

# **Annual Groundwater Monitoring Report**

Southwestern Electric Power Company

J. Robert Welsh Power Plant  
CN 602843245; RN100213370

## **Bottom Ash Storage Pond CCR Management Unit**

1187 Country Road 4865

Titus County

Pittsburg, Texas

**January 31, 2022**

Prepared by:  
American Electric Power Service Corporation  
1 Riverside Plaza  
Columbus, Ohio 43215



An **AEP** Company

BOUNDLESS ENERGY™

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**Appendix 6:** Groundwater monitoring Field and laboratory reports

### **Abbreviations:**

ASD - Alternate Source Demonstration

BASP – Bottom Ash Storage Pond

CCR – Coal Combustion Residual

GWPS - Groundwater protection standards

SSI - Statistically Significant Increase

SSL - Statistically Significant Level

TCEQ – Texas Commission on Environmental Quality

## **I. Overview**

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for an existing Coal Combustion Residual (CCR) unit at Southwestern Electric Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), J. Robert Welsh Power Plant. The Texas Commission on Environmental Quality's (TCEQ's) CCR rules require that the Annual Groundwater Monitoring Report be posted to the operating record for the preceding year no later than January 31, 2022.

In general, the following activities were completed:

- At the start of the current annual reporting period, the BASP was operating under the Detection Monitoring program;
- At the end of the current annual reporting period, the BASP was operating under the Detection Monitoring program;
- Data and statistical analysis not available for the previous reporting period indicates that during the 2<sup>nd</sup> semi-annual sampling event held October 2020:
  - the following Appendix III parameters exceeded background concentrations:
    - Sulfate and TDS, in AD-4C as possible SSIs
- During the 1<sup>st</sup> semi-annual sampling event held in June 2021:
  - the following Appendix III parameters exceeded background concentrations:
    - Calcium, Sulfate and TDS in AD-4C as possible SSIs
- During the 2<sup>nd</sup> semi-annual sampling event held in October 2021:
  - No Appendix III parameters exceeded background concentrations;
- The background data was re-established on December 8, 2021.
- ASD for the 2<sup>nd</sup> semi-annual 2020 potential SSIs for Sulfate and TDS was certified March 4, 2021 and submitted to TCEQ May 5, 2021 for approval.
- ASD for the 1<sup>st</sup> semi-annual 2021 potential SSIs for Calcium, Sulfate, and TDS was certified November 22, 2021 and submitted to TCEQ on November 23, 2021.
- Closure of the BASP was initiated April 6, 2021 in accordance with the written closure plan dated February 11, 2021.

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map, aerial photograph or a drawing showing the BASP CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers (Attached as **Appendix 1**, where applicable);
- Statistical comparison of monitoring data to determine if there have been SSI(s) or SSL(s) (Attached as **Appendix 2**, where applicable);
- A discussion of whether any alternate source demonstrations were performed, and the conclusions (Attached as **Appendix 3**, where applicable);
- A summary of any transition between monitoring programs, or an alternate monitoring frequency, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring, in addition to identifying the constituents detected at a SSI over background concentrations (Notices Attached as **Appendix 4**, where applicable);
- Identification of any monitoring wells that were installed, or decommissioned during the preceding year, along with a statement as to why that happened (Attached as **Appendix 5**, where applicable); and
- Other information required to be included in the annual report, field sheets, analytical reports, etc.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

## II. Groundwater Monitoring Well Locations and Identification Numbers

The figure that follows depicts the PE-certified groundwater monitoring network for the Bottom Ash Storage Pond (BASP), the monitoring well locations, and their corresponding identification numbers is provided below.

BASP Monitoring Wells	
Up Gradient	Down Gradient
AD-1	AD-3
AD-5	AD-4C
AD-17	AD-16R

Note: AD-2 is used for gauging purposes



## III. Monitoring Wells Installed or Decommissioned

There were no groundwater monitoring wells installed or decommissioned during this reporting period.

#### **IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rate and Direction and Discussion**

Appendix 1 contains potentiometric maps with the static water elevation, groundwater flow direction for each monitoring event and tables showing groundwater velocity and the groundwater quality data collected under 30 TAC 352.941.

- The groundwater flow rate and direction for the confirmatory sampling events reflect that seen during the semi-annual sampling events.

#### **V. Groundwater Quality Data Statistical Analysis**

Appendix 2 contains the statistical analysis reports available for this reporting period.

Data and statistical analysis not available for the previous reporting period indicated that during the 2<sup>nd</sup> semi-annual 2020 groundwater sampling event (October, 2020):

Potential SSIs were determined for:

- Sulfate and TDS, in AD-4C

Data and statistical analysis completed during the 1<sup>st</sup> semi-annual groundwater sampling event held in June 2021 indicated that:

Potential SSIs were determined for:

- Calcium, Sulfate and TDS in AD-4C

Data and statistical analysis completed during the 2<sup>nd</sup> semi-annual groundwater sampling event held in October 2021 indicated that:

- No potential SSIs were determined

After a minimum of four detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Background values for the BASP were updated December 2021. Details on the calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated December 8, 2021.

**VI. Alternate Source Demonstrations Completed**

Alternate source demonstrations (ASDs) were conducted for:

2<sup>nd</sup> semi-annual 2020 groundwater sampling event:

- Sulfate and TDS in AD-4C
- ASDs for these potential SSIs were certified March 4, 2021 and submitted to TCEQ May 5, 2021 for approval.

1<sup>st</sup> semi-annual 2021 groundwater sampling event:

- Calcium, Sulfate, and TDS in AD-4C
- ASDs for these potential SSIs were certified November 22, 2021 and submitted to TCEQ on November 23, 2021 for approval.

Since successful ASDs were completed for all potential SSIs, the unit remained in detection monitoring. The ASD demonstrations are in Appendix 3.

**VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency**

No transition was made during the reporting period and the CCR Unit remained in detection monitoring.

**VIII. Other Information Required**

Closure of the BASP was initiated on April 6, 2021 in accordance with the written closure plan dated February 11, 2021.

Field sheets and laboratory reports are located in Appendix 6.

**IX. Description of Any Problems Encountered and Actions Taken**

No significant problems were encountered.

**X. A Projection of Key Activities for the Upcoming Year**

- Detection monitoring on a semi-annual schedule for 30 TAC 352 Appendix III constituents;
- Evaluation of the detection monitoring results from a statistical analysis viewpoint, looking for SSIs;
- Conduct ASDs, if needed;
- Responding to any new data received in light of TCEQ's CCR rule requirements;
- Preparation of the next annual groundwater report;

- Continue closure by removal activities of the BASP.



## APPENDIX 1

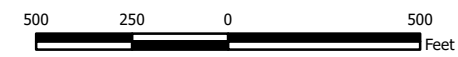
Potentiometric maps and Tables that follow show the groundwater monitoring data collected, the rate and direction of groundwater flow, and a summary showing the number of samples collected per monitoring well. The dates that the samples were collected also is shown.



- Legend**
- Groundwater Monitoring Well
  - Groundwater Elevation Contour
  - Groundwater Elevation Contour (Inferred)
  - Approximate Groundwater Flow Direction
  - CCR Units

**Notes**

- Monitoring well coordinates and water level data (collected on June 2, 2021) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016).
- Groundwater elevation units are feet above mean sea level.



11/22/2021  
*Beth Ann Gross*  
 Geosyntec Consultants  
 Texas Registered Engineering Firm No. F-1182

**Groundwater Potentiometric Map  
 June 2021**

AEP Welsh Power Plant  
 Cason, Texas

**Geosyntec**  
 consultants

Columbus, Ohio

2021/11/19

Figure  
**1**



- Legend**
- Groundwater Monitoring Well
  - Groundwater Elevation Contour
  - Groundwater Elevation Contour (Inferred)
  - Approximate Groundwater Flow Direction
  - CCR Units

**Notes**

- Monitoring well coordinates and water level data (collected on October 21, 2021) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016).
- Groundwater elevation units are feet above mean sea level.



*Beth Ann Gross*

January 25, 2022

Geosyntec Consultants, Inc.  
Texas Firm Registration No. 1182

**Groundwater Potentiometric Map  
October 2021**

AEP Welsh Power Plant  
Cason, Texas

**Geosyntec**  
consultants

Figure  
**2**

Columbus, Ohio

2022/01/20

Distance between wells.

	AD-1	AD-2	AD-3	AD-4C	AD-5	AD-6	AD-7	AD-8	AD-9	AD-10	AD-11	AD-12	AD-13	AD-14	AD-15	AD-16R	AD-17
AD-1	-	1083.7	1329.8	1304.3	2611.8	2133.7	2515.6	2677.1	1797.4	1961.0	1510.0	1379.4	1445.6	1169.2	2361.0	1558.3	1876.4
AD-2		-	547.2	1044.6	3701.466	3379.7	3372.1	3369.2	2531.5	2422.1	2015.7	2347.6	2148.8	1546.7	3033.9	1737.9	2725.4
AD-3			-	615.0	3888.4	3377.6	3237.9	3149.4	2342.6	2108.7	1751.5	2693.8	2007.4	1295.3	2822.2	1332.8	3176.0
AD-4C				-	3632.5	3077.4	2728.7	2565.9	1795.8	1488.4	1170.2	2657.3	1486.6	758.6	2240.3	718.2	3205.5
AD-5					-	580.0	2141.1	2753.3	2522.0	3128.3	2918.9	1598.5	3024.8	3022.1	2745.3	3418.4	1729.4
AD-6						-	1647.8	2244.4	1935.8	2517.7	2325.1	1392.6	1861.5	2444.5	2198.9	2814.5	1725.5
AD-7							-	644.5	965.3	1473.1	1577.6	2659.6	1250.7	1976.8	734.8	2148.8	3166.7
AD-8								-	861.6	1108.4	1396.9	3090.5	1238.4	1860.4	337.5	1878.6	3645.0
AD-9									-	614.4	633.4	2414.6	376.6	1028.0	567.5	1197.6	3013.3
AD-10										-	455.3	2842.4	708.1	877.6	804.9	791.3	3454.6
AD-11											-	2482.0	456.2	470.4	1059.2	562.4	3085.9
AD-12												-	2148.3	2305.2	2900.6	2740.2	617.1
AD-13													-	754.4	939.5	1002.3	2753.1
AD-14														-	1519.7	429.5	2906.9
AD-15															-	1560.0	3476.1
AD-16R																-	3340.9
AD-17																	-

Wells CCR Unit monitoring wells

	up	AD-1	AD-2	BASP	BASP	up	AD-5	AD-6	AD-7	PBAP	PBAP	LF	AD-11	AD-12	LF	AD-14	AD-15	BASP	up	AD-17	AD-18	AD-22	AD-23
TOC, ft		357.57	346.16	333.10	333.28	351.00	346.33	350.82	340.01	343.09	343.01	342.18	369.33	347.00	345.43	343.29	353.55	357.10		346.17	360.22	368.82	
D(R bgs)		25.00	25.00	17.00	15.00	30.00	33.00	38.00	26.00	35.00	35.00	20.00	30.00	16.00	18.00	46.00	27.00	40.00		29.00	20.00	20.00	
11/17/17		16.39	8.06	6.89	12.66				13.25	12.59		13.28		12.46	12.8	20.48							
2/23/17		17.83	8.18	8.39	14.83				15.74	15.04		13.93		15.17	14.56	21.36							
6/6/17		16.96	9.03	7.65	14				14.11	13.33		14.11		14.75	14.23	21.26	25.16						
8/18/17		17.19	15.06	9.01	7.87	13.76	13.25	16.51	13.49	13.15	18.85	13.84	21.43	14.98	14.66	21.05	26.18	22.86					
10/6/17		17.87	NG	9.86	9.08	13.6	13.89	NG	NG	13.62	NG	14.33	NG	15.58	15.52	21.22	26.37	22.93					
5/23/18		17.26		11.31	8.74	15.44			14.29	13.77		15.82		16.62	14.86	23.03	24.83	24.25					
8/14/18		18.41		10.08	9.85	14.63			14.17	13.51		14.51		15.99	16.05	21.72	26.64	23.15					
2/20/19		15.62	12.69	7.13	6.78	12.85	12.76	16.52	13.64	13.06	19.09	13.38	18.97	13.4	11.18	20.69	22.16	22.24					
5/30/19		11.89		7.45	7.13	13.46			13.92	13.26		14.1		13.54	10.66	21.26	14.53	21.97					
7/24/19		13.62	13.61	8.38	8.55	14.11		16.21	14.21	13.52	19.25	14.21		14.77	13.58	21.86	21.38	22.16					
2/17/20		15.69				12.44			13.97	13.51		14.08		13.62	11.99	21.17		22.16					
5/20/20		13.48	12.94	7.72	7.08	13.21	12.71	16.56	3.69	13.34	19.4	13.85	19.11	13.71	11.46	21.12	23.13	22	5.41	2.29	4.21		
7/22/20		15.39		8.62	8.65	13.96			14.01	13.95		14.25		15.23	14.26	21.52	23.99	22.25					
10/14/20		17.01	14.94	9.53	9.09	13.65	13.18	17.41	14.65	14.49	19.39	14.69	20.84	16.03	5.39	22.17	25.88	22.41	7.85	10.38	11.19		
12/10/20		17.53		9.59	8.11	13.39											26.43	22.47					
2/23/21		15.89				12.84												22.38					
06/02/21		11.75	11.45	6.74	6.41	13.85	10.37	16.92	13.17	13.17	19.14	13.48	18.21	12.31	9.55	20.84	22.96	22.17	4.58	1.13	1.00		
07/20/21		14.69		8.36	7.83	14.4												23.75	22.28				
10/20/21		17.03	15.07	10.24	9.7	14.25	13.7	17.54	14.78	14.58	19.63	15.1	21.36	16.06	15.7	22.96	25.97	22.57					

Hydraulic gradient. Use row 73 10/20/2021

	AD-1	AD-2	AD-3	AD-4C	AD-5	AD-6	AD-7	AD-8	AD-9	AD-10	AD-11	AD-12	AD-13	AD-14	AD-15	AD-16R	AD-17
AD-1	-		0.2561	0.2539	0.1236	0.1516	0.1339	0.1242	0.1854	0.1659	0.2176	0.2344	0.2263	0.2976	0.1402	0.2116	0.1707
AD-2		-	0.6223	0.3170	0.0872	0.0957	0.0999	0.0987	0.1317	0.1343	0.1630	0.1378	0.1522	0.2250	0.1091	0.1897	0.1175
AD-3			-	0.0154	0.0045	0.0050	0.0012	0.0025	0.0031	0.0073	0.0069	0.0064	0.0067	0.0057	0.0034	0.0081	0.0064
AD-4C				-	0.0023	0.0024	0.0021	0.0006	0.0012	0.0039	0.0022	0.0029	0.0027	0.0023	0.0001	0.0019	0.0034
AD-5					-	0.0012	0.0065	0.0041	0.0008	0.0019	0.0003	0.0014	0.0003	0.0014	0.0029	0.0020	0.0015
AD-6						-	0.0080	0.0040	0.0050	0.0007	0.0021	0.0001	0.0019	0.0100	0.0033	0.0022	0.0019
AD-7							-	0.0064	0.0036	0.0078	0.0052	0.0050	0.0077	0.0057	0.0079	0.0033	0.0052
AD-8								-	0.0008	0.0067	0.0029	0.0030	0.0045	0.0082	0.0050	0.0015	0.0034
AD-9									-	0.0131	0.0075	0.0041	0.0165	0.0143	0.0041	0.0030	0.0043
AD-10										-	0.0072	0.0007	0.0026	0.0259	0.0071	0.0057	0.0014
AD-11											-	0.0021	0.0031	0.0414	0.0023	0.0022	0.0027
AD-12												-	0.0017	0.0107	0.0026	0.0023	0.0049
AD-13													-	0.0277	0.0041	0.0026	0.0025
AD-14														-	0.0112	0.0425	0.0095
AD-15															-	0.0008	0.0031
AD-16R																-	0.0028
AD-17																	-

effective porosity(n) = 0.3  
 Hydraulic conductivity of aquifer (k) = 18.25ft/yr  
 Max gradient (dh/dl)  
 0.622

$$v = k \frac{(dh / dl)}{n}$$

Groundwater elevations, sea level

	BKG	aux	BASP	BASP	BKG	aux	aux	PBAP	PBAP	aux	LF	aux	LF	LF	PBAP	BASP	BKG	aux	aux	aux	AD-18	AD-22	AD-23	Max	Min	gw velocity
TOC, ft	357.57	346.16	333.10	333.28	351.00	346.33	350.82	340.01	343.09	343.01	342.18	369.33	347.00	345.43	343.29	353.55	357.10	346.17	360.22	368.82						
01/17/17	341.18		325.04	326.39	338.34			326.76	330.50		328.90		334.54	332.63	322.81		333.94						338.34	322.81	0.774	50.85
02/23/17	339.74		324.92	324.89	336.17			324.27	328.05		328.25		331.83	330.87	321.93		333.94					336.17	321.93	0.770	50.59	
06/06/17	340.61		324.07	325.63	337.00			326.01	329.76		328.07		332.25	331.20	322.03	328.39	334.55					337.00	322.03	0.720	47.30	
08/18/17	340.38	331.10	324.09	325.41	337.24	333.08	334.31	326.52	329.94	324.16	328.34	347.90	332.02	330.77	322.24	327.37	334.24									

**Residence Time Calculation Summary Welsh  
Bottom Ash Storage Pond**

*Geosyntec Consultants, Inc.*

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2021-06		2021-07 <sup>[3]</sup>		2021-10	
			Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Bottom Ash Storage Pond	AD-1 <sup>[1]</sup>	2.0	3.8	16.2	3.9	15.7	3.0	20.5
	AD-3 <sup>[2]</sup>	2.0	6.1	9.9	21.1	2.9	6.3	9.7
	AD-4C <sup>[2]</sup>	2.0	4.6	13.3	19.1	3.2	3.5	17.5
	AD-5 <sup>[1]</sup>	2.0	2.1	28.7	1.7	36.8	1.2	52.6
	AD-16R <sup>[2]</sup>	2.0	4.0	15.1	2.4	25.6	1.7	35.2
	AD-17 <sup>[1]</sup>	2.0	8.7	7.0	2.1	28.7	7.3	8.3

Notes:

[1] - Upgradient Well

[2] - Downgradient Well

[3] - Two-of-two verification sampling

**Table 1 - Groundwater Data Summary: AD-1  
Welsh - BASP  
Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/26/2016	Background	0.346	36.5	5	< 0.083 U1	5.9	42	252
7/27/2016	Background	0.35	39.6	4	< 0.083 U1	5.3	36	239
9/30/2016	Background	0.332	15	5	< 0.083 U1	5.4	35	173
10/19/2016	Background	0.398	19.1	4	< 0.083 U1	5.2	42	192
12/12/2016	Background	0.394	8.74	4	< 0.083 U1	5.2	40	200
1/17/2017	Background	0.656	129	4	< 0.083 U1	7.1	68	538
2/23/2017	Background	0.7	147	9	< 0.083 U1	6.9	68	612
6/7/2017	Background	0.449	15.1	4	< 0.083 U1	5.1	42	176
10/6/2017	Detection	0.453	14.3	4	< 0.083 U1	5.3	40	160
5/24/2018	Detection	0.345	10.2	4	< 0.083 U1	2.2	43	150
8/14/2018	Detection	0.443	5.95	5	< 0.083 U1	5.2	44	160
2/20/2019	Detection	0.504	142	2.82	0.24	7.3	49.2	522
5/30/2019	*	0.689	138	1.59	0.29	6.7	43.3	588
7/24/2019	Detection	0.644	62.7	2	0.106 J1	6.0	58	180
2/17/2020	*	0.626	115	3.41	0.31	5.8	56.3	488
5/20/2020	Detection	0.801	126	1.83	0.20	7.2	51.4	508
10/14/2020	Detection	0.670	3.88	2.16	0.25	4.5	66.9	183
2/23/2021	*	0.617	113	--	0.31	6.6	--	--
6/2/2021	Detection	0.786	97.1	2.26	0.30	6.2	61.4	400
10/20/2021	Detection	0.732	4.8	2.21	0.22	4.4	72.4	190

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

\* Sample is not associated with a specific monitoring program.

**Table 1 - Groundwater Data Summary: AD-1  
Welsh - BASP  
Appendix IV Constituents**

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
5/26/2016	Background	< 0.93 U1	1.39361 J1	191	0.271453 J1	0.213294 J1	0.240267 J1	1.15339 J1	1.184	< 0.083 U1	< 0.68 U1	0.01	0.033	0.53149 J1	1.74922 J1	0.959865 J1
7/27/2016	Background	< 0.93 U1	< 1.05 U1	191	0.315631 J1	0.0940357 J1	< 0.23 U1	0.615933 J1	0.9952	< 0.083 U1	< 0.68 U1	0.019	0.00793 J1	< 0.29 U1	1.81763 J1	< 0.86 U1
9/30/2016	Background	< 0.93 U1	2.96797 J1	141	0.382874 J1	< 0.07 U1	5	0.850408 J1	1.38	< 0.083 U1	3.38434 J1	0.014	0.01773 J1	< 0.29 U1	1.02629 J1	< 0.86 U1
10/19/2016	Background	< 0.93 U1	< 1.05 U1	114	0.311247 J1	< 0.07 U1	0.412131 J1	0.649606 J1	1.141	< 0.083 U1	< 0.68 U1	0.008	0.00534 J1	1.39872 J1	2.03168 J1	1.25062 J1
12/12/2016	Background	< 0.93 U1	< 1.05 U1	72	0.34133 J1	< 0.07 U1	< 0.23 U1	0.424105 J1	0.719	< 0.083 U1	< 0.68 U1	0.008	0.01521 J1	< 0.29 U1	1.85825 J1	< 0.86 U1
1/17/2017	Background	< 0.93 U1	< 1.05 U1	410	0.0366913 J1	< 0.07 U1	< 0.23 U1	0.480125 J1	3.009	< 0.083 U1	< 0.68 U1	0.000275956 J1	< 0.005 U1	< 0.29 U1	4.04737 J1	< 0.86 U1
2/23/2017	Background	< 0.93 U1	< 1.05 U1	488	< 0.02 U1	< 0.07 U1	< 0.23 U1	0.765099 J1	4.309	< 0.083 U1	< 0.68 U1	0.001	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
6/7/2017	Background	< 0.93 U1	1.14 J1	93.46	0.37 J1	< 0.07 U1	0.66 J1	0.77 J1	0.676	< 0.083 U1	< 0.68 U1	0.00902	0.007 J1	< 0.29 U1	2.1 J1	< 0.86 U1

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

pCi/L: picocuries per liter

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: AD-3**

**Welsh - BASP**

**Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/31/2016	Background	0.02	1.41	9	< 0.083 U1	6.6	4	106
7/27/2016	Background	0.02	0.706	8	< 0.083 U1	6.7	5	118
9/30/2016	Background	0.02	0.5	9	< 0.083 U1	4.8	6	127
10/19/2016	Background	0.06	0.794	8	< 0.083 U1	3.7	9	112
12/12/2016	Background	0.02	1.05	8	< 0.083 U1	4.7	11	138
1/19/2017	Background	0.02	0.746	9	< 0.083 U1	4.6	4	76
2/23/2017	Background	0.02	0.573	9	< 0.083 U1	4.7	5	104
6/7/2017	Background	0.03326	0.543	9	0.2625 J1	4.5	5	104
10/6/2017	Detection	0.02055	0.908	9	< 0.083 U1	5.2	7	114
5/24/2018	Detection	0.0069 J1	0.545	8	< 0.083 U1	4.4	3	98
11/13/2018	Detection	0.009 J1	0.684	8	< 0.083 U1	5.2	4.05	114
2/20/2019	Detection	0.01 J1	0.817	9.4	0.13	4.8	1.9	110
4/30/2019	Detection	0.007	--	9.34	--	4.1	--	--
5/30/2019	*	< 0.02 U1	3.02	9.03	0.18	4.3	2.3	110
7/24/2019	Detection	< 0.02 U1	1.35	7	0.09 J1	4.6	6	116
11/25/2019	Detection	--	0.734	--	--	--	--	--
5/20/2020	Detection	< 0.02 U1	0.724	7.99	0.11	4.6	2.7	236
7/22/2020	Detection	--	--	--	--	4.7	--	114
10/14/2020	Detection	< 0.02 U1	0.705	7.31	0.16	4.6	3.5	116
6/2/2021	Detection	0.036 J1	0.7	7.98	0.18	4.4	3.38	110
10/20/2021	Detection	< 0.009 U1	0.9	7.16	0.15	4.2	6.02	130

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

\* Sample is not associated with a specific monitoring program.



**Table 1 - Groundwater Data Summary: AD-3  
Welsh - BASP  
Appendix IV Constituents**

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
5/31/2016	Background	< 0.93 U1	1.56793 J1	53	0.286352 J1	< 0.07 U1	0.464721 J1	1.49214 J1	1.018	< 0.083 U1	< 0.68 U1	0.01	0.85	< 0.29 U1	0.995807 J1	1.31537 J1
7/27/2016	Background	3.21106 J1	< 1.05 U1	36	0.349485 J1	< 0.07 U1	0.515023 J1	1.19046 J1	0.183	< 0.083 U1	< 0.68 U1	0.024	0.589	1.43134 J1	2.40188 J1	< 0.86 U1
9/30/2016	Background	2.70729 J1	2.61987 J1	43	0.188596 J1	0.0802799 J1	0.659763 J1	1.44845 J1	0.552	< 0.083 U1	< 0.68 U1	0.019	0.39	< 0.29 U1	1.79734 J1	< 0.86 U1
10/19/2016	Background	2.47184 J1	1.97572 J1	41	0.451723 J1	0.277085 J1	0.818782 J1	1.53187 J1	1.589	< 0.083 U1	< 0.68 U1	0.018	0.351	6	< 0.99 U1	< 0.86 U1
12/12/2016	Background	< 0.93 U1	< 1.05 U1	45	0.262387 J1	< 0.07 U1	0.627352 J1	1.34901 J1	0.546	< 0.083 U1	< 0.68 U1	0.017	0.321	< 0.29 U1	< 0.99 U1	< 0.86 U1
1/19/2017	Background	< 0.93 U1	2.13113 J1	41	0.235263 J1	< 0.07 U1	0.647294 J1	1.6345 J1	0.35	< 0.083 U1	< 0.68 U1	0.014	0.504	< 0.29 U1	< 0.99 U1	< 0.86 U1
2/23/2017	Background	< 0.93 U1	< 1.05 U1	37	0.209151 J1	< 0.07 U1	< 0.23 U1	1.1537 J1	0.4592	< 0.083 U1	< 0.68 U1	0.014	0.501	< 0.29 U1	< 0.99 U1	< 0.86 U1
6/7/2017	Background	< 0.93 U1	1.91 J1	38	0.24 J1	0.08 J1	0.75 J1	1.28 J1	0.459	0.2625 J1	< 0.68 U1	0.01503	0.365	< 0.29 U1	< 0.99 U1	< 0.86 U1

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

pCi/L: picocuries per liter

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: AD-4C  
Welsh - BASP  
Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/31/2016	Background	0.05	0.798	10	< 0.083 U1	5.4	32	204
7/27/2016	Background	0.03	0.666	12	< 0.083 U1	5.5	35	208
9/30/2016	Background	0.02	0.5	11	< 0.083 U1	5.0	45	212
10/19/2016	Background	0.04	0.578	10	< 0.083 U1	4.3	35	212
12/12/2016	Background	0.02	0.341	11	< 0.083 U1	4.6	36	252
1/19/2017	Background	0.02	0.761	10	< 0.083 U1	4.7	43	184
2/23/2017	Background	0.02	0.467	9	< 0.083 U1	5.1	40	196
6/7/2017	Background	0.03331	0.573	10	< 0.083 U1	4.9	39	228
10/6/2017	Detection	0.02565	0.654	11	< 0.083 U1	5.4	44	226
5/24/2018	Detection	0.02505	0.434	14	< 0.083 U1	5.2	42	224
8/14/2018	Detection	--	--	15	--	5.0	--	--
11/13/2018	Detection	0.01 J1	0.609	7.5	< 0.083 U1	5.8	56	220
12/18/2018	Detection	--	--	--	--	4.9	58	--
2/20/2019	Detection	0.01 J1	0.931	9.18	0.1 J1	5.2	60.1	242
4/30/2019	Detection	0.014	--	--	--	4.8	56.2	--
5/30/2019	*	< 0.02 U1	0.564	14.8	0.16	4.6	52.8	208
7/24/2019	Detection	< 0.02 U1	0.586	13	< 0.083 U1	3.9	52	284
12/19/2019	Detection	--	--	--	--	--	--	226
5/20/2020	Detection	< 0.02 U1	0.679	15.1	0.11	5.1	69.0	268
7/22/2020	Detection	--	--	--	--	4.7	71.8	280
10/13/2020	Detection	< 0.02 U1	0.613	13.1	0.18	4.9	76.1	278
12/10/2020	Detection	--	--	--	--	4.9	78.2	288
6/2/2021	Detection	0.038 J1	1.1	13.3	0.16	4.6	82.4	280
7/26/2021	Detection	--	1.4	--	--	4.6	71.9	280
10/20/2021	Detection	0.021 J1	0.8	14.3	0.15	4.3	76.8	280

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

\* Sample is not associated with a specific monitoring program.

**Table 1 - Groundwater Data Summary: AD-4C  
Welsh - BASP  
Appendix IV Constituents**

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
5/31/2016	Background	< 0.93 U1	< 1.05 U1	88	0.407928 J1	< 0.07 U1	9	1.19093 J1	1.289	< 0.083 U1	< 0.68 U1	0.004	0.191	< 0.29 U1	1.12526 J1	< 0.86 U1
7/27/2016	Background	< 0.93 U1	< 1.05 U1	59	0.335947 J1	< 0.07 U1	4	0.852951 J1	0.571	< 0.083 U1	< 0.68 U1	0.015	0.185	1.09296 J1	2.52271 J1	< 0.86 U1
9/30/2016	Background	< 0.93 U1	1.51249 J1	74	0.274296 J1	< 0.07 U1	8	0.986752 J1	2.572	< 0.083 U1	< 0.68 U1	0.006	0.16	< 0.29 U1	1.95938 J1	< 0.86 U1
10/19/2016	Background	< 0.93 U1	1.74748 J1	69	0.347477 J1	0.0809157 J1	9	1.08565 J1	1.657	< 0.083 U1	< 0.68 U1	0.006	0.141	3.20217 J1	1.18291 J1	< 0.86 U1
12/12/2016	Background	< 0.93 U1	2.24683 J1	21	0.133622 J1	< 0.07 U1	0.944028 J1	0.305391 J1	0.685	< 0.083 U1	< 0.68 U1	0.004	0.143	< 0.29 U1	1.27423 J1	< 0.86 U1
1/19/2017	Background	< 0.93 U1	1.85604 J1	75	0.221609 J1	< 0.07 U1	4	1.02773 J1	2.045	< 0.083 U1	< 0.68 U1	0.005	0.125	< 0.29 U1	< 0.99 U1	< 0.86 U1
2/23/2017	Background	< 0.93 U1	< 1.05 U1	30	0.102645 J1	< 0.07 U1	0.421354 J1	0.364739 J1	0.517	< 0.083 U1	< 0.68 U1	0.004	0.098	< 0.29 U1	< 0.99 U1	< 0.86 U1
6/7/2017	Background	< 0.93 U1	1.19 J1	51.42	0.19 J1	0.08 J1	4.03	0.75 J1	0.953	< 0.083 U1	< 0.68 U1	0.00482	0.147	< 0.29 U1	< 0.99 U1	< 0.86 U1

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

pCi/L: picocuries per liter

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

**Table 1 - Groundwater Data Summary: AD-5**

**Welsh - BASP**

**Appendix III Constituents**

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/31/2016	Background	0.03	36.9	15	0.3469 J1	6.4	123	337
7/28/2016	Background	0.04	44.7	16	< 0.083 U1	5.4	163	360
9/30/2016	Background	0.04	46.3	15	0.2436 J1	5.3	190	416
10/20/2016	Background	0.05	50.7	14	< 0.083 U1	5.9	267	448
12/13/2016	Background	0.05	49.6	13	< 0.083 U1	6.2	233	484
1/17/2017	Background	0.04	49.8	14	< 0.083 U1	6.3	234	438
2/23/2017	Background	0.04	33	15	< 0.083 U1	5.5	127	286
6/7/2017	Background	0.05281	49.7	14	< 0.083 U1	6.0	82	300
10/6/2017	Detection	0.04322	33.1	16	< 0.083 U1	5.6	82	258
5/24/2018	Detection	0.05007	28.1	22	< 0.083 U1	6.2	60	242
8/15/2018	Detection	0.050	40.5	19	< 0.083 U1	6.2	240	428
2/21/2019	Detection	0.033	33.9	24.7	0.21	5.4	46.5	220
5/30/2019	*	0.03 J1	30.0	22.3	0.29	6.3	51.3	238
7/24/2019	Detection	0.04 J1	41.1	18	0.112 J1	6.3	90	354
2/17/2020	*	0.03 J1	39.8	19.8	0.22	5.5	43.7	248
5/20/2020	Detection	0.03 J1	40.2	22.3	0.18	6.8	55.5	264
10/14/2020	Detection	0.04 J1	36.6	18.8	0.18	6.5	148	338
2/23/2021	*	0.03 J1	30.9	--	0.23	6.0	--	--
6/2/2021	Detection	0.027 J1	24.4	19.6	0.21	5.8	53.8	220
10/20/2021	Detection	0.038 J1	38.4	17.4	0.17	5.6	155	370

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

\* Sample is not associated with a specific monitoring program.

**Table 1 - Groundwater Data Summary: AD-5  
Welsh - BASP  
Appendix IV Constituents**

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
5/31/2016	Background	< 0.93 U1	< 1.05 U1	57	0.149801 J1	0.0765156 J1	0.555038 J1	14	1.634	0.3469 J1	< 0.68 U1	0.135	0.01135 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
7/28/2016	Background	2.05116 J1	2.90819 J1	93	0.518653 J1	0.502155 J1	0.411466 J1	15	4.75	< 0.083 U1	< 0.68 U1	0.191	0.01516 J1	< 0.29 U1	1.08901 J1	< 0.86 U1
9/30/2016	Background	< 0.93 U1	4.7609 J1	87	0.251584 J1	< 0.07 U1	0.90676 J1	14	3.33	0.2436 J1	< 0.68 U1	0.186	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
10/20/2016	Background	< 0.93 U1	< 1.05 U1	70	0.08781 J1	0.107488 J1	0.248085 J1	9	2.319	< 0.083 U1	< 0.68 U1	0.225	< 0.005 U1	1.36984 J1	< 0.99 U1	< 0.86 U1
12/13/2016	Background	< 0.93 U1	1.15381 J1	53	0.164529 J1	0.203546 J1	0.747921 J1	13	2.182	< 0.083 U1	< 0.68 U1	0.199	0.00802 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
1/17/2017	Background	< 0.93 U1	< 1.05 U1	47	0.0574718 J1	0.180502 J1	< 0.23 U1	12	1.023	< 0.083 U1	< 0.68 U1	0.239	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
2/23/2017	Background	< 0.93 U1	< 1.05 U1	42	0.0306858 J1	< 0.07 U1	< 0.23 U1	13	1.788	< 0.083 U1	< 0.68 U1	0.166	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
6/7/2017	Background	< 0.93 U1	3.85 J1	87.7	0.08 J1	0.39 J1	0.28 J1	11.93	2.32	< 0.083 U1	< 0.68 U1	0.124	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

pCi/L: picocuries per liter

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: AD-16R

Welsh - BASP

Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/6/2017	Background	0.04198	2.75	7	0.3438 J1	3.7	54	204
6/28/2017	Background	0.06398	1.24	6	0.2512 J1	3.9	55	200
7/7/2017	Background	0.02699	2.07	36	< 0.083 U1	3.4	52	184
7/14/2017	Background	0.04415	2.39	6	0.2516 J1	3.5	44	160
7/21/2017	Background	0.03237	2.5	7	0.2615 J1	3.5	54	180
7/28/2017	Background	0.02841	1.92	7	< 0.083 U1	2.8	48	162
8/2/2017	Background	0.03177	1.86	7	< 0.083 U1	3.0	49	174
8/11/2017	Background	0.06192	1.83	8	< 0.083 U1	4.1	44	164
8/18/2017	Background	0.0304	1.44	7	< 0.083 U1	3.4	46	160
8/31/2017	Background	0.02841	1.33	7	< 0.083 U1	3.9	63	152
10/6/2017	Detection	0.04672	0.896	7	< 0.083 U1	3.3	82	152
1/18/2018	Detection	--	--	--	--	4.0	58.6	--
5/23/2018	Detection	0.03202	2.53	6	< 0.083 U1	3.8	67	204
8/14/2018	Detection	--	--	--	--	3.9	44	--
11/13/2018	Detection	0.02 J1	0.467	6.5	< 0.083 U1	5.6	54	186
2/20/2019	Detection	0.03 J1	2	6.78	0.2	4.7	52.8	200
4/30/2019	Detection	0.015	--	--	--	3.9	--	--
5/29/2019	*	< 0.02 U1	1.36	5.43	0.19	3.9	41.6	80
7/24/2019	Detection	0.03 J1	1.50	7	0.13 J1	3.6	70	250
12/19/2019	Detection	--	--	--	--	--	--	134
5/20/2020	Detection	0.02 J1	1.54	7.09	0.16	3.4	71.4	242
7/22/2020	Detection	--	--	--	--	3.2	--	224
10/14/2020	Detection	0.02 J1	0.550	6.50	0.14	3.3	53.1	183
6/2/2021	Detection	0.028 J1	1.0	7.02	0.28	3.7	65.4	190
10/20/2021	Detection	0.019 J1	0.4	7.12	0.11	3.6	39.0	170

Notes:

mg/L: milligrams per liter

SU: standard unit

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

\* Sample is not associated with a specific monitoring program.

