0-DUP	12/29/08	X	X		X	Emory River mile marker 2.0
KIF-ERM4.0	12/29/08	X	X		X	Emory River mile marker 4.0

Figure 1 shows a map of all surface water sampling locations.

## SAMPLING RESULTS

The attached tables contain unvalidated summary analytical results for all EPA collected surface water data, sorted by date. Each table includes the Tennessee Water Quality Criteria for Domestic Water Supply (Rule 1200-4-3-.03) (TWQC) for comparative purposes. These criteria mirror the Federal Maximum Contaminant Levels for public water systems. Both the total and dissolved phases of each constituent were compared to TWQCs.

Analytical results from the samples collected on December 23, 2008 indicate levels of several constituents at or above their respective TWQCs. Sample KIF-ERM0.1 exceeded the TWQC for antimony, beryllium, cadmium, chromium, and lead in total analysis; and arsenic in both total and dissolved phase analysis.

In the report released on January 4, 2009, samples KIF-CRM5.5 and KIF-ERM4.0 were reported as exceeding the TWQC for total thallium. After further review of the laboratory quality control data, thallium was determined not to be detected in the sample.

Samples TT-ERM1.9 and TT-ERM1.9-DUP, a duplicate sample collected from the same location immediately following TT-ERM1.9 exceeded the TWQC for total arsenic. Sample KIF-CRM0.0 exceeded the TWQC for dissolved thallium.

Samples collected on December 28, 2008 showed fewer exceedances of the TWQCs than the samples collected on December 23, 2008. Sample 081228-ERER-WS02 and its duplicate exceeded the TWQC for total arsenic. In addition, 081228-ERER-WS02-DUP exceeded the TWQCs for dissolved thallium. The reproducibility of the total mercury exceedance previously report in sample 081228-ERER-WS02-DUP was verified. The lab reanalyzed the sample two additional times and the results showed no detection of mercury. Sample 081228-KCPS-WS04 exceeded the TWQC for total arsenic. Comparing the two data sets, a general decrease in total suspended solids (TSS) and metal concentration is observed. The data indicates that settling of the released ash has reduced particulate and metal levels in the water column. Dispersion may also be a factor in reduced contaminant measurements.

As of January 4, 2008, samples collected from upstream locations along the Clinch and Emory Rivers are currently at the laboratory awaiting analysis.

As of January 3, 2008, TVA had collected 60 water samples, utilizing 10 consistent locations along the river system to allow for comparison of the data.

## CONCLUSION

This report provides an initial characterization of the river. Elevated levels of metals have been measured in the Clinch and Emory Rivers following the ash release. River sediments were not sampled in this study. EPA recommends continued characterization of the Emory and Clinch Rivers throughout the duration of the clean up.



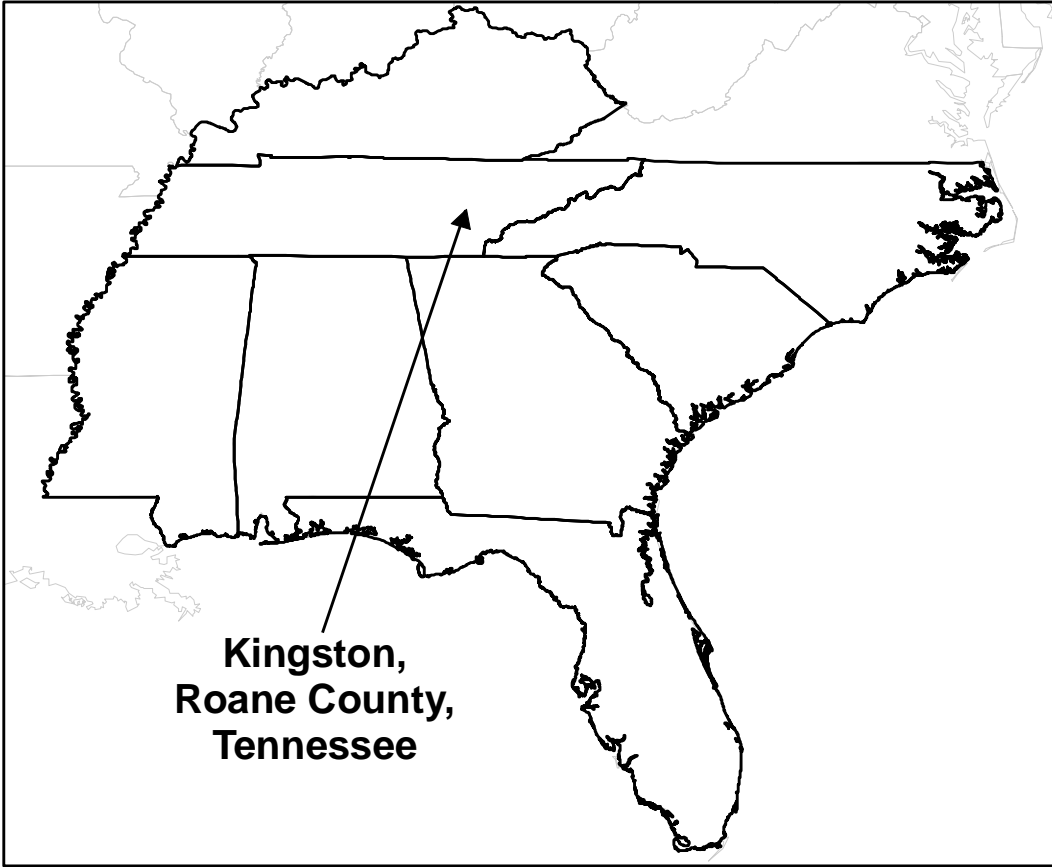
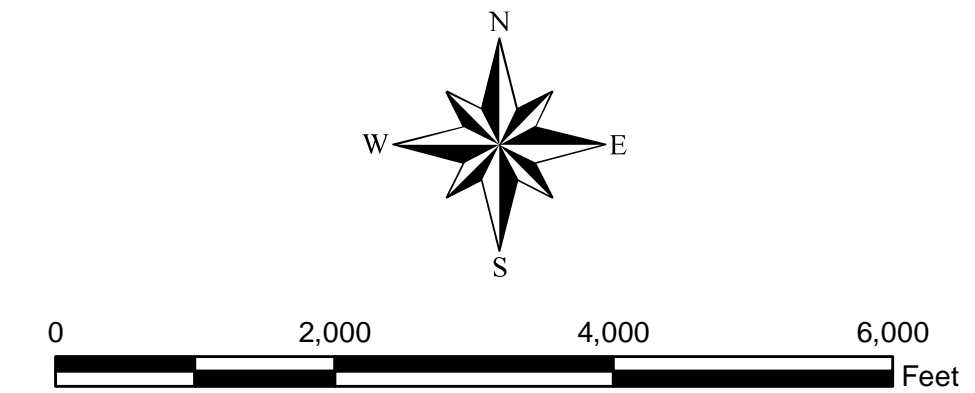


LEGEND

- EPA SURFACE WATER SAMPLE LOCATION
- ✚ RIVER MILE MARKER

Notes:  
CRM = Clinch River Mile  
ERM = Emory River Mile  
TRM = Tennessee River Mile  
KIF = Kingston Fossil

Samples beginning with KIF indicate samples split with TVA.



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

**TVA KINGSTON  
FOSSIL PLANT SITE**

FIGURE 1

**EPA SURFACE WATER  
SAMPLING LOCATIONS**





**TABLE 2**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 23, 2008**

<b>Sample Designation:</b>	<b>TWQC</b>	<b>KIF-CRM 4.0</b>	<b>KIF-ERM 0.1</b>	<b>KIF-CRM 5.5</b>
<b>Sample Collection Date:</b>		<b>12/23/2008</b>	<b>12/23/2008</b>	<b>12/23/2008</b>
<b>Field Quality Control:</b>				
<b>Total Suspended Solids (mg/L)</b>				
Total Suspended Solids	NL	NA	14700	NA
<b>Dissolved Metals (mg/L)</b>				
Aluminum	NL	NA	0.164 J	NA
Antimony	0.006	NA	0.02 U	NA
Arsenic	0.01	NA	<b>0.0116 J</b>	NA
Barium	2	NA	0.0345	NA
Beryllium	0.004	NA	0.01 U	NA
Cadmium	0.005	NA	0.005 U	NA
Calcium	NL	NA	9.38	NA
Chromium	0.1	NA	0.01 U	NA
Cobalt	NL	NA	0.02 U	NA
Copper	1.3	NA	0.00170 J	NA
Iron	NL	NA	0.187	NA
Lead	0.015	NA	0.01 U	NA
Magnesium	NL	NA	2.20	NA
Manganese	NL	NA	0.153	NA
Mercury	0.002	NA	0.0002 U	NA
Nickel	NL	NA	0.02 U	NA
Potassium	NL	NA	1.28	NA
Selenium	0.05	NA	0.00749 J	NA
Silica	NL	NA	NA	NA
Silver	NL	NA	0.01 U	NA
Sodium	NL	NA	5.65	NA
Thallium	0.002	NA	0.00774 J	NA
Vanadium	NL	NA	0.00341 J	NA
Zinc	NL	NA	0.00772 J	NA
<b>Total Metals (mg/L)</b>				
Aluminum	NL	1.53	121	0.986
Antimony	0.006	0.02 U	<b>0.00655 J</b>	0.02 U
Arsenic	0.01	0.00392 J	<b>1.49</b>	0.00501 J
Barium	2	0.0430	1.47	0.0385
Beryllium	0.004	0.01 U	<b>0.0119</b>	0.01 U
Cadmium	0.005	0.005 U	<b>0.0155</b>	0.005 U
Calcium	NL	30.8	38.2	35.0
Chromium	0.1	0.01 U	<b>0.127</b>	0.01 U
Cobalt	NL	0.02 U	0.0768	0.02 U
Copper	1.3	0.01 U	0.225	0.01 U
Iron	NL	1.08	67.0	0.733
Lead	0.015	0.00461 J	<b>0.0754</b>	0.01 U
Magnesium	NL	8.51	12.4	9.94
Manganese	NL	0.0938	1.89	0.0453
Mercury	0.002	0.0002 U	0.0002 U	0.0002 U
Nickel	NL	0.02 U	0.103	0.02 U
Potassium	NL	2.44	32.1	2.45
Selenium	0.05	0.02 U	0.0180 J	0.02 U
Silver	NL	0.01 U	0.01 U	0.01 U
Sodium	NL	5.85	4.85	6.83
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.00243 J	0.465	0.01 U
Zinc	NL	0.00404 J	0.266	0.02 U

Notes:

Highlighted results exceeded the Tennessee Water Quality Criteria.

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

mg/L = Milligrams per liter

NA = The sample was not analyzed for this analyte.

NL = Not listed

TWQC Tennessee Water Quality Criteria

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

**TABLE 2**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 23, 2008**

<b>Sample Designation:</b>	<b>TWQC</b>	<b>KIF- ERM 2.1</b>	<b>KIF-ERM 4.0</b>	<b>TT-ERM 1.9</b>
<b>Sample Collection Date:</b>		<b>12/23/2008</b>	<b>12/23/2008</b>	<b>12/23/2008</b>
<b>Field Quality Control:</b>				
<b>Total Suspended Solids (mg/L)</b>				
Total Suspended Solids	NL	NA	NA	NA
<b>Dissolved Metals (mg/L)</b>				
Aluminum	NL	NA	NA	NA
Antimony	0.006	NA	NA	NA
Arsenic	0.01	NA	NA	NA
Barium	2	NA	NA	NA
Beryllium	0.004	NA	NA	NA
Cadmium	0.005	NA	NA	NA
Calcium	NL	NA	NA	NA
Chromium	0.1	NA	NA	NA
Cobalt	NL	NA	NA	NA
Copper	1.3	NA	NA	NA
Iron	NL	NA	NA	NA
Lead	0.015	NA	NA	NA
Magnesium	NL	NA	NA	NA
Manganese	NL	NA	NA	NA
Mercury	0.002	NA	NA	NA
Nickel	NL	NA	NA	NA
Potassium	NL	NA	NA	NA
Selenium	0.05	NA	NA	NA
Silica	NL	NA	NA	NA
Silver	NL	NA	NA	NA
Sodium	NL	NA	NA	NA
Thallium	0.002	NA	NA	NA
Vanadium	NL	NA	NA	NA
Zinc	NL	NA	NA	NA
<b>Total Metals (mg/L)</b>				
Aluminum	NL	1.13	0.338	2.20
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.05 U	0.05 U	0.0208 J
Barium	2	0.0405	0.0304	0.0565
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	8.04	7.81	9.11
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.01 U	0.01 U	0.00406 J
Iron	NL	0.660	0.262	1.37
Lead	0.015	0.01 U	0.01 U	0.00625 J
Magnesium	NL	2.14	1.78	2.20
Manganese	NL	0.0738	0.0368	0.0898
Mercury	0.002	0.0002 U	0.0002 U	0.0002 U
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	1.52	1.35	1.71
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silver	NL	0.01 U	0.01 U	0.01 U
Sodium	NL	2.56	2.53	2.63
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.00255 J	0.01 U	0.00741 J
Zinc	NL	0.00461 J	0.02 U	0.0371

Notes:

Highlighted results exceeded the Tennessee Water Quality Criteria.

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TWQC Tennessee Water Quality Criteria

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**TABLE 2**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 23, 2008**

<b>Sample Designation:</b>	<b>TWQC</b>	<b>TT-ERM1.9-DUP</b>	<b>KIF-TRM568.5</b>	<b>KIF-CRM 0.0</b>
<b>Sample Collection Date:</b>		<b>12/23/2008</b>	<b>12/23/2008</b>	<b>12/23/2008</b>
<b>Field Quality Control:</b>		<b>Field Duplicate</b>		
<b>Total Suspended Solids (mg/L)</b>				
Total Suspended Solids	NL	NA	10.5	14.5
<b>Dissolved Metals (mg/L)</b>				
Aluminum	NL	NA	0.2 U	0.0268 J
Antimony	0.006	NA	0.02 U	0.02 U
Arsenic	0.01	NA	0.05 U	0.05 U
Barium	2	NA	0.0176 J	0.0189 J
Beryllium	0.004	NA	0.01 U	0.01 U
Cadmium	0.005	NA	0.005 U	0.005 U
Calcium	NL	NA	13.8	14.8
Chromium	0.1	NA	0.01 U	0.01 U
Cobalt	NL	NA	0.02 U	0.02 U
Copper	1.3	NA	0.01 U	0.01 U
Iron	NL	NA	0.1 U	0.1 U
Lead	0.015	NA	0.01 U	0.01 U
Magnesium	NL	NA	3.52	3.80
Manganese	NL	NA	0.00464 J	0.00944 J
Mercury	0.002	NA	0.0002 U	0.0002 U
Nickel	NL	NA	0.02 U	0.02 U
Potassium	NL	NA	1.57	1.78
Selenium	0.05	NA	0.02 U	0.02 U
Silica	NL	NA	NA	NA
Silver	NL	NA	0.01 U	0.01 U
Sodium	NL	NA	7.48	8.04
Thallium	0.002	NA	0.02 U	<b>0.00463 J</b>
Vanadium	NL	NA	0.01 U	0.01 U
Zinc	NL	NA	0.02 U	0.02 U
<b>Total Metals (mg/L)</b>				
Aluminum	NL	2.58	0.291	0.265
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	<b>0.0337 J</b>	0.05 U	0.00351 J
Barium	2	0.0643	0.0218	0.0215
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	9.26	16.2	15.9
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.00508 J	0.01 U	0.01 U
Iron	NL	1.77	0.255	0.234
Lead	0.015	0.00492 J	0.01 U	0.01 U
Magnesium	NL	2.27	4.17	4.09
Manganese	NL	0.0970	0.0288	0.0248
Mercury	0.002	0.0002 U	0.0002 U	0.0002 U
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	1.80	1.97	1.92
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silver	NL	0.01 U	0.01 U	0.01 U
Sodium	NL	2.68	8.90	8.67
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.0108	0.01 U	0.01 U
Zinc	NL	0.0350	0.02 U	0.02 U

Notes:

Highlighted results exceeded the Tennessee Water Quality Criteria.

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**TABLE 2**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 23, 2008**

<b>Sample Designation:</b>	<b>TWQC</b>	<b>KIF-CRM 2.0</b>
<b>Sample Collection Date:</b>		<b>12/23/2008</b>
<b>Field Quality Control:</b>		
<b>Total Suspended Solids (mg/L)</b>		
Total Suspended Solids	NL	79.5
<b>Dissolved Metals (mg/L)</b>		
Aluminum	NL	0.0302 J
Antimony	0.006	0.02 U
Arsenic	0.01	0.05 U
Barium	2	0.0311
Beryllium	0.004	0.01 U
Cadmium	0.005	0.005 U
Calcium	NL	22.9
Chromium	0.1	0.01 U
Cobalt	NL	0.02 U
Copper	1.3	0.01 U
Iron	NL	0.0481 J
Lead	0.015	0.01 U
Magnesium	NL	6.30
Manganese	NL	0.0149 J
Mercury	0.002	0.0002 U
Nickel	NL	0.02 U
Potassium	NL	1.58
Selenium	0.05	0.02 U
Silica	NL	NA
Silver	NL	0.01 U
Sodium	NL	4.50
Thallium	0.002	0.02 U
Vanadium	NL	0.01 U
Zinc	NL	0.02 U
<b>Total Metals (mg/L)</b>		
Aluminum	NL	0.905
Antimony	0.006	0.02 U
Arsenic	0.01	0.00310 J
Barium	2	0.0436
Beryllium	0.004	0.01 U
Cadmium	0.005	0.005 U
Calcium	NL	27.3
Chromium	0.1	0.01 U
Cobalt	NL	0.02 U
Copper	1.3	0.01 U
Iron	NL	0.607
Lead	0.015	0.01 U
Magnesium	NL	7.57
Manganese	NL	0.0512
Mercury	0.002	0.0002 U
Nickel	NL	0.02 U
Potassium	NL	2.14
Selenium	0.05	0.02 U
Silver	NL	0.01 U
Sodium	NL	5.43
Thallium	0.002	0.02 U
Vanadium	NL	0.00237 J
Zinc	NL	0.02 U

Notes:

Highlighted results exceeded the Tennessee Water Quality Criteria.

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mg/L = Milligrams per liter

NA = The sample was not analyzed for this analyte.

NL = Not listed

TWQC Tennessee Water Quality Criteria

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



**TABLE 3**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 28 - 29, 2008**

Sample Designation:	TWQC	081228-ERPL-WS01	081228-ERER-WS02	081228-ERER-WS02-DUP
Sample Collection Date:		12/28/2008	12/28/2008	12/28/2008
Field Quality Control:				Field Duplicate
<b>Total Suspended Solids (mg/L)</b>				
Total Suspended Solids	NL	58	160	186
<b>Dissolved Metals (mg/L)</b>				
Aluminum	NL	0.152 J	0.0680 J	0.0643 J
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.05 U	0.05 U	0.05 U
Barium	2	0.0171 J	0.0197 J	0.0205
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	6.83	6.42	6.40
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.01 U	0.01 U	0.01 U
Iron	NL	0.155	0.0827 J	0.0832 J
Lead	0.015	0.01 U	0.01 U	0.01 U
Magnesium	NL	2.20	1.76	1.76
Manganese	NL	0.0155	0.0129 J	0.0120 J
Mercury	0.002	0.00004 J	0.00001 J	0.00003 J
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	0.993	1.07	1.06
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silica	NL	1.99	1.92	1.91
Silver	NL	0.0004 J	0.01 U	0.01 U
Sodium	NL	1.88	1.90	1.90
Thallium	0.002	0.02 U	0.02 U	0.0047 J
Vanadium	NL	0.01 U	0.01 U	0.01 U
Zinc	NL	0.02 U	0.02 U	0.02 U
<b>Total Metals (mg/L)</b>				
Aluminum	NL	5.84	1.85	1.85
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.00629 J	0.0127 J	0.0106 J
Barium	2	0.0389	0.0468	0.0434
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	8.55	9.00	7.35
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.00536 J	0.00524 J	0.00331 J
Iron	NL	6.22	1.48	1.49
Lead	0.015	0.00886 J	0.01 U	0.01 U
Magnesium	NL	3.11	2.38	2.28
Manganese	NL	0.0921	0.0629	0.0585
Mercury	0.002	0.00004 J	0.0002 U	0.0002 U
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	1.81	1.83	1.73
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silver	NL	0.01 U	0.01 U	0.01 U
Sodium	NL	2.05	2.27	2.04
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.0150	0.00593 J	0.00505 J
Zinc	NL	0.0125 J	0.0473	0.00719 J

Notes:

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TWQC Tennessee Water Quality Criteria

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**TABLE 3**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 28 - 29, 2008**

<b>Sample Designation:</b>	<b>TWQC</b>	<b>081228-SGUBR-WS03</b>	<b>081228-KCPS-WS04</b>	<b>KIF-TRM568.5</b>
<b>Sample Collection Date:</b>		<b>12/28/2008</b>	<b>12/28/2008</b>	<b>12/29/2008</b>
<b>Field Quality Control:</b>				
<b>Total Suspended Solids (mg/L)</b>				
Total Suspended Solids	NL	68	969	9.50
<b>Dissolved Metals (mg/L)</b>				
Aluminum	NL	0.2 U	0.0361 J	0.2 U
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.05 U	0.05 U	0.05 U
Barium	2	0.0319	0.0276	0.0184 J
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	30.3	23.3	14.1
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.01 U	0.01 U	0.01 U
Iron	NL	0.1 U	0.0398 J	0.1 U
Lead	0.015	0.01 U	0.01 U	0.01 U
Magnesium	NL	9.44	6.78	3.71
Manganese	NL	0.015 U	0.015 U	0.015 U
Mercury	0.002	0.00003 J	0.00007 J	0.00001 J
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	1.56	1.45	1.62
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silica	NL	2.01	1.97	1.81
Silver	NL	0.01 U	0.0005 J	0.01 U
Sodium	NL	5.84	4.68	8.62
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.01 U	0.01 U	0.01 U
Zinc	NL	0.02 U	0.02 U	0.02 U
<b>Total Metals (mg/L)</b>				
Aluminum	NL	2.27	8.20	0.257
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.00773 J	<b>0.0480 J</b>	0.05 U
Barium	2	0.0514	0.142	0.0260
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	34.2	25.1	16.6
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.00219 J	0.02 U
Copper	1.3	0.00282 J	0.0141	0.01 U
Iron	NL	2.51	3.99	0.305
Lead	0.015	0.01 U	0.00589 J	0.01 U
Magnesium	NL	11.5	7.98	4.69
Manganese	NL	0.0715	0.0816	0.0508
Mercury	0.002	0.00188	0.00006 J	0.0002 U
Nickel	NL	0.02 U	0.00604 J	0.02 U
Potassium	NL	2.18	3.59	2.05
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silver	NL	0.01 U	0.01 U	0.01 U
Sodium	NL	6.71	4.95	10.8
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.00625 J	0.0261	0.01 U
Zinc	NL	0.00777 J	0.0333	0.02 U

Notes:

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**TABLE 3**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 28 - 29, 2008**

<b>Sample Designation:</b>	<b>TWQC</b>	<b>KIF-CRM0.0</b>	<b>KIF-CRM2.0</b>	<b>TT-CRM2.5</b>
<b>Sample Collection Date:</b>		<b>12/29/2008</b>	<b>12/29/2008</b>	<b>12/29/2008</b>
<b>Field Quality Control:</b>				
<b>Total Suspended Solids (mg/L)</b>				
Total Suspended Solids	NL	46	14.5	13
<b>Dissolved Metals (mg/L)</b>				
Aluminum	NL	0.2 U	0.2 U	0.2 U
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.05 U	0.05 U	0.05 U
Barium	2	0.0172 J	0.0288	0.0280
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	14.2	24.7	27.8
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.01 U	0.01 U	0.01 U
Iron	NL	0.1 U	0.1 U	0.1 U
Lead	0.015	0.01 U	0.01 U	0.01 U
Magnesium	NL	3.72	7.40	8.41
Manganese	NL	0.015 U	0.015 U	0.015 U
Mercury	0.002	0.00001 J	0.00009 J	0.00010 J
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	1.62	1.45	1.51
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silica	NL	1.87	1.94	1.89
Silver	NL	0.01 U	0.01 U	0.0007 J
Sodium	NL	8.63	5.15	5.67
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.01 U	0.01 U	0.01 U
Zinc	NL	0.02 U	0.02 U	0.02 U
<b>Total Metals (mg/L)</b>				
Aluminum	NL	0.751	0.516	0.355
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.05 U	0.05 U	0.05 U
Barium	2	0.0311	0.0411	0.0384
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	16.4	28.6	31.2
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.00168 J	0.01 U	0.01 U
Iron	NL	1.12	0.466	0.328
Lead	0.015	0.01 U	0.01 U	0.01 U
Magnesium	NL	4.71	9.21	10.1
Manganese	NL	0.159	0.0507	0.0495
Mercury	0.002	0.00005 J	0.00006 J	0.00006 J
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	2.10	1.87	1.86
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silver	NL	0.01 U	0.01 U	0.00038 J
Sodium	NL	10.5	6.08	6.58
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.01 U	0.01 U	0.01 U
Zinc	NL	0.00634 J	0.02 U	0.02 U

Notes:

Highlighted results exceeded the Tennessee Water Quality Criteria.

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**TABLE 3**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 28 - 29, 2008**

<b>Sample Designation:</b>	<b>TWQC</b>	<b>KIF-CRM4.0</b>	<b>KIF-CRM5.5</b>	<b>KIF-ERM0.1</b>
<b>Sample Collection Date:</b>		<b>12/29/2008</b>	<b>12/29/2008</b>	<b>12/29/2008</b>
<b>Field Quality Control:</b>				
<b>Total Suspended Solids (mg/L)</b>				
Total Suspended Solids	NL	9.50	9	8.50
<b>Dissolved Metals (mg/L)</b>				
Aluminum	NL	0.2 U	0.2 U	0.0265 J
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.05 U	0.05 U	0.05 U
Barium	2	0.0286	0.0292	0.0240
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	28.5	30.2	13.3
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.01 U	0.01 U	0.01 U
Iron	NL	0.1 U	0.1 U	0.0376 J
Lead	0.015	0.01 U	0.01 U	0.01 U
Magnesium	NL	8.61	9.14	3.92
Manganese	NL	0.015 U	0.015 U	0.0126 J
Mercury	0.002	0.00003 J	0.00023	0.00002 J
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	1.51	1.56	1.18
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silica	NL	1.96	1.95	1.94
Silver	NL	0.0003 J	0.0003 J	0.0004 J
Sodium	NL	5.78	6.14	3.18
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.01 U	0.01 U	0.01 U
Zinc	NL	0.02 U	0.02 U	0.02 U
<b>Total Metals (mg/L)</b>				
Aluminum	NL	0.355	0.308	0.400
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.05 U	0.05 U	0.05 U
Barium	2	0.0374	0.0379	0.0320
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	31.7	34.1	14.7
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.01 U	0.01 U	0.01 U
Iron	NL	0.335	0.294	0.323
Lead	0.015	0.01 U	0.01 U	0.01 U
Magnesium	NL	10.3	11.1	4.63
Manganese	NL	0.0473	0.0518	0.0427
Mercury	0.002	0.00016 J	0.00003 J	0.00001 J
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	1.84	1.90	1.47
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silver	NL	0.01 U	0.01 U	0.01 U
Sodium	NL	6.63	7.08	3.35
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.01 U	0.01 U	0.01 U
Zinc	NL	0.02 U	0.02 U	0.02 U

Notes:

Highlighted results exceeded the Tennessee Water Quality Criteria.

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**TABLE 3**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 28 - 29, 2008**

Sample Designation:	Maximum	KIF-ERM-1.75	KIF-ERM4.0	KIF-ERM2.0
Sample Collection Date:	Contaminant	12/29/2008	12/29/2008	12/29/2008
Field Quality Control:	Levels			
<b>Total Suspended Solids (mg/L)</b>				
Total Suspended Solids	NL	12.5	9.50	21.5
<b>Dissolved Metals (mg/L)</b>				
Aluminum	NL	0.0439 J	0.0441 J	0.0411 J
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.05 U	0.05 U	0.05 U
Barium	2	0.0223	0.0226	0.0218
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	6.12	6.42	5.87
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.01 U	0.01 U	0.01 U
Iron	NL	0.0569 J	0.0621 J	0.0598 J
Lead	0.015	0.01 U	0.01 U	0.01 U
Magnesium	NL	1.54	1.64	1.47
Manganese	NL	0.0221	0.0275	0.0227
Mercury	0.002	0.00016 J	0.00021	0.00020 U
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	1.03	1.16	1.02
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silica	NL	1.85	2.07	1.86
Silver	NL	0.01 U	0.01 U	0.0007 J
Sodium	NL	1.95	2.02	1.91
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.01 U	0.01 U	0.01 U
Zinc	NL	0.02 U	0.02 U	0.02 U
<b>Total Metals (mg/L)</b>				
Aluminum	NL	0.587	0.582	0.995
Antimony	0.006	0.02 U	0.02 U	0.02 U
Arsenic	0.01	0.05 U	0.05 U	0.05 U
Barium	2	0.0328	0.0325	0.0377
Beryllium	0.004	0.01 U	0.01 U	0.01 U
Cadmium	0.005	0.005 U	0.005 U	0.005 U
Calcium	NL	6.83	6.92	6.81
Chromium	0.1	0.01 U	0.01 U	0.01 U
Cobalt	NL	0.02 U	0.02 U	0.02 U
Copper	1.3	0.01 U	0.01 U	0.01 U
Iron	NL	0.414	0.397	0.643
Lead	0.015	0.01 U	0.01 U	0.01 U
Magnesium	NL	1.87	1.92	1.87
Manganese	NL	0.0408	0.0442	0.0446
Mercury	0.002	0.00020 U	0.00005 J	0.00003 J
Nickel	NL	0.02 U	0.02 U	0.02 U
Potassium	NL	1.34	1.41	1.44
Selenium	0.05	0.02 U	0.02 U	0.02 U
Silver	NL	0.01 U	0.01 U	0.01 U
Sodium	NL	2.03	2.09	2.06
Thallium	0.002	0.02 U	0.02 U	0.02 U
Vanadium	NL	0.01 U	0.01 U	0.00230 J
Zinc	NL	0.02 U	0.00408 J	0.00467 J

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**TABLE 3**  
**EPA START UNVALIDATED SURFACE WATER SAMPLING RESULTS**  
**SAMPLES COLLECTED DECEMBER 28 - 29, 2008**

<b>Sample Designation:</b>	<b>Maximum</b>	<b>KIF-ERM2.0-DUP</b>
<b>Sample Collection Date:</b>	<b>Contaminant</b>	<b>12/29/2008</b>
<b>Field Quality Control:</b>	<b>Levels</b>	<b>Field Duplicate</b>
<b>Total Suspended Solids (mg/L)</b>		
Total Suspended Solids	NL	16.5
<b>Dissolved Metals (mg/L)</b>		
Aluminum	NL	0.0420 J
Antimony	0.006	0.02 U
Arsenic	0.01	0.05 U
Barium	2	0.0219
Beryllium	0.004	0.01 U
Cadmium	0.005	0.005 U
Calcium	NL	6.29
Chromium	0.1	0.01 U
Cobalt	NL	0.02 U
Copper	1.3	0.01 U
Iron	NL	0.0583 J
Lead	0.015	0.01 U
Magnesium	NL	1.47
Manganese	NL	0.0238
Mercury	0.002	0.00020 U
Nickel	NL	0.02 U
Potassium	NL	1.03
Selenium	0.05	0.02 U
Silica	NL	1.84
Silver	NL	0.01 U
Sodium	NL	1.91
Thallium	0.002	0.02 U
Vanadium	NL	0.01 U
Zinc	NL	0.0067 J
<b>Total Metals (mg/L)</b>		
Aluminum	NL	0.998
Antimony	0.006	0.02 U
Arsenic	0.01	0.05 U
Barium	2	0.0375
Beryllium	0.004	0.01 U
Cadmium	0.005	0.005 U
Calcium	NL	6.71
Chromium	0.1	0.01 U
Cobalt	NL	0.02 U
Copper	1.3	0.00198 J
Iron	NL	0.625
Lead	0.015	0.01 U
Magnesium	NL	1.83
Manganese	NL	0.0437
Mercury	0.002	0.00007 J
Nickel	NL	0.02 U
Potassium	NL	1.42
Selenium	0.05	0.02 U
Silver	NL	0.01 U
Sodium	NL	2.02
Thallium	0.002	0.02 U
Vanadium	NL	0.00218 J
Zinc	NL	0.00409 J

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