2017 Annual Groundwater Monitoring and Corrective Action Report

Tennessee Valley Authority
Allen Fossil Plant East Ash Disposal Area CCR Unit

Prepared for:
Tennessee Valley Authority
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January 31, 2018

Reference: 2017 Annual Groundwater Monitoring and Corrective Action Report
TVA Allen Fossil Plant East Ash Disposal Area CCR Unit

This report documents 2017 groundwater monitoring activities as required under the Federal coal combustion residuals (CCR) rule (the CCR Rule; 40 CFR 257.90(e)) at the Tennessee Valley Authority (TVA) Allen Fossil Plant (ALF) East Ash Disposal Area CCR Unit. TVA established a groundwater monitoring network and program at the ALF East Ash Disposal Area CCR Unit in accordance with 40 CFR 257.90. During 2017, TVA performed the following groundwater monitoring activities:

- A required groundwater quality monitoring network was established and certified by a qualified Professional Engineer as required by 40 CFR 257.91.
- Monitoring wells were video-logged and resurveyed to confirm accuracy in the documented well construction records.
- A groundwater quality sampling and analysis program was developed and implemented as required by 40 CFR 257.90.
- The required baseline monitoring of network wells was initiated and independent baseline samples, as required by 40 CFR 257.94(b), were collected.
- The sampling and analysis for the first detection monitoring event was completed in October 2017 in accordance with the CCR Rule [40 CFR 257.93 and 257.94(a)].
- Statistical analysis of baseline data was performed in accordance with the CCR Rule.
- No problems were encountered during the first-year phase of the TVA Ground Water Quality Monitoring Program and therefore, no further action has been recommended, except for the planned key activities for 2018 that are outlined below.

The projected key activities for 2018 are:

- Statistical procedures of the detection monitoring event were performed in accordance with the CCR Rule 40 CFR 257.93(h). Although not required to be included in this 2017 Annual Report, TVA has provided the January 15, 2018 determination of any statistically significant increases (SSIs) over background for the first detection monitoring event as shown in Table 1.
- Perform confirmation of SSIs via retesting procedures and error checking. Investigate whether the SSI over background resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality as specified in 40 CFR 257.94(e)(2).
- Perform an alternate source demonstration in accordance with 40 CFR 257.94(e)(2).
- Establish an assessment monitoring program in accordance with 40 CFR 257.94(e)(1) where applicable, if unable to establish that SSIs were the result of another source or the result of an error.
- Perform further field and desktop Site Characterization Investigations to improve the ALF Conceptual Site Model (CSM).
- Continue semi-annual detection monitoring at the certified groundwater monitoring network consistent with 40 CFR 257.94 for the 2018 Annual Groundwater Monitoring and Corrective Action Report.
- Continue and improve TVA's third-party Quality Assurance Program to evaluate groundwater analytical data using best practices concerning field methods and validation techniques, as well as the application of the most appropriate statistical methods.

- Review new data as it becomes available and implement changes to the groundwater monitoring program as necessary to maintain compliance with 40 CFR 257.90 through 257.98.
- Comply with recordkeeping requirements as specified in 40 CFR 257.105(h), notification requirements specified in 40 CFR 257.106(h) and internet requirements specified in 40 CFR 257.107(h).

GROUNDWATER MONITORING WELL NETWORK

The monitoring well network for the ALF East Ash Disposal Area CCR Unit consists of one background well (ALF-210) and eight downgradient wells (ALF-201, ALF-202, ALF-203, ALF-204, ALF-205, ALF-206, ALF-212 and ALF-213). Figure 1 is an aerial photograph that shows the groundwater monitoring well locations. The downgradient wells are installed at the waste boundary. The monitoring well network was designed for a single CCR Unit (East Ash Disposal Area).

No monitoring wells in the CCR network were installed or decommissioned during the 2017 reporting period. The certification of the groundwater monitoring system required under 40 CFR 257.91(f) is included in the facility operating record and on the CCR Compliance Data and Information website: https://www.tva.gov/Environment/Environmental-Stewardship/Coal-Combustion-Residuals.

GROUNDWATER SAMPLING AND LABORATORY ANALYTICAL TESTING

A groundwater sampling and analysis program was developed and includes procedures and techniques for: sample collection; sample preservation and shipment; analytical procedures; chain-of-custody control; and, quality assurance and quality control (QA/QC) required by 40 CFR 257.93(a). The groundwater monitoring program includes sampling and analysis procedures designed to provide monitoring results that are an accurate representation of groundwater quality at background and downgradient wells.

The first round of detection monitoring was completed in compliance with 40 CFR 257.94 and results are summarized in Table 1. Baseline groundwater samples were obtained between November 2016 and August 2017. Baseline groundwater sampling results are summarized in Table 2. A summary of groundwater sample locations, well designations, analytes sampled, sampling dates and monitoring program status is provided in Table 3.

Baseline data for both Appendix III and IV constituents were required to be collected prior to the establishment of upper prediction limits (UPLs) or Groundwater Protection Standards (GWPS). Under a CCR-required assessment monitoring program, GWPS will be established in accordance with 40 CFR 257.95(h), at which time maximum contaminant levels (MCLs) may or may not be considered the appropriate GWPS depending on background well concentrations for each Appendix IV constituent. The appropriate GWPS will establish the assessment groundwater monitoring program and any assessment of corrective measures.

Groundwater elevations were measured in each monitoring well immediately prior to purging during each sampling event as required by 40 CFR 257.93(c). Groundwater elevations and McKellar Lake surface water elevations are summarized in Table 4. Groundwater flow directions were determined for each sampling event, and a generalized depiction of groundwater flow direction is illustrated on Figure 2. The groundwater directional flow at the ALF East Ash Disposal Area is influenced by McKellar Lake to the north of the site. The primary groundwater flow direction is to the north toward McKellar Lake.

Testing for hydraulic conductivity at the background or downgradient groundwater monitoring wells, as summarized in Table 5, was determined by a recent hydrogeologic evaluation. The uppermost aquifer at the ALF CCR Unit is the Alluvial Aquifer. These alluvial deposits are composed of a fine to medium-grained silty sand with intervals of fine-grained silts and clays in the upper portion of the unit and fine- to coarse-grained sand with trace fine- to coarse-grained gravel in the lower portion. The alluvial deposits are underlain by the fine-grained Cook Mountain Formation (hydrogeologically referred to as the upper Claiborne confining unit in this location). The Cook Mountain Formation is underlain by the Memphis Sand, which is characterized by predominantly very fine to very coarse-grained sand with lenses of fine grained material and is referred to as the Memphis Aquifer.

Hydraulic conductivity testing results are summarized in Table 4. Testing data indicates the Alluvial Aquifer has a geometric mean hydraulic conductivity of 1.68×10^{-2} centimeters per second (cm/sec) (Stantec, 2017). Linear groundwater flow velocity was calculated for the uppermost aquifer using:

- the geometric mean hydraulic conductivity calculated from hydraulic testing;
- horizontal hydraulic gradients measured during the implementation of the groundwater sampling and analysis program, ranging from 0.0015 to 0.0019 feet per foot (ft/ft); and,
- an effective porosity ranging from 35% in the native sand to 48% in the native silt.

The average linear flow velocity in the uppermost aquifer ranges from approximately 54 to 94 feet per year.

The groundwater monitoring data was evaluated using statistical procedures as required by 40 CFR 257.93(f) through 257.93(h). The statistical method certification is included in the facility operating record and the CCR Compliance Data and Information website. Background groundwater quality was established for the upgradient or background monitoring wells.

NARRATIVE DISCUSSION OF ANY TRANSITION BETWEEN MONITORING PROGRAMS

In January 2018 TVA evaluated the groundwater monitoring data for SSIs over background levels for the constituents listed in Appendix III[1] as required by 40 CFR 257.93(h). Although not required to be included in this 2017 Annual Groundwater Monitoring and Corrective Action Report concerning the preceding calendar year, TVA has provided the January 15, 2018 determination (based on the current dataset) of any SSIs over background for the first detection monitoring event. The groundwater analytical results from the initial round of detection monitoring indicated SSIs of Appendix III CCR constituents at the downgradient monitoring wells. TVA plans to perform confirmation of SSIs via retesting procedures and error checking and to investigate whether the SSI over background resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality as specified in 40 CFR 257.94(e)(2). TVA also plans to perform investigations to determine whether a source other than the CCR materials contained within the ALF East Ash Disposal Area are the cause of any verified SSI over background as specified in 40 CFR 257.94(e)(2). If TVA is unable to demonstrate that the SSI was a result of error or another source, then an Assessment Monitoring Program will be established and implemented as specified in 40 CFR 257.95.

[1] Appendix III CCR Constituents: boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids (TDS)

LIMITATIONS

This document entitled 2017 Annual Groundwater Monitoring and Corrective Action Report was prepared by Stantec Consulting Services Inc. ("Stantec") for the Tennessee Valley Authority (the "Client"). The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec relied upon data and information supplied to it by the client.

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References:

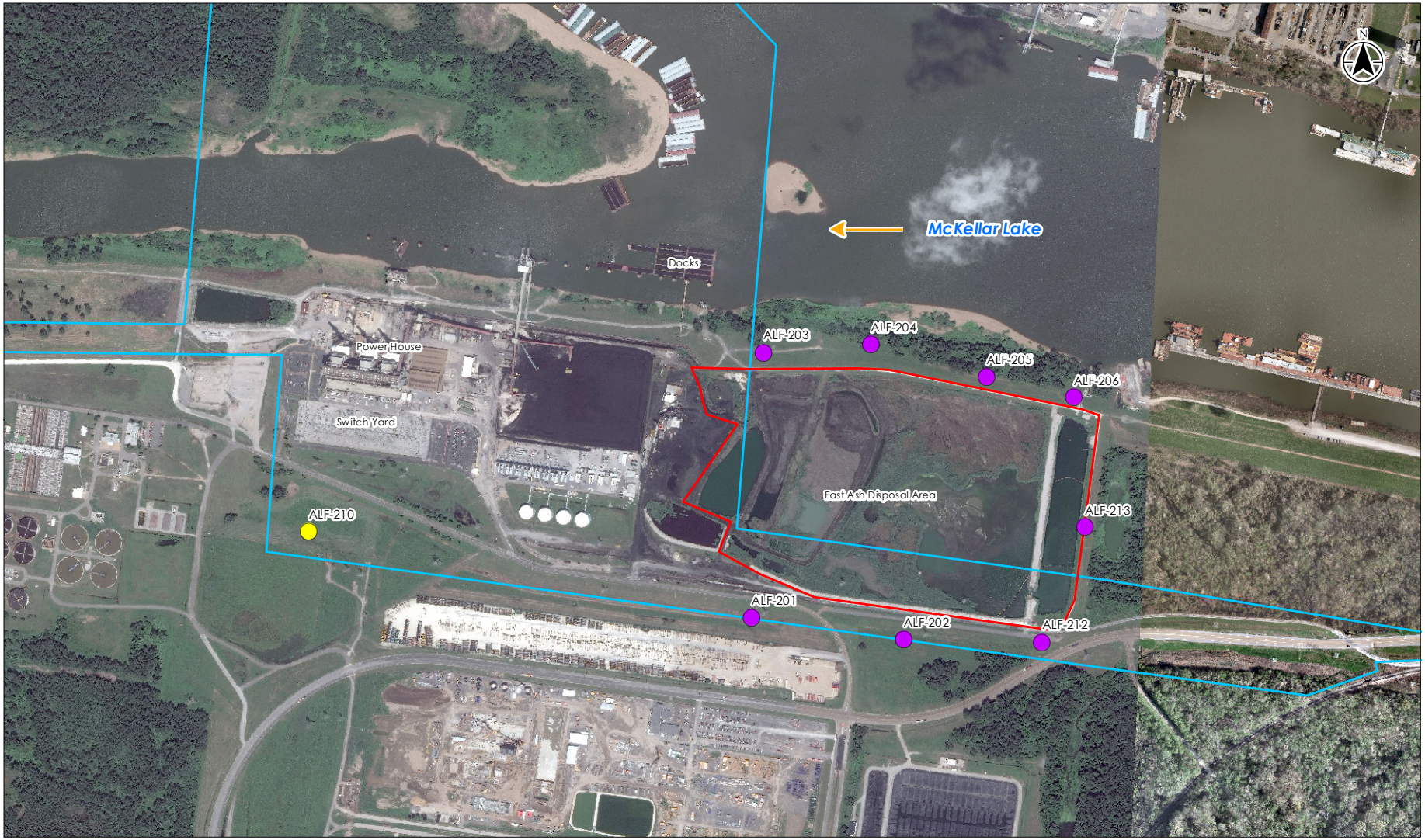
Stantec, 2017. *TVA Allen Fossil Plant Remedial Investigation Report (DRAFT)*. December 20, 2017

Attachments:

Figure 1 – Map with CCR Unit Background and Downgradient Wells
Figure 2 – Generalized Groundwater Flow Direction Map

Table 1 – Detection Monitoring Groundwater Sampling Results
Table 2 – Baseline Groundwater Sampling Results
Table 3 – Groundwater Sampling Summary
Table 4 – Groundwater and Surface Water Elevation Summary
Table 5 – Hydraulic Conductivity Data Summary

FIGURES



Background Well

Downgradient Well

CCR Unit Subject to CCR Rule

TVA Property Boundary

0 500 1,000 Feet

1:12,000 (At original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Client (dated 2016)

Stantec

TVA

Project Location	182603174
City of Memphis	Prepared by WSW on 2018-01-30
Shelby County,	Technical Review by SB on 2018-01-30
Tennessee	Independent Review by JK on 2018-01-30

Client/Project
Tennessee Valley Authority
Allen Fossil Plant
CCR Rule

Figure No.
1

Title
Map with CCR Unit Background and Downgradient Wells

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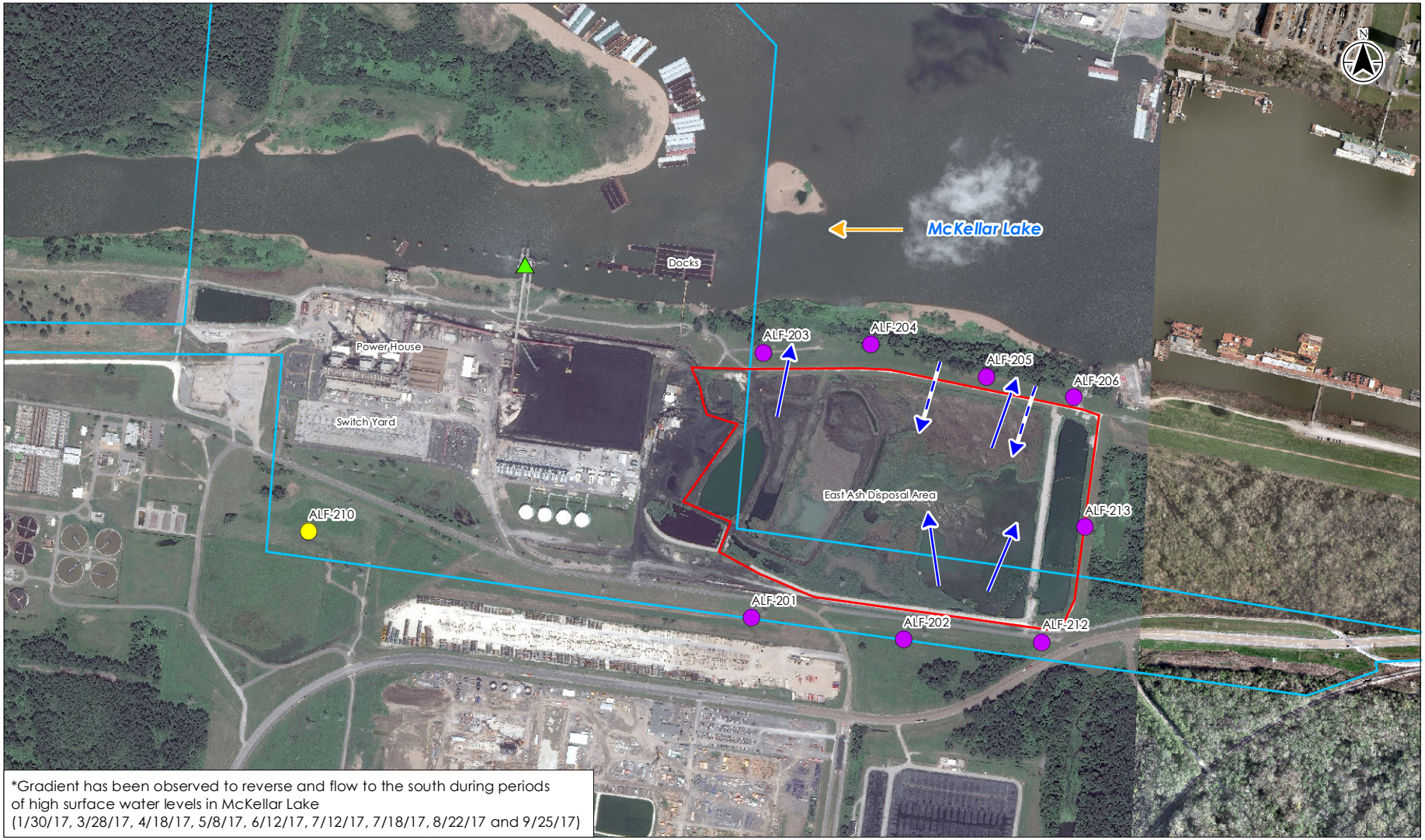

*Gradient has been observed to reverse and flow to the south during periods of high surface water levels in McKellar Lake (1/30/17, 3/28/17, 4/18/17, 5/8/17, 6/12/17, 7/12/17, 7/18/17, 8/22/17 and 9/25/17)

Staff Gauge

Background Well

Downgradient Well

Groundwater Flow Direction

Groundwater Flow Direction (Gradient Reverses)*

CCR Unit Subject to CCR Rule

TVA Property Boundary

Groundwater flow directions are based on McKellar Lake elevations and groundwater elevations from CCR and Non-CCR monitoring wells.

0 500 1,000 Feet

1:12,000 (At original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 StatePlane Tennessee FIPS 4100 Feet
2. Imagery Provided by Client (dated 2016)

Stantec

TVA

Project Location	182603174
City of Memphis Shelby County, Tennessee	Prepared by WSW on 2018-01-30 Technical Review by SB on 2018-01-30 Independent Review by JK on 2018-01-30

Client/Project
Tennessee Valley Authority
Allen Fossil Plant
CCR Rule

Figure No.
2

Title
Generalized Groundwater Flow Direction Map

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TABLES

TABLE 1
Detection Monitoring Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Constituent	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	TDS
Unit	mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
BTV (UPL)	0.0984	166	1.88	0.377	6.59 – 6.90*	28.9	555
Well ID	Detection Monitoring First Round Results (for samples taken on September 25-26, 2017)						
ALF-201	**3.38**	90.4	**12.3**	**1.24**	**7.00**	**85.4**	506
ALF-202	**5.39**	21.7	**15.4**	**3.76**	**7.66**	**139**	375
ALF-203	**4.73**	10.1	**17.5**	**4.46**	**9.74**	**222**	**676**
ALF-204	**0.418**	66.6	**17.7**	0.259	**7.20**	13.8	358
ALF-205	**6.97**	82.7	**21.9**	**1.63**	**7.03**	**99.9**	530
ALF-206	**0.117**	41.9	**17.0**	0.357	**7.27**	24.2	227
ALF-212	**2.41**	76.1	**17.9**	**1.75**	**7.10**	14.8	490
ALF-213	**0.222**	59.6	**14.0**	0.278	**7.05**	9.59	315
ALF-210	0.066	115	1.04	0.218	6.74	12.7	483

Notes:

Bold and underlined concentration indicates an SSI over background

SSI - Statistically Significant Increase

BTV - Background Threshold Values

UPL - Upper Prediction Limit

TDS - Total Dissolved Solids

mg/L - milligrams per liter

SU - Standard Unit

Well ALF-210 is a background monitoring well. Sampling data included to document detection monitoring groundwater sampling results.

* indicates the lower bound of the range is the lower prediction limit (LPL). The upper bound is the UPL.

TABLE 2
Baseline Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Monitoring Well		ALF-201																			
Sample Date		15-Nov-16		30-Jan-17		28-Feb-17		28-Mar-17		18-Apr-17		10-May-17		13-Jun-17		13-Jul-17		19-Jul-17		24-Aug-17	
Sample Type		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline	
Location/Well ID		ALF-201		ALF-201		ALF-201		ALF-201		ALF-201		ALF-201		ALF-201		ALF-201		ALF-201		ALF-201	
Sample ID		ALF-GW-005-11152016		ALF-GW-005-01302017		ALF-GW-005-02282017		ALF-GW-005-03282017		ALF-GW-005-04182017		ALF-GW-005-05102017		ALF-GW-005-06132017		ALF-GW-005-07132017		ALF-GW-005-07192017		ALF-GW-005-08242017	
Well Designation		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient	
Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Total Metals																					
Antimony	mg/L	< 0.000269	U*	< 0.000634	U*	< 0.000670	U*	< 0.00131	U*	< 0.000443	U	< 0.000443	U	< 0.000443	U	< 0.00143	U*	< 0.000443	U	<0.000443	U
Arsenic	mg/L	0.00173	J	0.00337		0.00392		0.00344		0.00365		0.00314		0.00267		0.00259		0.00247		0.0185	
Barium	mg/L	0.219		0.386		0.200		0.206		0.319		0.463		0.190		0.225		0.224		0.358	
Beryllium	mg/L	< 0.000102	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U
Boron	mg/L	3.87		1.90	J	5.13		3.57		1.46		1.65		2.94		2.82		3.31		3.68	
Cadmium	mg/L	< 0.000152	U	< 0.0000781	U	< 0.000110	U*	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	0.000194	J	< 0.0000781	U	< 0.0000781	U	<0.0000781	U
Calcium	mg/L	90.6		127		74.5		79.6		114		139		91.0		101		108		103	
Chromium	mg/L	< 0.000339	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	UJ	0.000381	J	< 0.000378	U	0.000562	J
Cobalt	mg/L	0.00115		0.00120		0.000944		0.000795		0.00140		< 0.000635	U*	0.000852		0.000648		0.000788		0.000769	
Lead	mg/L	< 0.0000675	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U
Lithium	mg/L	0.0168		0.0244		0.0168		< 0.0157	U*	0.0207		0.0225		0.0156		0.0159		0.0159		0.0160	
Mercury	mg/L	< 0.0000521	U	< 0.0000521	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U
Molybdenum	mg/L	0.247		0.0317		0.396		0.290		0.0373		0.0230		0.240		0.239		0.244		0.300	
Selenium	mg/L	0.000452	J	< 0.00127	U	< 0.00127	U	0.00286	J	< 0.00127	U	< 0.00127	U	0.00222	J	0.00394	J	0.00212	J	0.00475	J
Thallium	mg/L	< 0.0000360	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U
Radium 226 + radium 228	pCi/L	< 0.865	U	< 1.33	U	0.644	J	< 0.184	UJ	0.907	J	< 1.83	U*	< 0.466	U	< 1.09	U*	0.549	J	< 1.48	U*
Anions																					
Chloride	mg/L	7.29		8.31		14.2		11.0		8.04		9.34		10.8		10.6		11.7		12.2	
Fluoride	mg/L	1.01		0.384		1.48		1.26		0.569		0.282		1.29		1.42		1.12		1.10	
Sulfate	mg/L	89.3		43.2		94.6		82.5		32.8		51.2		77.5		75.2		79.1		81.0	
General Chemistry																					
Total Dissolved Solids	mg/L	484		530		477		491		514		572		497		508		533		505	
Field pH																					
pH (field)	SU	6.94		6.85		7.04		6.9		6.88		6.80		6.95		7.55		6.91		7.07	

Notes:
NA - Not Available
Q - Data Qualifier
U* - Result should be considered "not-detected" because it was detected in a rinsate blank or laboratory blank at a similar level
J - Quantitation is approximate due to limitations identified during data validation
UJ - Analyte not detected, but the reporting limit may or may not be higher due to a bias identified during data validation
U - Analyte not detected
mg/L - milligrams per liter
pCi/L - picoCurie per liter
SU - Standard Unit

TABLE 2
Baseline Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Monitoring Well		ALF-202																			
Sample Date		14-Nov-16		30-Jan-17		28-Feb-17		28-Mar-17		18-Apr-17		10-May-17		13-Jun-17		13-Jul-17		19-Jul-17		23-Aug-17	
Sample Type		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline	
Location/Well ID		ALF-202		ALF-202		ALF-202		ALF-202		ALF-202		ALF-202		ALF-202		ALF-202		ALF-202		ALF-202	
Sample ID		ALF-GW-006-11142016		ALF-GW-006-01302017		ALF-GW-006-02282017		ALF-GW-006-03282017		ALF-GW-006-04182017		ALF-GW-006-05102017		ALF-GW-006-06132017		ALF-GW-006-07132017		ALF-GW-006-07192017		ALF-GW-006-08232017	
Well Designation		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient	
Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Total Metals																					
Antimony	mg/L	< 0.000217	U*	< 0.000944	U*	< 0.000443	U*	< 0.00107	U*	< 0.000443	U	< 0.000443	U	< 0.000443	U	< 0.000958	U*	< 0.000443	U	< 0.000726	U*
Arsenic	mg/L	0.177	J	0.176		0.199		0.245		0.197		0.234		0.228		0.221		0.298		0.281	
Barium	mg/L	0.0703		0.0751		0.0665		0.0735		0.0637		0.0712		0.0745		0.0716		0.0825		0.0769	
Beryllium	mg/L	< 0.000102	U	< 0.000131	UJ	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	0.000157	
Boron	mg/L	5.37		6.13		6.06		5.51		4.90		7.16		6.01		5.10		5.74		6.29	
Cadmium	mg/L	0.000171	J	0.000109	J	< 0.000151	U*	0.0000980	J	0.000135	J	0.000187	J	0.000214	J	< 0.0000781	U	0.0000820	J	< 0.0000781	U
Calcium	mg/L	24.8		24.2		22.1		20.4		20.9		23.4		23.1		24.9		28.3		25.9	
Chromium	mg/L	< 0.000339	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	UJ	< 0.000378	U	< 0.000378	U	< 0.000378	U
Cobalt	mg/L	0.000220	J	0.000109	J	0.000138	J	0.000120	J	0.000105	J	< 0.000129	U*	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	0.000242	J
Lead	mg/L	0.000883	J	0.000619	J	0.000908	J	0.000924	J	0.000686	J	0.000563	J	0.000481	J	< 0.000318	U	< 0.000318	U	0.000810	J
Lithium	mg/L	0.00838		< 0.0118	U*	< 0.00929	U*	< 0.00803	U*	0.00753		< 0.00765	U*	0.00787		0.00798		0.00812		0.00719	
Mercury	mg/L	< 0.0000521	U	< 0.0000521	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U
Molybdenum	mg/L	0.473		0.313		0.288		0.291		0.288		0.309		0.329		0.340		0.349		0.478	
Selenium	mg/L	< 0.000348	U	< 0.00127	U	< 0.00127	U	0.00150	J	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U
Thallium	mg/L	< 0.0000360	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U
Radium 226 + radium 228	pCi/L	< 0.479	U	< 1.05	U	< 0.609	U	< 0.918	U*	0.458	J	< 0.381	UJ	< 0.448	U	< 0.446	U	< 0.318	U	< 0.531	U
Anions																					
Chloride	mg/L	13.8		17.0		16.9		13.5		16.4		15.5		16.2		16.2		15.3		16.4	
Fluoride	mg/L	4.45		3.46		3.49		3.63		3.50		3.09		3.60		3.68		3.67		3.29	
Sulfate	mg/L	133		168		164		137		153		153		147		152		136		151	
General Chemistry																					
Total Dissolved Solids	mg/L	335		391		392		392		373		386		371		383		391		406	
Field pH																					
pH (field)	SU	7.90		7.46		7.45		7.29		7.45		7.34		7.23		7.55		7.54			

Notes:
NA - Not Available
Q - Data Qualifier
U* - Result should be considered "not-detected" because it was detected in a rinsate blank or laboratory blank at a similar level
J - Quantitation is approximate due to limitations identified during data validation
UJ - Analyte not detected, but the reporting limit may or may not be higher due to a bias identified during data validation
U - Analyte not detected
mg/L - milligrams per liter
pCi/L - picoCurie per liter
SU - Standard Unit

TABLE 2
Baseline Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Monitoring Well		ALF-203																			
Sample Date		16-Nov-16		31-Jan-17		01-Mar-17		29-Mar-17		19-Apr-17		09-May-17		14-Jun-17		14-Jul-17		19-Jul-17		23-Aug-17	
Sample Type		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline	
Location/Well ID		ALF-203		ALF-203		ALF-203		ALF-203		ALF-203		ALF-203		ALF-203		ALF-203		ALF-203		ALF-203	
Sample ID		ALF-GW-007-11162016		ALF-GW-007-01312017		ALF-GW-007-03012017		ALF-GW-007-03292017		ALF-GW-007-04192017		ALF-GW-007-05092017		ALF-GW-007-06142017		ALF-GW-007-07142017		ALF-GW-007-07192017		ALF-GW-007-08232017	
Well Designation		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient	
Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Total Metals																					
Antimony	mg/L	< 0.000990	U*	< 0.00168	U*	< 0.00140	U*	< 0.00197	U*	< 0.00181	U*	< 0.00193	U*	0.00136	J	< 0.00247	U*	< 0.00197	U*	< 0.00218	U*
Arsenic	mg/L	3.90	J	3.23		3.22		3.62		2.89		3.56		3.37		3.52		4.14		3.55	
Barium	mg/L	0.0362		0.0395		0.0348		0.0329		0.0355		0.0448		0.0368		0.0333		0.0336		0.0312	
Beryllium	mg/L	0.000149	J	0.000145		0.000228	J	< 0.000131	U	0.000175	J	0.000249	J	0.000256	J	0.000191	J	0.000151	J	0.000189	J
Boron	mg/L	3.87		5.25	J	5.77		5.31		4.08		6.83		5.57		5.23		5.41		5.76	
Cadmium	mg/L	0.00256		0.00274		0.00235		0.00355		0.00372		0.00361		0.00302		0.00298		0.00308		0.00298	
Calcium	mg/L	16.1		15.8		14.0		10.1		13.1		14.2		13.2		12.2		12.4		10.4	
Chromium	mg/L	0.00214		0.00277		< 0.00193	U*	0.00253		0.00264		0.00227		0.00270		0.00328		0.00299		0.00215	
Cobalt	mg/L	0.00144		0.00119		0.00118		0.00149		0.00130		0.00121		0.00112		0.00127		0.00135		0.000848	
Lead	mg/L	0.0362		0.0420		0.0363		0.0604		0.0613		0.0639		0.0568		0.0559		0.0565		0.0673	
Lithium	mg/L	< 0.00405	U*	< 0.00669	U*	< 0.00488	U*	< 0.00310	U*	0.00319	J	< 0.00341	U*	0.00296	J	0.00360	J	0.00281	J	< 0.00212	U
Mercury	mg/L	< 0.0000521	U	< 0.0000521	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	0.0000883	J	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	0.0000891	J
Molybdenum	mg/L	0.284		0.267		0.256		0.270		0.254		0.296		0.276		0.284		0.307		0.301	
Selenium	mg/L	0.00696		0.00526		0.00549		0.0108	J	0.00723		0.00644		0.00545		0.00798		0.00787		0.00767	
Thallium	mg/L	< 0.0000360	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U
Radium 226 + radium 228	pCi/L	< 0.630	U	< 0.653	U	< 0.841	U	< 1.05	U	1.75	J	< 0.900	U*	< 1.83	U	< 1.93	U*	< 1.48	UJ	< 1.26	U
Anions																					
Chloride	mg/L	12.6		13.6		13.8		11.9		14.8		14.4		15.2		16.0		15.2		17.7	
Fluoride	mg/L	5.26		4.14		4.97		5.01		4.94		4.53		5.44		5.53		5.26		4.34	
Sulfate	mg/L	141		184		188		143		158		152		157		164		153		187	
General Chemistry																					
Total Dissolved Solids	mg/L	420		557		533		506		490		508		519		524		529		627	
Field pH																					
pH (field)	SU	8.72		8.85		9.07		9.1		9.1		9.06		9.07		9.29		9.36		10.10	

Notes:
NA - Not Available
Q - Data Qualifier
U* - Result should be considered "not-detected" because it was detected in a rinsate blank or laboratory blank at a similar level
J - Quantitation is approximate due to limitations identified during data validation
UJ - Analyte not detected, but the reporting limit may or may not be higher due to a bias identified during data validation
U - Analyte not detected
mg/L - milligrams per liter
pCi/L - picoCurie per liter
SU - Standard Unit

TABLE 2
Baseline Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Monitoring Well		ALF-204																			
Sample Date		16-Nov-16		31-Jan-17		01-Mar-17		29-Mar-17		19-Apr-17		09-May-17		14-Jun-17		14-Jul-17		19-Jul-17		23-Aug-17	
Sample Type		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline	
Location/Well ID		ALF-204		ALF-204		ALF-204		ALF-204		ALF-204		ALF-204		ALF-204		ALF-204		ALF-204		ALF-204	
Sample ID		ALF-GW-008-11162016		ALF-GW-008-01312017		ALF-GW-008-03012017		ALF-GW-008-03292017		ALF-GW-008-04192017		ALF-GW-008-05092017		ALF-GW-008-06142017		ALF-GW-008-07142017		ALF-GW-008-07192017		ALF-GW-008-08232017	
Well Designation		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient	
Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Total Metals																					
Antimony	mg/L	< 0.000164	U*	< 0.000820	U*	< 0.000613	U*	< 0.000840	U*	< 0.000507	U*	< 0.000443	U	< 0.000443	U	< 0.00116	U*	< 0.000443	U	< 0.000443	U
Arsenic	mg/L	0.0460	J	0.0428		0.0368		0.0499		0.0491		0.0569		0.0455		0.0387		0.0473		0.0364	
Barium	mg/L	0.358		0.318		0.332		0.296		0.300		0.332		0.285		0.257		0.261		0.242	
Beryllium	mg/L	< 0.000102	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U
Boron	mg/L	0.461		0.659	J	0.598		0.525		0.467		0.721		0.534		0.551		0.660		0.543	
Cadmium	mg/L	< 0.000152	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U
Calcium	mg/L	64.6		78.5		75.8		61.4		75.2		78.0		67.1		68.2		72.1		67.4	
Chromium	mg/L	< 0.000339	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	0.000405	J	< 0.000378	U	< 0.000378	U
Cobalt	mg/L	0.000132	J	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U
Lead	mg/L	< 0.0000675	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U
Lithium	mg/L	0.00992		< 0.0140	U*	< 0.0127	U*	< 0.00949	U*	0.00894		< 0.00923	U*	0.00852		0.00909		0.00814		0.00755	
Mercury	mg/L	< 0.0000521	U	< 0.0000521	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U
Molybdenum	mg/L	0.00525		0.00693		0.00261	J	0.00624		0.00861		0.00963		0.00908		0.00767		0.00820		0.00772	
Selenium	mg/L	< 0.000348	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U
Thallium	mg/L	< 0.0000360	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U
Radium 226 + radium 228	pCi/L	< 0.630	U	< 0.239	U	0.965	J	< 0.966	U	0.901	J	< 0.795	U*	< 0.383	U	< 0.637	U*	1.07	J	< 0.0573	U
Anions																					
Chloride	mg/L	11.4		18.0		19.0		15.4		17.4		16.6		17.3		17.5		18.2		18.3	
Fluoride	mg/L	0.249		0.224		2.50		0.283		0.289		0.233		0.310		0.262		0.247		0.220	
Sulfate	mg/L	9.72		2.25		0.792	J	1.33		6.29		16.8		13.8		13.0		10.0		12.1	
General Chemistry																					
Total Dissolved Solids	mg/L	398		458		422		400		403		375		380		354		341		366	
Field pH																					
pH (field)	SU	7.00		7.00		7.09		7.10		7.01		7.02		7.07		6.99		7.12		7.25	

Notes:
NA - Not Available
Q - Data Qualifier
U* - Result should be considered "not-detected" because it was detected in a rinsate blank or laboratory blank at a similar level
J - Quantitation is approximate due to limitations identified during data validation
UJ - Analyte not detected, but the reporting limit may or may not be higher due to a bias identified during data validation
U - Analyte not detected
mg/L - milligrams per liter
pCi/L - picoCurie per liter
SU - Standard Unit

TABLE 2
Baseline Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Monitoring Well		ALF-205																			
Sample Date		16-Nov-16		31-Jan-17		01-Mar-17		29-Mar-17		18-Apr-17		09-May-17		14-Jun-17		13-Jul-17		19-Jul-17		24-Aug-17	
Sample Type		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline	
Location/Well ID		ALF-205		ALF-205		ALF-205		ALF-205		ALF-205		ALF-205		ALF-205		ALF-205		ALF-205		ALF-205	
Sample ID		ALF-GW-009-11162016		ALF-GW-009-01312017		ALF-GW-009-03012017		ALF-GW-009-03292017		ALF-GW-009-04182017		ALF-GW-009-05092017		ALF-GW-009-06142017		ALF-GW-009-07132017		ALF-GW-009-07192017		ALF-GW-009-08242017	
Well Designation		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient	
Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Total Metals																					
Antimony	mg/L	< 0.000303	U*	< 0.000751	U*	< 0.000628	U*	< 0.00133	U*	< 0.000601	U*	< 0.000443	U	< 0.000443	U	< 0.000856	U*	< 0.000443	U	< 0.000634	U*
Arsenic	mg/L	0.00110	J	0.00154		0.00122		0.00141		0.00195		0.00266		0.00160		0.00183		0.00159		< 0.00203	U*
Barium	mg/L	0.106		0.0833		0.0885		0.0784		0.103		0.131		0.110		0.100		0.0913		0.112	
Beryllium	mg/L	< 0.000102	U	< 0.000131	UJ	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U
Boron	mg/L	6.99		6.72	J	7.46		6.29		5.53		8.81		7.95		7.47		7.88		9.14	
Cadmium	mg/L	< 0.000152	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	0.000126	J	0.000206	J	< 0.0000781	U	< 0.0000781	U	0.000170	J
Calcium	mg/L	61.8		53.3		54.3		43.9		61.4		74.2		62.3		59.4		58.1		58.4	
Chromium	mg/L	< 0.000339	U	0.000424	J	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U
Cobalt	mg/L	0.000966		0.00132		0.00111		0.00101		0.00106		0.00105		0.000903		0.00113		0.00114		0.00101	
Lead	mg/L	0.0000880	J	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U
Lithium	mg/L	0.0148		< 0.0161	U*	< 0.0141	U*	< 0.0114	U*	0.0127		0.0145		0.0134		0.0132		0.0124		0.0124	
Mercury	mg/L	< 0.0000521	U	< 0.0000521	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U
Molybdenum	mg/L	0.252		0.279		0.299		0.325		0.292		0.314		0.325		0.311		0.337		0.365	
Selenium	mg/L	0.000816	J	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U
Thallium	mg/L	< 0.0000360	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U
Radium 226 + radium 228	pCi/L	< 0.734	U	< 0.578	U	< 0.227	U	< 0.0561	U	0.787	J	< 0.448	U*	< 0.564	U	< 0.657	U	< 0.168	U	< 0.432	U
Anions																					
Chloride	mg/L	15.1		23.1		23.0		20.3		23.4		22.2		23.3		23.1		23.9		23.6	
Fluoride	mg/L	1.90		2.54		2.50		2.68		2.48		2.06		2.55		2.57		2.53		2.31	
Sulfate	mg/L	94.8		123		125		91.0		103		94.4		107		108		94.7		114	
General Chemistry																					
Total Dissolved Solids	mg/L	401		461		455		436		454		492		469		462		455		457	
Field pH																					
pH (field)	SU	7.17		7.21		7.22		7.32		7.11		7.05		7.08		7.24		7.27		7.4	

Notes:
NA - Not Available
Q - Data Qualifier
U* - Result should be considered "not-detected" because it was detected in a rinsate blank or laboratory blank at a similar level
J - Quantitation is approximate due to limitations identified during data validation
UJ - Analyte not detected, but the reporting limit may or may not be higher due to a bias identified during data validation
U - Analyte not detected
mg/L - milligrams per liter
pCi/L - picoCurie per liter
SU - Standard Unit

TABLE 2
Baseline Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Monitoring Well		ALF-206																			
Sample Date		16-Nov-16		30-Jan-17		28-Feb-17		29-Mar-17		18-Apr-17		09-May-17		13-Jun-17		13-Jul-17		19-Jul-17		23-Aug-17	
Sample Type		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline	
Location/Well ID		ALF-206		ALF-206		ALF-206		ALF-206		ALF-206		ALF-206		ALF-206		ALF-206		ALF-206		ALF-206	
Sample ID		ALF-GW-010-11162016		ALF-GW-010-01302017		ALF-GW-010-02282017		ALF-GW-010-03292017		ALF-GW-010-04182017		ALF-GW-010-05092017		ALF-GW-010-06132017		ALF-GW-010-07132017		ALF-GW-010-07192017		ALF-GW-010-08232017	
Well Designation		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient	
Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Total Metals																					
Antimony	mg/L	< 0.000227	U*	< 0.000691	U*	< 0.000527	U*	< 0.000910	U*	< 0.000762	U*	< 0.000443	U	< 0.000443	U	< 0.00250	U*	< 0.000543	U*	< 0.000443	U
Arsenic	mg/L	0.00322	J	0.00448		0.00536		0.00580		0.00489		0.00644		0.00531		0.00555		0.00750		0.00471	
Barium	mg/L	0.241		0.245		0.232		0.237		0.243		0.281		0.238		0.229		0.233		0.197	
Beryllium	mg/L	< 0.000102	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U
Boron	mg/L	0.121		0.125	J	0.118		0.0932		0.0879		0.131		0.103		0.113		0.178		< 0.141	U*
Cadmium	mg/L	< 0.000152	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U
Calcium	mg/L	50.0		50.2		46.0		42.5		44.0		45.4		39.8		40.0		42.9		43.4	
Chromium	mg/L	< 0.000339	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	UJ	< 0.000378	U	< 0.000378	U	< 0.000378	U
Cobalt	mg/L	0.0000500	J	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U
Lead	mg/L	< 0.0000675	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U
Lithium	mg/L	< 0.00752	U*	< 0.00931	U*	< 0.00768	U*	< 0.00642	U*	0.00550		< 0.00585	U*	0.00584		0.00686		0.00550		0.00532	
Mercury	mg/L	< 0.0000521	U	< 0.0000521	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U
Molybdenum	mg/L	0.00277	J	0.00203	J	0.00169	J	< 0.00170	U*	0.00221	J	< 0.00263	U*	0.00233	J	0.00246	J	0.00230	J	< 0.00340	U*
Selenium	mg/L	< 0.000348	U	< 0.00127	U	< 0.00127	U	0.00127	J	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U
Thallium	mg/L	< 0.0000360	U	< 0.0000531	U	< 0.000198	U*	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.000163	U*
Radium 226 + radium 228	pCi/L	< 0.751	U	< 0.652	U	< 0.595	U	< 0.603	U*	0.746	J	< 0.413	U*	< 0.209	U	< 0.886	U*	< 0.328	U	< 0.325	U
Anions																					
Chloride	mg/L	11.7		17.8		17.5		16.9		18.3		17.3		16.4		16.4		15.8		16.9	
Fluoride	mg/L	0.302		0.315		0.240		0.361		0.355		0.331		0.401		0.372		0.331		0.337	
Sulfate	mg/L	16.2		17.1		17.3		18.0		21.8		23.0		24.3		23.4		18.2		23.0	
General Chemistry																					
Total Dissolved Solids	mg/L	242		220		242		236		215		229		218		216		168		227	
Field pH																					
pH (field)	SU	7.15		7.07		7.09		7.03		7.06		7.12		7.21		7.27		7.27		7.4	

Notes:
NA - Not Available
Q - Data Qualifier
U* - Result should be considered "not-detected" because it was detected in a rinsate blank or laboratory blank at a similar level
J - Quantitation is approximate due to limitations identified during data validation
UJ - Analyte not detected, but the reporting limit may or may not be higher due to a bias identified during data validation
U - Analyte not detected
mg/L - milligrams per liter
pCi/L - picoCurie per liter
SU - Standard Unit

TABLE 2
Baseline Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Monitoring Well		ALF-210																			
Sample Date		15-Nov-16		30-Jan-17		28-Feb-17		28-Mar-17		18-Apr-17		09-May-17		13-Jun-17		13-Jul-17		18-Jul-17		23-Aug-17	
Sample Type		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline	
Location/Well ID		ALF-210		ALF-210		ALF-210		ALF-210		ALF-210		ALF-210		ALF-210		ALF-210		ALF-210		ALF-210	
Sample ID		ALF-GW-014-11152016		ALF-GW-014-01302017		ALF-GW-014-02282017		ALF-GW-014-03282017		ALF-GW-014-04182017		ALF-GW-014-05092017		ALF-GW-014-06132017		ALF-GW-014-07132017		ALF-GW-014-07182017		ALF-GW-014-08232017	
Well Designation		Background		Background		Background		Background		Background		Background		Background		Background		Background		Background	
Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Total Metals																					
Antimony	mg/L	< 0.000330	U*	< 0.000998	U*	< 0.000565	U*	< 0.00142	U*	< 0.000478	U*	< 0.000443	U	< 0.000443	U	< 0.00103	U*	< 0.000669	U*	< 0.000918	U*
Arsenic	mg/L	0.00957	J	0.00346		0.0106		0.00924		0.00351		0.00293		0.00671		0.00637		0.00703		0.00474	
Barium	mg/L	0.298		0.323		0.328		0.313		0.339		0.424		0.361		0.335		0.324		0.311	
Beryllium	mg/L	< 0.000102	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U
Boron	mg/L	0.0803		0.0840		0.0794	J	0.0675	J	0.0694	J	0.0831		0.0691	J	< 0.0830	U*	0.0807		0.0805	
Cadmium	mg/L	< 0.000152	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U
Calcium	mg/L	133		137		137		123		132		158		131		136		135		132	
Chromium	mg/L	< 0.000339	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	UJ	< 0.000378	U	< 0.000378	U	< 0.000378	U
Cobalt	mg/L	0.00246		0.000212	J	0.00182		0.000726		0.000164	J	< 0.0000960	U*	0.000970		0.00105		0.00181		0.00124	
Lead	mg/L	< 0.0000675	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U
Lithium	mg/L	0.0231		0.0246		0.0233		0.0210		0.0204		0.0230		0.0206		0.0211		0.0207		0.0203	
Mercury	mg/L	< 0.0000521	U	< 0.0000521	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U
Molybdenum	mg/L	0.00237	J	0.00154	J	0.00258	J	0.00141	J	0.00137	J	< 0.00108	U*	0.00122	J	0.00122	J	0.00161	J	< 0.00176	U*
Selenium	mg/L	0.000687	J	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U
Thallium	mg/L	< 0.0000360	U	0.000135	J	< 0.000110	U*	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U
Radium 226 + radium 228	pCi/L	< 0.568	U	< 0.887	U	< 0.724	U	< 0.992	U*	0.844	J	< 0.830	U*	0.685	J	< 0.518	U	1.13	J	< 0.551	U
Anions																					
Chloride	mg/L	1.14		1.28		1.11	J	1.18		1.50		1.40		1.34		1.45		1.56		1.21	
Fluoride	mg/L	0.189		0.169		0.183		0.216		0.261		0.227		0.287		0.279		0.208		0.212	
Sulfate	mg/L	5.49		0.876	J	5.14		1.62		0.970	J	3.08		7.54		11.1		8.47		12.5	
General Chemistry																					
Total Dissolved Solids	mg/L	488		488		506		503		491		537		524		495		496		481	
Field pH																					
pH (field)	SU	6.67		6.78		6.73		6.73		6.76		6.83		6.73		6.72		6.72		6.78	

Notes:
NA - Not Available
Q - Data Qualifier
U* - Result should be considered "not-detected" because it was detected in a rinsate blank or laboratory blank at a similar level
J - Quantitation is approximate due to limitations identified during data validation
UJ - Analyte not detected, but the reporting limit may or may not be higher due to a bias identified during data validation
U - Analyte not detected
mg/L - milligrams per liter
pCi/L - picoCurie per liter
SU - Standard Unit

TABLE 2
Baseline Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Monitoring Well		ALF-212																			
Sample Date		15-Nov-16		31-Jan-17		28-Feb-17		28-Mar-17		18-Apr-17		10-May-17		13-Jun-17		13-Jul-17		19-Jul-17		23-Aug-17	
Sample Type		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline	
Location/Well ID		ALF-212		ALF-212		ALF-212		ALF-212		ALF-212		ALF-212		ALF-212		ALF-212		ALF-212		ALF-212	
Sample ID		ALF-GW-016-11152016		ALF-GW-016-01312017		ALF-GW-016-02282017		ALF-GW-016-03282017		ALF-GW-016-04182017		ALF-GW-016-05102017		ALF-GW-016-06132017		ALF-GW-016-07132017		ALF-GW-016-07192017		ALF-GW-016-08232017	
Well Designation		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient	
Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Total Metals																					
Antimony	mg/L	< 0.000166	U*	< 0.000611	U*	< 0.000834	U*	< 0.000663	U*	< 0.000443	U	< 0.000443	U	< 0.000443	U	< 0.000567	U*	< 0.000443	U	< 0.000535	U*
Arsenic	mg/L	0.0116	J	0.0122		0.0154		0.0145		0.00845		0.00556		0.00793		0.00885		0.0123		0.0363	
Barium	mg/L	0.273		0.285		0.305		0.286		0.287		0.324		0.303		0.305		0.299		0.241	
Beryllium	mg/L	< 0.000102	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U
Boron	mg/L	2.77		3.27	J	3.06		2.21		2.39		3.76		3.05		2.80		3.30		2.21	
Cadmium	mg/L	< 0.000152	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U
Calcium	mg/L	91.6		102		101		91.9		96.3		109		99.2		105		105		74.5	
Chromium	mg/L	< 0.000339	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	UJ	< 0.000378	U	< 0.000378	U	0.000406	J
Cobalt	mg/L	0.000283	J	< 0.000239	U*	0.000393	J	0.000216	J	0.000254	J	< 0.000251	U*	0.000235	J	0.000263	J	0.000322	J	0.000192	J
Lead	mg/L	< 0.0000675	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	0.000376	J
Lithium	mg/L	0.0146		< 0.0177	U*	0.0163		< 0.0143	U*	0.0149		0.0172		0.0158		0.0147		0.0148		0.0103	
Mercury	mg/L	< 0.0000521	U	< 0.0000521	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U
Molybdenum	mg/L	0.0385		0.0377		0.0408		0.0388		0.0396		0.0456		0.0408		0.0439		0.0474		0.0407	
Selenium	mg/L	< 0.000348	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U
Thallium	mg/L	< 0.0000360	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U
Radium 226 + radium 228	pCi/L	< 0.609	U	< 0.448	U	< 0.740	U	< 0.644	U*	0.906	J	< 1.06	U*	< 0.880	U	< 1.33	U*	< 0.524	U	< 0.974	U*
Anions																					
Chloride	mg/L	10.3		20.2		20.0		17.5		20.7		20.3		21.0		21.3		21.8		18.5	
Fluoride	mg/L	1.63		1.42		1.42		1.19		1.02		0.656		0.842		0.982		0.961		2.22	
Sulfate	mg/L	16.0		18.9		17.9		13.8		18.1		22.2		19.4		24.6		20.2		9.26	
General Chemistry																					
Total Dissolved Solids	mg/L	443		522		491		495		480		502		488		487		468		402	
Field pH																					
pH (field)	SU	6.96		6.94		6.97		6.89		6.93		6.86		6.99		6.97		6.98		7.26	

Notes:
NA - Not Available
Q - Data Qualifier
U* - Result should be considered "not-detected" because it was detected in a rinsate blank or laboratory blank at a similar level
J - Quantitation is approximate due to limitations identified during data validation
UJ - Analyte not detected, but the reporting limit may or may not be higher due to a bias identified during data validation
U - Analyte not detected
mg/L - milligrams per liter
pCi/L - picoCurie per liter
SU - Standard Unit

TABLE 2
Baseline Groundwater Sampling Results

Allen Fossil Plant
Memphis, Tennessee

Monitoring Well		ALF-213																			
Sample Date		16-Nov-16		31-Jan-17		28-Feb-17		28-Mar-17		18-Apr-17		10-May-17		13-Jun-17		13-Jul-17		19-Jul-17		23-Aug-17	
Sample Type		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline		Baseline	
Location/Well ID		ALF-213		ALF-213		ALF-213		ALF-213		ALF-213		ALF-213		ALF-213		ALF-213		ALF-213		ALF-213	
Sample ID		ALF-GW-017-11162016		ALF-GW-017-01312017		ALF-GW-017-02282017		ALF-GW-017-03282017		ALF-GW-017-04182017		ALF-GW-017-05102017		ALF-GW-017-06132017		ALF-GW-017-07132017		ALF-GW-017-07192017		ALF-GW-017-08232017	
Well Designation		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient		Downgradient	
Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Total Metals																					
Antimony	mg/L	< 0.000184	U*	< 0.000694	U*	< 0.000741	U*	< 0.000645	U*	< 0.000443	U	< 0.000443	U	< 0.000443	U	< 0.000443	U	< 0.000443	U	< 0.000443	U
Arsenic	mg/L	0.0316	J	0.0164		0.0151		0.0114		0.00799		0.00753		0.00703		0.00840		0.0127		0.0396	
Barium	mg/L	0.211		0.174		0.172		0.165		0.201		0.259		0.255		0.272		0.279		0.324	
Beryllium	mg/L	< 0.000102	U	< 0.000131	UJ	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U	< 0.000131	U
Boron	mg/L	0.189		0.201	J	0.199		0.150		0.159		0.207		0.189		0.291		0.189		< 0.254	U*
Cadmium	mg/L	< 0.000152	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U	< 0.0000781	U
Calcium	mg/L	55.1		46.0		43.0		35.6		37.8		37.9		35.5		37.7		42.8		58.8	
Chromium	mg/L	< 0.000339	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	U	< 0.000378	UJ	< 0.000378	U	< 0.000378	U	< 0.000378	U
Cobalt	mg/L	0.000265	J	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	< 0.0000947	U	0.000100	J
Lead	mg/L	< 0.0000675	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U	< 0.000318	U
Lithium	mg/L	0.0103		< 0.0117	U*	< 0.0103	U*	< 0.00762	U*	0.00771		< 0.00819	U*	0.00757		0.00823		0.00735		0.00827	
Mercury	mg/L	< 0.0000521	U	< 0.0000521	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U	< 0.0000653	U
Molybdenum	mg/L	0.00518		0.00468	J	0.00409	J	0.00376	J	0.00402	J	0.00438	J	0.00402	J	0.00361	J	0.00392	J	< 0.00350	U*
Selenium	mg/L	< 0.000348	U	< 0.00127	U	< 0.00127	U	0.00179	J	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U	< 0.00127	U
Thallium	mg/L	< 0.0000360	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U	< 0.0000531	U
Radium 226 + radium 228	pCi/L	< 0.0809	U	< 0.660	U	< 0.771	U	< 0.148	U	0.790	J	< 0.601	UJ	0.760	J	< 0.932	U*	1.09		< 0.558	U*
Anions																					
Chloride	mg/L	11.7		15.8		16.3		13.5		16.2		15.6		16.1		15.9		15.5		14.9	
Fluoride	mg/L	0.239		0.422		0.272		0.479		0.518		0.474		0.555		0.508		0.444		0.322	
Sulfate	mg/L	2.48		20.1		26.0		22.5		27.6		29.8		31.4		29.6		23.7		13.6	
General Chemistry																					
Total Dissolved Solids	mg/L	300		267		264		221		206		221		231		234		228		304	
Field pH																					
pH (field)	SU	6.98		6.98		7.06		6.98		6.99		6.92		7.05		7.2		7.18		7.16	

Notes:
NA - Not Available
Q - Data Qualifier
U* - Result should be considered "not-detected" because it was detected in a rinsate blank or laboratory blank at a similar level
J - Quantitation is approximate due to limitations identified during data validation
UJ - Analyte not detected, but the reporting limit may or may not be higher due to a bias identified during data validation
U - Analyte not detected
mg/L - milligrams per liter
pCi/L - picoCurie per liter
SU - Standard Unit

TABLE 3
Groundwater Sampling Summary

Allen Fossil Plant
Memphis, Tennessee

Well ID	Well Designation	Number of Groundwater Samples Collected	Baseline / Background Sample Dates										Baseline Monitoring Program Description	Number of Groundwater Samples Collected	Detection Monitoring: September 25-26, 2017	Detection Monitoring Program Description
			November 14-16, 2016	January 30-31, 2017	February 28-March 1, 2017	March 28-29, 2017	April 18-19, 2017	May 9-10, 2017	June 13-14, 2017	July 13-14, 2017	July 18-19, 2017	August 23-24, 2017				
ALF-201	Downgradient	10	X	X	X	X	X	X	X	X	X	X	Baseline Monitoring - Minimum of eight independent samples from each background and downgradient monitoring well - 257.94(b) - Appendix III and Appendix IV Constituents	1	X	Detection Monitoring - 257.94(a) - Appendix III Constituents
ALF-202	Downgradient	10	X	X	X	X	X	X	X	X	X	X	Baseline Monitoring - Minimum of eight independent samples from each background and downgradient monitoring well - 257.94(b) - Appendix III and Appendix IV Constituents	1	X	Detection Monitoring - 257.94(a) - Appendix III Constituents
ALF-203	Downgradient	10	X	X	X	X	X	X	X	X	X	X	Baseline Monitoring - Minimum of eight independent samples from each background and downgradient monitoring well - 257.94(b) - Appendix III and Appendix IV Constituents	1	X	Detection Monitoring - 257.94(a) - Appendix III Constituents
ALF-204	Downgradient	10	X	X	X	X	X	X	X	X	X	X	Baseline Monitoring - Minimum of eight independent samples from each background and downgradient monitoring well - 257.94(b) - Appendix III and Appendix IV Constituents	1	X	Detection Monitoring - 257.94(a) - Appendix III Constituents
ALF-205	Downgradient	10	X	X	X	X	X	X	X	X	X	X	Baseline Monitoring - Minimum of eight independent samples from each background and downgradient monitoring well - 257.94(b) - Appendix III and Appendix IV Constituents	1	X	Detection Monitoring - 257.94(a) - Appendix III Constituents
ALF-206	Downgradient	10	X	X	X	X	X	X	X	X	X	X	Baseline Monitoring - Minimum of eight independent samples from each background and downgradient monitoring well - 257.94(b) - Appendix III and Appendix IV Constituents	1	X	Detection Monitoring - 257.94(a) - Appendix III Constituents
ALF-210	Background	10	X	X	X	X	X	X	X	X	X	X	Baseline Monitoring - Minimum of eight independent samples from each background and downgradient monitoring well - 257.94(b) - Appendix III and Appendix IV Constituents	1	X	Detection Monitoring - 257.94(a) - Appendix III Constituents
ALF-212	Downgradient	10	X	X	X	X	X	X	X	X	X	X	Baseline Monitoring - Minimum of eight independent samples from each background and downgradient monitoring well - 257.94(b) - Appendix III and Appendix IV Constituents	1	X	Detection Monitoring - 257.94(a) - Appendix III Constituents

TABLE 3
Groundwater Sampling Summary

Allen Fossil Plant
Memphis, Tennessee

Well ID	Well Designation	Number of Groundwater Samples Collected	Baseline / Background Sample Dates										Baseline Monitoring Program Description	Number of Groundwater Samples Collected	Detection Monitoring: September 25-26, 2017	Detection Monitoring Program Description
			November 14-16, 2016	January 30-31, 2017	February 28-March 1, 2017	March 28-29, 2017	April 18-19, 2017	May 9-10, 2017	June 13-14, 2017	July 13-14, 2017	July 18-19, 2017	August 23-24, 2017				
ALF-213	Downgradient	10	X	X	X	X	X	X	X	X	X	X	Baseline Monitoring - Minimum of eight independent samples from each background and downgradient monitoring well - 257.94(b) - Appendix III and Appendix IV Constituents	1	X	Detection Monitoring - 257.94(a) - Appendix III Constituents

Notes:
Appendix III Constituents - boron, calcium, chloride, fluoride, pH, sulfate, total dissolved solids (TDS)
Appendix IV Constituents - antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, radium 226 and radium 228 combined

Notes:
Appendix III Constituents - boron, calcium, chloride, fluoride, pH, sulfate, TDS

TABLE 4
Groundwater and Surface Water Elevation Summary

Allen Fossil Plant
Memphis, Tennessee

Groundwater Elevation Collection Date		17-Nov-16	30-Jan-17	28-Feb-17	28-Mar-17	18-Apr-17	08-May-17	12-Jun-17	12-Jul-17	18-Jul-17	22-Aug-17	25-Sep-17
Monitoring Well	**Units**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Detection**
ALF-201	ft-MSL	186.96	194.01	190.47	192.21	196.18	200.20	198.49	195.45	193.85	189.39	186.68
ALF-202	ft-MSL	203.76	206.39	205.39	205.80	205.79	206.67	206.70	205.72	205.37	204.48	204.29
ALF-203	ft-MSL	189.48	201.04	192.56	195.27	202.26	210.27	201.62	198.55	195.49	191.05	189.06
ALF-204	ft-MSL	182.60	200.51	187.17	192.19	203.40	209.63	199.13	196.23	191.56	183.82	179.69
ALF-205	ft-MSL	183.18	199.61	187.51	191.79	199.62	208.17	198.74	195.58	191.12	184.23	179.92
ALF-206	ft-MSL	182.76	199.86	187.24	192.06	199.80	208.64	198.87	196.03	191.63	184.02	179.77
ALF-210	ft-MSL	186.38	195.37	190.44	192.52	197.45	202.99	199.75	196.17	194.02	188.75	185.64
ALF-212	ft-MSL	203.42	205.98	205.16	205.51	205.19	205.95	205.71	204.95	204.59	203.79	204.03
ALF-213	ft-MSL	184.30	196.78	188.12	191.57	197.55	204.18	197.91	195.17	191.99	185.90	182.44
Surface Water Elevation Collection Date		**17-Nov-16**	**30-Jan-17**	**28-Feb-17**	**28-Mar-17**	**18-Apr-17**	**08-May-17**	**12-Jun-17**	**12-Jul-17**	**18-Jul-17**	**22-Aug-17**	**25-Sep-17**
McKellar Lake	**Units**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Baseline**	**Detection**
Staff Gauge - Morning	ft-MSL	181.62	207.08	190.72	196.92	206.18	216.98	204.33	201.37	195.74	186.94	183.55
Staff Gauge - Afternoon	ft-MSL	181.43	207.07	190.45	196.87	205.69	217.25	204.10	201.13	195.65	186.67	183.55
Average Staff Gauge	ft-MSL	181.53	207.08	190.59	196.90	205.94	217.12	204.22	201.25	195.70	186.81	183.55

Notes:

ft-MSL: feet above mean sea level

TABLE 5
Hydraulic Conductivity Data Summary

Allen Fossil Plant
Memphis, Tennessee

Well ID	Well Designation	Slug Test Hydraulic Conductivity (cm/sec)
ALF-209	Alluvial deposits	1.47E-02
ALF-214	Alluvial deposits	9.30E-03
ALF-216	Alluvial deposits	5.80E-03
ALF P-4S	Alluvial deposits	2.97E-02
ACC-5B	Alluvial deposits	5.60E-02
Geometric Mean of Hydraulic Conductivity (cm/sec)		**1.68E-02**

Notes:
cm/sec - centimeters per second
Source: *Stantec, TVA Allen Fossil Plant Remedial Investigation Report (DRAFT)* , December 20, 2017
Non-CCR monitoring wells (ALF-209, ALF-214, ALF-216, ALF P-4S and ACC-5B) screened in alluvial deposits were used to calculate geometric mean of hydraulic conductivity