**Table 1 - Groundwater Data Summary: AD-16R  
Welsh - BASP  
Appendix IV Constituents**

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
6/6/2017	Background	< 0.93 U1	7.07	46.4	2.21	1.03	1.76	41.74	6.66	0.3438 J1	< 0.68 U1	0.0293	< 0.005 U1	< 0.29 U1	1.98 J1	< 0.86 U1
6/28/2017	Background	< 0.93 U1	5.28	41.43	2.16	0.92 J1	0.95 J1	40.87	12.11	0.2512 J1	< 0.68 U1	0.02932	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
7/7/2017	Background	< 0.93 U1	4.13 J1	44.56	2.08	0.97 J1	1.44	41.75	25.16	< 0.083 U1	< 0.68 U1	0.02846	< 0.005 U1	< 0.29 U1	2.09 J1	1.2 J1
7/14/2017	Background	< 0.93 U1	6.31	54.35	2.01	1.09	0.84 J1	37.88	9.12	0.2516 J1	< 0.68 U1	0.02391	0.009 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
7/21/2017	Background	< 0.93 U1	3.88 J1	51.06	2.09	1.02	1.43	40.86	9.81	0.2615 J1	< 0.68 U1	0.02653	< 0.005 U1	< 0.29 U1	1 J1	< 0.86 U1
7/28/2017	Background	< 0.93 U1	3.7	48.51	2.17	1.28	1.07	45.33	8.52	< 0.083 U1	< 0.68 U1	0.02617	0.006 J1	< 0.29 U1	1.27 J1	1.43 J1
8/2/2017	Background	< 0.93 U1	4.46 J1	49.61	2.06	1.22	0.95 J1	43.11	5.45	< 0.083 U1	< 0.68 U1	0.02498	< 0.005 U1	< 0.29 U1	1.74	2.02
8/11/2017	Background	< 0.93 U1	4.93 J1	47.52	1.89	1.13	0.96 J1	40.37	--	< 0.083 U1	< 0.68 U1	0.02347	0.008 J1	< 0.29 U1	1.36 J1	< 0.86 U1
8/18/2017	Background	< 0.93 U1	2.35 J1	43.85	1.91	1.08	0.8 J1	40.05	5.56	< 0.083 U1	< 0.68 U1	0.02466	0.009 J1	< 0.29 U1	< 0.99 U1	0.92 J1
8/31/2017	Background	< 0.93 U1	2.12 J1	44.14	1.75	1.04	1.18	37.56	6.68	< 0.083 U1	< 0.68 U1	0.02429	0.006 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

pCi/L: picocuries per liter

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

Table 1 - Groundwater Data Summary: AD-17

## Welsh - BASP

## Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Sulfate	Total Dissolved Solids
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/26/2016	Background	0.121	200	43	0.4023 J1	7.2	1,166	1,810
7/27/2016	Background	0.119	195	32	0.4135 J1	5.7	1,005	1,576
9/30/2016	Background	0.111	191	36	0.3055 J1	6.2	1,055	1,663
10/20/2016	Background	0.124	194	32	0.583 J1	6.1	1,163	1,612
12/13/2016	Background	0.135	196	31	0.5399 J1	6.0	1,096	1,560
1/17/2017	Background	0.101	196	33	< 0.083 U1	5.9	1,445	1,686
2/22/2017	Background	0.135	189	30	< 0.083 U1	5.7	1,055	1,628
6/6/2017	Background	0.121	188	30	< 0.083 U1	5.8	1,105	1,578
10/5/2017	Detection	0.183	183	31	< 0.083 U1	5.9	1,090	1,548
5/24/2018	Detection	0.239	193	39	< 0.083 U1	6.3	1,067	1,836
8/15/2018	Detection	0.118	187	--	--	5.6	--	--
2/21/2019	Detection	0.151	207	43.2	0.18	6.9	1,060	1,722
5/30/2019	*	0.158	202	41.7	< 0.04 U1	6.1	1,120	1,546
7/24/2019	Detection	0.113	216	37	0.085 J1	6.0	1,127	1,864
2/17/2020	*	0.104	184	36.0	0.16	5.9	1,070	1,750
5/20/2020	Detection	0.115	250	47.7	0.15	5.7	1,190	1,890
10/14/2020	Detection	0.100	185	35.7	0.17	5.4	1,060	1,720
2/23/2021	*	0.098	168	--	0.17	5.6	--	--
6/2/2021	Detection	0.124	233	44.9	0.31	5.7	1,210	1,890
10/20/2021	Detection	0.104	164	37.3	0.16	5.1	1,040	1,710

## Notes:

mg/L: milligrams per liter

SU: standard unit

&lt;: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag.

In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.

In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

\* Sample is not associated with a specific monitoring program.



**Table 1 - Groundwater Data Summary: AD-17  
Welsh - BASP  
Appendix IV Constituents**

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
5/26/2016	Background	< 0.93 U1	1.37501 J1	21	0.173275 J1	2	1	63	1.525	0.4023 J1	< 0.68 U1	0.37	0.032	< 0.29 U1	< 0.99 U1	< 0.86 U1
7/27/2016	Background	1.13716 J1	< 1.05 U1	20	0.307264 J1	4	1	68	2.78	0.4135 J1	< 0.68 U1	0.374	0.02133 J1	1.04115 J1	4.56733 J1	< 0.86 U1
9/30/2016	Background	< 0.93 U1	< 1.05 U1	31	0.175474 J1	0.848199 J1	3	58	2.358	0.3055 J1	< 0.68 U1	0.354	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
10/20/2016	Background	< 0.93 U1	< 1.05 U1	34	0.200656 J1	2	4	65	2.224	0.583 J1	< 0.68 U1	0.394	< 0.005 U1	0.322249 J1	3.34422 J1	< 0.86 U1
12/13/2016	Background	< 0.93 U1	< 1.05 U1	17	0.0498325 J1	3	0.816224 J1	68	2.384	0.5399 J1	< 0.68 U1	0.323	0.01485 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1
1/17/2017	Background	< 0.93 U1	< 1.05 U1	14	0.0319852 J1	3	68	68	2.436	< 0.083 U1	< 0.68 U1	0.341	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
2/22/2017	Background	< 0.93 U1	< 1.05 U1	20	0.0665729 J1	2	1	73	2.288	< 0.083 U1	< 0.68 U1	0.331	< 0.005 U1	< 0.29 U1	< 0.99 U1	< 0.86 U1
6/6/2017	Background	< 0.93 U1	< 1.05 U1	10.33	< 0.02 U1	6.06	< 0.23 U1	74.8	1.598	< 0.083 U1	< 0.68 U1	0.329	0.013 J1	< 0.29 U1	< 0.99 U1	< 0.86 U1

Notes:

µg/L: micrograms per liter

mg/L: milligrams per liter

pCi/L: picocuries per liter

<: Non-detect value. Analytes which were not detected are shown as less than the method detection limit (MDL) followed by a 'U1' flag. In analytical data prior to 5/18/2021, U1 flags were reported as U in the analytical report.

--: Not analyzed

J1: Concentration estimated. Analyte was detected between the method detection limit and the reporting limit. In analytical data prior to 5/18/2021, J1 flags were reported as J in the analytical report.

## **APPENDIX 2**

Where applicable, shown in this appendix the are results from statistical analyses, and a description of the statistical analysis method chosen. These statistical analyses are conducted separately for each constituent in each monitoring well.

## Memorandum

Date: February 4, 2021

To: David Miller (AEP)

Copies to: Jill Parker-Witt (AEP)

From: Allison Kreinberg (Geosyntec)

Subject: Evaluation of Detection Monitoring Data at  
Welsh Plant's Bottom Ash Storage Pond (BASP)

---

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), the second semi-annual detection monitoring event at the Bottom Ash Storage Pond (BASP), an existing CCR unit at the Welsh Power Plant located in Pittsburg, Texas, was completed on October 13-14, 2020. Based on the results, a two-of-two verification sampling was completed on December 10, 2020.

Background values for the BASP were previously calculated in January 2018. After a minimum of four detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated December 10, 2019.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is only concluded if both samples in a series of two exceeds the UPL (or are below the LPL for pH). In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values are compared in Table 1 and noted exceedances are described in the list below.

- Sulfate concentrations exceeded the intrawell UPL of 63.7 mg/L in both the initial (76.1 mg/L) and second (78.2 mg/L) samples collected at AD-4C. Thus, an SSI over background is concluded for sulfate at AD-4C.
- Total dissolved solids (TDS) concentrations exceeded the intrawell UPL of 255 mg/L in both the initial (278 mg/L) and second (288 mg/L) samples collected at AD-4C. Thus, an SSI over background is concluded for TDS at AD-4C.

In response to the exceedance noted above, the Welsh BASP CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for sulfate and TDS will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Welsh BASP will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

**Table 1: Detection Monitoring Data Evaluation  
Welsh - BASP**

Parameter	Unit	Description	AD-3	AD-4C		AD-16R
			10/14/2020	10/13/2020	12/10/2020	10/14/2020
Boron	mg/L	Intrawell Background Value (UPL)	0.0580	0.0529		0.0638
		Analytical Result	0.02	0.02	--	0.02
Calcium	mg/L	Intrawell Background Value (UPL)	1.32	0.961		3.15
		Analytical Result	0.705	0.613	--	0.550
Chloride	mg/L	Intrawell Background Value (UPL)	9.40	15.6		8.02
		Analytical Result	7.31	13.1	--	6.50
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00		1.00
		Analytical Result	0.16	0.18	--	0.14
pH	SU	Intrawell Background Value (UPL)	6.6	5.8		5.0
		Intrawell Background Value (LPL)	3.1	4.2		2.6
		Analytical Result	4.6	4.9	--	3.3
Sulfate	mg/L	Intrawell Background Value (UPL)	10.6	63.7		73.2
		Analytical Result	3.5	<b>76.1</b>	<b>78.2</b>	53.1
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	140	255		221
		Analytical Result	116	<b>278</b>	<b>288</b>	183

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

**Bold values exceed the background value.**

Background values are shaded gray.

## ATTACHMENT A

Certification by a Qualified Professional Engineer

American Electric Power Service Corporation  
Texas Registered Engineering Firm No. F-3341

**CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER**

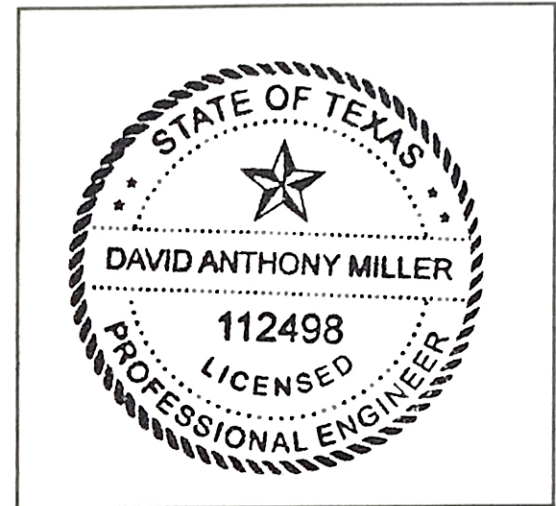
I certify that the selected statistical method, described above and in the December 10, 2019 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Welsh BASP CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature



112498

License Number

TEXAS

Licensing State

02.04.21

Date

## Memorandum

Date: August 23, 2021

To: David Miller (AEP)

Copies to: Jill Parker-Witt (AEP)

From: Allison Kreinberg (Geosyntec)

Subject: Evaluation of Detection Monitoring Data at  
Welsh Plant's Bottom Ash Storage Pond (BASP)

---

In accordance with the Texas Commission on Environmental Quality (TCEQ) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (30 TAC 352, "CCR rule"), the first semi-annual detection monitoring event of 2021 at the Bottom Ash Storage Pond (BASP), an existing CCR unit at the Welsh Power Plant located in Pittsburg, Texas, was completed on June 2, 2021. Based on the results, a two-of-two verification sampling was completed on July 26, 2021.

Background values for the BASP were previously calculated in January 2018. After a minimum of four detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these revised background values are described in Geosyntec's *Statistical Analysis Summary* report, dated December 10, 2019.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is only concluded if both samples in a series of two exceeds the UPL (or are below the LPL for pH). In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.



Detection monitoring results and the relevant background values are compared in Table 1 and noted exceedances are described in the list below.

- Calcium concentrations exceeded the intrawell UPL of 0.961 mg/L in both the initial (1.1 mg/L) and second (1.4 mg/L) samples collected at AD-4C. Thus, an SSI over background is concluded for calcium at AD-4C.
- Sulfate concentrations exceeded the intrawell UPL of 63.7 mg/L in both the initial (82.4 mg/L) and second (71.9 mg/L) samples collected at AD-4C. Thus, an SSI over background is concluded for sulfate at AD-4C.
- Total dissolved solids (TDS) concentrations exceeded the intrawell UPL of 255 mg/L in both the initial (280 mg/L) and second (280 mg/L) samples collected at AD-4C. Thus, an SSI over background is concluded for TDS at AD-4C.

In response to the exceedance noted above, the Welsh BASP CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for calcium, sulfate, and TDS will be conducted in accordance with 30 TAC 352.941(c). If the ASD is successful, the Welsh BASP will remain in detection monitoring.

The statistical analysis was conducted in accordance with 30 TAC 352.931 and completed within 90 days of sampling and analysis. A certification of these statistics by a qualified professional engineer is provided in Attachment A.

**Table 1: Detection Monitoring Data Evaluation  
Welsh - Bottom Ash Storage Pond**

Analyte	Unit	Description	AD-3	AD-4C		AD-16R
			6/2/2021	6/2/2021	7/26/2021	6/2/2021
Boron	mg/L	Intrawell Background Value (UPL)	0.0580	0.0529		0.0638
		Analytical Result	0.036	0.038	--	0.028
Calcium	mg/L	Intrawell Background Value (UPL)	1.32	0.961		3.15
		Analytical Result	0.7	<b>1.1</b>	<b>1.40</b>	1.0
Chloride	mg/L	Intrawell Background Value (UPL)	9.40	15.6		8.02
		Analytical Result	7.98	13.3	--	7.02
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00		1.00
		Analytical Result	0.18	0.16	--	0.28
pH	SU	Intrawell Background Value (UPL)	6.6	5.8		5.0
		Intrawell Background Value (LPL)	3.1	4.2		2.6
		Analytical Result	4.4	4.6	--	3.7
Sulfate	mg/L	Intrawell Background Value (UPL)	10.6	63.7		73.2
		Analytical Result	3.38	<b>82.4</b>	<b>71.9</b>	65.4
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	140	255		221
		Analytical Result	110	<b>280</b>	<b>280</b>	190

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

**Bold values exceed the background value.**

Background values are shaded gray.

## ATTACHMENT A

Certification by a Qualified Professional Engineer

American Electric Power Service Corporation  
Texas Registered Engineering Firm No. F-3341

**CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER**

I certify that the selected statistical method, described above and in the December 10, 2019 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Welsh BASP CCR management area and that the requirements of 30 TAC 352.931(a) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller  
Signature



112498  
License Number

TEXAS  
Licensing State

08.23.21  
Date

## Memorandum

Date: December 15, 2021

To: David Miller (AEP)

Copies to: Jill Parker-Witt (AEP)

From: Allison Kreinberg (Geosyntec)

Subject: Evaluation of Detection Monitoring Data at  
Welsh Plant's Bottom Ash Storage Pond (BASP)

---

In accordance with the Texas Commission on Environmental Quality (TCEQ) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (30 TAC 352, "CCR rule"), the second semi-annual detection monitoring event of 2021 at the Bottom Ash Storage Pond (BASP), an existing CCR unit at the Welsh Power Plant located in Pittsburg, Texas, was completed on October 20, 2021.

Background values for the BASP were originally calculated in January 2018. After a minimum of four detection monitoring events, the results of those events were compared to the existing background and the dataset was updated as appropriate. Revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of the most recent revision to the background values are described in Geosyntec's *Statistical Analysis Summary* report, dated December 8, 2021.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is only concluded if both samples in a series of two exceeds the UPL (or are below the LPL for pH). In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values are compared in Table 1. No SSIs were observed at the Welsh BASP CCR unit, and as a result the Welsh BASP will remain in detection monitoring.

The statistical analysis was conducted in accordance with 30 TAC 352.931 and completed within 90 days of sampling and analysis. A certification of these statistics by a qualified professional engineer is provided in Attachment A.

**Table 1: Detection Monitoring Data Evaluation  
Welsh - Bottom Ash Storage Pond**

Analyte	Unit	Description	AD-3	AD-4C	AD-16R
			10/20/2021	10/20/2021	10/20/2021
Boron	mg/L	Intrawell Background Value (UPL)	0.0444	0.0481	0.0595
		Analytical Result	0.009	0.021	0.019
Calcium	mg/L	Intrawell Background Value (UPL)	1.31	1.19	2.95
		Analytical Result	0.9	0.8	0.4
Chloride	mg/L	Intrawell Background Value (UPL)	9.83	16.0	7.79
		Analytical Result	7.16	14.3	7.12
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00	1.00
		Analytical Result	0.15	0.15	0.11
pH	SU	Intrawell Background Value (UPL)	5.3	5.7	4.8
		Intrawell Background Value (LPL)	3.9	4.1	2.7
		Analytical Result	4.2	4.3	3.6
Sulfate	mg/L	Intrawell Background Value (UPL)	9.54	82.8	75.7
		Analytical Result	6.02	76.8	39.0
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	136	301	251
		Analytical Result	130	280	170

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

**Bold values exceed the background value.**

Background values are shaded gray.

## ATTACHMENT A

Certification by a Qualified Professional Engineer

American Electric Power Service Corporation  
Texas Registered Engineering Firm No. F-3341



**CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER**

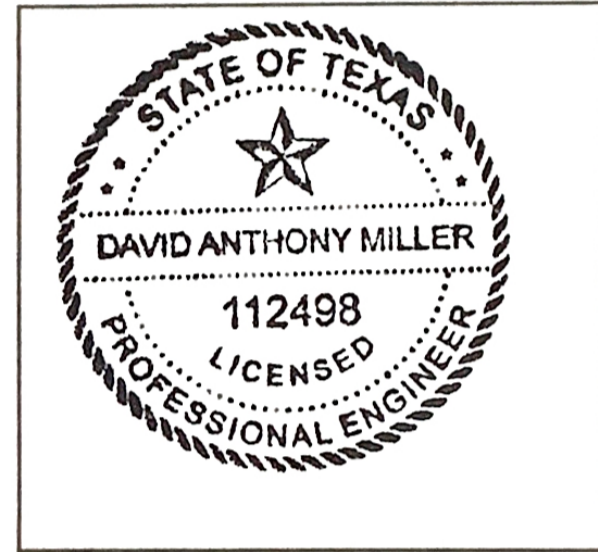
I certify that the selected statistical method, described above and in the December 8, 2021 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Welsh BASP CCR management area and that the requirements of 30 TAC 352.931(a) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature



112498

License Number

TEXAS

Licensing State

12.16.21

Date

**STATISTICAL ANALYSIS SUMMARY-**  
**Background Update Calculations**  
**Bottom Ash Storage Pond –**  
**J. Robert Welsh Plant**  
**Pittsburg, Texas**

*Submitted to*



1 Riverside Plaza  
Columbus, Ohio 43215-2372

*Submitted by*



engineers | scientists | innovators

941 Chatham Lane  
Suite 103  
Columbus, Ohio 43221

December 8, 2021  
CHA8500

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## LIST OF ATTACHMENTS

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Attachment B	Statistical Analysis Output

## LIST OF ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
ASD	Alternative Source Demonstration
BASP	Bottom Ash Storage Ponds
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Value
EPA	Environmental Protection Agency
LFB	Laboratory Fortified Blanks
LPL	Lower Prediction Limit
LRB	Laboratory Reagent Blanks
NELAP	National Environmental Laboratory Accreditation Program
PQL	Practical Quantitation Limit
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

## SECTION 1

### EXECUTIVE SUMMARY

In accordance with the Texas Commission on Environmental Quality's (TCEQ's) regulations regarding the disposal of coal combustion residuals (CCRs) in landfills and surface impoundments (Title 30 Chapter 352, "CCR rule"), groundwater monitoring has been conducted at the Bottom Ash Storage Ponds (BASP), an existing CCR unit at the J. Robert Welsh Power Plant located in Pittsburg, Texas. Recent groundwater monitoring results were incorporated into the BASP background dataset as appropriate and the site-specific background values were re-established for use in future detection monitoring events.

A minimum of eight monitoring events were completed prior to October 2017 to establish background concentrations for Appendix III and Appendix IV parameters under the CCR rule. Prediction limits for Appendix III parameters were previously updated in December 2019 using data until May 2019 (Geosyntec, 2019). Since the last background update, four semiannual detection monitoring events were conducted between July 2019 and June 2021.

Data from these four events, including both initial and verification results, were evaluated for inclusion in the background dataset. Two additional events not associated with detection monitoring were also evaluated for inclusion in the background dataset. Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact the usability of the data.

The detection monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. The compliance data were reviewed for outliers, and one value was removed from the compliance dataset prior to updating upper prediction limits (UPLs) for each Appendix III parameter and the lower prediction limit (LPL) for pH to represent background values.

Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

## SECTION 2

### BOTTOM ASH STORAGE POND EVALUATION

#### 2.1 Previous Background Calculations

A minimum of eight background monitoring events were completed from May 2016 through September 2017 to establish background concentrations for Appendix III and Appendix IV parameters under the CCR rule. The data were reviewed for outliers and trends prior to calculating upper prediction limits (UPLs) for each Appendix III parameter. Lower prediction limits (LPLs) were also established for pH. Intrawell prediction limits were selected for boron, calcium, chloride, fluoride, sulfate, and total dissolved solids (TDS) with a one-of-two resampling plan, and interwell prediction limits with a one-of-two resampling plan were selected for pH. Tests for pH were revised to intrawell prediction limits based on an alternative source demonstration (ASD) certified on April 13, 2018 (Geosyntec, 2018a). The statistical analyses to establish background levels are detailed in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018b).

As recommended in the USEPA *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance* (Unified Guidance), background values should be updated every four to eight measurements (USEPA, 2009). Prediction limits for Appendix III parameters were previously updated in December 2019 using data until May 2019 (Geosyntec, 2019). Intrawell tests using a one-of-two retesting procedure were selected and updated for all Appendix III parameters. These prediction limits were used for detection monitoring events completed between July 2019 and June 2021.

#### 2.2 Data Validation & QA/QC

Four semiannual detection monitoring events, which were completed between July 2019 and June 2021, have been conducted at the BASP since the previous background update (which used data through May 2019). If the initial results for each detection monitoring event identified possible exceedances, verification sampling was completed on an individual well/parameter basis. Thus, a minimum of four samples have been collected from each compliance well since the previous background update. A summary of data collected during these detection monitoring events is found in Table 1. Two additional sampling events, conducted in February 2020 and February 2021 at select wells, were not associated with detection monitoring efforts. However, these events were also included in the background dataset update. The results from these two additional events are also provided in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.31 statistics software. The export was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

## 2.3 Statistical Analysis

The data used to conduct the statistical analyses described below are summarized in Table 1. Statistical analyses for the BASP were conducted in accordance with the *Statistical Analysis Plan* (Geosyntec, 2021). The complete statistical analysis results are included in Attachment B.

Time series plots of Appendix III parameters are included in Attachment B and were used to evaluate concentrations over time and to provide an initial screening of suspected outliers and trends. Box plots were also compiled to provide visual representation of variations between wells and within individual wells (Attachment B).

### 2.3.1 Outlier Evaluation

Potential outliers were evaluated using Tukey's outlier test; i.e., data points were considered potential outliers if they met one of the following criteria:

$$x_i < \tilde{x}_{0.25} - 3 \times IQR \quad (1)$$

or

$$x_i > \tilde{x}_{0.75} + 3 \times IQR \quad (2)$$

where:

- $x_i$  = individual data point
- $\tilde{x}_{0.25}$  = first quartile
- $\tilde{x}_{0.75}$  = third quartile
- $IQR$  = the interquartile range =  $\tilde{x}_{0.75} - \tilde{x}_{0.25}$

Data that were evaluated as potential outliers are summarized in Attachment B. One outlier was identified in the data collected for the four most recent detection monitoring events. The high TDS value of 236 mg/L at AD-3 on May 20, 2020 was flagged and removed from the dataset to construct a statistical limit that is representative of present-day groundwater quality and conservative from a regulatory perspective.

### 2.3.2 Establishment of Updated Background Dataset

Analysis of variance (ANOVA) was conducted during the initial background screening to assist in identifying if intrawell tests are the most appropriate statistical approach for assessing Appendix III parameters. Intrawell tests compare compliance data from a single well to background data within the same well and are most appropriate when 1) upgradient wells exhibit spatial variation; 2) when statistical limits constructed from upgradient wells would not be conservative from a regulatory perspective; or 3) when downgradient water quality is not impacted compared to upgradient water quality for the same parameter. Periodic updating of background statistical limits is necessary as natural systems continuously change due to physical changes to the environment. For intrawell analyses, data for all wells and constituents are re-evaluated when a minimum of four new data points are available. These four (or more) new data points are used to determine if earlier concentrations are representative of present-day groundwater quality.

Mann-Whitney (Wilcoxon rank-sum) tests were used to compare the medians of historical data (May 2016 – May 2019) to the new compliance samples (July 2019 – June 2021). Results were evaluated to determine if the medians of the two groups were similar at the 99% confidence level. Where no significant difference was found, the new compliance data were added to the background dataset. Where a statistically significant difference was found between the medians of the two groups, the data were reviewed to evaluate the cause of the difference and to determine if adding newer data to the background dataset, replacing the background dataset with the newer data, or continuing to use the existing background dataset was most appropriate. If the differences appeared to have been caused by a release, then the previous background dataset would have continued to be used.

The complete Mann-Whitney test results and a summary of the significant findings can be found in Attachment B.

Significant differences were found between the two groups for the following upgradient well/parameter pairs:

- A decrease was found for chloride at AD-1;
- Decreases were found for fluoride at AD-1, AD-5, and AD-17; and
- An increase was found for TDS at AD-17.

The background datasets for all upgradient wells were updated because the magnitudes of the differences were minimal, and these data represent naturally occurring groundwater quality not impacted by a release.

Statistically significant differences were found between the two groups for the following downgradient well/parameter pairs:



- A decrease was found for chloride at AD-3;
- Decreases were found for fluoride at AD-3 and AD-16R;
- An increase was found sulfate at AD-4C; and
- An increase was found TDS at AD-4C.

For downgradient well/parameter pairs with statistically significant increases or decreases, the magnitude of the difference was small or similar to those observed in upgradient wells; thus, the background dataset was updated to include the compliance dataset. For sulfate in downgradient well AD-4C, a steady increase in concentration was observed in recent measurements. However, previous alternative source demonstrations attributed the increase in concentrations to natural variability since similar patterns were observed in upgradient wells; thus, the background dataset was updated with the new data. In addition, the significant decrease for fluoride resulted from a decrease in reporting limits for the more recent data, and the dataset was also updated to include the new data. The background dataset for fluoride may be truncated in the future to use only the more recent dataset with lower concentrations when it can be demonstrated that the laboratory consistently meets the lower reporting limits.

After the revised background set was established, a parametric or non-parametric analysis was selected based on the distribution of the data and the frequency of non-detect data. Estimated results less than the practical quantitation limit (PQL) – i.e., “J-flagged” data – were considered detections and the estimated results were used in the statistical analyses. Non-parametric analyses were selected for datasets with at least 50% non-detect data or datasets that could not be normalized. Parametric analyses were selected for datasets (either transformed or untransformed) that passed the Shapiro-Wilk / Shapiro-Francia test for normality. The Kaplan-Meier non-detect adjustment was applied to datasets with between 15% and 50% non-detect data. For datasets with fewer than 15% non-detect data, non-detect data were replaced with one half of the PQL. The selected analysis (i.e., parametric or non-parametric) and transformation (where applicable) for each background dataset are shown in Attachment B.

### **2.3.3 Updated Prediction Limits**

All historical data through July 2021 were used to update the intrawell UPLs and represent background values. Intrawell LPLs were also generated for pH. The updated prediction limits are summarized in Table 2.

The intrawell UPLs and LPLs were calculated for a one-of-two retesting procedure; i.e., if at least one sample in a series of two does not exceed the UPL and the pH result is greater than or equal to the LPL, then it can be concluded that an SSI has not occurred. In practice, where the initial result does not exceed the UPL and the pH result is greater than or equal to the LPL, a second sample will not be collected. The retesting procedures allow achieving an acceptably high

statistical power to detect changes at downgradient wells for constituents evaluated using intrawell prediction limits.

## **2.4 Conclusions**

Four detection monitoring events were completed in accordance with the CCR Rule. Two additional events completed in February 2020 and February 2021 were also included in the new dataset. The laboratory and field data from these events were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. Mann-Whitney tests were completed to evaluate whether data from the detection monitoring events could be added to the existing background dataset. Where appropriate, the background datasets were updated, and UPLs and LPLs were recalculated. Intrawell tests using a one-of-two retesting procedure were selected and updated for all Appendix III parameters

### **SECTION 3**

#### **REFERENCES**

Geosyntec Consultants, 2018a. Alternative Source Demonstration Report – Federal CCR Rule. J. Robert Welsh Plant. April.

Geosyntec Consultants, 2018b. Statistical Analysis Summary. Bottom Ash Storage Pond – J. Robert Welsh Plant. January.

Geosyntec Consultants, 2019. Statistical Analysis Summary. Bottom Ash Storage Pond – J. Robert Welsh Plant. December.

Geosyntec Consultants. 2021. Statistical Analysis Plan - J. Robert Welsh Plant. December.

United States Environmental Protection Agency (USEPA). 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09-007. March

# TABLES

**Table 1: Groundwater Data Summary  
Welsh Plant - Bottom Ash Storage Pond**

Parameter	Unit	AD-1						AD-3					
		7/24/2019	2/17/2020	5/20/2020	10/14/2020	2/23/2021	6/2/2021	7/24/2019	11/25/2019	5/20/2020	7/22/2020	10/14/2020	6/2/2021
		2019-D2	*	2020-D1	2020-D2	*	2021-D1	2019-D2	2019-D2-R1	2020-D1	2020-D1-R1	2020-D2	2021-D1
Boron	mg/L	0.644	0.626	0.801	0.670	0.617	0.786	0.05 U	-	0.05 U	-	0.05 U	0.036 J
Calcium	mg/L	62.7	115	126	3.88	113	97.1	1.35	0.734	0.724	-	0.705	0.7
Chloride	mg/L	2	3.41	1.83	2.16	-	2.26	7	-	7.99	-	7.31	7.98
Fluoride	mg/L	0.106 J	0.31	0.20	0.25	0.31	0.30	0.09 J	-	0.11	-	0.16	0.18
Sulfate	mg/L	58	56.3	51.4	66.9	-	61.4	6	-	2.7	-	3.5	3.38
Total Dissolved Solids	mg/L	180	488	508	183	-	400	116	-	236	114	116	110
pH	SU	6.0	5.8	7.2	4.5	6.6	6.2	4.6	-	4.6	4.7	4.6	4.4

Parameter	Unit	AD-4C								
		7/24/2019	12/19/2019	5/20/2020	7/22/2020	10/13/2020	10/14/2020	12/10/2020	6/2/2021	7/26/2021
		2019-D2	2019-D2-R1	2020-D1	2020-D1-R1	2020-D2	2020-D2	2020-D2-R1	2021-D1	2021-D1-R1
Boron	mg/L	0.05 U	-	0.05 U	-	-	0.05 U	-	0.038 J	-
Calcium	mg/L	0.586	-	0.679	-	-	0.613	-	1.1	1.4
Chloride	mg/L	13	-	15.1	-	13.1	-	-	13.3	-
Fluoride	mg/L	1 U	-	0.11	-	0.18	-	-	0.16	-
Sulfate	mg/L	52	-	69.0	71.8	76.1	-	78.2	82.4	71.9
Total Dissolved Solids	mg/L	284	226	268	280	278	-	288	280	280
pH	SU	3.9	-	5.1	4.7	4.9	-	4.9	4.6	4.6

Parameter	Unit	AD-5						AD-16R					
		7/24/2019	2/17/2020	5/20/2020	10/14/2020	2/23/2021	6/2/2021	7/24/2019	12/19/2019	5/20/2020	7/22/2020	10/14/2020	6/2/2021
		2019-D2	*	2020-D1	2020-D2	*	2021-D1	2019-D2	2019-D2-R1	2020-D1	2020-D1-R1	2020-D2	2021-D1
Boron	mg/L	0.04 J	0.03 J	0.03 J	0.04 J	0.03 J	0.027 J	0.03 J	-	0.02 J	-	0.02 J	0.028 J
Calcium	mg/L	41.1	39.8	40.2	36.6	30.9	24.4	1.50	-	1.54	-	0.550	1.0
Chloride	mg/L	18	19.8	22.3	18.8	-	19.6	7	-	7.09	-	6.50	7.02
Fluoride	mg/L	0.112 J	0.22	0.18	0.18	0.23	0.21	0.13 J	-	0.16	-	0.14	0.28
Sulfate	mg/L	90	43.7	55.5	148	-	53.8	70	-	71.4	-	53.1	65.4
Total Dissolved Solids	mg/L	354	248	264	338	-	220	250	134	242	224	183	190
pH	SU	6.3	5.5	6.8	6.5	6.0	5.8	3.6	-	3.4	3.2	3.3	3.7

Parameter	Unit	AD-17					
		7/24/2019	2/17/2020	5/20/2020	10/14/2020	2/23/2021	6/2/2021
		2019-D2	*	2020-D1	2020-D2	*	2021-D1
Boron	mg/L	0.113	0.104	0.115	0.100	0.098	0.124
Calcium	mg/L	216	184	250	185	168	233
Chloride	mg/L	37	36.0	47.7	35.7	-	44.9
Fluoride	mg/L	0.085 J	0.16	0.15	0.17	0.17	0.31
Sulfate	mg/L	1,127	1,070	1,190	1,060	-	1,210
Total Dissolved Solids	mg/L	1,864	1,750	1,890	1,720	-	1,890
pH	SU	6.0	5.9	5.7	5.4	5.6	5.7

Notes:

mg/L: milligrams per liter

SU: standard unit

U: Parameter was not present in concentrations above the method detection limit and is reported as the reporting limit

J: Estimated value. Parameter was detected in concentrations below the reporting limit

--: Not Measured

D1: First semi-annual detection monitoring event of the year

D2: Second semi-annual detection monitoring event of the year

R1: First verification event associated with detection monitoring round

\* February 2020 and February 2021 data are not associated with any semiannual detection monitoring events but were included in the background update.

**Table 2: Background Level Summary  
Welsh Plant: Bottom Ash Storage Pond**

<b>Analyte</b>	<b>Unit</b>	<b>Description</b>	<b>AD-3</b>	<b>AD-4C</b>	<b>AD-16R</b>
Boron	mg/L	Intrawell Background Value (UPL)	0.0444	0.0481	0.0595
Calcium	mg/L	Intrawell Background Value (UPL)	1.31	1.19	2.95
Chloride	mg/L	Intrawell Background Value (UPL)	9.83	16.0	7.79
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00	1.00
pH	SU	Intrawell Background Value (UPL)	5.3	5.7	4.8
		Intrawell Background Value (LPL)	3.9	4.1	2.7
Sulfate	mg/L	Intrawell Background Value (UPL)	9.54	82.8	75.7
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	136	301	251

Notes

UPL: Upper prediction limit

LPL: Lower prediction limit

## ATTACHMENT A

Certification by Qualified Professional Engineer

American Electric Power Service Corporation  
Texas Registered Engineering Firm No. F-3341

**CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER**

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Welsh BASP CCR management area and that the requirements of § 352.931(a) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature



112498

License Number

TEXAS

Licensing State

12.09.21

Date

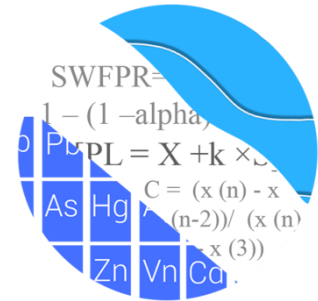


**ATTACHMENT B**  
**Statistical Analysis Output**

# GROUNDWATER STATS CONSULTING

November 15, 2021

Geosyntec Consultants  
Attn: Ms. Allison Kreinberg  
941 Chatham Lane, #103  
Columbus, OH 43221



Re: Welsh Bottom Ash Storage Pond (BASP)  
Background Update - 2021

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the screening for the proposed background update of groundwater data through July 2021 for American Electric Power's Welsh BASP. The analysis complies with the Texas Commission of Environmental Quality rule 30 TAC 352 for the Disposal of Coal Combustion Residuals (CCR) from Electric Utilities (CCR Rule, 2015) as well as with the United States Environmental Protection Agency (USEPA) Unified Guidance (2009).

Sampling began at Welsh BASP for the CCR program in 2016, and 8 background samples have been collected at each of the groundwater monitoring wells. The monitoring well network, as provided by Geosyntec Consultants, consists of the following:

- **Upgradient wells:** AD-1, AD-5, and AD-17
- **Downgradient wells:** AD-3, AD-4C, and AD-16R

Data were sent electronically to Groundwater Stats Consulting, and the statistical analysis report was prepared according to the background screening conducted in December 2017 that was approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to Groundwater Stats Consulting. The analysis was reviewed by Andrew Collins, Project Manager for Groundwater Stats Consulting.

The following CCR Detection Monitoring constituents were evaluated:

- **Appendix III Parameters:** boron, calcium, chloride, fluoride, pH, sulfate, and TDS

Time series plots are provided for all wells and constituents, and are used to evaluate concentrations over time as well as for the purpose of updating statistical limits (Figure A). Additionally, box plots are included for all constituents at upgradient and downgradient wells (Figure B). The time series plots are used to initially screen for suspected outliers and trends, while the box plots provide visual representation of variation within individual wells and between all wells. Values in background which have been flagged as outliers may be seen in a lighter font and as a disconnected symbol on the graph. A summary of these values follows this letter (Figure C).

During the background screening conducted in December 2017 data at all wells were evaluated for the following: 1) outliers; 2) trends; 3) most appropriate statistical method for Appendix III parameters based on site characteristics of groundwater data upgradient of the facility; and 4) eligibility of downgradient wells when intrawell statistical methods are recommended. Power curves were provided with the initial screening and demonstrated that the selected statistical methods for Appendix III parameters comply with the USEPA Unified Guidance recommendations as discussed below.

### **Summary of Statistical Method:**

- Intrawell prediction limits, combined with a 1-of-2 resample plan for boron, calcium, chloride, fluoride, pH, sulfate, and TDS

Parametric prediction limits are utilized when the screened historical data follow a normal or transformed-normal distribution. When data cannot be normalized or the majority of data are non-detects, a nonparametric test is utilized. While the false positive rate associated with the parametric limits is based on an annual 10% as recommended by the EPA Unified Guidance (2009), the false positive rate associated with the nonparametric limits is dependent upon the available background sample size, number of future comparisons, and verification resample plan. The distribution of data is tested using the Shapiro-Wilk/Shapiro-Francia test for normality. After testing for normality and performing any adjustments as discussed below (US EPA, 2009), data are analyzed using either parametric or non-parametric prediction limits.

- No statistical analyses are required on wells and analytes containing 100% non-detects (USEPA Unified Guidance, 2009, Chapter 6).

- When data contain <15% non-detects in background, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit utilized for non-detects is the most recent practical quantification limit (PQL) as reported by the laboratory.
- When data contain between 15-50% non-detects, the Kaplan-Meier non-detect adjustment is applied to the background data. This technique adjusts the mean and standard deviation of the historical concentrations to account for concentrations below the reporting limit.
- Nonparametric prediction limits are used on data containing greater than 50% non-detects.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of an additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered to be a false positive result and, therefore, no further action is necessary.

Natural systems continuously evolve due to physical changes made to the environment. Examples include capping a landfill, paving areas near a well, or lining a drainage channel to prevent erosion. Periodic updating of background statistical limits will be necessary to accommodate these types of changes. In the intrawell case, data for all wells and constituents are re-evaluated when a minimum of 4 new data points are available to determine whether earlier concentrations are representative of present-day groundwater quality. In some cases, the earlier portion of data are deselected prior to construction of limits in order to provide sensitive limits that will rapidly detect changes in groundwater quality. Even though the data are excluded from the calculation, the values will continue to be reported and shown in tables and graphs.

## **Summary of Historical Background Screening – December 2017**

### Outlier Evaluation

Time series plots were used to identify suspected outliers, or extreme values that would result in limits that are not conservative from a regulatory perspective, in proposed background data. Suspected outliers at all wells for Appendix III parameters were formally tested using Tukey's box plot method and, when identified, flagged in the computer database with "o" and deselected prior to construction of statistical limits.

Tukey's outlier test noted a high value for chloride in well AD-16R, and this value was flagged in the database. The results of Tukey's test were submitted with the previous background screening report.

### Seasonality

No seasonal patterns were observed on the time series plots for any of the detected data; therefore, no deseasonalizing adjustments were made to the data. When seasonal patterns are observed, data may be deseasonalized so that the resulting limits will correctly account for the seasonality as a predictable pattern rather than random variation or a release.

### Trend Tests

While trends may be visual, a quantification of the trend and its significance is needed. The Sen's Slope/Mann Kendall trend test was used to evaluate all data at each well to identify statistically significant increasing or decreasing trends. In the absence of suspected contamination, significant trending data are typically not included as part of the background data used for construction of prediction limits. This step serves to eliminate the trend and, thus, reduce variation in background. When statistically significant decreasing trends are present, earlier data are evaluated to determine whether earlier concentration levels are significantly different than current reported concentrations and will be deselected as necessary. When the historical records of data are truncated for the reasons above, a summary report will be provided to show the date ranges used in construction of the statistical limits.

The results of the trend analyses showed concentrations were stable over time with no statistically significant increasing or decreasing trends, except for one decreasing trend for TDS in well AD-16R. This trend was relatively low in magnitude when compared to average concentrations; therefore, no adjustments were required.

### Appendix III – Determination of Spatial Variation

The Analysis of Variance (ANOVA) is typically used to statistically evaluate differences in average concentrations among upgradient wells, which assists in identifying the most appropriate statistical approach. Interwell tests, which compare downgradient well data to statistical limits constructed from pooled upgradient well data, are appropriate when average concentrations are similar across upgradient wells. Intrawell tests, which compare compliance data from a single well to screened historical data within the same well, are appropriate when upgradient wells exhibit spatial variation and when statistical limits

constructed from upgradient wells would not be conservative from a regulatory perspective.

The ANOVA identified variation for all Appendix III parameters except for pH. Therefore, intrawell prediction limits were recommended for boron, calcium, chloride, fluoride, sulfate, and TDS. While interwell prediction limits would typically be recommended for pH, due to the variation in groundwater quality upgradient of the facility, evidence provided by Geosyntec Consultants supported the use of intrawell testing to accommodate groundwater quality and natural variability for all parameters.

### **Background Update – Conducted in October 2021**

Background data sets were evaluated during this analysis for the appropriateness of consolidating new measurements through July 2021 with screened historical data for construction of updated intrawell prediction limits. This process requires a minimum of four new measurements as mentioned above. Time series graphs and Tukey's outlier test were used to identify potential outliers. The Mann-Whitney test for equality of medians was used to determine whether background data sets were eligible for updating with newer measurements as discussed below.

Intrawell limits constructed from carefully screened background data from within each well serve to provide statistical limits that are conservative (i.e. lower) from a regulatory perspective, and that will rapidly identify a change in more recent compliance data from within a given well. This statistical method removes the element of variation from across wells and eliminates the chance of mistaking natural spatial variation for a release from the facility. Intrawell prediction limits, which compare the most recent compliance sample from a given well to historical data from the same well, are updated by testing for the appropriateness of consolidating new sampling observations with the screened background data.

#### Outlier Analysis

Prior to updating background data sets, samples were re-evaluated for all well/constituent pairs using Tukey's outlier test and visual screening on data through the July 2021 sample event. The last background update was performed in 2019 and the results were submitted at that time. In previous reports, Tukey's outlier test noted high values that were flagged as outliers for chloride in wells AD-1 and AD-16R, and for sulfate in well AD-17.

In this background update, Tukey's identified additional outliers for pH and TDS in well AD-3. These values were flagged as outliers in order to construct statistical limits that are

conservative from a regulatory perspective and represent present-day groundwater quality. No changes to previously flagged outliers were made during this analysis. As mentioned above, flagged data are displayed in a lighter font and as a disconnected symbol on the time series reports, as well as in a lighter font on the accompanying data pages. An updated summary of Tukey's test results and flagged measurements follows this letter.

### Mann-Whitney Evaluation

For constituents requiring intrawell prediction limits, the Mann-Whitney (Wilcoxon Rank Sum) test was used to compare the medians of historical data through May 2019 to the new compliance samples at each well through July 2021 to evaluate whether the groups are statistically different at the 99% confidence level, in which case background data may be updated with compliance data (Figure D). An exception to this is sulfate in well AD-4C, where previously established historical data through December 2018 is compared to more recent data through July 2021. Statistically significant differences (either an increase or decrease in median concentrations) were found between the two groups for the following well/constituent pairs:

Increase:

- Sulfate: AD-4C
- TDS: AD-17 (upgradient) and AD-4C

Decrease:

- Chloride: AD-1 (upgradient) and AD-3
- Fluoride: AD-1, AD-5, AD-17 (all upgradient), AD-3, and AD-16R

Typically, when the test concludes that the medians of the two groups are statistically significantly different, particularly in the downgradient wells, the background data sets are not updated to include the newer data unless it can be reasonably justified that the change in concentrations reflects a naturally occurring shift unrelated to practices at the site. In studies such as the current one, in which at least one of the segments being compared is of short duration, the comparison is complicated by the fact that normal short-term variation may be mistaken for long-term change in medians.

For upgradient well/constituent pairs determined to have statistically significant differences (both increases and decreases) in median concentrations between background and compliance samples, the differences were minimal and reflective of naturally changing groundwater quality upgradient of the facility.

Additionally, concentrations at downgradient well/constituent pairs with statistically significant differences (both increases and decreases) in median concentrations in all cases were comparable to or less than those observed in upgradient wells. In the case of sulfate at well AD-4C, an alternative source demonstration reportedly attributed the increase in concentrations to natural variability since similar patterns were observed in upgradient wells. The significant differences noted for fluoride resulted from current concentrations reported below the historical reporting limit. Therefore, all records were updated with compliance data through July 2021 for construction of statistical limits reflective of present-day groundwater quality.

### Statistical Limits

Intrawell prediction limits using all historical data through July 2021, combined with a 1-of-2 resample plan, were constructed and a summary of the updated limits follows this letter (Figure E).

Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Welsh BASP. If you have any questions or comments, please feel free to contact us.

For Groundwater Stats Consulting,



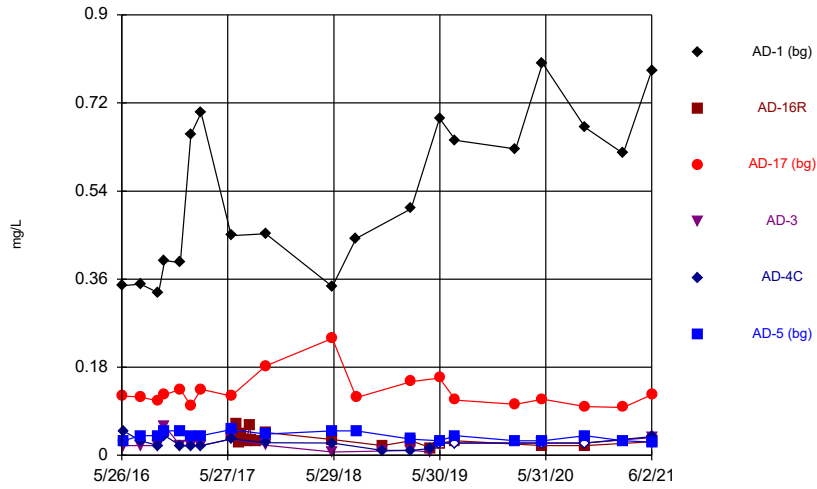
Tristan Clark  
Groundwater Analyst



Kristina L. Rayner  
Groundwater Statistician

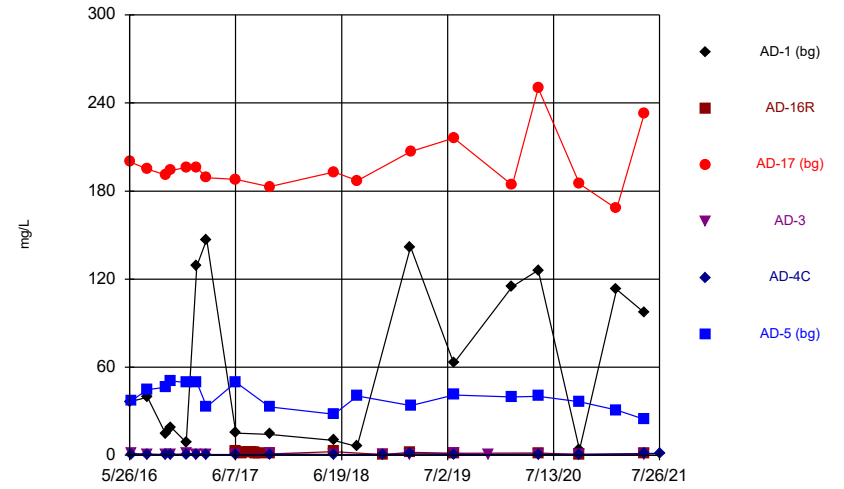


Time Series



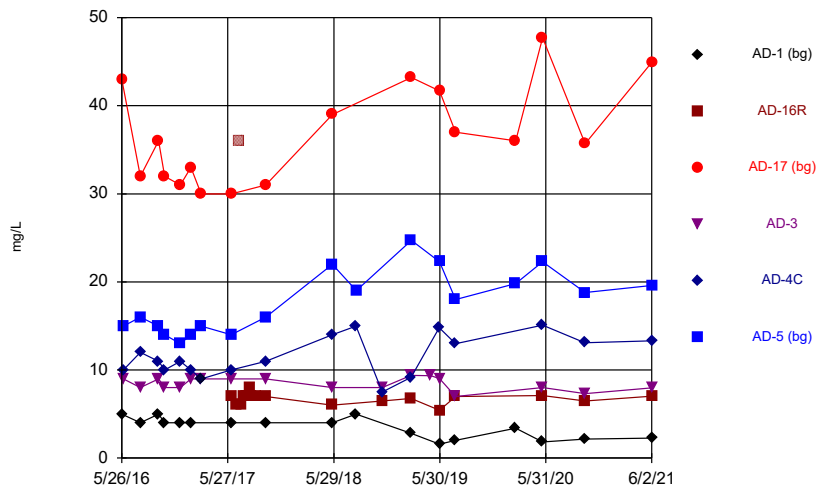
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 Welsh BASP Client: Geosyntec Data: Welsh BASP

Time Series



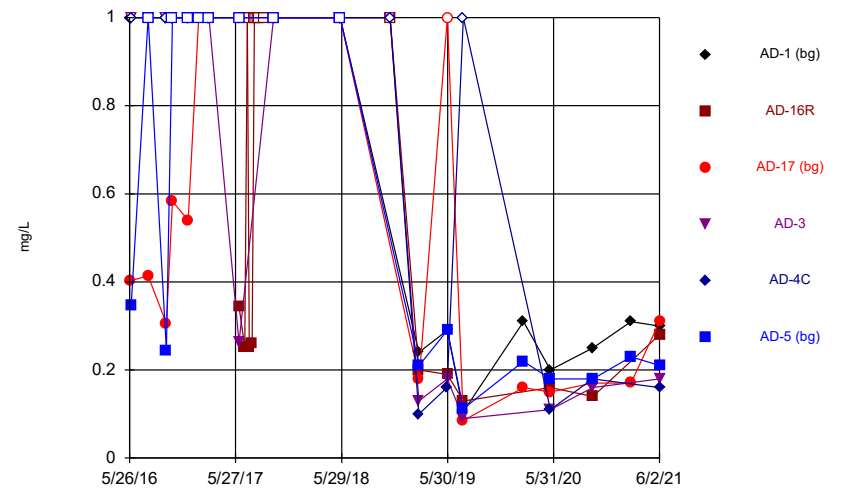
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Time Series



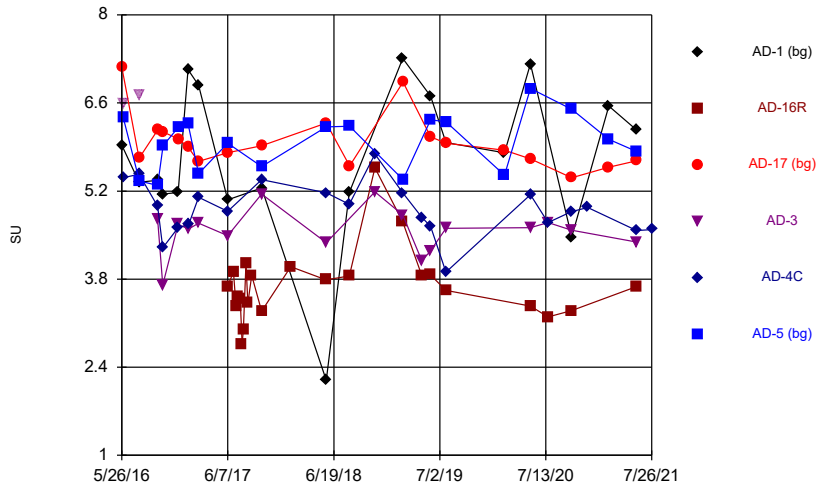
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Time Series



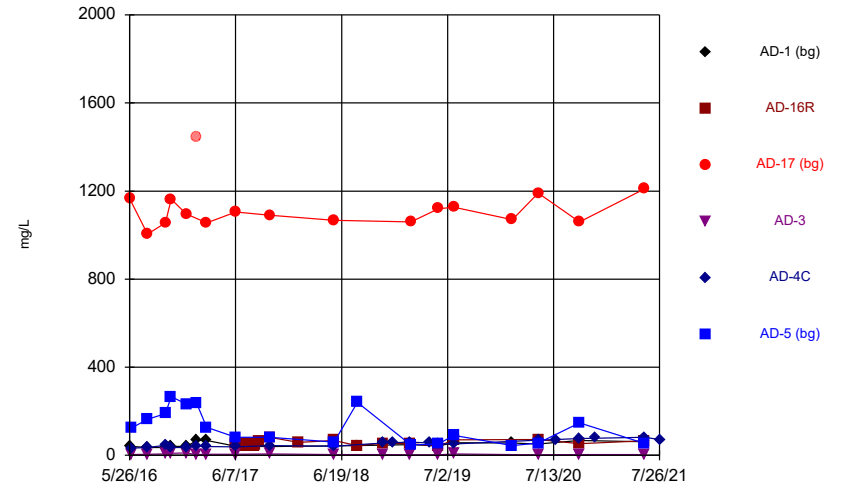
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Time Series



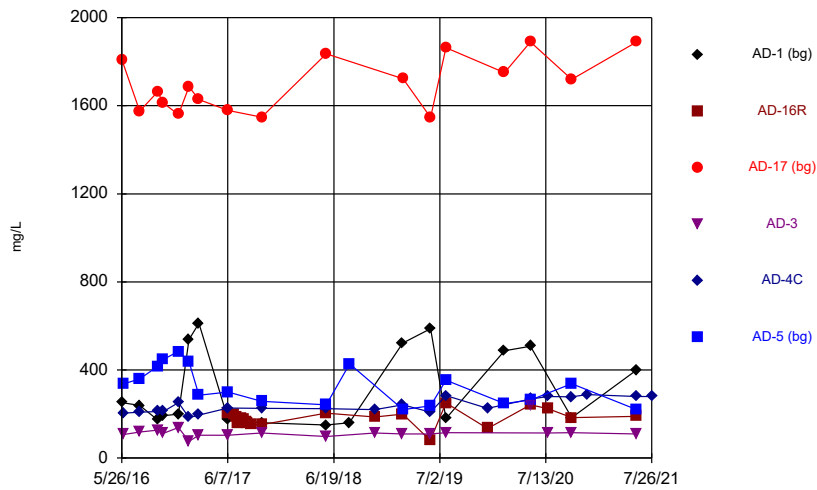
Constituent: pH, field Analysis Run 11/4/2021 3:55 PM  
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Time Series



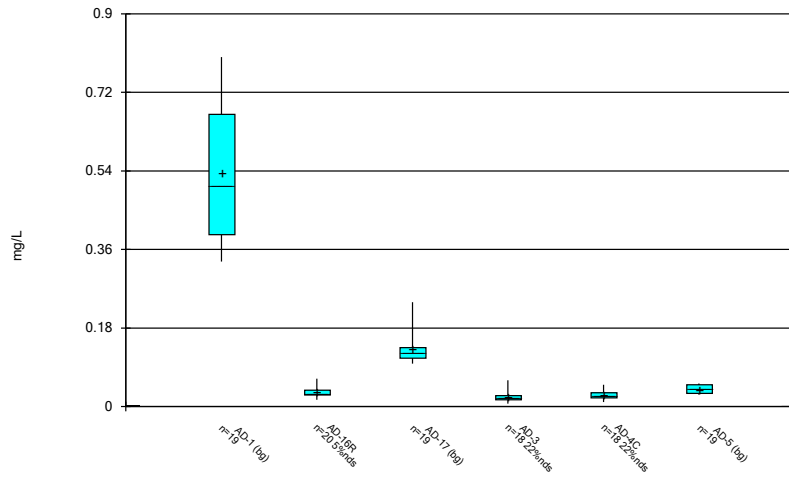
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Time Series



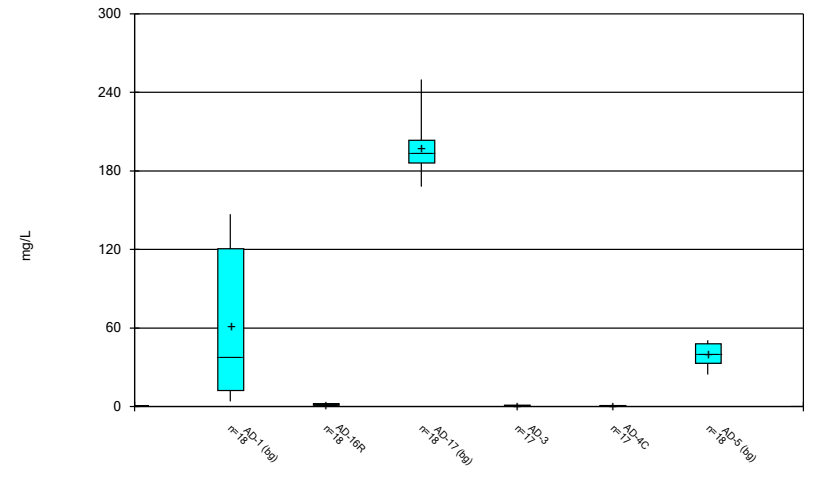
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 Welsh BASP Client: Geosyntec Data: Welsh BASP

Box & Whiskers Plot



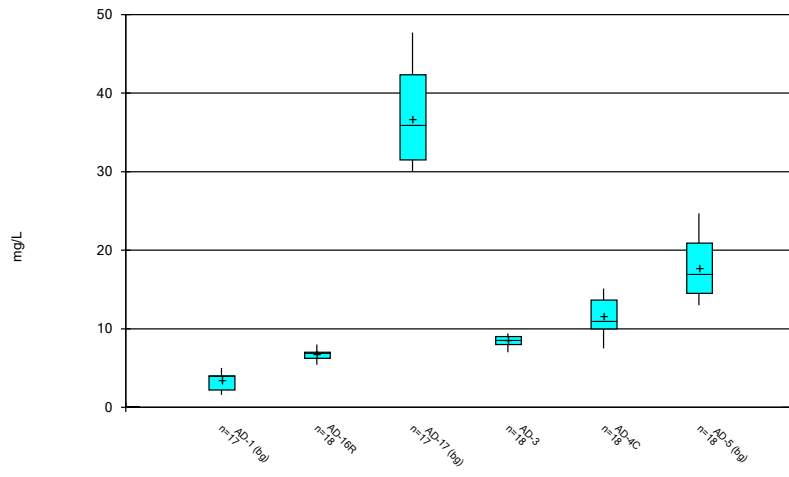
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Box & Whiskers Plot



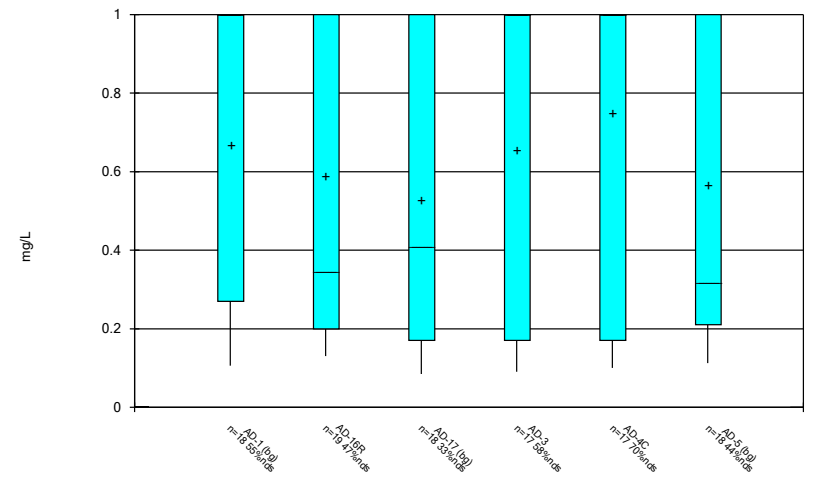
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Box & Whiskers Plot



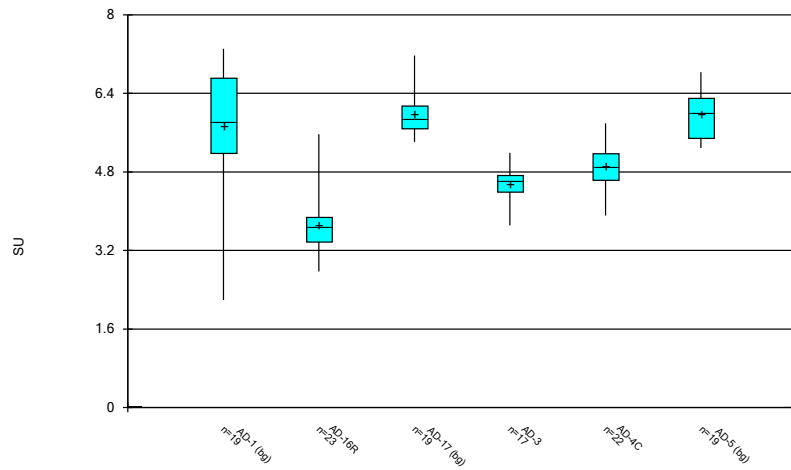
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Box & Whiskers Plot



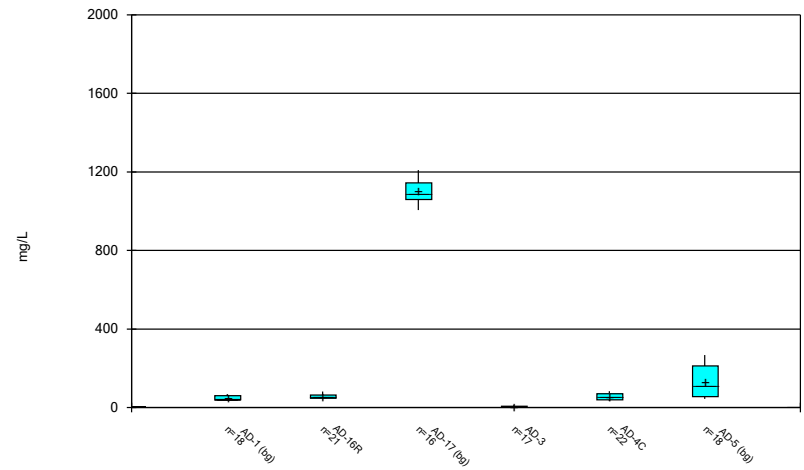
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 Welsh BASP Client: Geosyntec Data: Welsh BASP

Box & Whiskers Plot



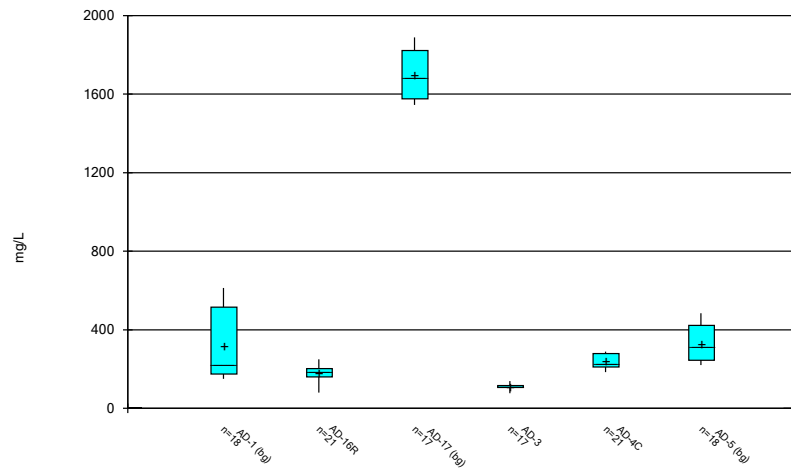
Constituent: pH, field Analysis Run 11/4/2021 3:56 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Box & Whiskers Plot



Constituent: Sulfate Analysis Run 11/4/2021 3:56 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Box & Whiskers Plot



Constituent: Total Dissolved Solids Analysis Run 11/4/2021 3:56 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

# Outlier Summary

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/4/2021, 4:03 PM

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	AD-1 Chloride (mg/L)	AD-16R Chloride (mg/L)	AD-3 pH, field (SU)	AD-17 Sulfate (mg/L)	AD-3 Total Dissolved Solids (mg/L)
5/31/2016			6.58 (o)		
7/27/2016			6.73 (o)		
1/20/2017				1445 (o)	
2/24/2017	9 (o)				
7/7/2017		36 (o)			
5/20/2020				236 (o)	

# Tukey's Outlier Test - Significant Results

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/4/2021, 4:01 PM

<u>Constituent</u>	<u>Well</u>	<u>Outlier</u>	<u>Value(s)</u>	<u>Date(s)</u>	<u>Method</u>	<u>Alpha</u>	<u>N</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>Distribution</u>	<u>Normality Test</u>
Chloride (mg/L)	AD-16R	Yes	36	7/7/2017	NP	NaN	19	8.28	6.737	In(x)	ShapiroWilk
pH, field (SU)	AD-3	Yes	6.58,6.73	5/31/2016,7/27/2016	NP	NaN	19	4.789	0.7379	In(x)	ShapiroWilk
Total Dissolved Solids (mg/L)	AD-3	Yes	236	5/20/2020	NP	NaN	18	117.9	31.98	In(x)	ShapiroWilk

# Tukey's Outlier Test - All Results

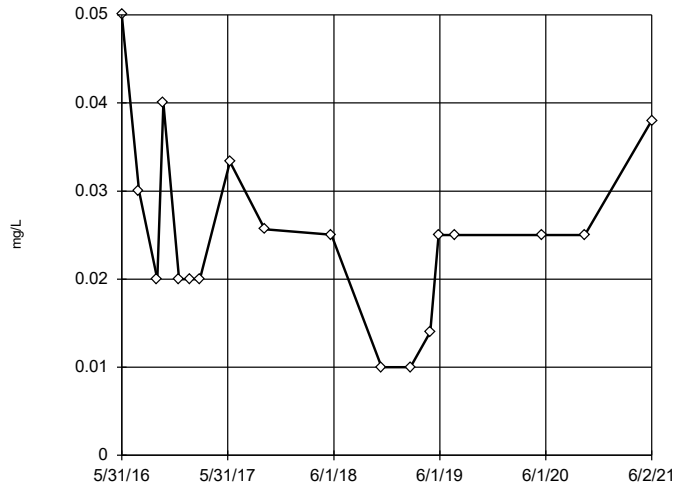
Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/4/2021, 4:01 PM

Constituent	Well	Outlier	Value(s)	Date(s)	Method	Alpha	N	Mean	Std. Dev.	Distribution	Normality Test
Boron (mg/L)	AD-1 (bg)	No	n/a	n/a	NP	NaN	19	0.537	0.1588	sqrt(x)	ShapiroWilk
Boron (mg/L)	AD-16R	No	n/a	n/a	NP	NaN	20	0.03411	0.01341	ln(x)	ShapiroWilk
Boron (mg/L)	AD-17 (bg)	No	n/a	n/a	NP	NaN	19	0.13	0.03398	ln(x)	ShapiroWilk
Boron (mg/L)	AD-3	No	n/a	n/a	NP	NaN	18	0.02237	0.01235	x^(1/3)	ShapiroWilk
Boron (mg/L)	AD-4C	No	n/a	n/a	NP	NaN	18	0.02533	0.01024	sqrt(x)	ShapiroWilk
Boron (mg/L)	AD-5 (bg)	No	n/a	n/a	NP	NaN	19	0.03927	0.008445	sqrt(x)	ShapiroWilk
Calcium (mg/L)	AD-1 (bg)	No	n/a	n/a	NP	NaN	18	61.12	54.53	ln(x)	ShapiroWilk
Calcium (mg/L)	AD-16R	No	n/a	n/a	NP	NaN	18	1.656	0.6709	normal	ShapiroWilk
Calcium (mg/L)	AD-17 (bg)	No	n/a	n/a	NP	NaN	18	197.5	19.15	ln(x)	ShapiroWilk
Calcium (mg/L)	AD-3	No	n/a	n/a	NP	NaN	17	0.7935	0.2592	ln(x)	ShapiroWilk
Calcium (mg/L)	AD-4C	No	n/a	n/a	NP	NaN	17	0.6876	0.2588	ln(x)	ShapiroWilk
Calcium (mg/L)	AD-5 (bg)	No	n/a	n/a	NP	NaN	18	39.41	7.958	normal	ShapiroWilk
Chloride (mg/L)	AD-1 (bg)	No	n/a	n/a	NP	NaN	18	3.782	1.712	ln(x)	ShapiroWilk
<b>Chloride (mg/L)</b>	<b>AD-16R</b>	<b>Yes</b>	<b>36</b>	<b>7/7/2017</b>	<b>NP</b>	<b>NaN</b>	<b>19</b>	<b>8.28</b>	<b>6.737</b>	<b>ln(x)</b>	<b>ShapiroWilk</b>
Chloride (mg/L)	AD-17 (bg)	No	n/a	n/a	NP	NaN	17	36.66	5.674	ln(x)	ShapiroWilk
Chloride (mg/L)	AD-3	No	n/a	n/a	NP	NaN	18	8.447	0.7151	x^3	ShapiroWilk
Chloride (mg/L)	AD-4C	No	n/a	n/a	NP	NaN	18	11.61	2.273	x^(1/3)	ShapiroWilk
Chloride (mg/L)	AD-5 (bg)	No	n/a	n/a	NP	NaN	18	17.69	3.528	ln(x)	ShapiroWilk
Fluoride (mg/L)	AD-1 (bg)	No	n/a	n/a	NP	NaN	18	0.667	0.3857	ln(x)	ShapiroWilk
Fluoride (mg/L)	AD-16R	No	n/a	n/a	NP	NaN	19	0.5899	0.4026	ln(x)	ShapiroWilk
Fluoride (mg/L)	AD-17 (bg)	No	n/a	n/a	NP	NaN	18	0.2594	0.1389	ln(x)	ShapiroWilk
Fluoride (mg/L)	AD-3	No	n/a	n/a	NP	NaN	17	0.6537	0.4281	ln(x)	ShapiroWilk
Fluoride (mg/L)	AD-4C	No	n/a	n/a	NP	NaN	17	0.7476	0.4034	ln(x)	ShapiroWilk
Fluoride (mg/L)	AD-5 (bg)	No	n/a	n/a	NP	NaN	18	0.5679	0.4004	ln(x)	ShapiroWilk
pH, field (SU)	AD-1 (bg)	No	n/a	n/a	NP	NaN	19	5.73	1.201	x^2	ShapiroWilk
pH, field (SU)	AD-16R	No	n/a	n/a	NP	NaN	23	3.703	0.5718	ln(x)	ShapiroWilk
pH, field (SU)	AD-17 (bg)	No	n/a	n/a	NP	NaN	19	5.978	0.4404	ln(x)	ShapiroWilk
<b>pH, field (SU)</b>	<b>AD-3</b>	<b>Yes</b>	<b>6.58,6.73</b>	<b>5/31/2016,7/27/2016</b>	<b>NP</b>	<b>NaN</b>	<b>19</b>	<b>4.789</b>	<b>0.7379</b>	<b>ln(x)</b>	<b>ShapiroWilk</b>
pH, field (SU)	AD-4C	No	n/a	n/a	NP	NaN	22	4.911	0.4175	x^2	ShapiroWilk
pH, field (SU)	AD-5 (bg)	No	n/a	n/a	NP	NaN	19	5.976	0.4451	x^3	ShapiroWilk
Sulfate (mg/L)	AD-1 (bg)	No	n/a	n/a	NP	NaN	18	49.25	11.12	ln(x)	ShapiroWilk
Sulfate (mg/L)	AD-16R	No	n/a	n/a	NP	NaN	21	55.66	10.66	ln(x)	ShapiroWilk
Sulfate (mg/L)	AD-17 (bg)	No	n/a	n/a	NP	NaN	17	1123	99.5	ln(x)	ShapiroWilk
Sulfate (mg/L)	AD-3	No	n/a	n/a	NP	NaN	17	4.872	2.394	ln(x)	ShapiroWilk
Sulfate (mg/L)	AD-4C	No	n/a	n/a	NP	NaN	22	53.43	15.74	ln(x)	ShapiroWilk
Sulfate (mg/L)	AD-5 (bg)	No	n/a	n/a	NP	NaN	18	127.2	76.81	ln(x)	ShapiroWilk
Total Dissolved Solids (mg/L)	AD-1 (bg)	No	n/a	n/a	NP	NaN	18	317.8	174.6	ln(x)	ShapiroWilk
Total Dissolved Solids (mg/L)	AD-16R	No	n/a	n/a	NP	NaN	21	180.2	37.34	x^2	ShapiroWilk
Total Dissolved Solids (mg/L)	AD-17 (bg)	No	n/a	n/a	NP	NaN	17	1699	123.5	ln(x)	ShapiroWilk
<b>Total Dissolved Solids (mg/L)</b>	<b>AD-3</b>	<b>Yes</b>	<b>236</b>	<b>5/20/2020</b>	<b>NP</b>	<b>NaN</b>	<b>18</b>	<b>117.9</b>	<b>31.98</b>	<b>ln(x)</b>	<b>ShapiroWilk</b>
Total Dissolved Solids (mg/L)	AD-4C	No	n/a	n/a	NP	NaN	21	238.1	33.55	ln(x)	ShapiroWilk
Total Dissolved Solids (mg/L)	AD-5 (bg)	No	n/a	n/a	NP	NaN	18	326.6	86.5	ln(x)	ShapiroWilk





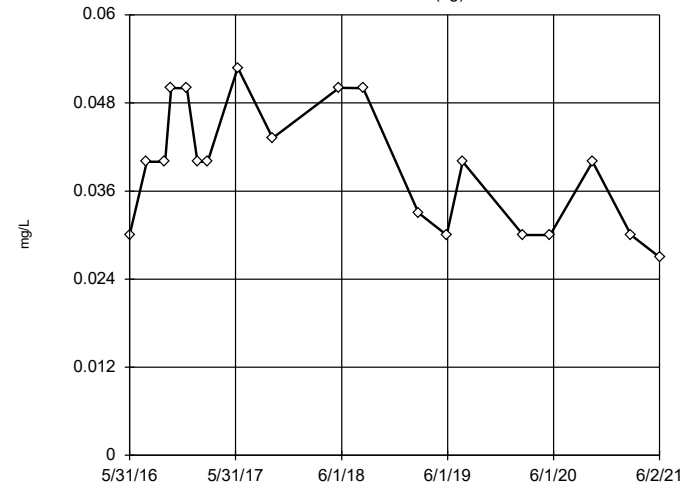
Tukey's Outlier Screening  
AD-4C



n = 18  
No outliers found. Tukey's method selected by user.  
Data were square root transformed to achieve best W statistic (graph shown in original units).  
High cutoff = 0.08246, low cutoff = 0.001031, based on IQR multiplier of 3.

Constituent: Boron Analysis Run 11/4/2021 4:00 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

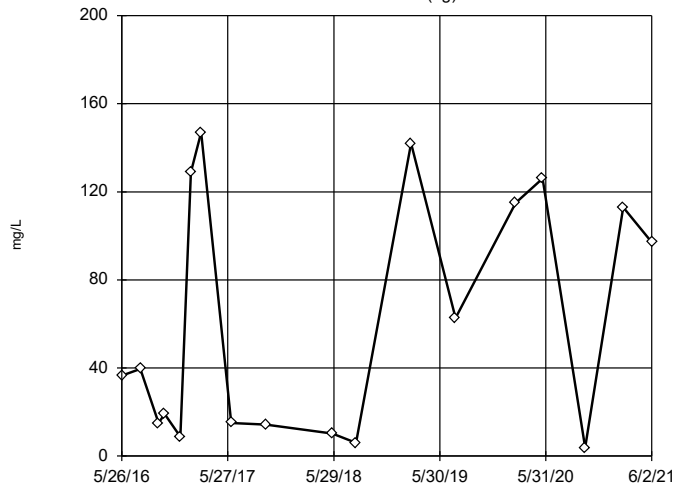
Tukey's Outlier Screening  
AD-5 (bg)



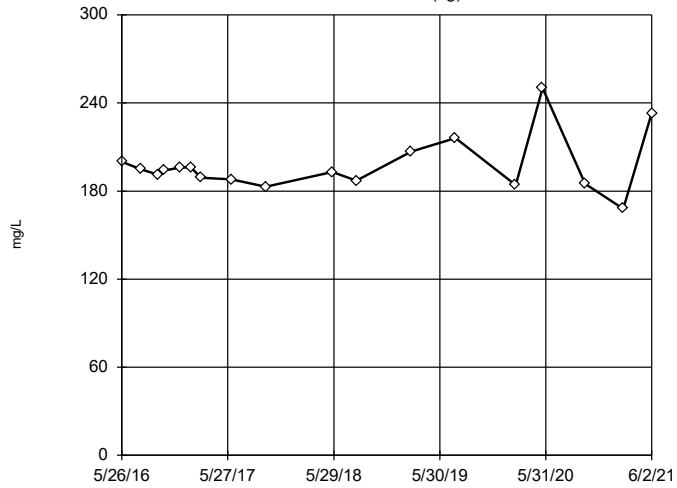
n = 19  
No outliers found. Tukey's method selected by user.  
Data were square root transformed to achieve best W statistic (graph shown in original units).  
High cutoff = 0.1405, low cutoff = 0.000484, based on IQR multiplier of 3.

Constituent: Boron Analysis Run 11/4/2021 4:00 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Tukey's Outlier Screening  
AD-1 (bg)



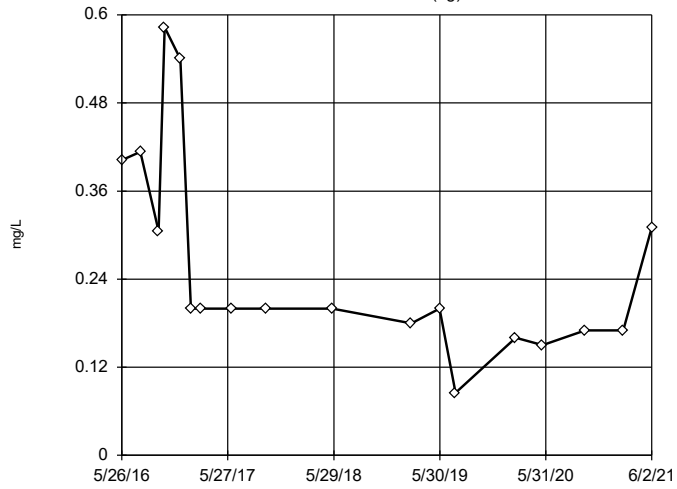
Tukey's Outlier Screening  
AD-17 (bg)



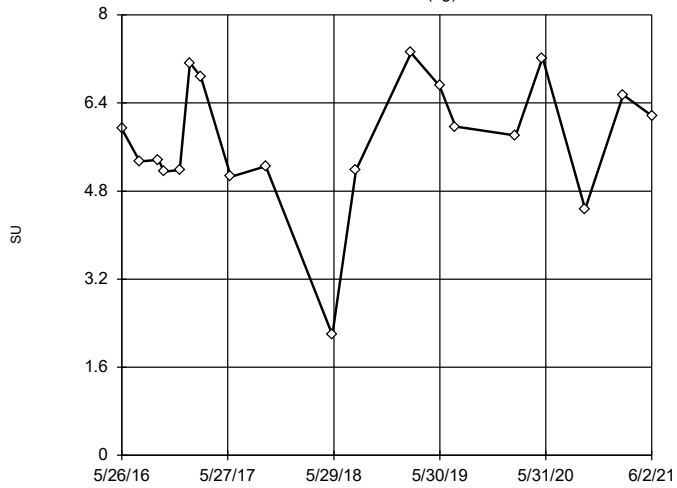




Tukey's Outlier Screening  
AD-17 (bg)



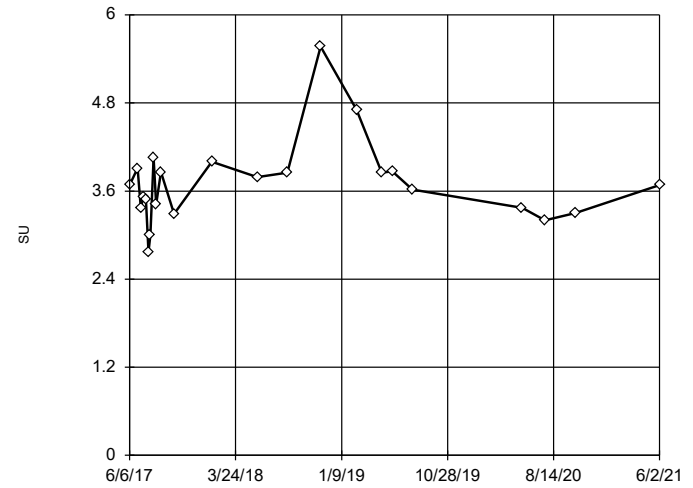
Tukey's Outlier Screening  
AD-1 (bg)



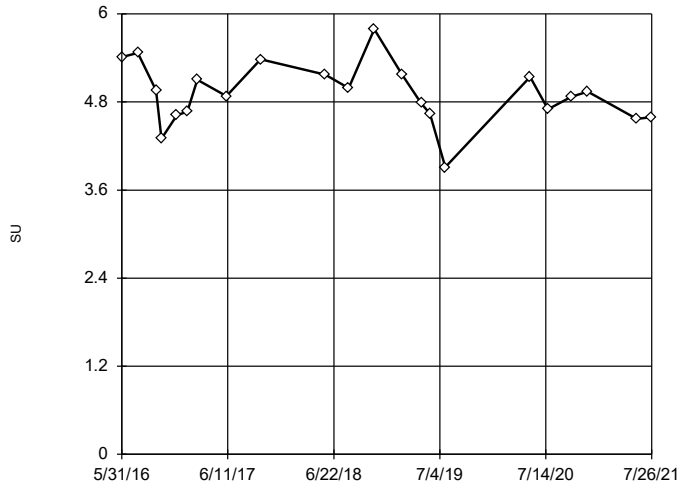
n = 19  
No outliers found.  
Tukey's method selected by user.  
Data were square transformed to achieve best W statistic (graph shown in original units).  
High cutoff = 9.98, low cutoff = -5.267, based on IQR multiplier of 3.

Constituent: pH, field Analysis Run 11/4/2021 4:01 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Tukey's Outlier Screening  
AD-16R



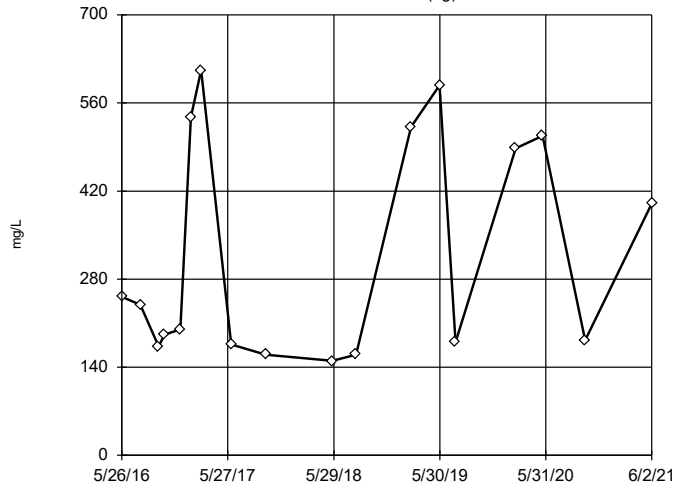
### Tukey's Outlier Screening AD-4C







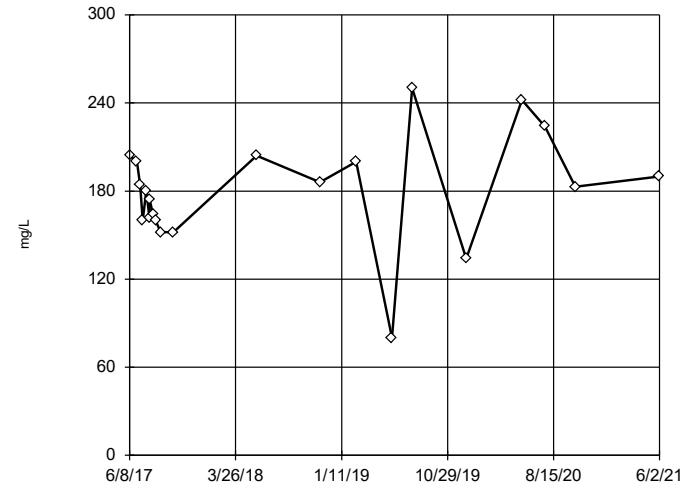
### Tukey's Outlier Screening AD-1 (bg)



n = 18  
No outliers found. Tukey's method selected by user.  
Data were natural log transformed to achieve best W statistic (graph shown in original units).  
High cutoff = 13235, low cutoff = 6.789, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:01 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

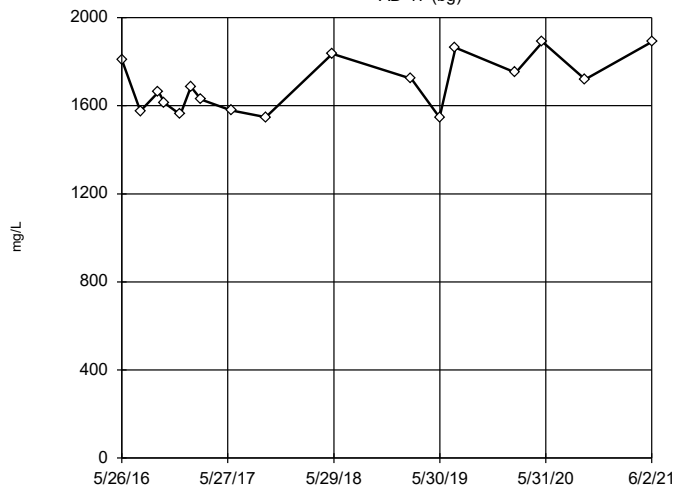
### Tukey's Outlier Screening AD-16R



n = 21  
No outliers found. Tukey's method selected by user.  
Data were square transformed to achieve best W statistic (graph shown in original units).  
High cutoff = 294, low cutoff = -141.5, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:01 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

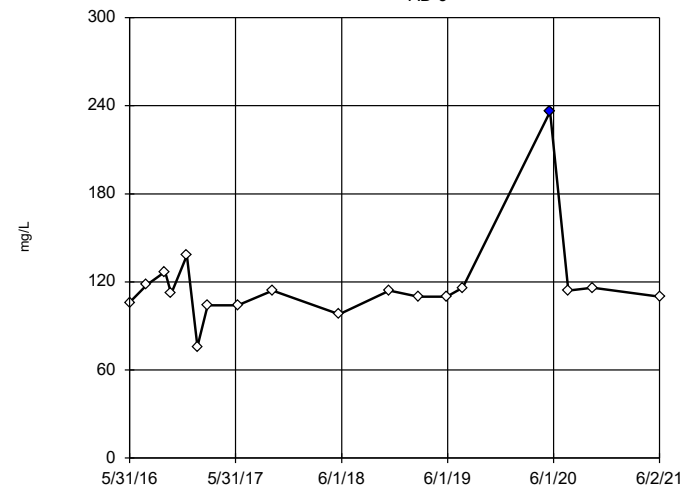
### Tukey's Outlier Screening AD-17 (bg)



n = 17  
No outliers found. Tukey's method selected by user.  
Data were natural log transformed to achieve best W statistic (graph shown in original units).  
High cutoff = 2816, low cutoff = 1021, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:01 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

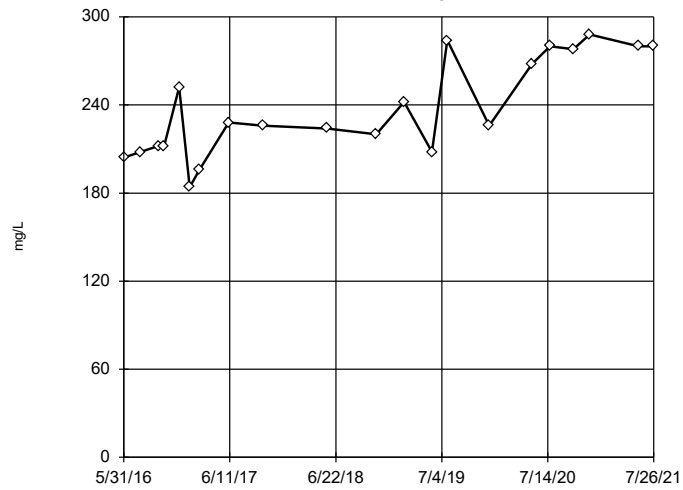
### Tukey's Outlier Screening AD-3



n = 18  
Outlier is drawn as solid. Tukey's method selected by user.  
Data were natural log transformed to achieve best W statistic (graph shown in original units).  
High cutoff = 161.9, low cutoff = 75.89, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:01 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

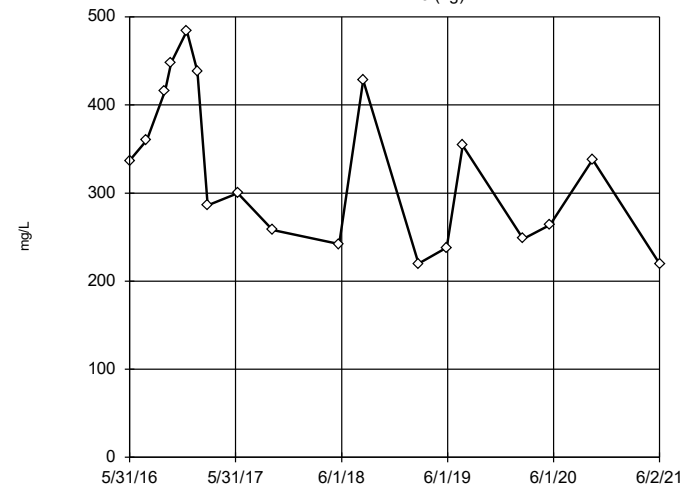
### Tukey's Outlier Screening AD-4C



n = 21  
 No outliers found.  
 Tukey's method selected by user.  
 Data were natural log transformed to achieve best W statistic (graph shown in original units).  
 High cutoff = 654.3, low cutoff = 89.54, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:01 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

### Tukey's Outlier Screening AD-5 (bg)



n = 18  
 No outliers found.  
 Tukey's method selected by user.  
 Data were natural log transformed to achieve best W statistic (graph shown in original units).  
 High cutoff = 2156, low cutoff = 47.94, based on IQR multiplier of 3.

Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:01 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

# Welch's t-test/Mann-Whitney - Significant Results

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/4/2021, 4:09 PM

<u>Constituent</u>	<u>Well</u>	<u>Calc.</u>	<u>0.01</u>	<u>Method</u>
Chloride (mg/L)	AD-1 (bg)	-2.683	Yes	Mann-W
Chloride (mg/L)	AD-3	-3.116	Yes	Mann-W
Fluoride (mg/L)	AD-1 (bg)	-3.035	Yes	Mann-W
Fluoride (mg/L)	AD-16R	-2.696	Yes	Mann-W
Fluoride (mg/L)	AD-17 (bg)	-2.72	Yes	Mann-W
Fluoride (mg/L)	AD-3	-3.045	Yes	Mann-W
Fluoride (mg/L)	AD-5 (bg)	-3.336	Yes	Mann-W
Sulfate (mg/L)	AD-4C	3.314	Yes	Mann-W
Total Dissolved Solids (mg/L)	AD-17 (bg)	2.584	Yes	Mann-W
Total Dissolved Solids (mg/L)	AD-4C	3.484	Yes	Mann-W

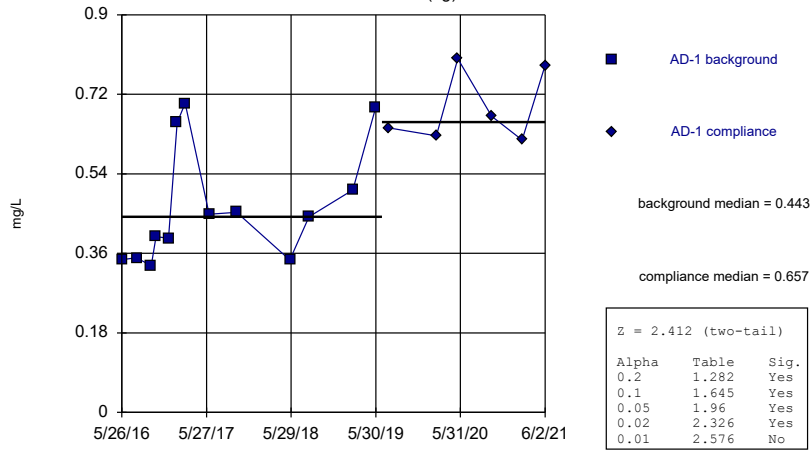
# Welch's t-test/Mann-Whitney - All Results

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/4/2021, 4:09 PM

<u>Constituent</u>	<u>Well</u>	<u>Calc.</u>	<u>0.01</u>	<u>Method</u>
Boron (mg/L)	AD-1 (bg)	2.412	No	Mann-W
Boron (mg/L)	AD-16R	-1.989	No	Mann-W
Boron (mg/L)	AD-17 (bg)	-2.459	No	Mann-W
Boron (mg/L)	AD-3	2.066	No	Mann-W
Boron (mg/L)	AD-4C	0.6442	No	Mann-W
Boron (mg/L)	AD-5 (bg)	-2.387	No	Mann-W
Calcium (mg/L)	AD-1 (bg)	0.7961	No	Mann-W
Calcium (mg/L)	AD-16R	-1.646	No	Mann-W
Calcium (mg/L)	AD-17 (bg)	0.1406	No	Mann-W
Calcium (mg/L)	AD-3	0.2635	No	Mann-W
Calcium (mg/L)	AD-4C	1.634	No	Mann-W
Calcium (mg/L)	AD-5 (bg)	-1.452	No	Mann-W
<b>Chloride (mg/L)</b>	<b>AD-1 (bg)</b>	<b>-2.683</b>	<b>Yes</b>	<b>Mann-W</b>
Chloride (mg/L)	AD-16R	1.282	No	Mann-W
Chloride (mg/L)	AD-17 (bg)	1.691	No	Mann-W
<b>Chloride (mg/L)</b>	<b>AD-3</b>	<b>-3.116</b>	<b>Yes</b>	<b>Mann-W</b>
Chloride (mg/L)	AD-4C	1.979	No	Mann-W
Chloride (mg/L)	AD-5 (bg)	1.635	No	Mann-W
<b>Fluoride (mg/L)</b>	<b>AD-1 (bg)</b>	<b>-3.035</b>	<b>Yes</b>	<b>Mann-W</b>
<b>Fluoride (mg/L)</b>	<b>AD-16R</b>	<b>-2.696</b>	<b>Yes</b>	<b>Mann-W</b>
<b>Fluoride (mg/L)</b>	<b>AD-17 (bg)</b>	<b>-2.72</b>	<b>Yes</b>	<b>Mann-W</b>
<b>Fluoride (mg/L)</b>	<b>AD-3</b>	<b>-3.045</b>	<b>Yes</b>	<b>Mann-W</b>
Fluoride (mg/L)	AD-4C	-2.039	No	Mann-W
<b>Fluoride (mg/L)</b>	<b>AD-5 (bg)</b>	<b>-3.336</b>	<b>Yes</b>	<b>Mann-W</b>
pH, field (SU)	AD-1 (bg)	0.7458	No	Mann-W
pH, field (SU)	AD-16R	-1.678	No	Mann-W
pH, field (SU)	AD-17 (bg)	-2.236	No	Mann-W
pH, field (SU)	AD-3	-0.1581	No	Mann-W
pH, field (SU)	AD-4C	-1.904	No	Mann-W
pH, field (SU)	AD-5 (bg)	1.096	No	Mann-W
Sulfate (mg/L)	AD-1 (bg)	2.175	No	Mann-W
Sulfate (mg/L)	AD-16R	1.931	No	Mann-W
Sulfate (mg/L)	AD-17 (bg)	1.305	No	Mann-W
Sulfate (mg/L)	AD-3	-1.023	No	Mann-W
<b>Sulfate (mg/L)</b>	<b>AD-4C</b>	<b>3.314</b>	<b>Yes</b>	<b>Mann-W</b>
Sulfate (mg/L)	AD-5 (bg)	-1.677	No	Mann-W
Total Dissolved Solids (mg/L)	AD-1 (bg)	0.3945	No	Mann-W
Total Dissolved Solids (mg/L)	AD-16R	1.598	No	Mann-W
<b>Total Dissolved Solids (mg/L)</b>	<b>AD-17 (bg)</b>	<b>2.584</b>	<b>Yes</b>	<b>Mann-W</b>
Total Dissolved Solids (mg/L)	AD-3	0.9684	No	Mann-W
<b>Total Dissolved Solids (mg/L)</b>	<b>AD-4C</b>	<b>3.484</b>	<b>Yes</b>	<b>Mann-W</b>
Total Dissolved Solids (mg/L)	AD-5 (bg)	-1.134	No	Mann-W

Mann-Whitney (Wilcoxon Rank Sum)

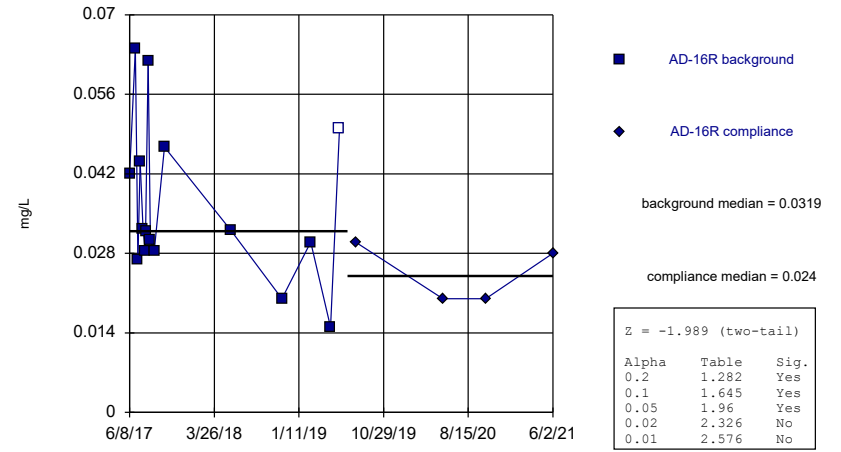
AD-1 (bg)



Constituent: Boron Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

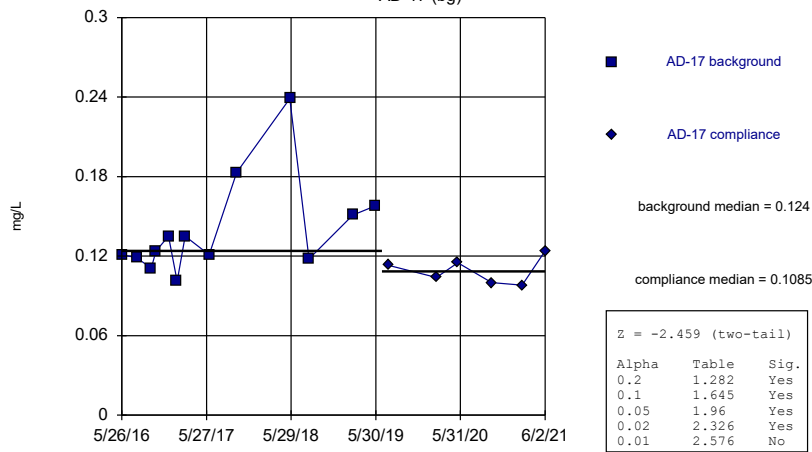
AD-16R



Constituent: Boron Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

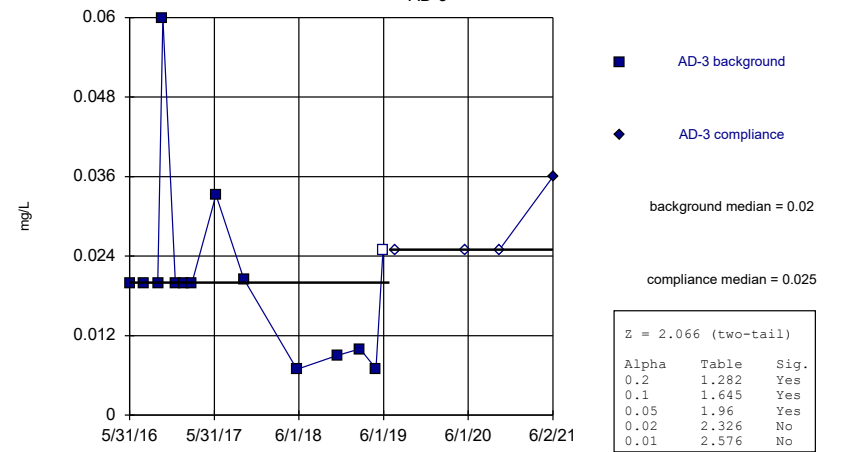
AD-17 (bg)



Constituent: Boron Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

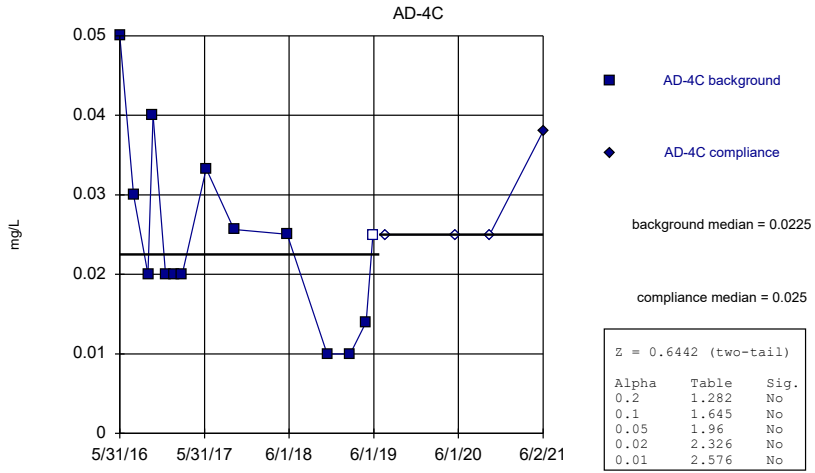
Mann-Whitney (Wilcoxon Rank Sum)

AD-3



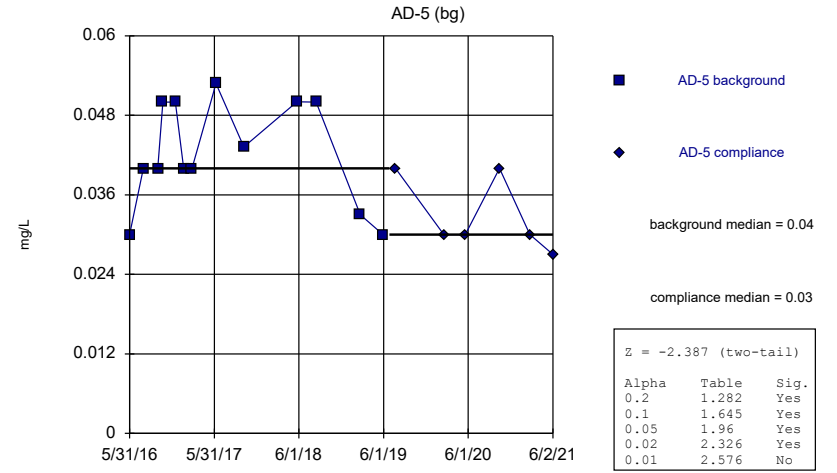
Constituent: Boron Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



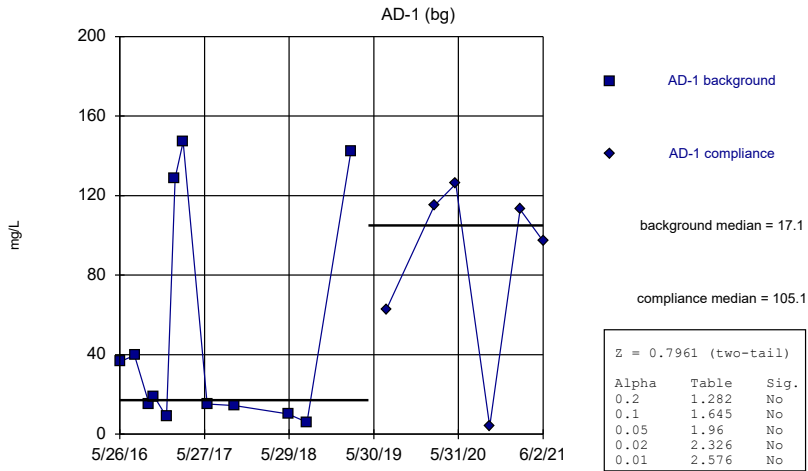
Constituent: Boron Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



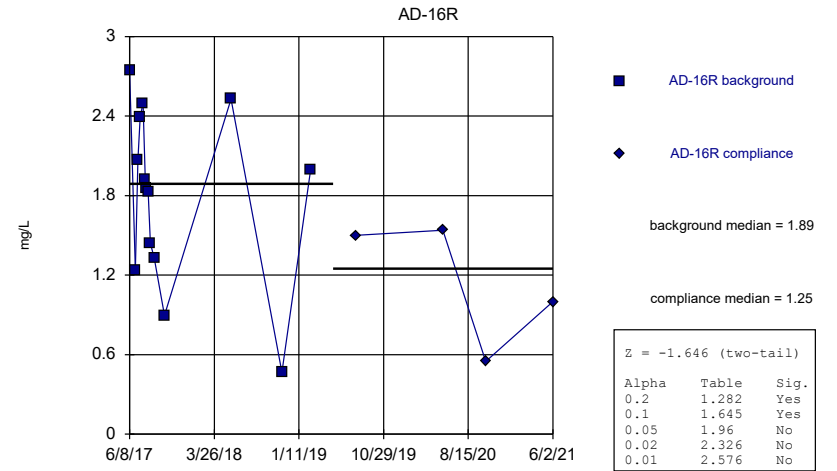
Constituent: Boron Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



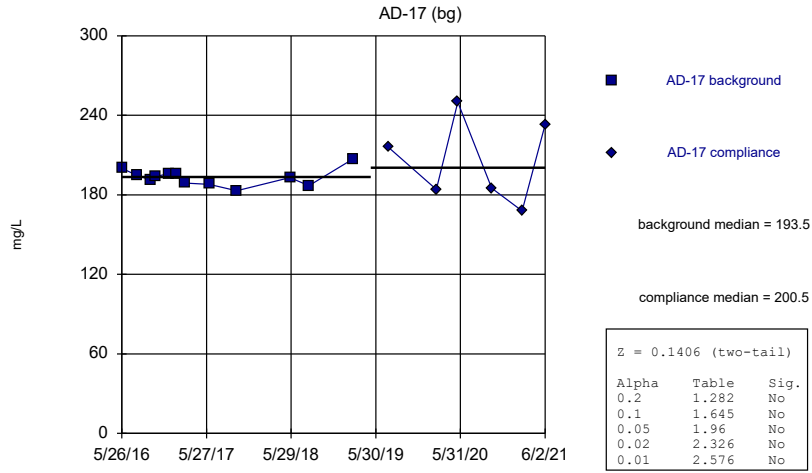
Constituent: Calcium Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



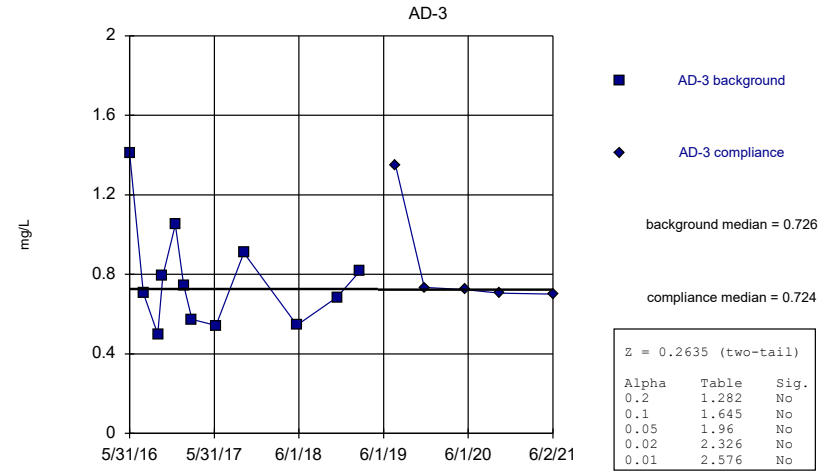
Constituent: Calcium Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



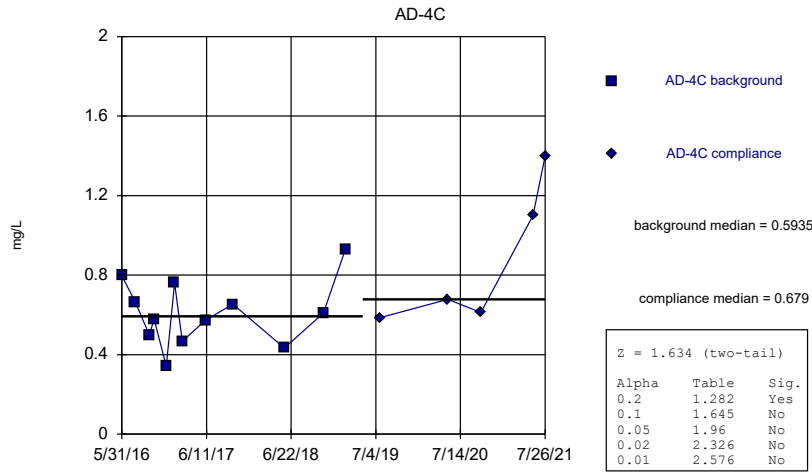
Constituent: Calcium Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



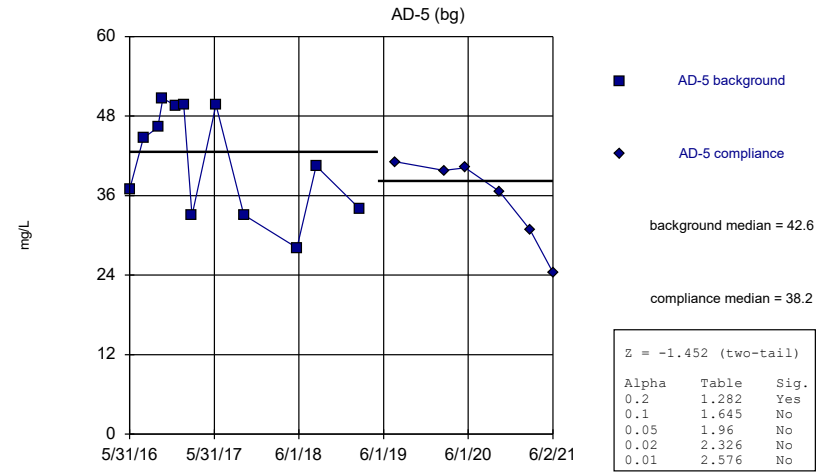
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 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



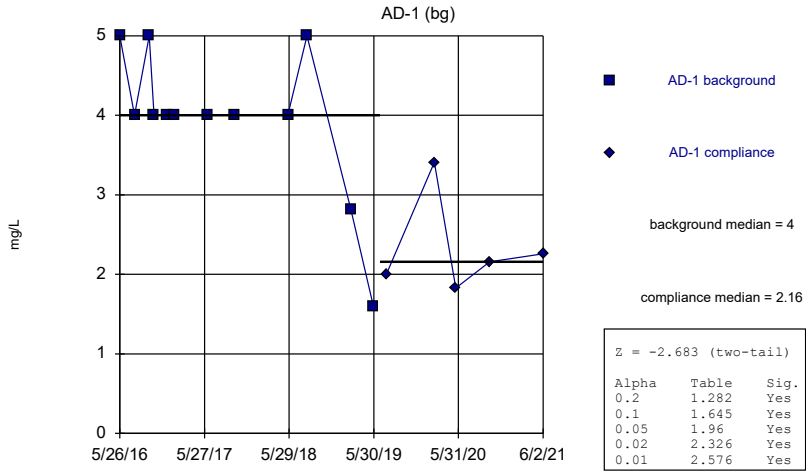
Constituent: Calcium Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



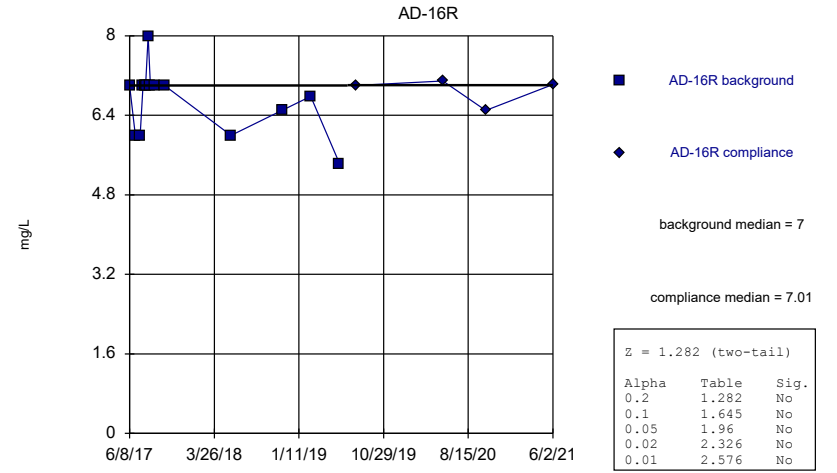
Constituent: Calcium Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



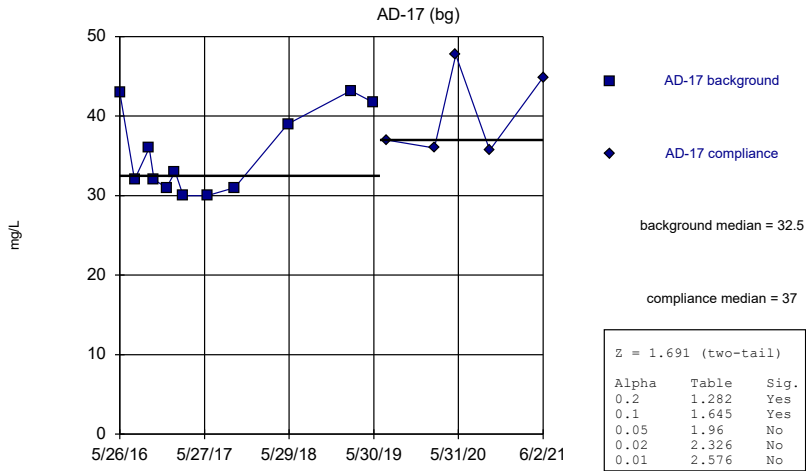
Constituent: Chloride Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



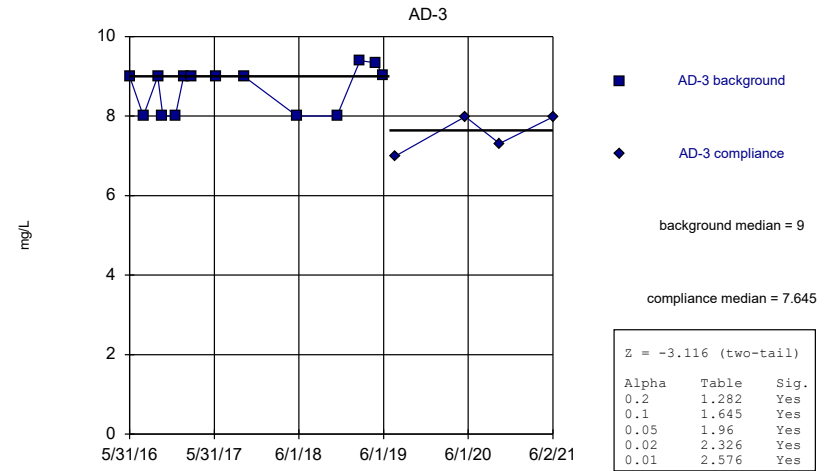
Constituent: Chloride Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



Constituent: Chloride Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

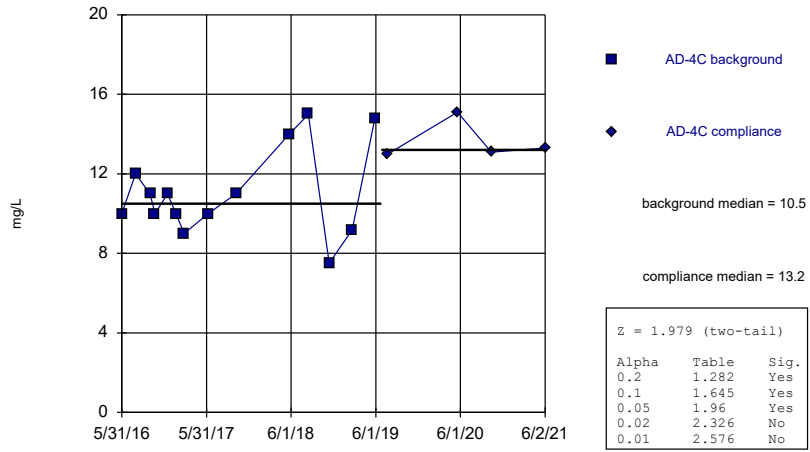


Constituent: Chloride Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP



Mann-Whitney (Wilcoxon Rank Sum)

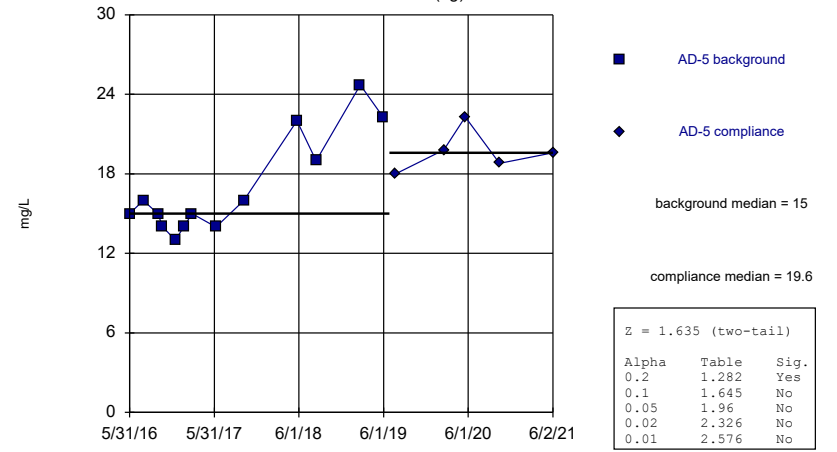
AD-4C



Constituent: Chloride Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

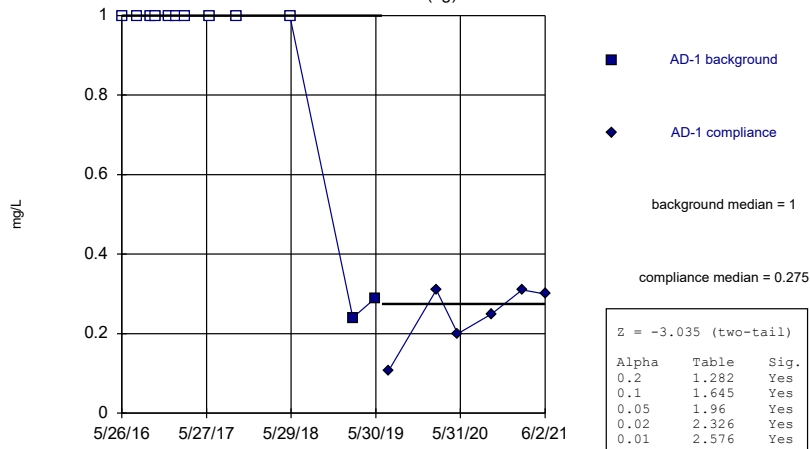
AD-5 (bg)



Constituent: Chloride Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

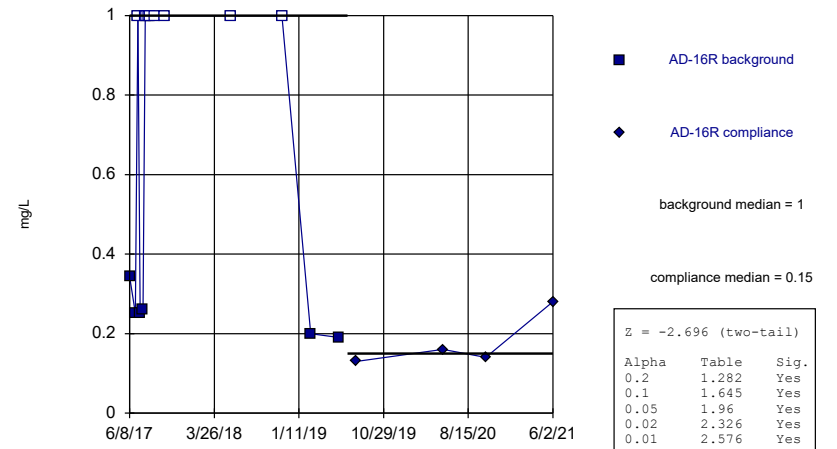
AD-1 (bg)



Constituent: Fluoride Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

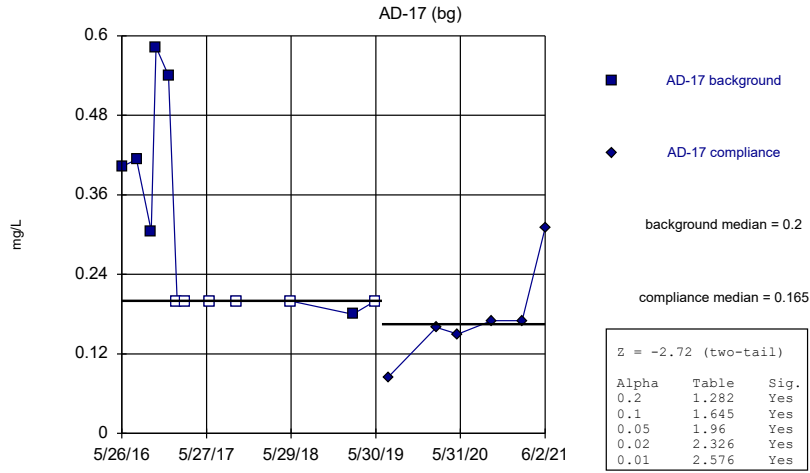
Mann-Whitney (Wilcoxon Rank Sum)

AD-16R



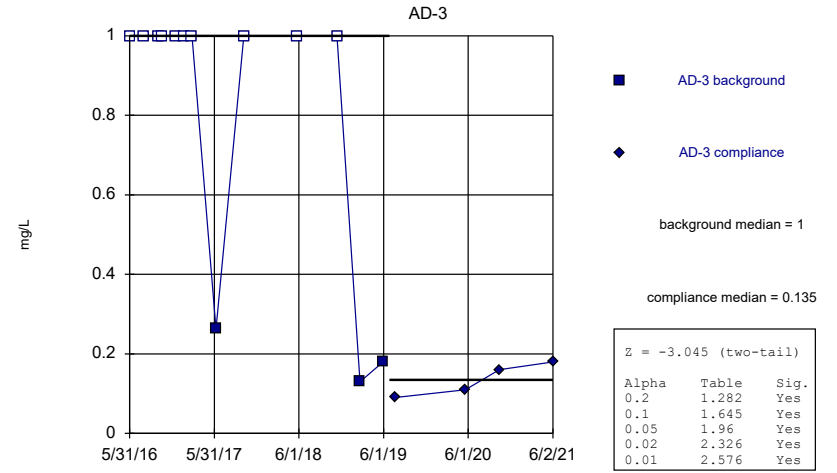
Constituent: Fluoride Analysis Run 11/4/2021 4:05 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



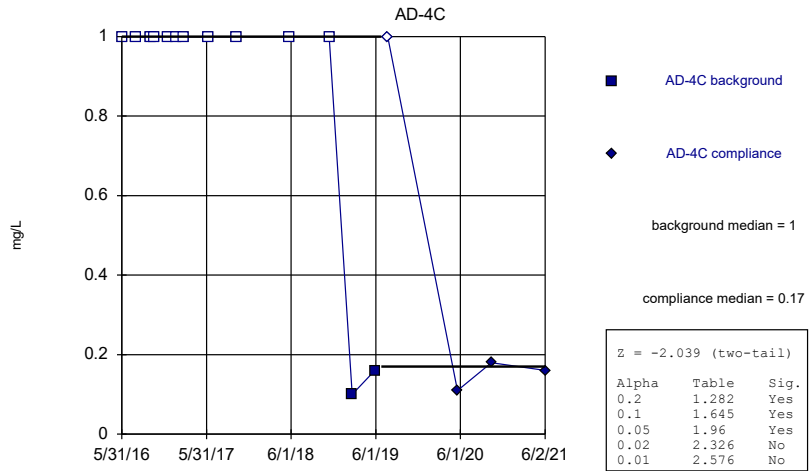
Constituent: Fluoride Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



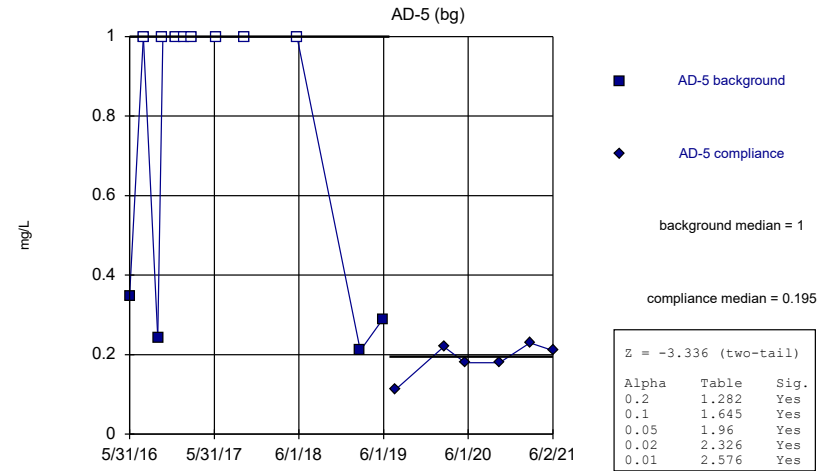
Constituent: Fluoride Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



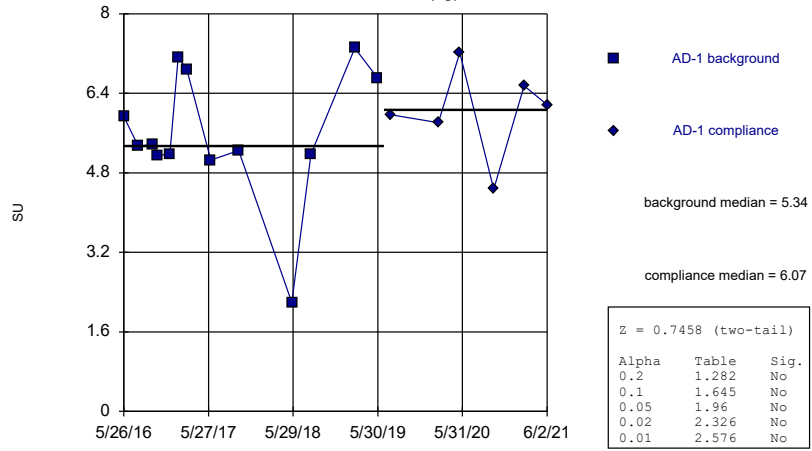
Constituent: Fluoride Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



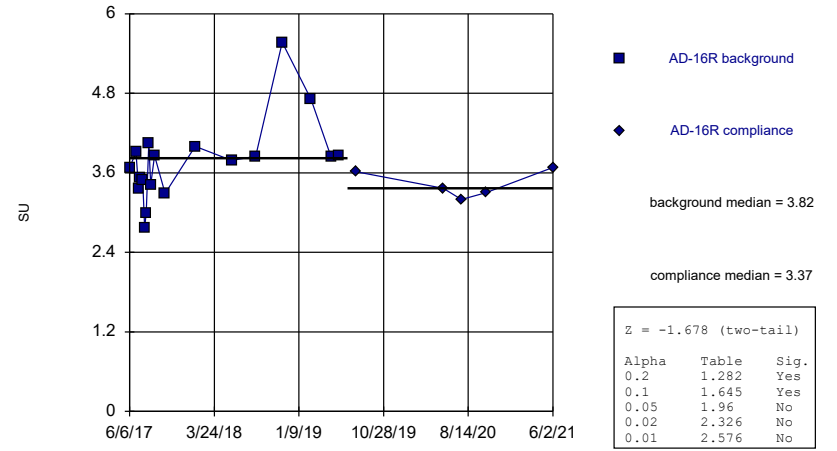
Constituent: Fluoride Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)  
AD-1 (bg)



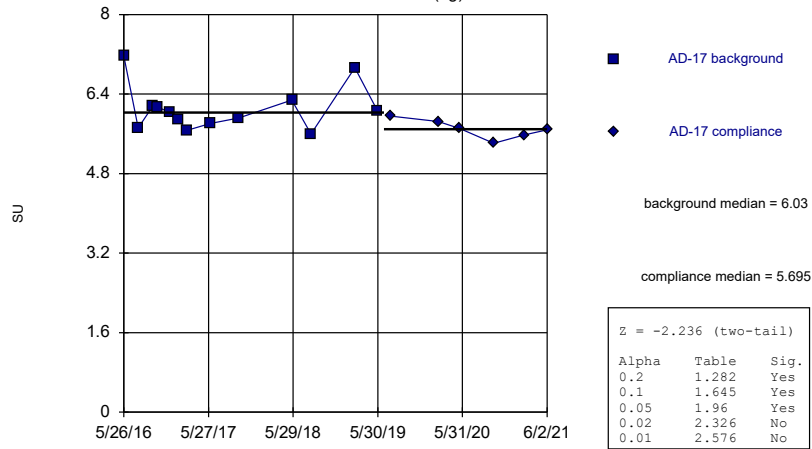
Constituent: pH, field Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)  
AD-16R



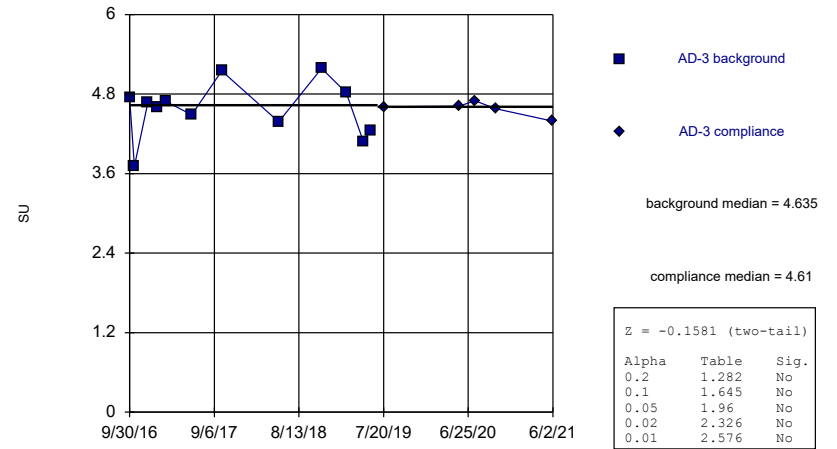
Constituent: pH, field Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)  
AD-17 (bg)



Constituent: pH, field Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

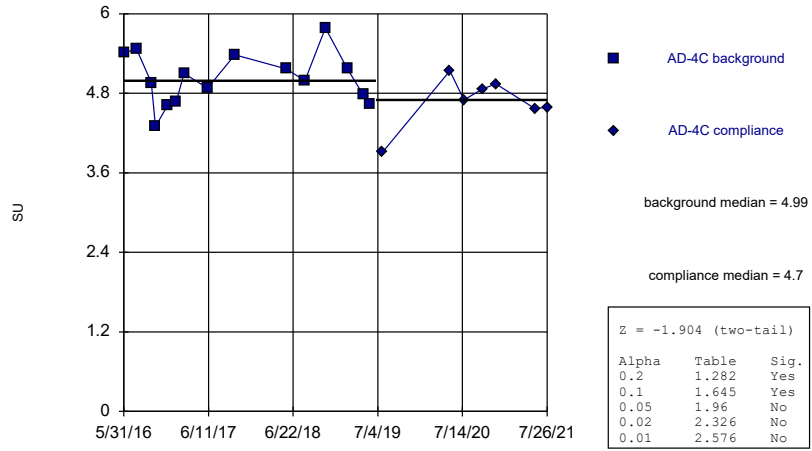
Mann-Whitney (Wilcoxon Rank Sum)  
AD-3



Constituent: pH, field Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

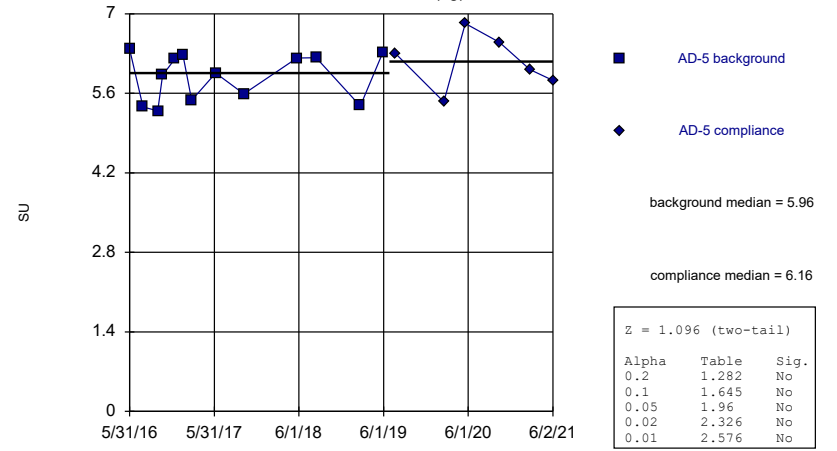
AD-4C



Constituent: pH, field Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

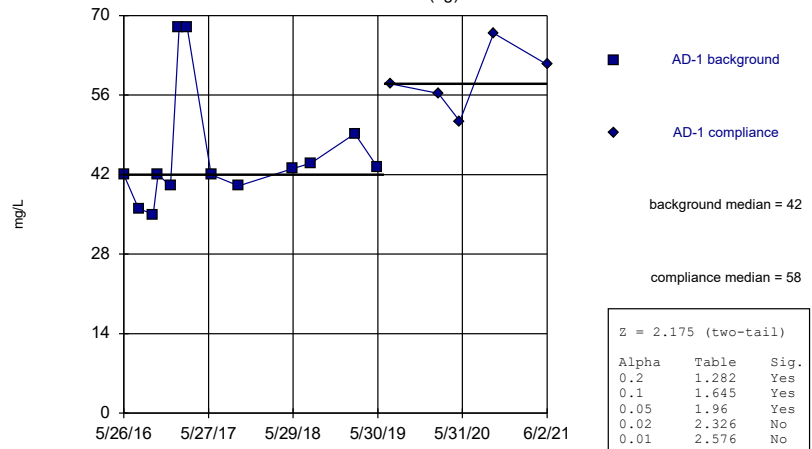
AD-5 (bg)



Constituent: pH, field Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

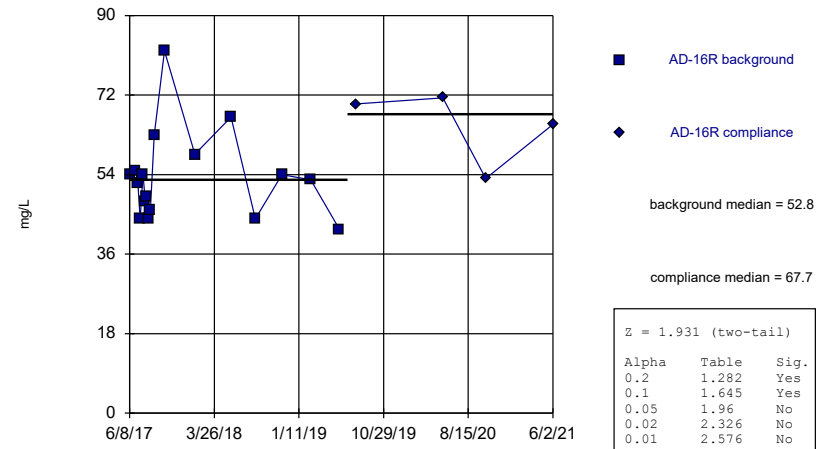
AD-1 (bg)



Constituent: Sulfate Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

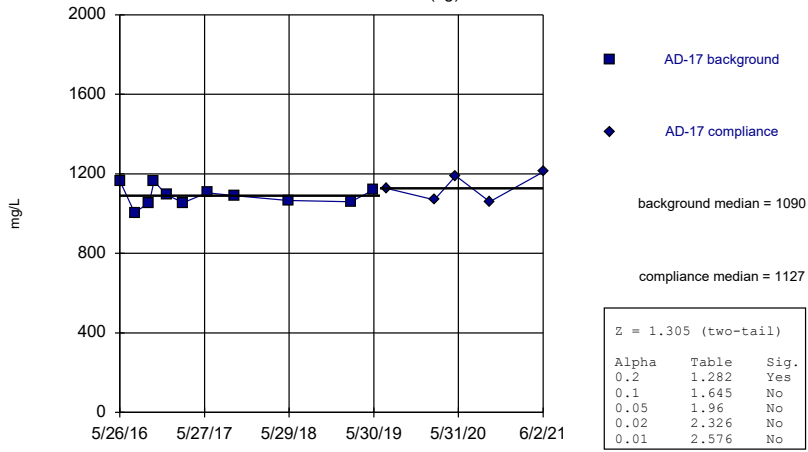
Mann-Whitney (Wilcoxon Rank Sum)

AD-16R



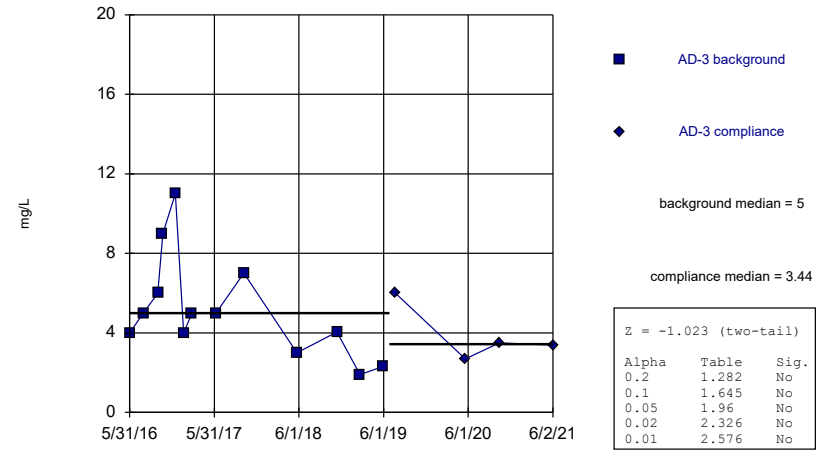
Constituent: Sulfate Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)  
AD-17 (bg)



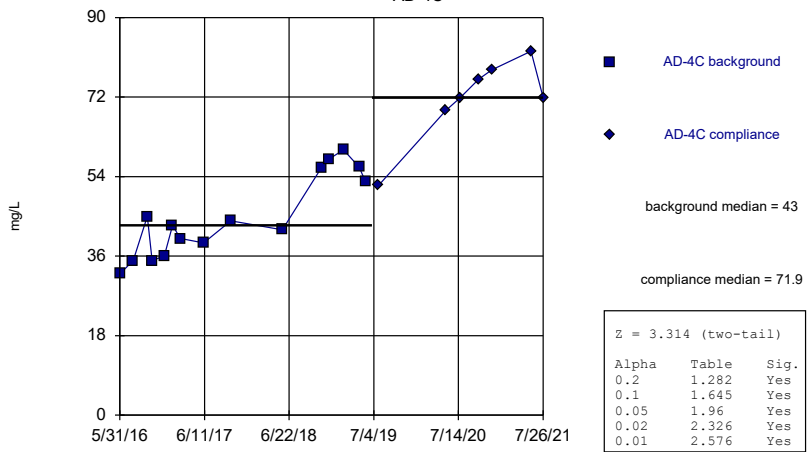
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Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)  
AD-3



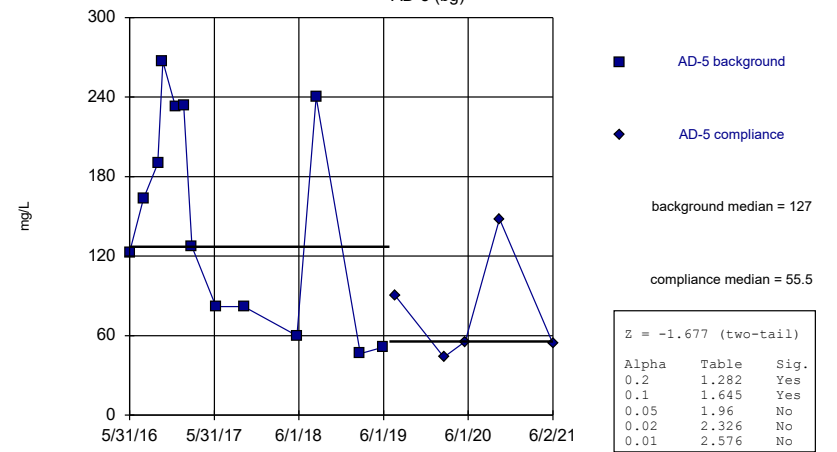
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Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)  
AD-4C



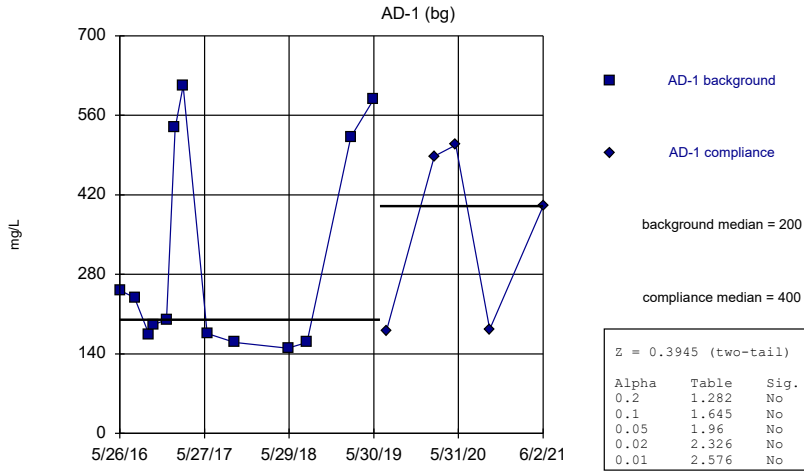
Constituent: Sulfate Analysis Run 11/4/2021 4:05 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)  
AD-5 (bg)



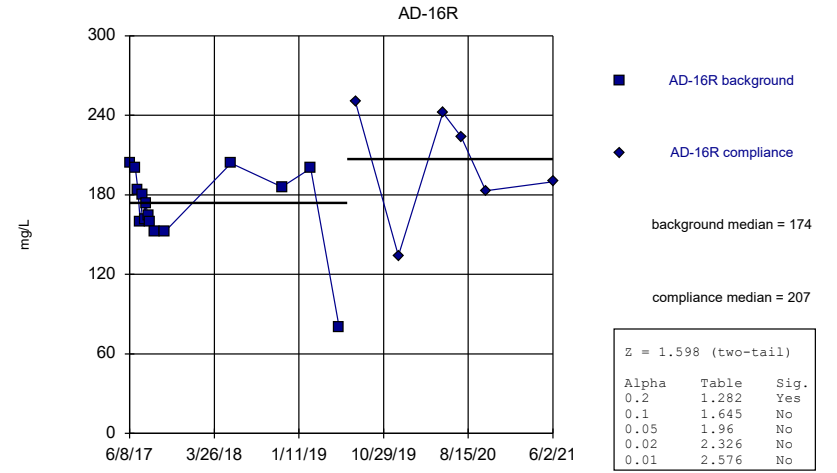
Constituent: Sulfate Analysis Run 11/4/2021 4:06 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



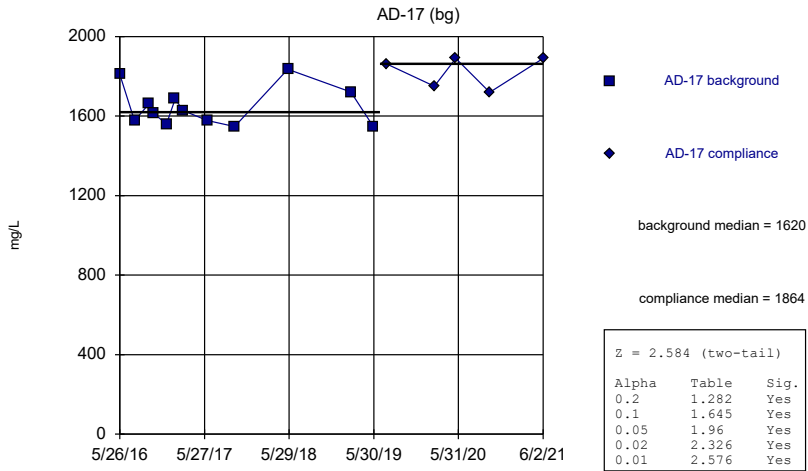
Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:06 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



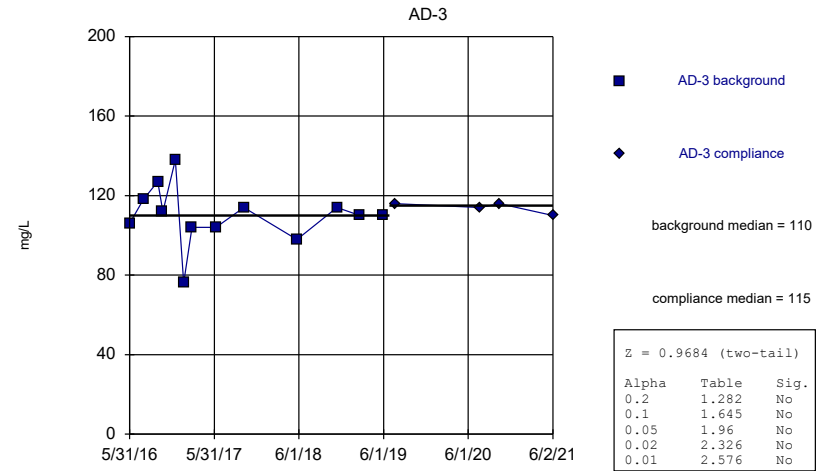
Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:06 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)



Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:06 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

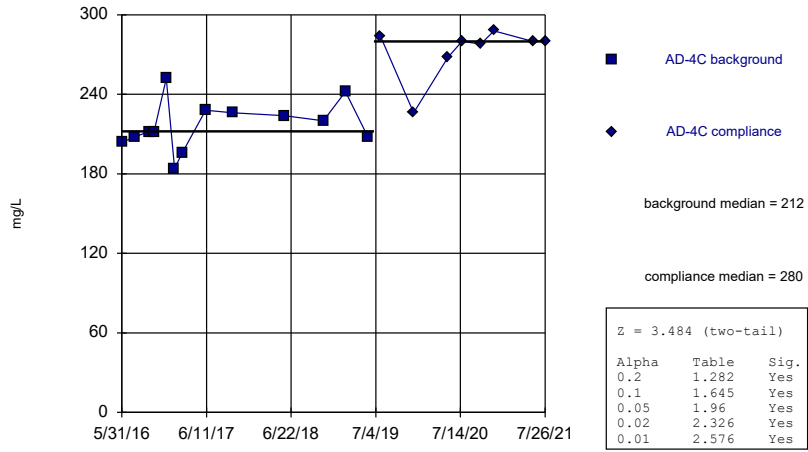
Mann-Whitney (Wilcoxon Rank Sum)



Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:06 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

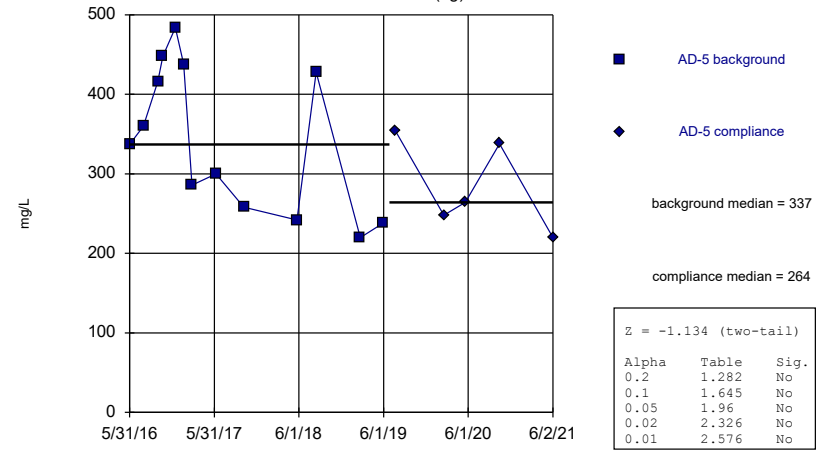
AD-4C



Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:06 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-5 (bg)



Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:06 PM  
 Welsh BASP Client: Geosyntec Data: Welsh BASP

# Intrawell Prediction Limits

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/4/2021, 4:13 PM

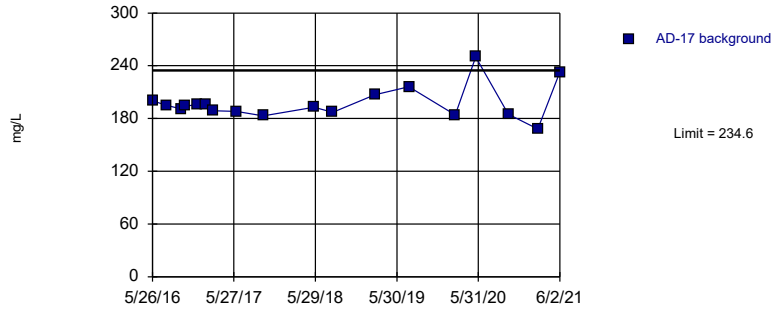
Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron (mg/L)	AD-1	0.8405	n/a	n/a	1 future	n/a	19	0.537	0.1588	0	None	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-16R	0.05947	n/a	n/a	1 future	n/a	20	0.03411	0.01341	5	None	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-17	0.1939	n/a	n/a	1 future	n/a	19	-2.066	0.2226	0	None	ln(x)	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-3	0.04438	n/a	n/a	1 future	n/a	18	0.1204	0.04673	22.22	Kaplan-Meier	sqrt(x)	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-4C	0.04806	n/a	n/a	1 future	n/a	18	0.02357	0.01268	22.22	Kaplan-Meier	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-5	0.05541	n/a	n/a	1 future	n/a	19	0.03927	0.008445	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-1	200.2	n/a	n/a	1 future	n/a	18	6.92	3.744	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-16R	2.952	n/a	n/a	1 future	n/a	18	1.656	0.6709	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-17	234.6	n/a	n/a	1 future	n/a	18	14.04	0.6625	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-3	1.314	n/a	n/a	1 future	n/a	17	0.8809	0.136	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-4C	1.192	n/a	n/a	1 future	n/a	17	0.6876	0.2588	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-5	54.77	n/a	n/a	1 future	n/a	18	39.41	7.958	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-1	5.708	n/a	n/a	1 future	n/a	17	3.475	1.145	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-16R	7.794	n/a	n/a	1 future	n/a	18	45.75	7.764	0	None	x^2	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-17	47.73	n/a	n/a	1 future	n/a	17	36.66	5.674	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-3	9.828	n/a	n/a	1 future	n/a	18	8.447	0.7151	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-4C	16	n/a	n/a	1 future	n/a	18	11.61	2.273	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-5	24.51	n/a	n/a	1 future	n/a	18	17.69	3.528	0	None	No	0.002505	Param Intra 1 of 2
Fluoride (mg/L)	AD-1	1	n/a	n/a	1 future	n/a	18	n/a	n/a	55.56	n/a	n/a	0.005373	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-16R	1	n/a	n/a	1 future	n/a	19	n/a	n/a	47.37	n/a	n/a	0.004832	NP Intra (normality) 1 of 2
Fluoride (mg/L)	AD-17	0.5471	n/a	n/a	1 future	n/a	18	0.4686	0.1404	33.33	Kaplan-Meier	sqrt(x)	0.002505	Param Intra 1 of 2
Fluoride (mg/L)	AD-3	1	n/a	n/a	1 future	n/a	17	n/a	n/a	58.82	n/a	n/a	0.005914	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-4C	1	n/a	n/a	1 future	n/a	17	n/a	n/a	70.59	n/a	n/a	0.005914	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-5	1	n/a	n/a	1 future	n/a	18	n/a	n/a	44.44	n/a	n/a	0.005373	NP Intra (normality) 1 of 2
pH, field (SU)	AD-1	8.025	3.435	n/a	1 future	n/a	19	5.73	1.201	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-16R	4.77	2.738	n/a	1 future	n/a	23	1.919	0.1425	0	None	sqrt(x)	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-17	6.822	5.19	n/a	1 future	n/a	19	1.814	0.0432	0	None	x^(1/3)	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-3	5.261	3.879	n/a	1 future	n/a	17	4.57	0.3544	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-4C	5.692	4.131	n/a	1 future	n/a	22	4.911	0.4175	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-5	6.827	5.125	n/a	1 future	n/a	19	5.976	0.4451	0	None	No	0.001253	Param Intra 1 of 2
Sulfate (mg/L)	AD-1	70.73	n/a	n/a	1 future	n/a	18	49.25	11.12	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-16R	75.7	n/a	n/a	1 future	n/a	21	55.66	10.66	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-17	1214	n/a	n/a	1 future	n/a	16	1102	56.55	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-3	9.542	n/a	n/a	1 future	n/a	17	4.872	2.394	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-4C	82.84	n/a	n/a	1 future	n/a	22	53.43	15.74	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-5	275.5	n/a	n/a	1 future	n/a	18	127.2	76.81	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-1	612	n/a	n/a	1 future	n/a	18	n/a	n/a	0	n/a	n/a	0.005373	NP Intra (normality) 1 of 2
Total Dissolved Solids (mg/L)	AD-16R	250.5	n/a	n/a	1 future	n/a	21	180.2	37.34	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-17	1940	n/a	n/a	1 future	n/a	17	1699	123.5	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-3	136	n/a	n/a	1 future	n/a	17	111	12.83	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-4C	301.2	n/a	n/a	1 future	n/a	21	238.1	33.55	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-5	493.6	n/a	n/a	1 future	n/a	18	326.6	86.5	0	None	No	0.002505	Param Intra 1 of 2







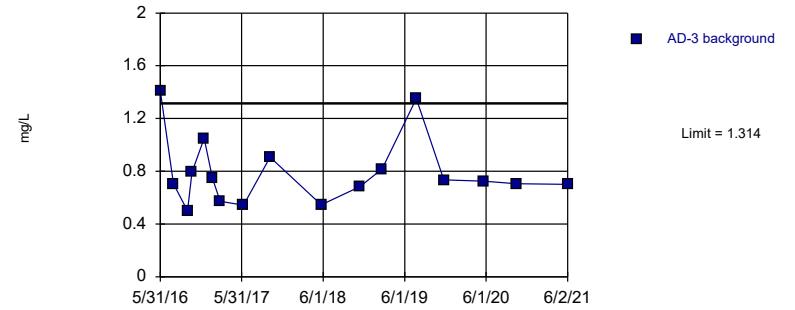
Prediction Limit  
Intrawell Parametric, AD-17 (bg)



Background Data Summary (based on square root transformation): Mean=14.04, Std. Dev.=0.6625, n=18. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8669, critical = 0.858. Kappa = 1.931 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

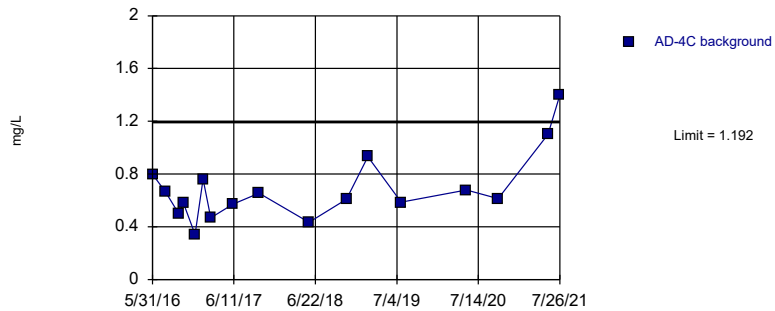
Prediction Limit  
Intrawell Parametric, AD-3



Background Data Summary (based on square root transformation): Mean=0.8809, Std. Dev.=0.136, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8769, critical = 0.851. Kappa = 1.951 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

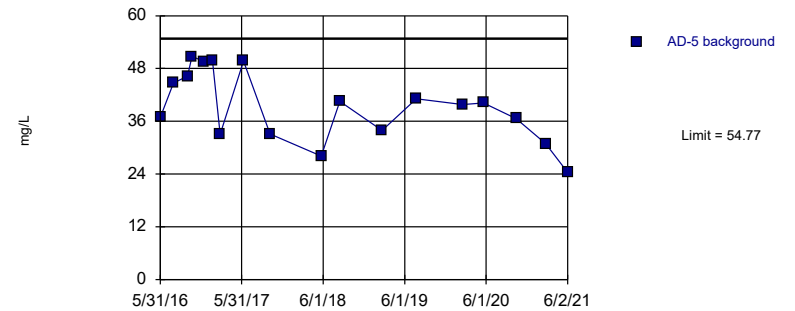
Prediction Limit  
Intrawell Parametric, AD-4C



Background Data Summary: Mean=0.6876, Std. Dev.=0.2588, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8753, critical = 0.851. Kappa = 1.951 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

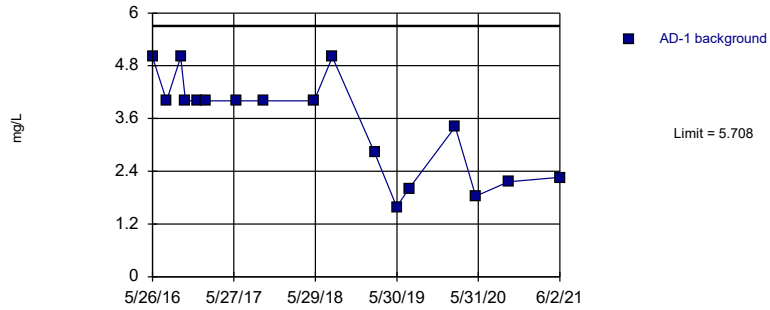
Prediction Limit  
Intrawell Parametric, AD-5 (bg)



Background Data Summary: Mean=39.41, Std. Dev.=7.958, n=18. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9526, critical = 0.858. Kappa = 1.931 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

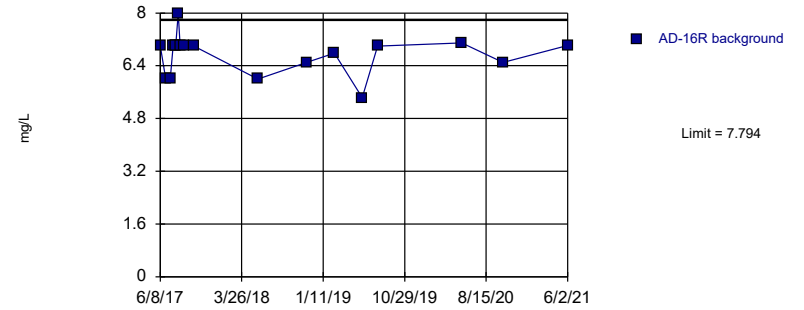
Prediction Limit  
Intrawell Parametric, AD-1 (bg)



Background Data Summary: Mean=3.475, Std. Dev.=1.145, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8806, critical = 0.851. Kappa = 1.951 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

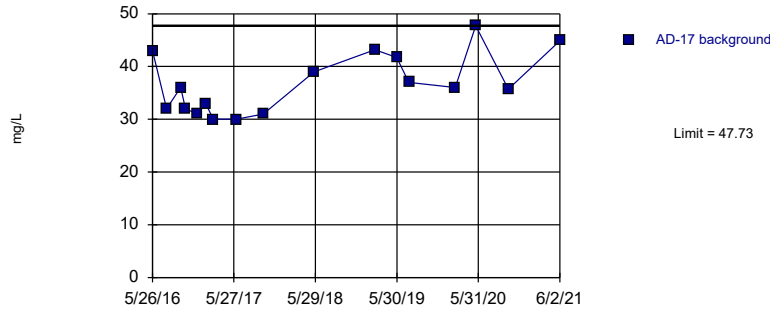
Prediction Limit  
Intrawell Parametric, AD-16R



Background Data Summary (based on square transformation): Mean=45.75, Std. Dev.=7.764, n=18. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8587, critical = 0.858. Kappa = 1.931 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

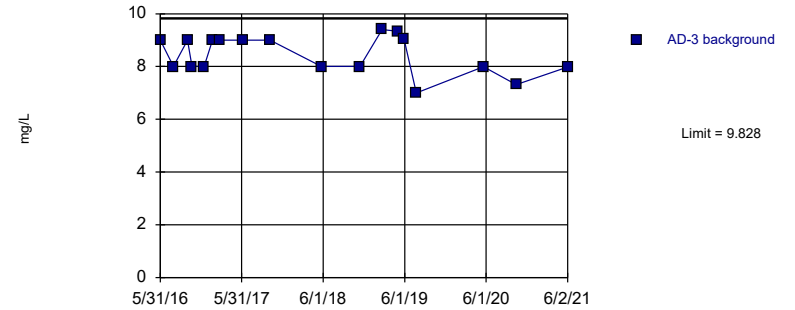
Prediction Limit  
Intrawell Parametric, AD-17 (bg)



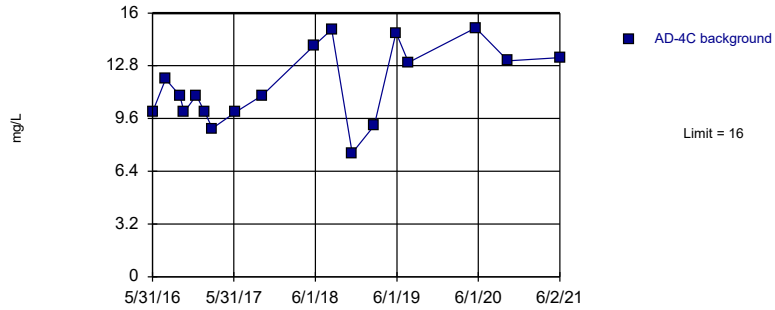
Background Data Summary: Mean=36.66, Std. Dev.=5.674, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9149, critical = 0.851. Kappa = 1.951 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit  
Intrawell Parametric, AD-3

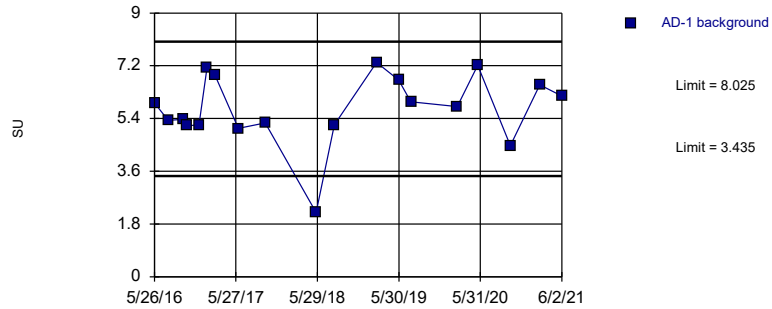


Prediction Limit  
Intrawell Parametric, AD-4C





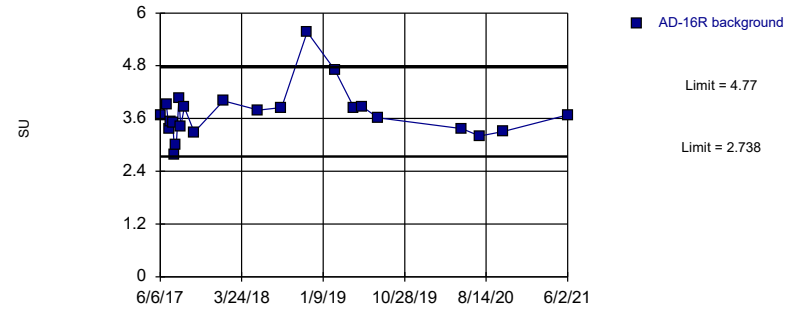
Prediction Limit  
Intrawell Parametric, AD-1 (bg)



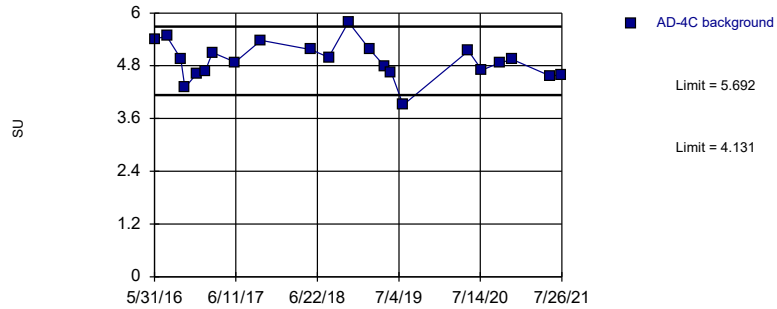
Background Data Summary: Mean=5.73, Std. Dev.=1.201, n=19. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.889, critical = 0.863. Kappa = 1.912 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit  
Intrawell Parametric, AD-16R

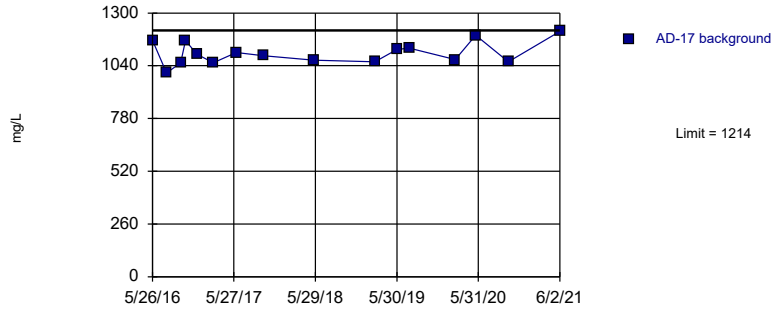


Prediction Limit  
Intrawell Parametric, AD-4C





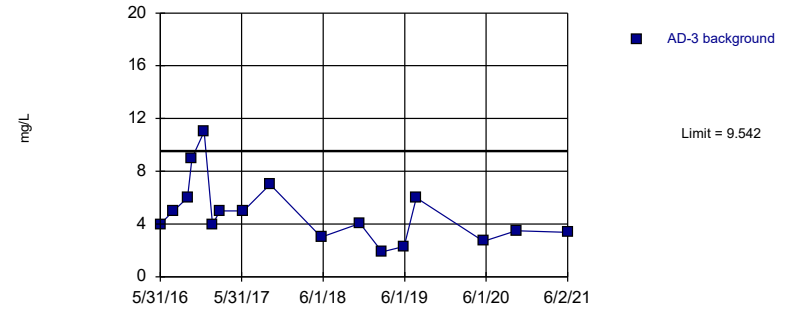
Prediction Limit  
Intrawell Parametric, AD-17 (bg)



Background Data Summary: Mean=1102, Std. Dev.=56.55, n=16. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.948, critical = 0.844. Kappa = 1.97 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

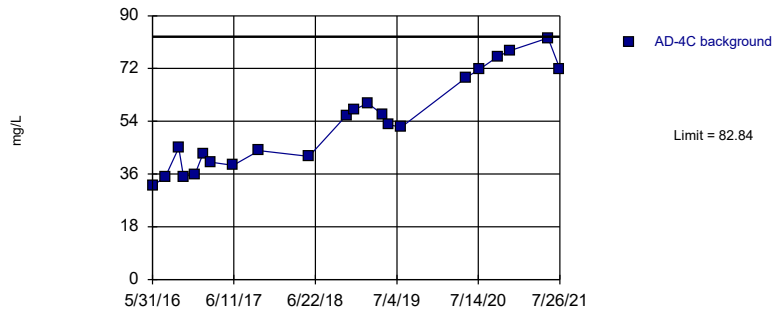
Prediction Limit  
Intrawell Parametric, AD-3



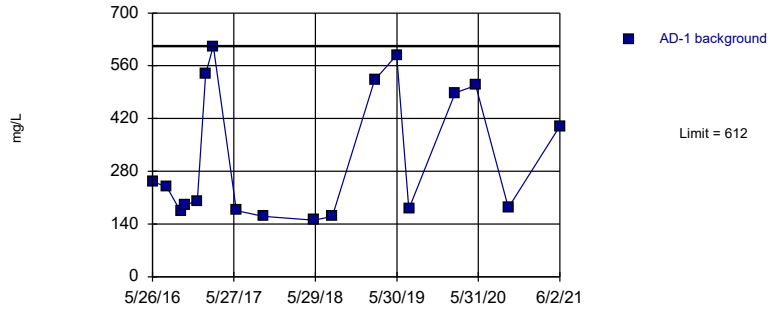
Background Data Summary: Mean=4.872, Std. Dev.=2.394, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8985, critical = 0.851. Kappa = 1.951 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

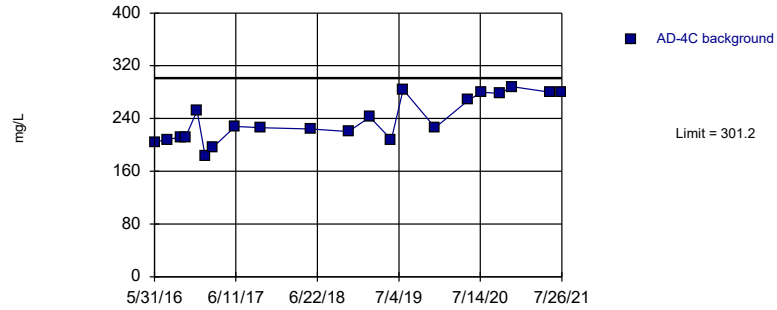
Prediction Limit  
Intrawell Parametric, AD-4C



Prediction Limit  
Intrawell Non-parametric, AD-1 (bg)



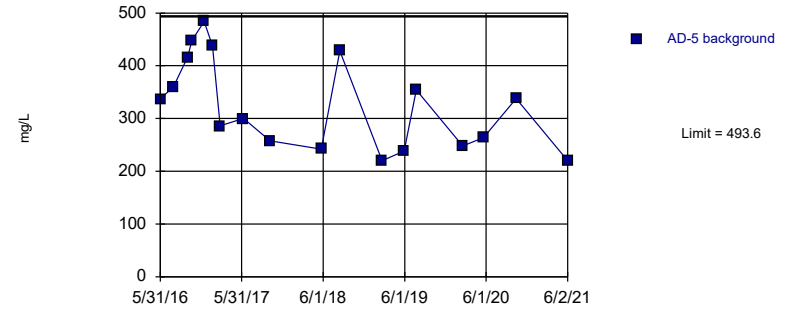
Prediction Limit  
Intrawell Parametric, AD-4C



Background Data Summary: Mean=238.1, Std. Dev.=33.55, n=21. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.903, critical = 0.873. Kappa = 1.88 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit  
Intrawell Parametric, AD-5 (bg)



Background Data Summary: Mean=326.6, Std. Dev.=86.5, n=18. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9169, critical = 0.858. Kappa = 1.931 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids Analysis Run 11/4/2021 4:11 PM  
Welsh BASP Client: Geosyntec Data: Welsh BASP

### **APPENDIX 3**

Alternate source demonstration(s) included in this appendix. Alternate sources are sources or reasons that explain that statistically significant increases over background or statistically significant levels above the groundwater protection standard are not attributable to the CCR unit.

# ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

## J. Robert Welsh Plant Bottom Ash Storage Pond Pittsburg, Texas

*Beth Ann Gross*

March 4, 2021



FOR PERMIT PURPOSES ONLY  
GEOSYNTEC CONSULTANTS, INC.  
TEXAS FIRM REGISTRATION NO 1182

*Submitted to*



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Columbus, Ohio 43215-2372

*Submitted by*

**Geosyntec**   
consultants

engineers | scientists | innovators

941 Chatham Lane, Suite 103  
Columbus, Ohio 43221

May 2021

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### LIST OF ATTACHMENTS

Attachment A	Certification by a Qualified Professional Engineer
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*Beth Ann Gross*

March 4, 2021

FOR PERMIT PURPOSES ONLY

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TEXAS FIRM REGISTRATION NO 1182

## LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
BASP	Bottom Ash Storage Pond
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
LPL	Lower Prediction Limit
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
SWFPR	Site-Wide False Positive Rate
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TPDES	Texas Pollutant Discharge Elimination System
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

## SECTION 1

### INTRODUCTION AND SUMMARY

This Alternative Source Demonstration (ASD) report has been prepared to address statistically significant increases (SSIs) for sulfate and total dissolved solids (TDS) in the groundwater monitoring network at the J. Robert Welsh Plant Bottom Ash Storage Pond (BASP), in Pittsburg, Texas, following the second semiannual detection monitoring event of 2020. The BASP is a wastewater pond permitted under the Texas Commission on Environmental Quality (TCEQ) Texas Pollutant Discharge Elimination System Permit No. WQ0001811000 as Pond No. 3.

Background values for the BASP were initially calculated in January 2018 with data from at least eight monitoring events. After a minimum of four detection monitoring events, the results of those events were compared to the existing background values, and the dataset was updated as appropriate (Geosyntec, 2019). Revised upper prediction limits (UPLs) were calculated at that time for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure to maintain an appropriate site-wide false positive rate (SWFPR). With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceed the UPL or, in the case of pH, are below the LPL. In practice, if the initial result did not exceed the UPL or was below the LPL, a second sample was not collected or analyzed.

The second semi-annual detection monitoring event of 2020 was performed in October 2020 (initial sampling event), and the results were compared to the calculated prediction limits. Where initial exceedances were identified, verification resampling was completed in December 2020. Following verification resampling, SSIs were identified for sulfate and TDS at well AD-4C using intrawell comparisons. A summary of the detection monitoring analytical results and the calculated prediction limits to which they were compared is provided in **Table 1**.

#### 1.1 CCR Rule Requirements

United States Environmental Protection Agency (USEPA) regulations (USEPA, 2015) regarding detection monitoring programs for coal combustion residuals (CCR) landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration (ASD) when an SSI is identified (40 CFR 257.94(e)(2)):

*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... verifying the accuracy of the information in the report.*



Pursuant to 40 CFR 257.94(e)(2), Geosyntec Consultants, Inc. (Geosyntec) has prepared this ASD report, which documents that the SSIs identified for sulfate and TDS at well AD-4C should not be attributed to the BASP at the Welsh Plant.

## **1.2 Demonstration of Alternative Sources**

An evaluation was completed to assess possible alternative sources to which the identified SSI could be attributed. Alternative sources were identified from amongst five types, based on the methodology provided by the Electric Power Research Institute (EPRI, 2017):

- ASD Type I: Sampling Causes;
- ASD Type II: Laboratory Causes;
- ASD Type III: Statistical Evaluation Causes;
- ASD Type IV: Natural Variation; and
- ASD Type V: Alternative Sources.

A demonstration was conducted to assess whether the increases in sulfate and TDS concentrations at well AD-4C were based on Type IV causes (natural variation) and not by a release from the BASP.

## SECTION 2

### ALTERNATIVE SOURCE DEMONSTRATION

The methods used to assess possible alternative sources of the SSIs for sulfate and TDS at AD-4C and the proposed alternative source are described below.

#### 2.1 Proposed Alternative Source

An initial review of groundwater sampling field forms, site geochemistry, and site historical data did not identify alternative sources due to a Type I issue (sampling causes). A review of the laboratory and statistical analyses did not identify any Type II (laboratory causes) or Type III (statistical evaluation causes) issues. Groundwater sampling, laboratory analysis, and statistical evaluations were generally completed in accordance with draft TCEQ guidance for groundwater monitoring (TCEQ, 2020). Further, an initial review of site geochemistry did not identify evidence of any Type V (anthropogenic) impacts. As described below, the SSIs observed at monitoring well AD-4C are attributed to natural variation, which is a Type IV cause.

##### 2.1.1 Sulfate and TDS

An SSI for sulfate was identified at monitoring well AD-4C. A site map showing the location of AD-4C and other network well locations is presented in **Figure 1**. The monitoring network includes background locations AD-1, AD-5, and AD-17 and compliance wells AD-3, AD-4C, and AD-16R. Groundwater flow beneath the BASP is generally toward the southeast, as shown in **Figure 2**.

Sulfate concentrations at background well AD-1, which is located immediately upgradient of the BASP and upgradient of AD-4C, have historically been above those observed at AD-4C (**Figure 3**). Prior to 2009, sulfate concentrations at AD-1 were generally higher and subject to significant variability, including a peak value of 616 milligrams per liter (mg/L) sulfate in June 2007. Since background monitoring was initiated in 2016, sulfate concentrations at both AD-1 and AD-4C appear to trend upwards at a similar rate. Thus, recent increases in sulfate concentrations at AD-4C may represent the migration of groundwater with higher concentrations of sulfate from upgradient locations such as AD-1.

In addition to sulfate, an SSI for TDS was identified at monitoring well AD-4C. TDS concentrations at all wells within the BASP network are displayed on **Figure 4**. TDS concentrations at background wells AD-1, AD-5, and AD-17 are all generally higher than AD-4C. The TDS concentrations of these background wells indicate TDS is highly variable within the aquifer unit. TDS concentrations at AD-1, which is directly upgradient of AD-4C, have been greater than TDS at AD-4C for four of the past six monitoring events. Even greater TDS concentrations are observed at AD-17, which is located further upgradient.

Boron is a conservative parameter which can function as a ‘tracer’ for potential CCR unit releases due to its lack of attenuation by chemical processes (e.g., sorption, precipitation) during groundwater flow and its high relative concentration in the BASP compared to downgradient groundwater. The concentration of boron in the BASP in October 2020 was 4.85 mg/L and the concentrations of boron at monitoring well AD-4C are consistently < 0.1 mg/L. Thus, if BASP water, which has a boron concentration approximately one order of magnitude greater than background well AD-1, were impacting groundwater quality at downgradient monitoring wells, an increase in boron concentrations at MW AD-4C commensurate with the observed increases in sulfate and TDS at the well would be expected. The current boron concentrations at AD-4C do not display an increasing or decreasing trend, which suggests that groundwater quality changes should not be attributed to a release from the BASP. Furthermore, boron concentrations at upgradient well AD-1 are consistently higher than those observed at AD-4C (**Figure 5**).

A mixing model was created to further illustrate how concentrations at AD-4C would be expected to change if the groundwater at AD-4C was affected by infiltration from the BASP. Groundwater data at AD-4C collected under the Federal CCR program in October 2016 was used to represent initial conditions at the monitoring location (100% groundwater), and BASP water data collected in August 2020 was used to represent the conditions in the BASP. A geochemical model (PHREEQC) was used to mix the groundwater sample with the BASP water at varying ratios in order to evaluate the changes in groundwater geochemistry under BASP water infiltration conditions. The output was compared to the reported groundwater concentrations at AD-4C in October 2020, which was the most recent sample collected containing the necessary major ion data. The mixing model output is included in a Piper Diagram presented as **Figure 6**, which visually represents the relative concentrations of major cations and anions in the analytical samples and mixing model outputs.

As illustrated in **Figure 6**, the mixing model predicts greater relative concentrations of calcium as the percent of BASP water added to the 2016 groundwater sample increases. However, the cation composition of groundwater at AD-4C appears unchanged between the 2016 and 2020 samples. Additionally, with greater inputs of the BASP water, the model predicts an increase in the relative percentage of sulfate as the relative percentage of chloride declines. However, the change in anion distribution between 2016 and 2020 in groundwater at AD-4C indicates that the chloride contribution has remained consistent while the relative concentration of alkalinity has declined.

The inconsistency of recently collected data at AD-4C with modeled outputs further indicates that changes in sulfate and TDS concentrations should not be attributed to mixing with BASP water. Rather, the elevated sulfate and boron concentrations at upgradient background well AD-1 suggest that changes in sulfate and TDS concentration at AD-4C are attributable to natural variation. This same conclusion was noted in a previously completed ASD for sulfate and TDS at well AD-4C (Geosyntec, 2020).

## 2.2 Sampling Requirements

The ASD described above supports the determination that the identified SSIs are from natural variation and not due to a release from the Welsh BASP. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will continue to be sampled for Appendix III parameters on a semi-annual basis.

## SECTION 3

### CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 40 CFR 257.94(e)(2) and supports the position that the identified sulfate and TDS SSIs at AD-4C should be attributed to natural variation and are not due to a release from the Welsh BASP. Therefore, no further action is warranted, and the Welsh BASP will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment A**.

## SECTION 4

### REFERENCES

- EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites. 3002010920. October.
- Geosyntec, 2019. Statistical Analysis Summary – Background Update Calculations. Bottom Ash Storage Pond – J. Robert Welsh Plant. December 2019.
- Geosyntec, 2020. Alternative Source Demonstration Report – Federal CCR Rule. J. Robert Welsh Plant – Bottom Ash Storage Pond. November 2020.
- TCEQ, 2020. Coal Combustion Residuals Groundwater Monitoring and Corrective Action Draft Technical Guideline No. 32. Topic: Coal Combustion Residuals (CCR) Groundwater Monitoring and Corrective Action. Waste Permits Division. May 2020.
- USEPA, 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance. EPA 530/R-09-007. March 2009.
- USEPA, 2015. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (Final Rule). Fed. Reg. 80 FR 21301, pp. 21301-21501, 40 CFR Parts 257 and 261, April.

# TABLES

**Table 1: Detection Monitoring Data Evaluation  
Welsh - BASP**

Parameter	Unit	Description	AD-3	AD-4C		AD-16R
			10/14/2020	10/13/2020	12/10/2020	10/14/2020
Boron	mg/L	Intrawell Background Value (UPL)	0.0580	0.0529		0.0638
		Analytical Result	0.02	0.02	--	0.02
Calcium	mg/L	Intrawell Background Value (UPL)	1.32	0.961		3.15
		Analytical Result	0.705	0.613	--	0.550
Chloride	mg/L	Intrawell Background Value (UPL)	9.40	15.6		8.02
		Analytical Result	7.31	13.1	--	6.50
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00		1.00
		Analytical Result	0.16	0.18	--	0.14
pH	SU	Intrawell Background Value (UPL)	6.6	5.8		5.0
		Intrawell Background Value (LPL)	3.1	4.2		2.6
		Analytical Result	4.6	4.9	--	3.3
Sulfate	mg/L	Intrawell Background Value (UPL)	10.6	63.7		73.2
		Analytical Result	3.5	<b>76.1</b>	<b>78.2</b>	53.1
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	140	255		221
		Analytical Result	116	<b>278</b>	<b>288</b>	183

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

mg/L: milligrams per liter

SU: standard units

**Bold values exceed the background value.**

Background values are shaded gray.



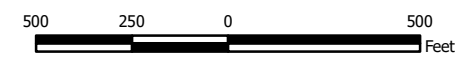
# FIGURES



- Monitoring Well Network**
- Downgradient Sampling Location
  - Background Sampling Location
  - Bottom Ash Storage Pond

**Notes**

- Monitoring well coordinates provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016).



**Site Layout  
Bottom Ash Storage Pond**

AEP Welsh Power Plant  
Cason, Texas

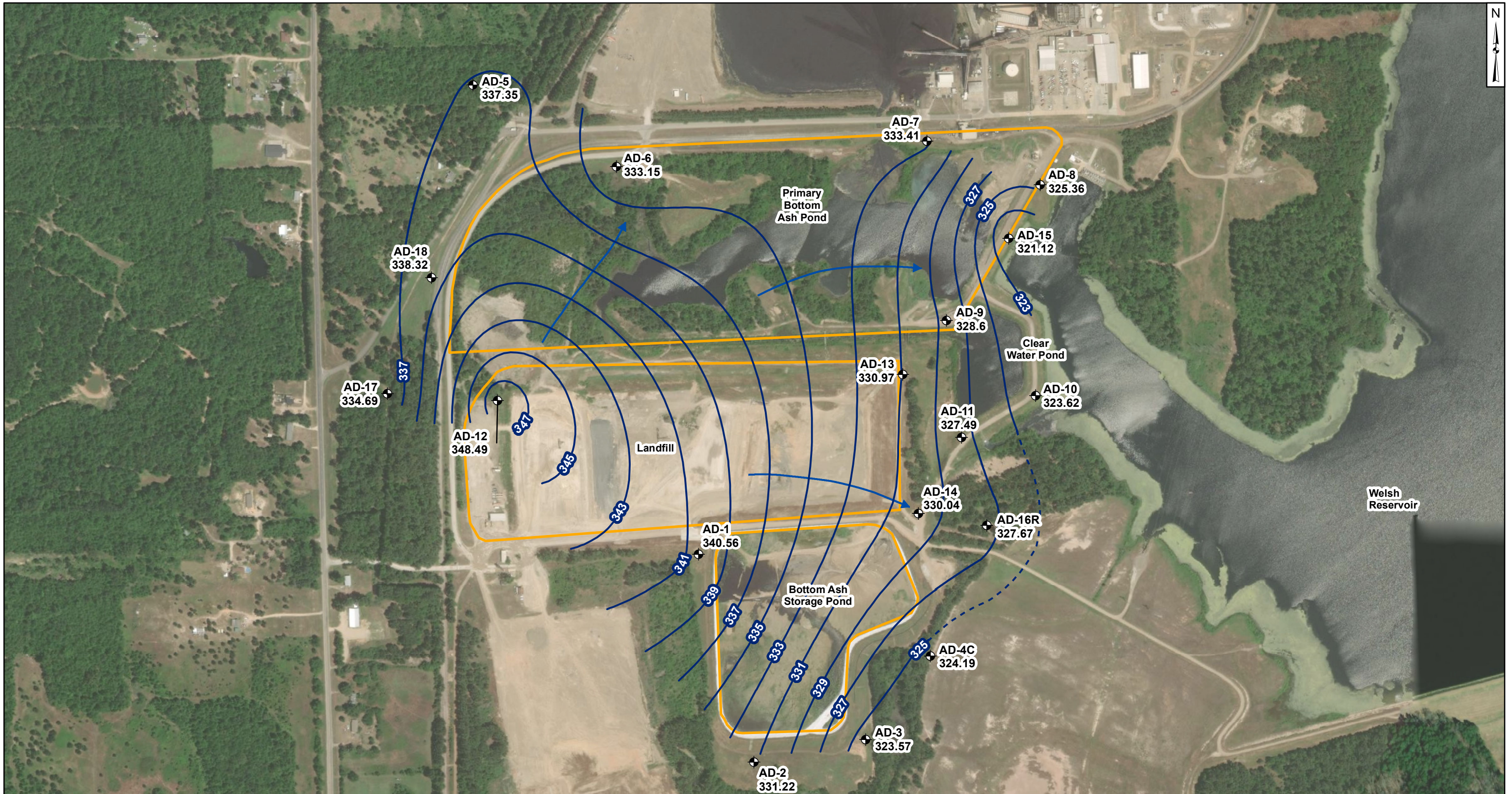
**Geosyntec**  
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Columbus, Ohio

2020/09/23

Figure

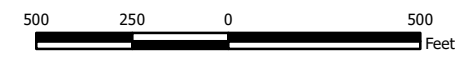
**1**



- Legend**
- ◆ Groundwater Monitoring Well
  - Groundwater Elevation Contour
  - - - Groundwater Elevation Contour (Inferred)
  - ➔ Approximate Groundwater Flow Direction
  - ▭ CCR Units

**Notes**

- Monitoring well coordinates and water level data (collected on October 12-14, 2020) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016).
- Groundwater elevation units are feet above mean sea level.
- This figure was originally provided in the 'Annual Groundwater Monitoring Report' (AEP, 2021).



**Groundwater Potentiometric Map  
October 2020**

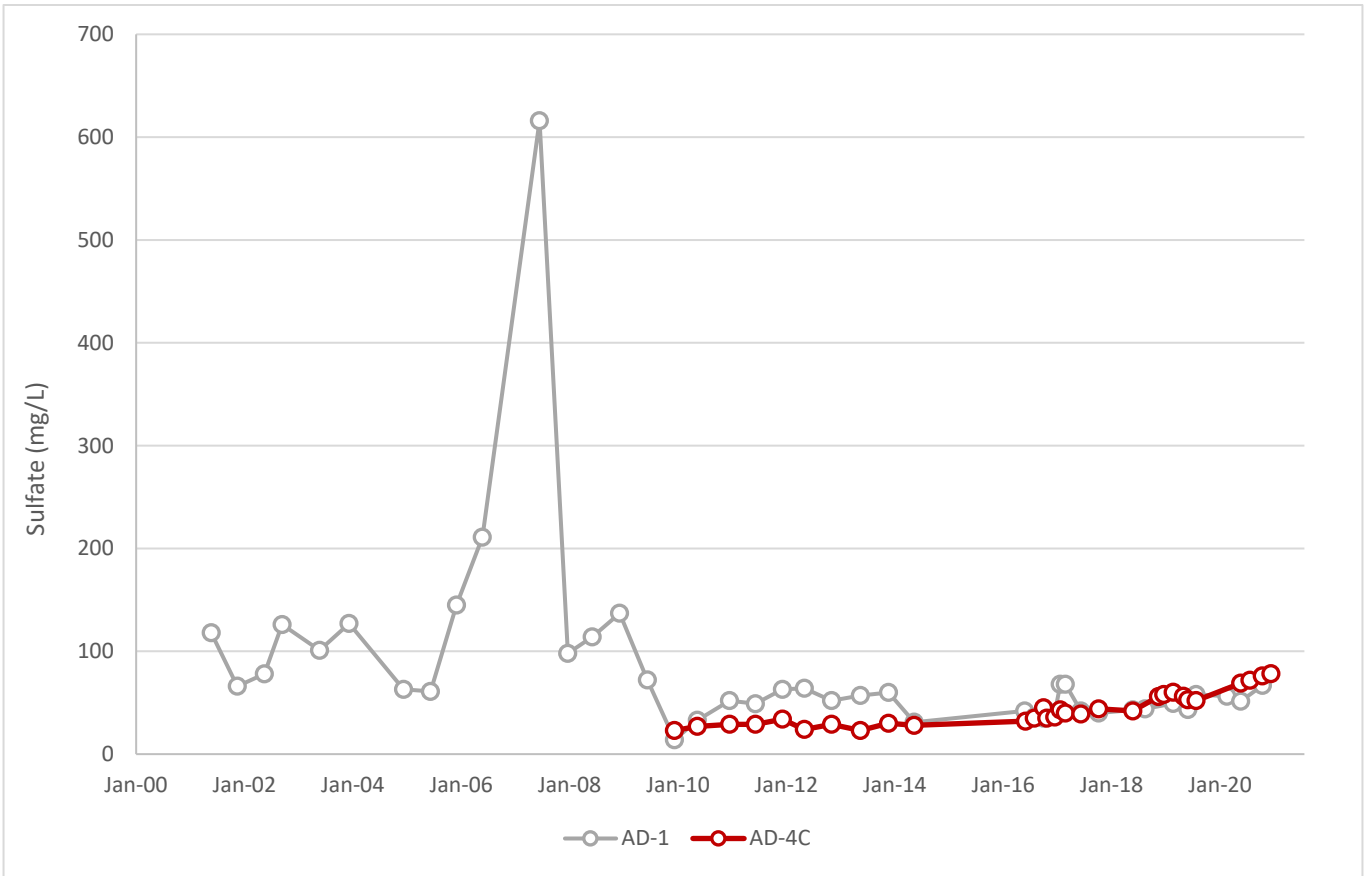
AEP Welsh Power Plant  
Cason, Texas

**Geosyntec**  
consultants

Columbus, Ohio

2021/01/06

Figure  
**2**



Notes: Sulfate time series diagram for BASP upgradient well AD-1 and downgradient well AD-4C. Data for AD-1 was collected as part of state and Federal CCR programs. Data for AD-4C was collected under the Federal CCR program.

**Sulfate Time Series Graph at AD-4C and Upgradient Well AD-1**  
Welsh Bottom Ash Storage Pond

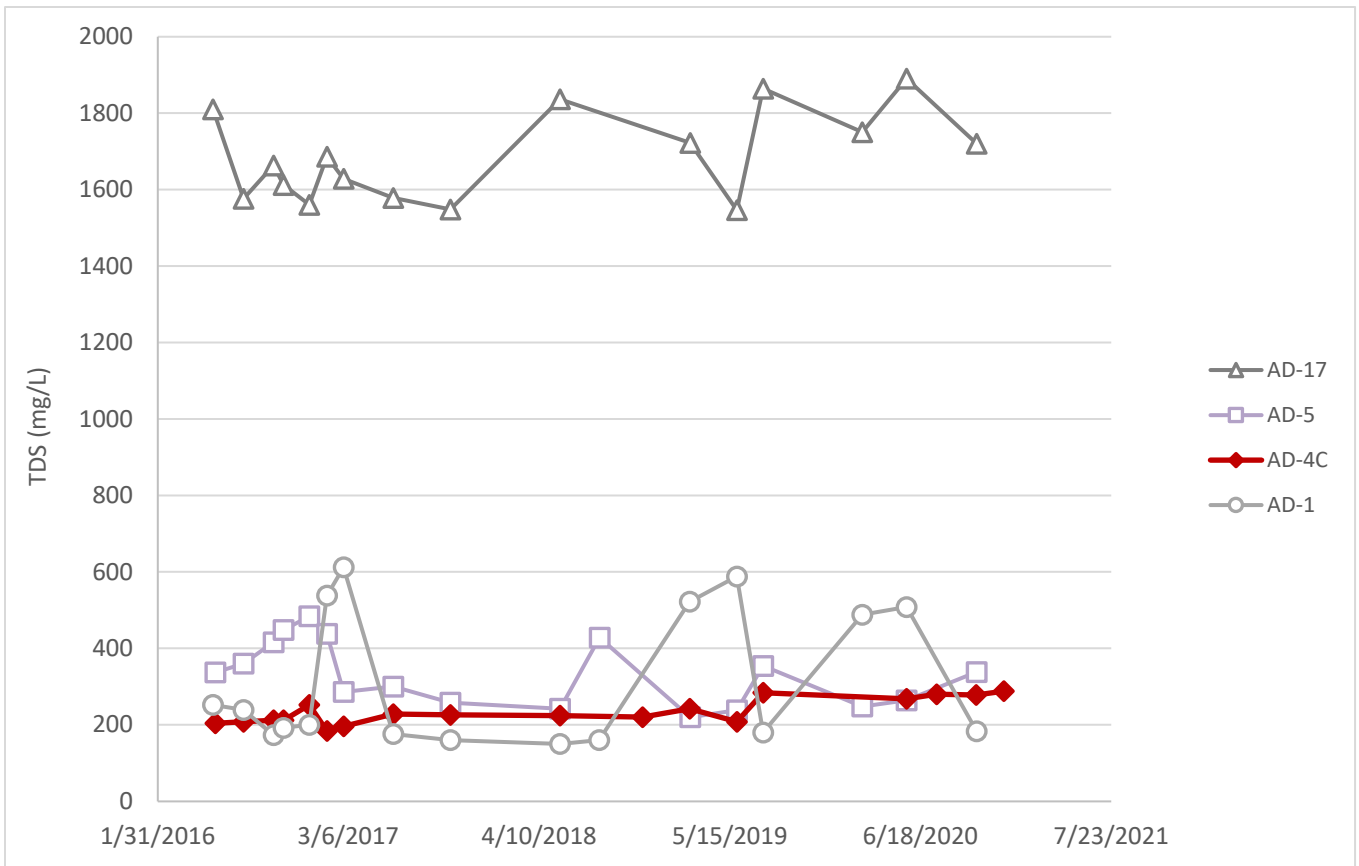
**Geosyntec**  
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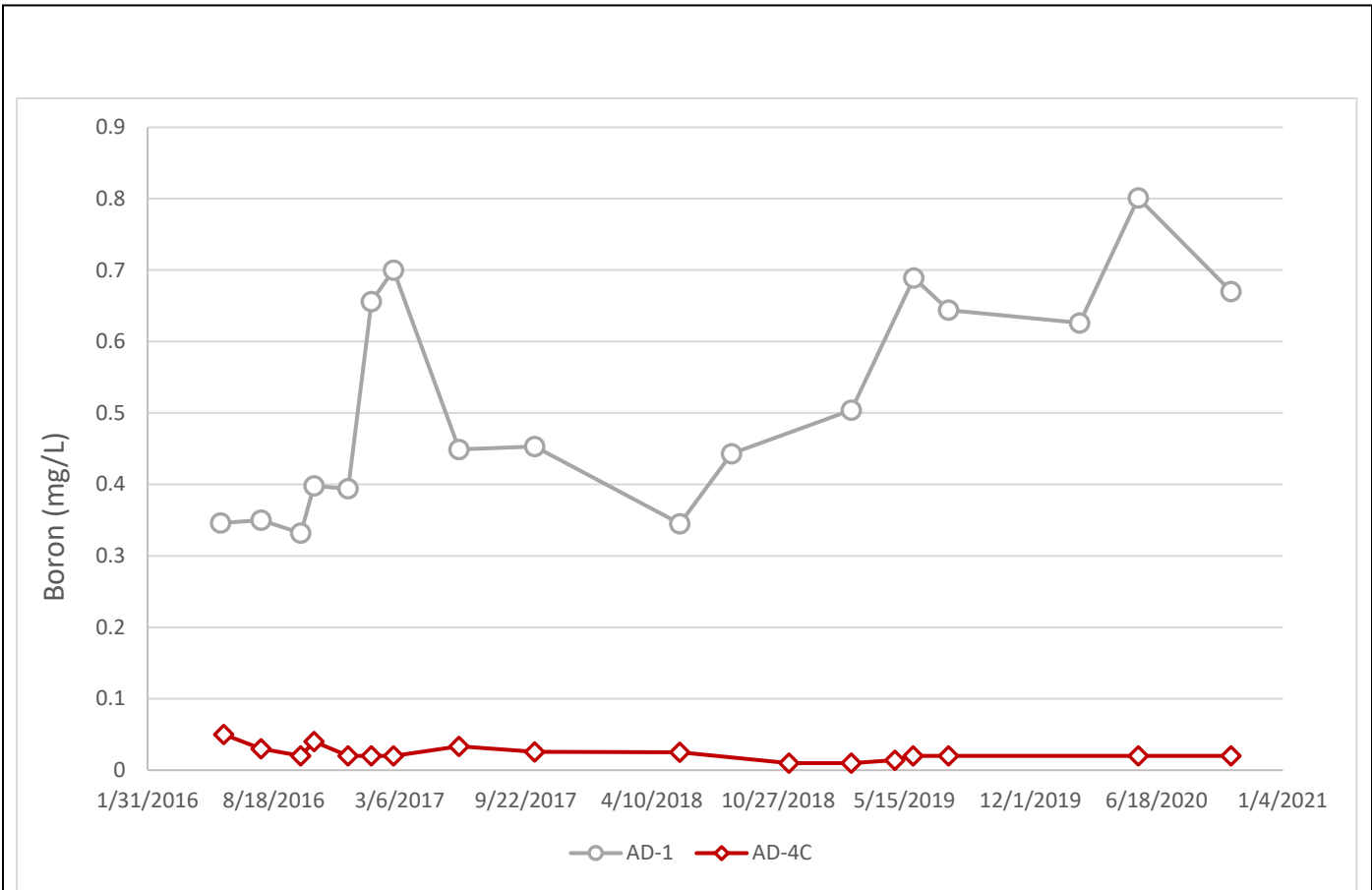


Figure  
**3**

Columbus, Ohio

05-April-2021





Notes: Boron data were collected under the Federal CCR program. Concentrations are shown in milligrams per liter (mg/L). Monitoring wells AD-1 is a background well, whereas AD-4C is a compliance well.

**Boron Time Series Graph**  
Welsh Bottom Ash Storage Pond

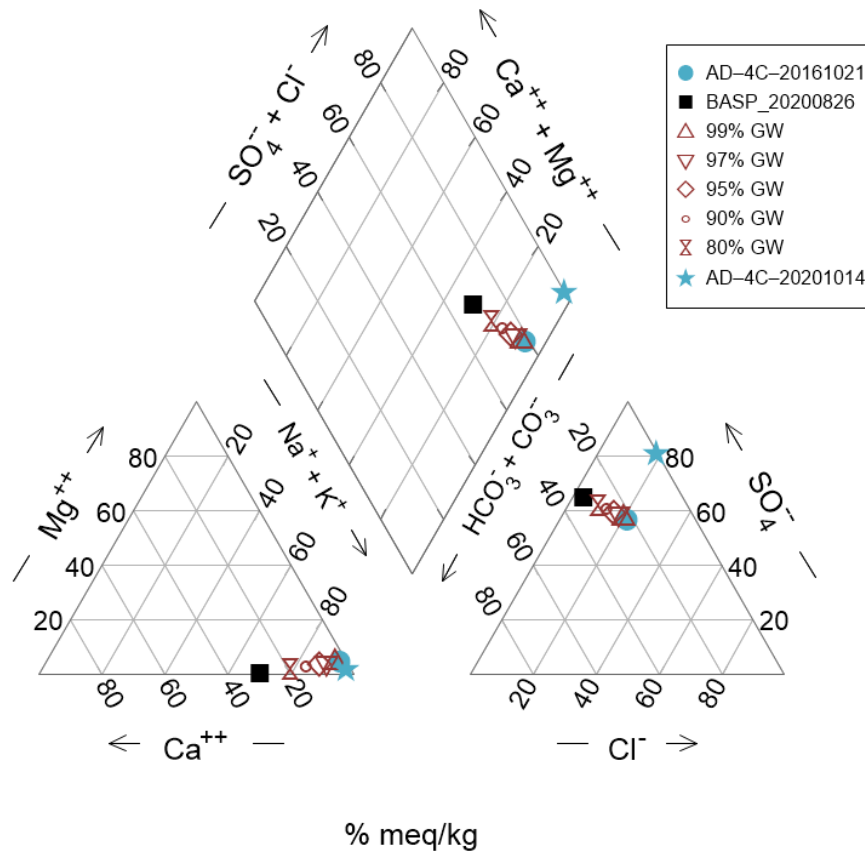
**Geosyntec**  
consultants



Figure  
**5**

Columbus, Ohio

05-April-2021



Notes: The October 2016 AD-4C groundwater sample the and October 2020 BASP sample were used as mixing model end members. The percentage input of the October 2020 BASP sample was varied, and the modeled output was compared to the October 2020 AD-4C groundwater sample. Results are shown in the relative percentage of milliequivalents per kilogram (meq/kg).

### Piper Diagram – Mixing Model

Welsh Bottom Ash Storage Pond

**Geosyntec**  
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Figure  
**6**

Columbus, OH

05-April-2021

# ATTACHMENT A

Certification by a Qualified Professional Engineer



**CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER**

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Welsh Bottom Ash Storage Pond CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.

Beth Ann Gross

Printed Name of Licensed Professional Engineer

Beth Ann Gross  
Signature



Geosyntec Consultants  
2039 Centre Pointe Boulevard, Suite 103  
Tallahassee, FL 32308

Texas Registered Engineering Firm  
No. F-1182

79864  
License Number

Texas  
Licensing State

March 4, 2021  
Date

# ALTERNATIVE SOURCE DEMONSTRATION REPORT TEXAS STATE CCR RULE

## J. Robert Welsh Plant Bottom Ash Storage Pond Pittsburg, Texas

*Submitted to*



1 Riverside Plaza  
Columbus, Ohio 43215-2372

*Submitted by*

**Geosyntec**   
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November 2021



Geosyntec Consultants  
Texas Registered Engineering Firm No.  
F-1182

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 1.1 CCR Rule Requirements..... 1-1  
 1.2 Demonstration of Alternative Sources..... 1-2  
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 2.1.1 Comparison of Calcium, Sulfate, and TDS Concentrations ..... 2-1  
 2.1.2 Supporting Evidence: Boron Concentrations ..... 2-2  
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 Figure 4                      Sulfate Time Series Graph  
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 Figure 7                      Piper Diagram – Mixing Model



Geosyntec Consultants  
Texas Registered Engineering Firm No.  
F-1182

**LIST OF ATTACHMENTS**

Attachment A                      Certification by a Qualified Professional Engineer

## LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
BASP	Bottom Ash Storage Pond
CCR	Coal Combustion Residuals
EPRI	Electric Power Research Institute
LPL	Lower Prediction Limit
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
SWFPR	Site-Wide False Positive Rate
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TPDES	Texas Pollutant Discharge Elimination System
UPL	Upper Prediction Limit

## SECTION 1

### INTRODUCTION AND SUMMARY

This Alternative Source Demonstration (ASD) report has been prepared to address statistically significant increases (SSIs) for calcium, sulfate, and total dissolved solids (TDS) in the groundwater monitoring network at the J. Robert Welsh Plant Bottom Ash Storage Pond (BASP), in Pittsburg, Texas, following the first semiannual detection monitoring event of 2021. The BASP is a wastewater pond permitted under the Texas Commission on Environmental Quality (TCEQ) Texas Pollutant Discharge Elimination System Permit No. WQ0001811000 as Pond No. 3.

Background values for the BASP were initially calculated in January 2018 with data from at least eight monitoring events. After a minimum of four detection monitoring events, the results of those events were compared to the existing background values, and the dataset was updated as appropriate (Geosyntec, 2019). Following the December 2019 background dataset update, revised upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure to maintain an appropriate site-wide false positive rate (SWFPR). With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceed the UPL or, in the case of pH, are below the LPL. In practice, if the initial result did not exceed the UPL or was not below the LPL, a second sample was not collected or analyzed.

The first semi-annual detection monitoring event of 2021 was performed in June 2021 (initial sampling event), and the results were compared to the calculated prediction limits. Where initial exceedances were identified, verification resampling was completed in July 2021. Following verification resampling, SSIs were identified for calcium, sulfate, and TDS at well AD-4C using intrawell comparisons. A summary of the detection monitoring analytical results and the calculated prediction limits to which they were compared is provided in **Table 1**.

#### 1.1 CCR Rule Requirements

Texas Commission on Environmental Quality (TCEQ) regulations (TCEQ, 2020b) regarding detection monitoring programs for coal combustion residuals (CCR) landfills and surface impoundments provide owners and operators with the option to make an alternative source demonstration (ASD) when an SSI is identified (30 TAC §352.941(c)(2)). In making a demonstration under this section, the owner or operator must:

*Within 90 days of making a determination of an SSI over the background value for any Appendix III constituent adopted by reference in § 352.1421 of this title, submit a report prepared and certified in accordance with § 352.4 of this title (relating to Engineering and Geoscientific Information), to the executive director, and any local pollution agency with jurisdiction that has requested to*

*be notified, demonstration that a source other than a coal combustion residuals unit caused the SSI or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.*

Pursuant to § 352.941(c)(2), Geosyntec Consultants, Inc. (Geosyntec) has prepared this ASD report, which documents that the SSIs identified for calcium, sulfate, and TDS at well AD-4C should not be attributed to the BASP at the Welsh Plant.

## **1.2 Demonstration of Alternative Sources**

An evaluation was completed to assess possible alternative sources to which the identified SSI could be attributed. Alternative sources were identified from amongst five types, based on the methodology provided by the Electric Power Research Institute (EPRI, 2017):

- ASD Type I: Sampling Causes;
- ASD Type II: Laboratory Causes;
- ASD Type III: Statistical Evaluation Causes;
- ASD Type IV: Natural Variation; and
- ASD Type V: Alternative Sources.

A demonstration was conducted to assess whether the increases in calcium, sulfate, and TDS concentrations at well AD-4C were based on Type IV causes (natural variation) and not by a release from the BASP.

## SECTION 2

### ALTERNATIVE SOURCE DEMONSTRATION

The methods used to assess possible alternative sources of the SSIs for calcium, sulfate and TDS at AD-4C and the proposed alternative source are described below.

#### 2.1 Proposed Alternative Source

An initial review of groundwater sampling field forms, site geochemistry, and site historical data did not identify alternative sources due to a Type I issue (sampling causes). A review of the laboratory and statistical analyses did not identify any Type II (laboratory causes) or Type III (statistical evaluation causes) issues. Groundwater sampling, laboratory analysis, and statistical evaluations were generally completed in accordance with draft TCEQ guidance for groundwater monitoring (TCEQ, 2020). Further, an initial review of site geochemistry did not identify evidence of any Type V (anthropogenic) impacts. As described below, the SSIs observed at monitoring well AD-4C are attributed to natural variation, which is a Type IV cause.

##### 2.1.1 Comparison of Calcium, Sulfate, and TDS Concentrations

SSIs for calcium, sulfate, and TDS were identified at monitoring well AD-4C. A site map showing the location of AD-4C and other network well locations is presented in **Figure 1**. The monitoring network includes background locations AD-1, AD-5, and AD-17 and compliance wells AD-3, AD-4C, and AD-16R. Groundwater flow beneath the BASP is generally toward the southeast, as shown in **Figure 2**.

Calcium concentrations at background wells AD-1, AD-5, and AD-17, which are located upgradient or cross-gradient of the BASP and AD-4C, have historically been much higher than those observed at AD-4C (**Figure 3**). Since background monitoring was initiated in 2016, calcium concentrations at AD-1, which is the closest upgradient well, have been subject to significant variability, with a peak concentration of 147 milligrams per liter (mg/L) in June 2017 and a minimum of 3.88 mg/L in October 2020. In contrast, calcium concentrations at AD-4C have ranged between 0.341 in December 2020 and 1.4 mg/L in July 2021. Calcium concentrations at background wells AD-5 and AD-17 have also been consistently above those observed at AD-4C. Given that the concentrations of calcium at AD-4C have consistently been one to two orders of magnitude lower than those of the background wells, the recently observed higher concentrations in calcium at AD-4C may represent the migration of groundwater with higher concentrations of calcium from upgradient locations such as AD-1.

Sulfate concentrations at background wells AD-1, AD-5, and AD-17 have historically been comparable to or higher than those observed at AD-4C (**Figure 4**). Prior to 2009, sulfate concentrations at AD-1 were generally higher and subject to significant variability, including a peak value of 616 milligrams per liter (mg/L) sulfate in June 2007. Since background monitoring was initiated in 2016, sulfate concentrations at both AD-1 and AD-4C appear to trend upwards at

a similar rate (**Figure 4**), suggesting the potential for regional changes in groundwater conditions. Sulfate concentrations at AD-17, the background well furthest from AD-4C, typically exceed 1000 mg/L, an order of magnitude greater than sulfate concentrations observed at AD-4C. Thus, recent increases in sulfate concentrations at AD-4C may represent the migration of groundwater with higher concentrations of sulfate from upgradient locations such as AD-1.

In addition to calcium and sulfate, an SSI for TDS was identified at monitoring well AD-4C. TDS concentrations at background wells AD-1, AD-5, and AD-17 are all generally comparable to or higher than AD-4C (**Figure 5**). The TDS concentrations of these background wells indicate TDS is highly variable within the aquifer unit. TDS concentrations at AD-1, which is directly upgradient of AD-4C, have been greater than TDS at AD-4C for four of the past six monitoring events. Even greater TDS concentrations are observed at AD-17, which is located further upgradient.

### 2.1.2 Supporting Evidence: Boron Concentrations

Boron is a conservative parameter which can function as a ‘tracer’ for potential CCR unit releases due to its lack of attenuation by chemical processes (e.g., sorption, precipitation) during groundwater flow and its high relative concentration in the BASP compared to downgradient groundwater. The concentration of boron in the BASP in August 2020 was 4.58 mg/L and the concentrations of boron at monitoring well AD-4C are consistently < 0.1 mg/L. Since the previous sample was collected in August 2020, there have been no notable changes in coal handling or sourcing at the plant that would have affected the composition of ash or pond water.

If BASP water, which has a boron concentration approximately one order of magnitude greater than background well AD-1, were impacting groundwater quality at downgradient monitoring wells, an increase in boron concentrations at MW AD-4C commensurate with the observed increases in sulfate and TDS at the well would be expected. The current boron concentrations at AD-4C do not display an increasing or decreasing trend, which suggests that groundwater quality changes should not be attributed to a release from the BASP (**Figure 6**). Furthermore, boron concentrations at upgradient well AD-1 are consistently higher than those observed at AD-4C.

### 2.1.3 Supporting Evidence: Mixing Model

A mixing model was created to further illustrate how concentrations at AD-4C would be expected to change if the groundwater at AD-4C was affected by infiltration from the BASP. Groundwater data at AD-4C collected under the Federal CCR program in October 2016 was used to represent initial conditions at the monitoring location (100% groundwater), and BASP water data collected in August 2020 was used to represent the conditions in the BASP. A geochemical model (PHREEQC) was used to mix the groundwater sample with the BASP water at varying ratios in order to evaluate the changes in groundwater geochemistry under BASP water infiltration conditions. The output was compared to the reported groundwater concentrations at AD-4C in October 2021. The mixing model output is included in a Piper Diagram presented as **Figure 7**, which visually represents the relative concentrations of major cations and anions in the analytical samples and mixing model outputs.



As illustrated in **Figure 7**, the mixing model predicts an increase in the relative percentage of sulfate as the relative percentage of chloride declines when the percent of BASP water added to the 2016 groundwater sample increases. However, the change in anion distribution between 2016 and 2021 in groundwater at AD-4C indicates that the chloride contribution has remained consistent while the relative concentration of alkalinity has declined.

The inconsistency of recently collected data at AD-4C with modeled outputs further indicates that changes in calcium, sulfate, and TDS concentrations should not be attributed to mixing with BASP water. Rather, the elevated sulfate and boron concentrations at upgradient background well AD-1 suggest that changes in calcium, sulfate, and TDS concentrations at AD-4C are attributable to natural variation. This same conclusion was noted in previously completed ASDs for sulfate and TDS at well AD-4C (Geosyntec, 2020; Geosyntec, 2021).

## **2.2 Sampling Requirements**

The ASD described above supports the determination that the identified SSIs are from natural variation and not due to a release from the Welsh BASP. Therefore, the unit will remain in the detection monitoring program. Groundwater at the unit will continue to be sampled for Appendix III parameters on a semi-annual basis and prediction limits will be updated when appropriate to incorporate recent data.

## SECTION 3

### CONCLUSIONS AND RECOMMENDATIONS

The preceding information serves as the ASD prepared in accordance with 30 TAC §352.941(c)(2) and supports the position that the identified calcium, sulfate, and TDS SSIs at AD-4C should be attributed to natural variation and are not due to a release from the Welsh BASP. Therefore, no further action is warranted, and the Welsh BASP will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in **Attachment A**.

## SECTION 4

### REFERENCES

- Arcadis, 2016. Bottom Ash Storage Pond – CCR Groundwater Monitoring Well Network Evaluation. J. Robert Welsh Power Plant. May.
- EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites. 3002010920. October.
- Geosyntec, 2019. Statistical Analysis Summary – Background Update Calculations. Bottom Ash Storage Pond – J. Robert Welsh Plant. December 2019.
- Geosyntec, 2020. Alternative Source Demonstration Report – Federal CCR Rule. J. Robert Welsh Plant – Bottom Ash Storage Pond. November 2020.
- Geosyntec, 2021. Alternative Source Demonstration Report – Federal CCR Rule. J. Robert Welsh Plant – Bottom Ash Storage Pond. May 2021.
- TCEQ, 2020a. Coal Combustion Residuals Groundwater Monitoring and Corrective Action Draft Technical Guideline No. 32. Topic: Coal Combustion Residuals (CCR) Groundwater Monitoring and Corrective Action. Waste Permits Division. May 2020.
- TCEQ, 2020b. Title 30, Part 1, Chapter 352: Coal Combustion Residuals Waste Management, May 22.

# TABLES

**Table 1: Detection Monitoring Data Evaluation  
Welsh - Bottom Ash Storage Pond**

Analyte	Unit	Description	AD-3	AD-4C		AD-16R
			6/2/2021	6/2/2021	7/26/2021	6/2/2021
Boron	mg/L	Intrawell Background Value (UPL)	0.0580	0.0529		0.0638
		Analytical Result	0.036	0.038	--	0.028
Calcium	mg/L	Intrawell Background Value (UPL)	1.32	0.961		3.15
		Analytical Result	0.7	<b>1.1</b>	<b>1.40</b>	1.0
Chloride	mg/L	Intrawell Background Value (UPL)	9.40	15.6		8.02
		Analytical Result	7.98	13.3	--	7.02
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00		1.00
		Analytical Result	0.18	0.16	--	0.28
pH	SU	Intrawell Background Value (UPL)	6.6	5.8		5.0
		Intrawell Background Value (LPL)	3.1	4.2		2.6
		Analytical Result	4.4	4.6	--	3.7
Sulfate	mg/L	Intrawell Background Value (UPL)	10.6	63.7		73.2
		Analytical Result	3.38	<b>82.4</b>	<b>71.9</b>	65.4
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	140	255		221
		Analytical Result	110	<b>280</b>	<b>280</b>	190

Notes:

UPL: Upper prediction limit

LPL: Lower prediction limit

**Bold values exceed the background value.**

Background values are shaded gray.

# FIGURES



**Monitoring Well Network**

- Downgradient Sampling Location
- Background Sampling Location
- Bottom Ash Storage Pond

**Notes**

- Monitoring well coordinates provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016).



**Site Layout  
Bottom Ash Storage Pond**

AEP Welsh Power Plant  
Cason, Texas

**Geosyntec**  
consultants

Columbus, Ohio

2020/09/23

Figure

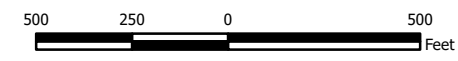
**1**



- Legend**
- Groundwater Monitoring Well
  - Groundwater Elevation Contour
  - Groundwater Elevation Contour (Inferred)
  - Approximate Groundwater Flow Direction
  - CCR Units

**Notes**

- Monitoring well coordinates and water level data (collected on June 2, 2021) provided by AEP.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016).
- Groundwater elevation units are feet above mean sea level.



11/22/2021  
*Beth Ann Gross*  
 Geosyntec Consultants  
 Texas Registered Engineering Firm No. F-1182

**Groundwater Potentiometric Map  
 June 2021**

AEP Welsh Power Plant  
 Cason, Texas

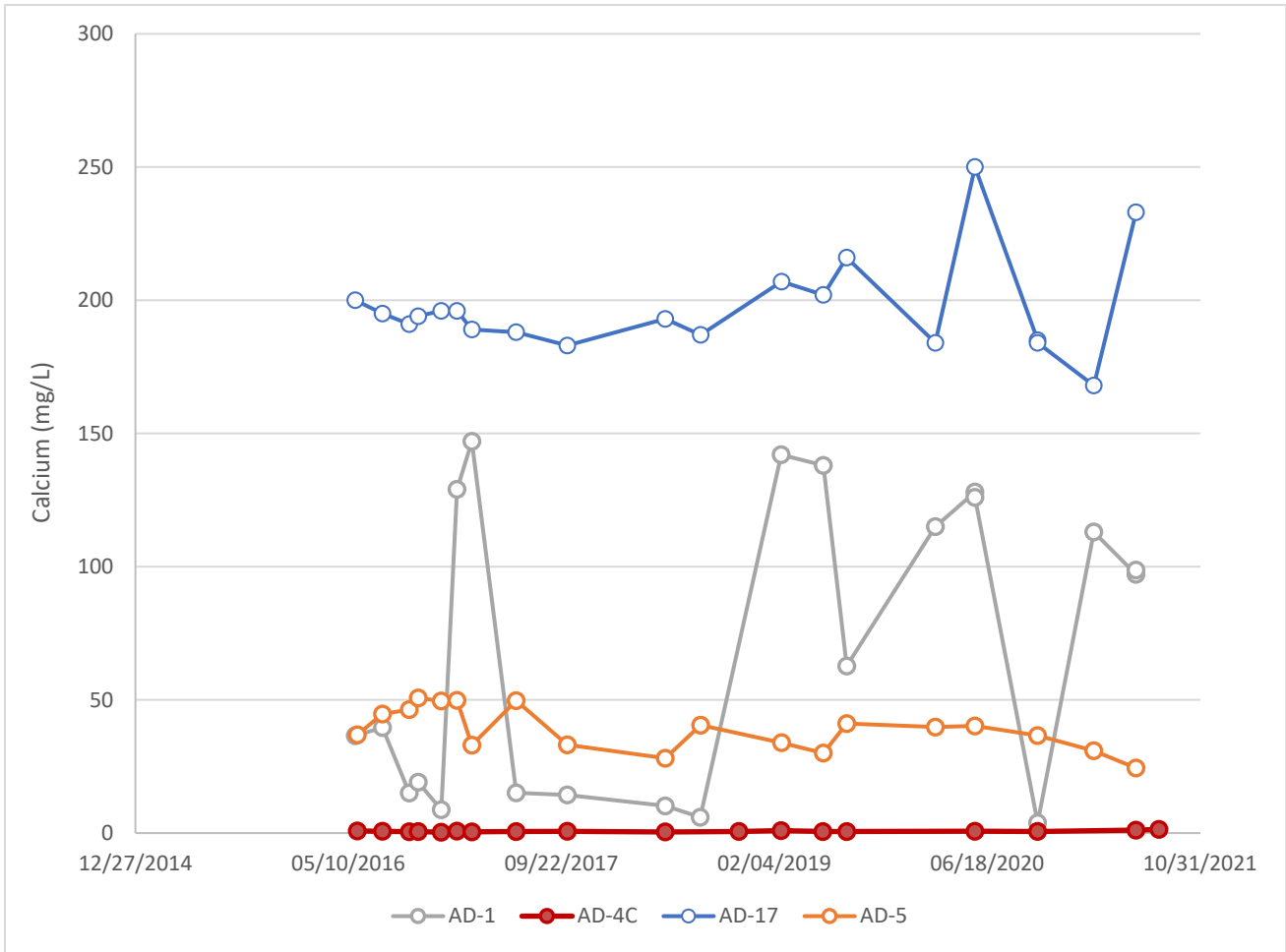
**Geosyntec**  
 consultants

Columbus, Ohio

2021/11/19

Figure  
**2**





Notes: Calcium time series diagram for BASP upgradient wells AD-1, AD-5, and AD-17 and downgradient well AD-4C. Data collected as part of state and Federal CCR programs.

**Calcium Time Series Graph**  
Welsh Bottom Ash Storage Pond

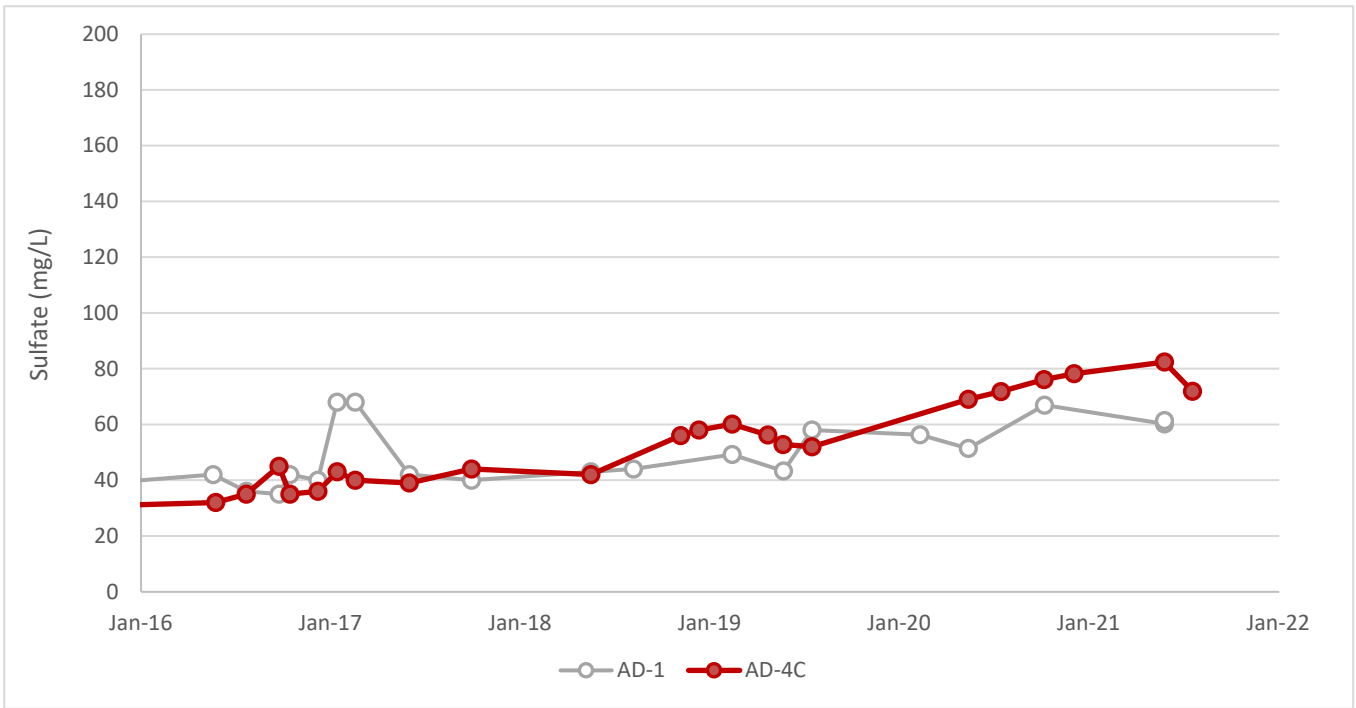
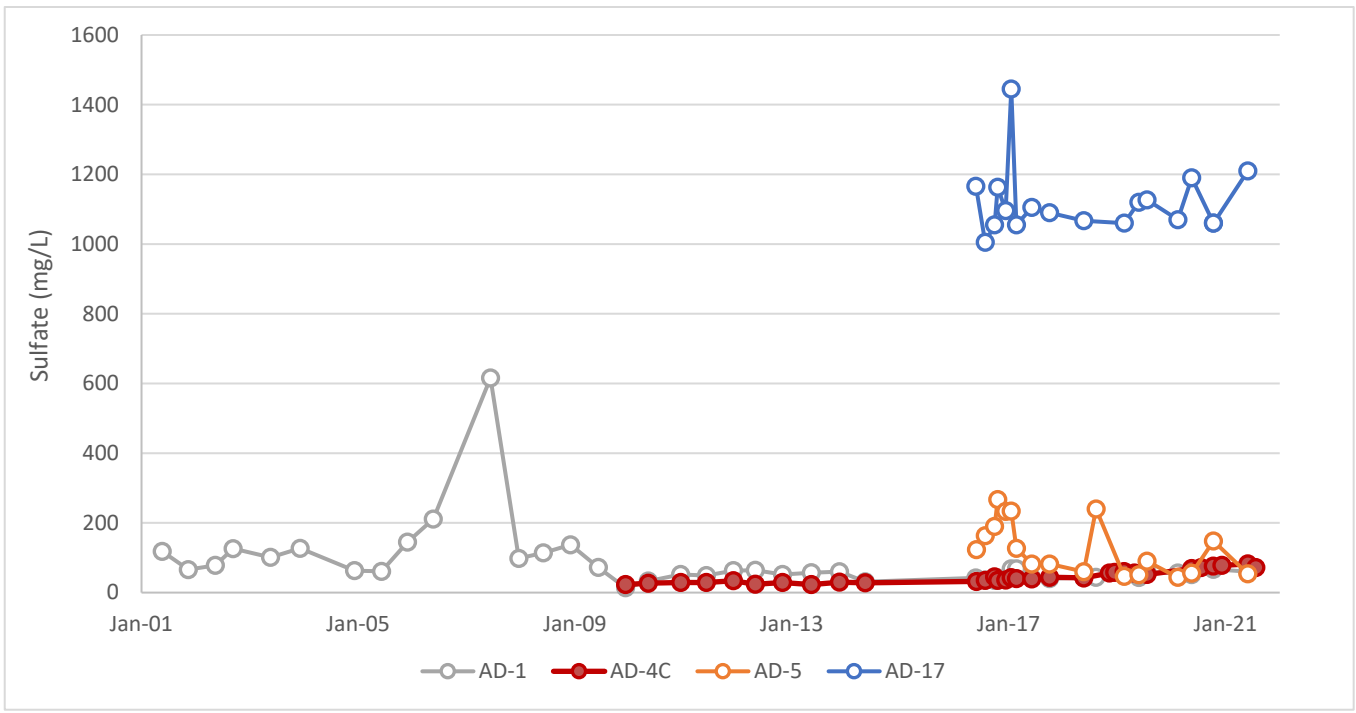
Geosyntec  
consultants



Figure  
3

Columbus, Ohio

October 2021



Notes: Sulfate time series diagram for BASP upgradient wells AD-1, AD-5 and AD-7, and downgradient well AD-4C. The bottom graph only shows AD-1 and AD-4C data from 2016 onwards. Data was collected as part of state and Federal CCR programs. Data for AD-4C was collected under the Federal CCR program.

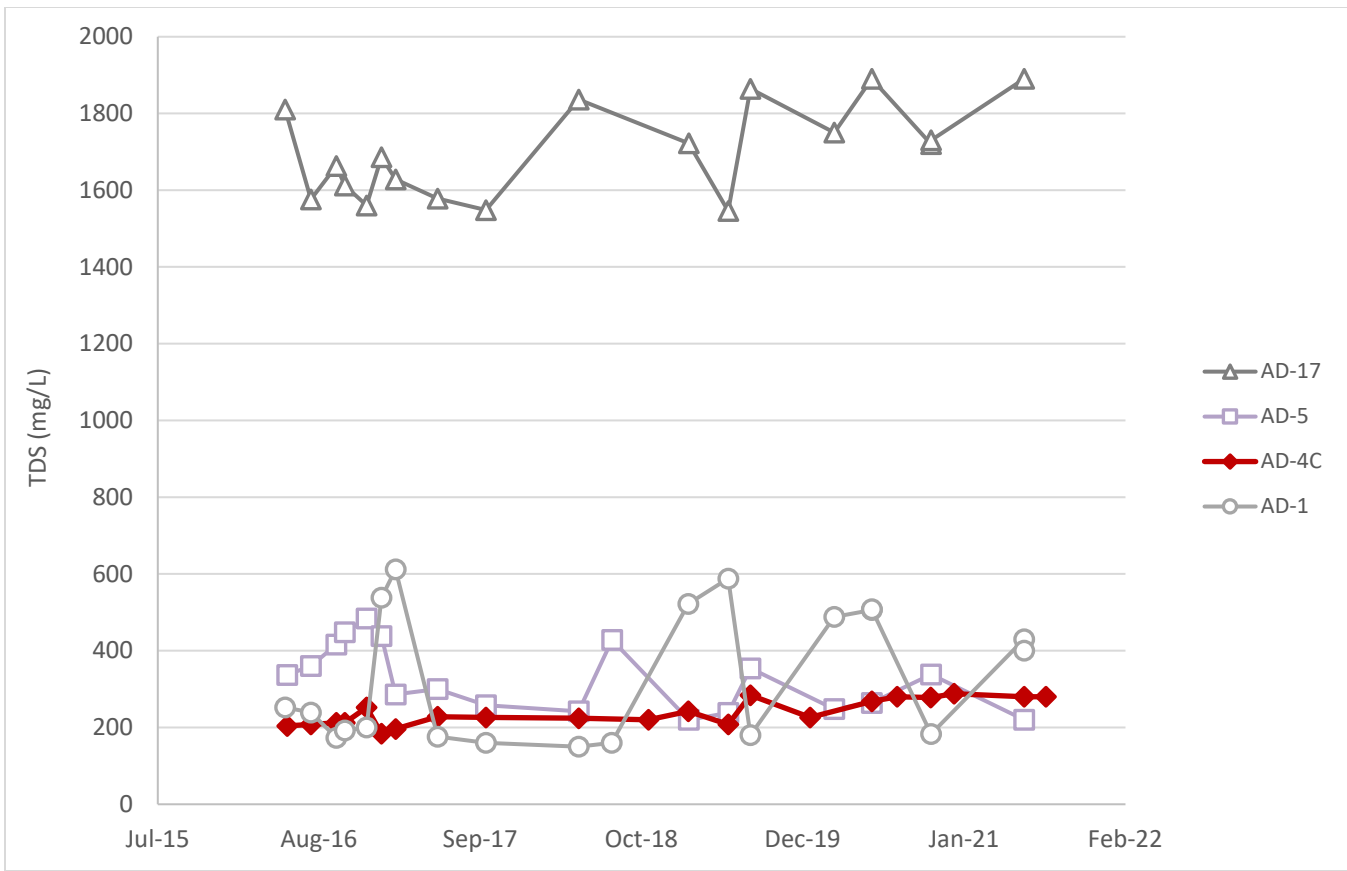
**Sulfate Time Series Graph**  
Welsh Bottom Ash Storage Pond



Figure  
4

Columbus, Ohio

October 2021



Notes: TDS data was collected under the Federal CCR rule. Monitoring wells AD-1, AD-5, and AD-17 are background wells, whereas AD-4C is a compliance well. Concentrations are shown in milligrams per liter (mg/L).

**TDS Time Series Graph**  
Welsh Bottom Ash Storage Pond

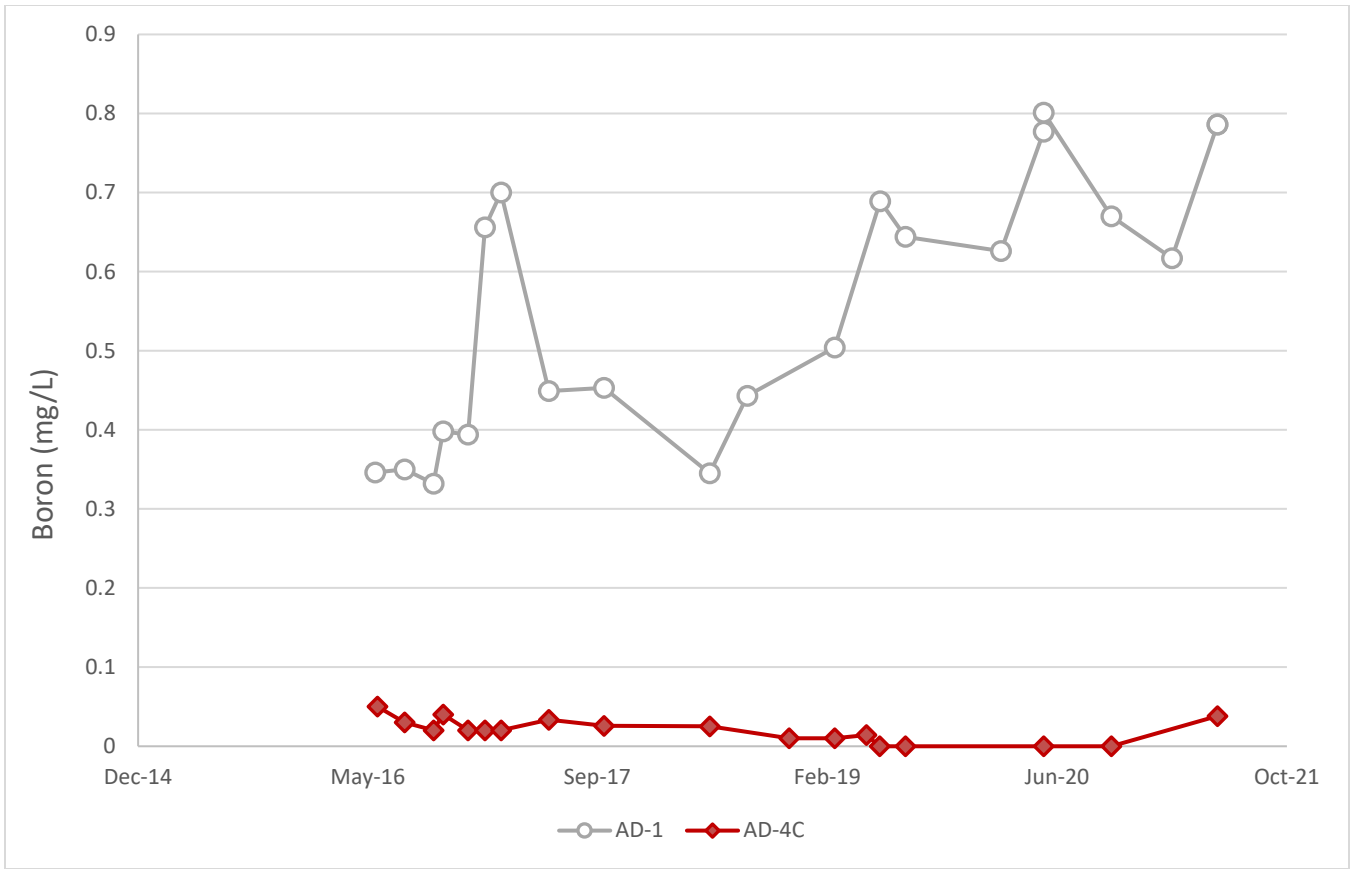
Geosyntec  
consultants



Figure  
5

Columbus, Ohio

October 2021



Notes: Boron data were collected under the Federal CCR program. Concentrations are shown in milligrams per liter (mg/L). Monitoring well AD-1 is a background well, whereas AD-4C is a compliance well.

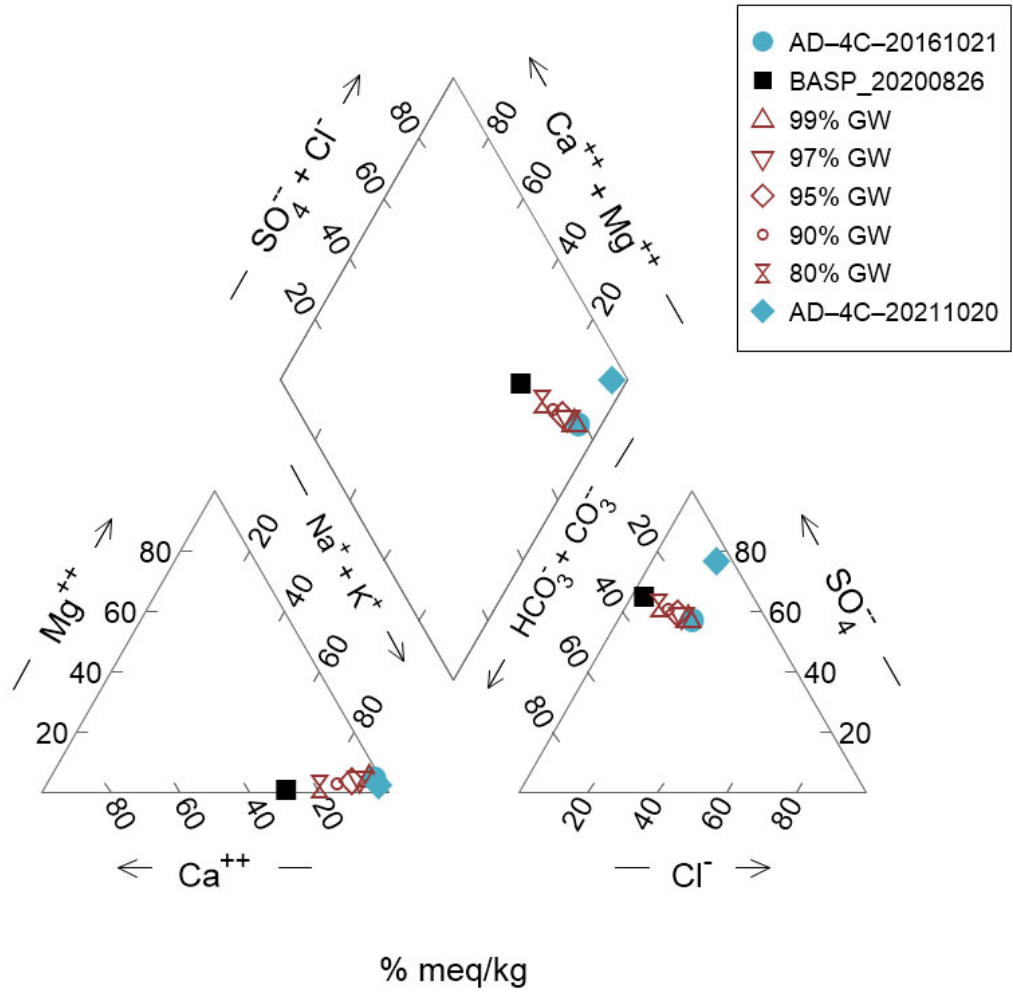
**Boron Time Series Graph**  
Welsh Bottom Ash Storage Pond



Figure  
**6**

Columbus, Ohio

October 2021



Notes: The October 2016 AD-4C groundwater sample the and October 2020 BASP sample were used as mixing model end members. The percentage input of the October 2020 BASP sample was varied, and the modeled output was compared to the October 2021 AD-4C groundwater sample. Results are shown in the relative percentage of milliequivalents per kilogram (meq/kg).

**Piper Diagram – Mixing Model**  
Welsh Bottom Ash Storage Pond



Figure  
**7**

Columbus, OH

19-November-2021

# ATTACHMENT A

Certification by Qualified Professional Engineer

**CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER**

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Welsh Bottom Ash Storage Pond CCR management area and that the requirements of § 352.941(c) have been met.

Beth Ann Gross

Printed Name of Licensed Professional Engineer

Beth Ann Gross

Signature



Geosyntec Consultants  
2039 Centre Pointe Boulevard, Suite 103  
Tallahassee, FL 32308

Texas Registered Engineering Firm  
No. F-1182

79864  
License Number

Texas  
Licensing State

11/22/2021  
Date

## **APPENDIX 4 - NA**

A summary of any transition between monitoring programs or an alternate monitoring frequency, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring



## **APPENDIX 5- NA**

Reports documenting monitoring well plugging and abandonment or well installation are included in the appendix. or other information required to be included in the annual report such as program related notification or assessment of corrective measures.

## APPENDIX 6

Field reports and analytical reports.

# CCR Groundwater Monitoring Well Inspection Form

Facility: Welsh      Sampling Period: 6-1-21  
 Sampling Contractor: Eagle EAV      Signature: [Signature]

Well No.	Well Locked	Lock Functioning	Well Locked After Sampling	Access to Well Maintained	Well Housing and Pad in Good Shape	Well Properly Labeled	Comments
AD-15	✓	✓	✓	✓	✓	✓	
AD-11	✓	✓	✓	✓	✓	✓	high vegetation
AD-14	✓	✓	✓	✓	✓	✓	high vegetation
AD-3	✓	✓	✓	✓	✓	✓	gap in lid allows wasp to nest
AD-16R	✓	✓	✓	✓	✓	✓	overgrown
AD-17	✓	✓	✓	✓	✓	✓	
AD-2	✓	✓	✓	✓	✓	✓	overgrown 11.45
AD-7	✓	✓	✓	✓	✓	✓	16.92
AD-10	✓	✓	✓	✓	✓	✓	overgrown 19.14
AD-18	✓	✓	✓	✓	✓	✓	4.58
AD-22	✓	✓	✓	✓	✓	✓	11.13 severely overgrown
AD-23	✓	✓	✓	✓	✓	✓	100 <del>severely</del> severely overgrown find

hard to

**Instructions:** Complete form and submit to AEP Environmental Services with Field Data. Place check mark for items that are satisfactory. Unsatisfactory items should be left blank with a note in the comments section on what needs to be remedied.

# CCR Groundwater Monitoring Well Inspection Form

Facility: AEP WFLSH PP      Sampling Period: 06/01-02/21  
 Sampling Contractor: EAGLE ENVIRONMENTAL      Signature: [Signature]

Well No.	Well Locked	Lock Functioning	Well Locked After Sampling	Access to Well Maintained	Well Housing and Pad in Good Shape	Well Properly Labeled	Comments
AD-13	✓	✓	✓	✓	✓	✓	
AD-09	✓	✓	✓	✓	✓	✓	
AD-08	✓	✓	✓	✓	✓	✓	
AD-05	✓	✓	✓	✓	✓	✓	
AD-01	✓	✓	✓	✓	✓	✓	
AD-04C	✓	✓	✓	✓	✓	✓	
AD-04B	✓	✓	✓	✓	✓	✓	NO LABEL 5.91
AD-04	✓	✓	✓	✓	✓	✓	15.03
AD-04A	✓	✓	✓	✓	✓	✓	NO LABEL 15.04
AD-12	✓	✓	✓	✓	✓	✓	PAD COVERED IN SOIL & OVERFLOWING 18.21
AD-06	✓	✓	✓	✓	✓	✓	PAD OVERFLOWING 10.37

**Instructions:** Complete form and submit to AEP Environmental Services with Field Data. Place check mark for items that are satisfactory. Unsatisfactory items should be left blank with a note in the comments section on what needs to be remedied.















# CCR Groundwater Monitoring Well Inspection Form

Facility: Webb      Sampling Period: 7-2021  
 Sampling Contractor: Esge Environmental      Signature: [Signature]

Well No.	Well Locked	Lock Functioning	Well Locked After Sampling	Access to Well Maintained	Well Housing and Pad in Good Shape	Well Properly Labeled	Comments
AD-5	✓	✓	✓	✓	✓	✓	dtw 14.6
AD-4C	✓	✓	✓	✓	✓	✓	dtw 7.83
AD-16R	✓	✓	✓	✓	✓	✓	dtw 23.75
AD-3	✓	✓	✓	✓	✓	✓	dtw 8.38
AD-1	✓	✓	✓	✓	✓	✓	dtw 14.69
AD-17	✓	✓	✓	✓	✓	✓	dtw 22.28

**Instructions:** Complete form and submit to AEP Environmental Services with Field Data. Place check mark for items that are satisfactory. Unsatisfactory items should be left blank with a note in the comments section on what needs to be remedied.





Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
T: 614-836-4221, Audinet 210-4221  
F: 614-836-4168, Audinet 210-4168  
<http://aepenv/labs>

### Water Analysis

Location: **Welsh PS**

Report Date: **10/24/2020**

#### AD-3

Sample Number: **202980-001**

Date Collected: **10/14/2020 13:15**

Date Received: **10/16/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO <sub>3</sub>	< 5	mg/L	U	20	5	MGK	10/16/2020 11:49	SM 2320B-2011
Chloride, Cl	7.31	mg/L		0.04	0.01	CRJ	10/20/2020 14:26	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.16	mg/L		0.06	0.01	CRJ	10/20/2020 14:26	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	116	mg/L		50	20	HRF	10/19/2020	SM 2540C-2011
Sulfate, SO <sub>4</sub>	3.5	mg/L		0.4	0.06	CRJ	10/20/2020 14:26	EPA 300.1-1997, Rev. 1.0

#### AD-4C

Sample Number: **202980-002**

Date Collected: **10/13/2020 10:59**

Date Received: **10/16/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO <sub>3</sub>	< 5	mg/L	U	20	5	MGK	10/16/2020 11:49	SM 2320B-2011
Chloride, Cl	13.1	mg/L		0.04	0.01	CRJ	10/20/2020 14:51	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.18	mg/L		0.06	0.01	CRJ	10/20/2020 14:51	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	278	mg/L		50	20	HRF	10/19/2020	SM 2540C-2011
Sulfate, SO <sub>4</sub>	76.1	mg/L		0.4	0.06	CRJ	10/20/2020 14:51	EPA 300.1-1997, Rev. 1.0

#### AD-16R

Sample Number: **202980-003**

Date Collected: **10/14/2020 10:26**

Date Received: **10/16/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO <sub>3</sub>	< 5	mg/L	U	20	5	MGK	10/16/2020 11:49	SM 2320B-2011
Chloride, Cl	6.50	mg/L		0.04	0.01	CRJ	10/20/2020 15:16	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.14	mg/L		0.06	0.01	CRJ	10/20/2020 15:16	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	183	mg/L		50	20	HRF	10/19/2020	SM 2540C-2011
Sulfate, SO <sub>4</sub>	53.1	mg/L		0.4	0.06	CRJ	10/20/2020 15:16	EPA 300.1-1997, Rev. 1.0

#### Duplicate BASP

Sample Number: **202980-004**

Date Collected: **10/14/2020 10:26**

Date Received: **10/16/2020**

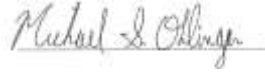
Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Alkalinity, as CaCO <sub>3</sub>	< 5	mg/L	U	20	5	MGK	10/16/2020 11:49	SM 2320B-2011
Chloride, