

2018 ANNUAL GROUNDWATER MONITORING  
AND CORRECTIVE ACTION REPORT  
BOTTOM ASH SETTLING AREA  
TECUMSEH ENERGY CENTER  
TECUMSEH, KANSAS

by Haley & Aldrich, Inc.  
Cleveland, Ohio

for Westar Energy, Inc.  
Topeka, Kansas

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**2018 Annual Groundwater Monitoring  
and Corrective Action Report**

This Annual Groundwater Monitoring and Corrective Action Report documents the groundwater monitoring system for the Tecumseh Energy Center Bottom Ash Settling Area consistent with applicable sections of § 257.90 through 257.98, and describes activities conducted in the prior calendar year (2018) and documents compliance with the United States Environmental Protection Agency Coal Combustion Residual Rule. I certify that the 2018 Annual Groundwater Monitoring and Corrective Action Report for the Bottom Ash Settling Area is, to the best of my knowledge, accurate and complete.

Signed:   
Professional Geologist

Print Name: Mark Nicholls  
Kansas License No.: Professional Geologist No. 881  
Title: Technical Expert 2  
Company: Haley & Aldrich, Inc.



## **1. Introduction**

This 2018 Annual Groundwater Monitoring and Corrective Action Report (Annual Report) addresses the Bottom Ash Settling Area (BASA; also known as the Bottom Ash Settling Pond) at the Tecumseh Energy Center (TEC), operated by Westar Energy, Inc. (Westar). This Annual Report was developed in accordance with the United States Environmental Protection Agency Coal Combustion Residual (CCR) Rule effective 19 October 2015 (Rule), specifically Code of Federal Regulations Title 40 (40 CFR), subsection § 257.90(e). The Annual Report documents the groundwater monitoring system for the BASA consistent with applicable sections of § 257.90 through 257.98, and describes activities conducted in the prior calendar year (2018) and documents compliance with the Rule. The specific requirements for the Annual Report listed in § 257.90(e) of the Rule are provided in Section 2 of this Annual Report and are in bold italic font, followed by a short narrative describing how each Rule requirement has been met.

## 2. 40 CFR § 257.90 Applicability

### 2.1 40 CFR § 257.90(a)

***Except as provided for in §257.100 for inactive CCR surface impoundments, all CCR landfills, CCR surface impoundments, and lateral expansions of CCR units are subject to the groundwater monitoring and corrective action requirements under §257.90 through 257.98.***

Westar has installed and certified a groundwater monitoring system at the TEC BASA. The BASA is subject to the groundwater monitoring and corrective action requirements described under 40 CFR § 257.90 through 257.98. This document addresses the requirement for the Owner/Operator to prepare an Annual Report per § 257.90(e) (Rule).

### 2.2 40 CFR § 257.90(e) – SUMMARY

***Annual groundwater monitoring and corrective action report. For existing CCR landfills and existing CCR surface impoundments, no later than January 31, 2018, and annually thereafter, the owner or operator must prepare an annual groundwater monitoring and corrective action report. For new CCR landfills, new CCR surface impoundments, and all lateral expansions of CCR units, the owner or operator must prepare the initial annual groundwater monitoring and corrective action report no later than January 31 of the year following the calendar year a groundwater monitoring system has been established for such CCR unit as required by this subpart, and annually thereafter. For the preceding calendar year, the annual report must document the status of the groundwater monitoring and corrective action program for the CCR unit, summarize key actions completed, describe any problems encountered, discuss actions to resolve the problems, and project key activities for the upcoming year. For purposes of this section, the owner or operator has prepared the annual report when the report is placed in the facility's operating record as required by §257.105(h)(1).***

This Annual Report describes monitoring completed and actions taken for the groundwater monitoring system at the TEC BASA as required by the Rule. Groundwater sampling and analysis was conducted in accordance with requirements described in § 257.93, and the status of the groundwater monitoring program described in § 257.94 and § 257.95 is also provided in this report. This Annual Report documents the applicable groundwater-related activities completed in the calendar year 2018.

#### 2.2.1 Status of the Groundwater Monitoring Program

Results of the detection monitoring statistical analyses completed in January 2018 identified statistically significant increased (SSI) concentration of Appendix III constituents in downgradient monitoring wells relative to concentrations observed in upgradient monitoring wells. No alternative source was identified. Accordingly, the groundwater monitoring program moved to and is currently implementing an assessment monitoring program.

### 2.2.2 Key Actions Completed

The 2017 Annual Groundwater Monitoring and Corrective Action Report was completed in January 2018. Statistical analysis was completed in January 2018 on analytical data from the initial detection monitoring sampling event. Appendix III SSIs were determined in January 2018, and Westar pursued an alternative source demonstration, which was not successful. Sampling for the first semi-annual detection monitoring event was completed in March 2018; however, due to the determination of SSIs and transition to an assessment monitoring program, no statistical analyses were completed on this data. An assessment monitoring program was established and the initial assessment monitoring sampling event was completed in June 2018. A second assessment monitoring sampling event including detected Appendix IV constituents from the initial assessment monitoring sampling event, as well as all Appendix III constituents, was completed in September 2018. Groundwater protection standards for detected Appendix IV constituents were established. Statistical analysis of the results from the second assessment monitoring sampling event are due to be completed in January 2019 and will be reported in the next annual report.

### 2.2.3 Problems Encountered

No noteworthy problems (i.e., problems could include damaged wells, issues with sample collection or lack of sampling, and problems with analytical analysis) were encountered for the TEC BASA groundwater monitoring program in 2018.

### 2.2.4 Actions to Resolve Problems

No problems were encountered at the TEC BASA in 2018, therefore, no actions to resolve problems were required.

### 2.2.5 Project Key Activities for Upcoming Year

Key activities planned for 2019 include the 2018 Annual Groundwater Monitoring and Corrective Action Report, statistical analysis of assessment monitoring analytical data collected in September 2018, and semi-annual assessment monitoring and subsequent statistical analysis.

## 2.3 40 CFR § 257.90(e) – INFORMATION

***At a minimum, the annual groundwater monitoring and corrective action report must contain the following information, to the extent available:***

### 2.3.1 40 CFR § 257.90(e)(1)

***A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;***

## 2018 Annual Groundwater Monitoring and Corrective Action Report

As required by § 257.90(e)(1), a map showing the locations of the CCR unit and associated upgradient and downgradient monitoring wells for the BASA is included in this report as Figure 1.

### 2.3.2 40 CFR § 257.90(e)(2) – Monitoring System Changes

*Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;*

No monitoring wells were installed or decommissioned during 2018.

### 2.3.3 40 CFR § 257.90(e)(3) – Summary of Sampling Events

*In addition to all the monitoring data obtained under §257.90 through §257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;*

In accordance with § 257.94(b), three independent samples (one detection monitoring sample, and two assessment monitoring samples) from each background and downgradient monitoring well were collected in 2018. Detection monitoring samples are summarized in Table I, and assessment monitoring samples are summarized in Table II. Both summary tables include the sample names, dates of sample collection, and monitoring data obtained for the groundwater monitoring program.

### 2.3.4 40 CFR § 257.90(e)(4) – Monitoring Transition Narrative

*A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and*

Initial detection monitoring statistical analyses were completed in January 2018 in accordance with § 257.94(b). The analyte concentrations from the downgradient wells for each of the Appendix III constituents from the 2017 detection monitoring sampling event from each location were compared to their respective prediction limit (PL). Once data is validated, a sample concentration greater than the PL is considered to represent an SSI. An SSI over background levels for one or more constituents listed in Appendix III were identified. A summary of the Appendix III SSIs identified in January 2018 is provided in Table III.

A successful demonstration that a source other than the CCR unit caused the SSI over background levels was not completed within 90 days of the SSI determination in accordance with 40 CFR §257.94(e)(2), and the assessment monitoring program was established by July 2018. The assessment monitoring program has been established to meet the requirements of 40 CFR §257.95.



### 2.3.5 40 CFR § 257.90(e)(5) – Other Requirements

***Other information required to be included in the annual report as specified in §257.90 through §257.98.***

This Annual Report documents activities conducted to comply with § 257.90 through § 257.95 of the Rule. It is understood that there are supplemental references in § 257.90 through § 257.98 to information that must be placed in the Annual Report. The following requirements include relevant and required information in the Annual Report for activities completed in calendar year 2018.

#### 2.3.5.1 40 CFR § 257.94(d)(3) – Demonstration for Alternative Detection Monitoring Frequency

***The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority in the annual groundwater monitoring and corrective action report required by § 257.90(e).***

An alternative groundwater detection monitoring sampling and analysis frequency has not been established for this unit, therefore, no demonstration or certification is applicable.

#### 2.3.5.2 40 CFR § 257.94(e)(2) – Detection Monitoring Alternate Source Demonstration

***The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority verifying the accuracy of the information in the report. If a successful demonstration is completed within the 90-day period, the owner or operator of the CCR unit may continue with a detection monitoring program under this section. If a successful demonstration is not completed within the 90-day period, the owner or operator of the CCR unit must initiate an assessment monitoring program as required under § 257.95. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority.***

An alternative source demonstration for detection monitoring SSIs was not successfully completed within 90 days for this unit, therefore, no demonstration or certification is applicable.

**2.3.5.3 40 CFR § 257.95(c)(3) – Demonstration for Alternative Assessment Monitoring Frequency**

***The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration for an alternative groundwater sampling and analysis frequency meets the requirements of this section. The owner or operator must include the demonstration providing the basis for the alternative monitoring frequency and the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority in the annual groundwater monitoring and corrective action report required by § 257.90(e).***

An alternative groundwater assessment monitoring sampling and analysis frequency has not been established for this unit, therefore, no demonstration or certification is applicable.

**2.3.5.4 40 CFR § 257.95(d)(3) – Assessment Monitoring Concentrations and Groundwater Protection Standards**

***Include the recorded concentrations required by paragraph (d)(1) of this section, identify the background concentrations established under § 257.94(b), and identify the groundwater protection standards established under paragraph (d)(2) of this section in the annual groundwater monitoring and corrective action report required by § 257.90(e).***

An assessment monitoring program is currently being implemented at the CCR unit. Two rounds of assessment monitoring sampling were completed in 2018. Analytical results for both downgradient and upgradient wells are provided in Table II. The groundwater protection standards established for the TEC BASA are included in Table IV.

**2.3.5.5 40 CFR § 257.95(g)(3)(ii) – Assessment Monitoring Alternate Source Demonstration**

***Demonstrate that a source other than the CCR unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. Any such demonstration must be supported by a report that includes the factual or evidentiary basis for any conclusions and must be certified to be accurate by a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to this section, and may return to detection monitoring if the constituents in appendices III and IV to this part are at or below background as specified in paragraph (e) of this section. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority.***

Assessment monitoring statistical analyses were not completed in 2018. Therefore, this criterion is not applicable.

2.3.5.6 *40 CFR § 257.96(a) – Demonstration for Additional Time for Assessment of Corrective Measures*

***Within 90 days of finding that any constituent listed in appendix IV to this part has been detected at a statistically significant level exceeding the groundwater protection standard defined under § 257.95(h), or immediately upon detection of a release from a CCR unit, the owner or operator must initiate an assessment of corrective measures to prevent further releases, to remediate any releases and to restore affected area to original conditions. The assessment of corrective measures must be completed within 90 days, unless the owner or operator demonstrates the need for additional time to complete the assessment of corrective measures due to site-specific conditions or circumstances. The owner or operator must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority attesting that the demonstration is accurate. The 90-day deadline to complete the assessment of corrective measures may be extended for no longer than 60 days. The owner or operator must also include the demonstration in the annual groundwater monitoring and corrective action report required by § 257.90(e), in addition to the certification by a qualified professional engineer or the approval from the Participating State Director or approval from EPA where EPA is the permitting authority.***

Assessment monitoring statistical analyses were not completed in 2018. Therefore, this criterion is not applicable.

## **TABLES**

**TABLE I**  
**SUMMARY OF ANALYTICAL RESULTS - DETECTION MONITORING**

WESTAR ENERGY, INC.  
 TECUMSEH ENERGY CENTER  
 BOTTOM ASH SETTLING AREA  
 TECUMSEH, KANSAS

Location	Upgradient	Downgradient		
	MW-7	MW-8	MW-9	MW-10
Measure Point (TOC)	878.28	888.01	886.98	887.08
Sample Name	MW-7-030918	MW-8-030918	MW-9-030918	MW-10-030918
Sample Date	3/9/2018	3/9/2018	3/9/2018	3/9/2018
Lab Data Reviewed and Accepted	4/16/2018	4/16/2018	4/16/2018	4/16/2018
Depth to Water (ft btoc)	23.44	29.11	33.58	33.75
Temperature (Deg C)	56.2	63.2	56.1	55.7
Conductivity (µS/cm)	1613	1858	1866	1894
Turbidity (NTU)	2.10	0.96	14.19	2.75
Boron, Total (mg/L)	<b>0.77</b>	<b>1.5</b>	<b>0.13</b>	<b>0.25</b>
Calcium, Total (mg/L)	<b>165</b>	<b>233</b>	<b>259</b>	<b>176</b>
Chloride (mg/L)	<b>193</b>	<b>233</b>	<b>188</b>	<b>227</b>
Fluoride (mg/L)	<b>0.37</b>	<b>0.33</b>	<b>0.38</b>	<b>0.55</b>
Sulfate (mg/L)	<b>547</b>	<b>846</b>	<b>26.1</b>	<b>136</b>
pH (su)	<b>7.0</b>	<b>6.8</b>	<b>6.7</b>	<b>6.8</b>
TDS (mg/L)	<b>1190</b>	<b>1390</b>	<b>1090</b>	<b>1120</b>

**Notes:**

*This detection monitoring sample was collected prior to the establishment of an assessment monitoring program. The program subsequently transitioned into assessment monitoring, and consequently statistical analyses were not conducted on these data.*

*µS/cm = micro Siemens per centimeter*

*ft btoc = feet below top of casing*

*Deg C = degrees Celsius*

*mg/L = milligrams per liter*

*NTU = Nephelometric Turbidity Unit*

*su = standard unit*

*TDS = total dissolved solids*

*TOC = top of casing*

***Bold value: Detection above laboratory reporting limit***

**TABLE II**  
**SUMMARY OF ANALYTICAL RESULTS - ASSESSMENT MONITORING**  
WESTAR ENERGY, INC.  
TECUMSEH ENERGY CENTER  
BOTTOM ASH SETTLING AREA  
TECUMSEH, KANSAS

Location	Upgradient		Downgradient					
	MW-7		MW-8		MW-9		MW-10	
Measure Point (TOC)	878.28		888.01		886.98		887.08	
Sample Name	MW-7-061118	MW-7-090618	MW-8-061118	MW-8-090618	MW-9-061118	MW-9-090618	MW-10-061118	MW-10-090618
Sample Date	6/11/2018	9/6/2018	6/11/2018	9/6/2018	6/11/2018	9/6/2018	6/11/2018	9/6/2018
Lab Data Reviewed and Accepted	7/16/2018	10/15/2018	7/16/2018	10/15/2018	7/16/2018	10/15/2018	7/16/2018	10/15/2018
Depth to Water (ft btoc)	23.45	23.57	26.53	22.80	33.56	34.61	33.65	33.95
Temperature (Deg C)	18.19	17.77	23.92	22.35	22.38	19.83	20.10	18.62
Conductivity (µS/cm)	1690	1730	1940	1940	1920	1940	1930	1940
Turbidity (NTU)	0.77	2.04	1.36	0.72	4.21	5.14	2.31	2.21
Boron, Total (mg/L)	--	<b>0.73</b>	--	<b>1.3</b>	--	<0.10	--	<b>0.23</b>
Calcium, Total (mg/L)	--	<b>167</b>	--	<b>222</b>	--	<b>250</b>	--	<b>173</b>
Chloride (mg/L)	--	<b>212</b>	--	<b>256</b>	--	<b>201</b>	--	<b>231</b>
Fluoride (mg/L)	--	<b>0.33</b>	--	<b>0.31</b>	--	<b>0.51</b>	--	<b>0.51</b>
Sulfate (mg/L)	--	<b>569</b>	--	<b>738</b>	--	<b>87</b>	--	<b>110</b>
pH (su)	--	<b>6.8</b>	--	<b>6.8</b>	--	<b>6.6</b>	--	<b>6.6</b>
TDS (mg/L)	--	<b>1290</b>	--	<b>1560</b>	--	<b>1320</b>	--	<b>1200</b>
Antimony, Total (mg/L)	<0.0010	--	<0.0010	--	<0.0010	--	<0.0010	--
Arsenic, Total (mg/L)	<b>0.0016</b>	<b>0.0015</b>	<b>0.0041</b>	<b>0.0028</b>	<b>0.097</b>	<b>0.099</b>	<b>0.041</b>	<b>0.040</b>
Barium, Total (mg/L)	<b>0.069</b>	<b>0.079</b>	<b>0.060</b>	<b>0.057</b>	<b>0.85</b>	<b>0.91</b>	<b>0.33</b>	<b>0.35</b>
Beryllium, Total (mg/L)	<0.0010	--	<0.0010	--	<0.0010	--	<0.0010	--
Cadmium, Total (mg/L)	<0.00050	--	<0.00050	--	<0.00050	--	<0.00050	--
Chromium, Total (mg/L)	<0.0050	--	<0.0050	--	<0.0050	--	<0.0050	--
Cobalt, Total (mg/L)	<b>0.0010</b>	<b>0.0010</b>	<b>0.0015</b>	<b>0.0014</b>	<b>0.014</b>	<b>0.011</b>	<0.0010	<0.0010
Lead, Total (mg/L)	<0.010	--	<0.010	--	<0.010	--	<0.010	--
Lithium, Total (mg/L)	<b>0.025</b>	<b>0.029</b>	<b>0.021</b>	<b>0.022</b>	<b>0.011</b>	<b>0.012</b>	<0.010	<0.010
Molybdenum, Total (mg/L)	<b>0.0082</b>	<b>0.0082</b>	<b>0.035</b>	<b>0.037</b>	<b>0.0018</b>	<0.0010	<b>0.0019</b>	<b>0.0027</b>
Selenium, Total (mg/L)	<0.0010	--	<0.0010	--	<0.0010	--	<0.0010	--
Thallium, Total	<0.0010	--	<0.0010	--	<0.0010	--	<0.0010	--
Mercury, Total (mg/L)	<0.00020	--	<0.00020	--	<0.00020	--	<0.00020	--
Fluoride (mg/L)	<b>0.33</b>	<b>0.33</b>	<b>0.26</b>	<b>0.31</b>	<b>0.50</b>	<b>0.51</b>	<b>0.48</b>	<b>0.51</b>
Radium-226 & 228 Combined (pCi/L)	<b>1.54</b>	<b>0.398</b>	<b>1.59</b>	<b>1.29</b>	<b>3.36</b>	<b>2.53</b>	<b>2.09</b>	<b>3.58</b>

**Note:**

The June sampling event was for Appendix IV constituents only. The September sampling event included Appendix IV constituents detected in the June sampling event, and all of the Appendix III constituents.

µS/cm = micro Siemens per centimeter

ft btoc = feet below top of casing

Deg C = degrees Celsius

mg/L = milligrams per liter

NTU = Nephelometric Turbidity Unit

pCi/L = picoCuries per liter

su = standard unit

TDS = total dissolved solids

TOC = top of casing

**Bold value: Detection above laboratory reporting limit**

**TABLE III**  
**SUMMARY OF APPENDIX III SSIs**  
 WESTAR ENERGY, INC.  
 TECUMSEH ENERGY CENTER  
 BOTTOM ASH SETTLING AREA  
 TECUMSEH, KANSAS

Well ID	Statistical Analysis Completed	Constituent
MW-8	January 2018	Boron
	January 2018	Calcium
	January 2018	Sulfate
	January 2018	TDS
MW-9	January 2018	Calcium
	January 2018	Fluoride
	January 2018	TDS
MW-10	January 2018	Calcium
	January 2018	Chloride
	January 2018	Fluoride

**Notes:**

*SSIs = statistically significant increases*

*TDS = total dissolved solids*

**TABLE IV**  
**GROUNDWATER PROTECTION STANDARDS**

WESTAR ENERGY, INC.  
TECUMSEH ENERGY CENTER  
BOTTOM ASH SETTLING AREA  
TECUMSEH, KANSAS

<b>Constituent</b>	<b>Groundwater Protection Standard (mg/L)</b>
Arsenic	0.010*
Barium	2*
Cobalt	0.006**
Fluoride	4.0*
Lithium	0.040**
Molybdenum	0.100**
Radium 226 & 228	5.9 pCi/L***

**Notes:**

\* Value set equal to the maximum contaminant level.

\*\* Value set based on regional screening levels.

\*\*\* Value set based on background level.

mg/L = milligrams per liter

pCi/L = picoCuries per liter






**FIGURE**

GIS FILE PATH: G:\Projects\Westar\Tecumseh Energy Center (TEC)\GIS\MXD\2018\_01\TEC\_BOTTOM ASH SETTLING POND\_MW\_LOC\_map.mxd — USER: dzinsmaier — LAST SAVED: 3/16/2018 10:28:19 AM

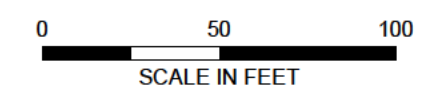


**LEGEND**

-  MONITORING WELL
-  PIEZOMETRIC OBSERVATION ONLY
-  ASH SETTLING AREA

**NOTE**

1. ALL LOCATIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: ESRI, 7 NOVEMBER 2015.



**HALEY ALDRICH** WESTAR ENERGY  
TECUMSEH ENERGY CENTER  
TECUMSEH, KANSAS

**BOTTOM ASH SETTLING AREA  
MONITORING WELL LOCATION MAP**

JANUARY 2019  
SCALE: AS SHOWN

FIGURE 1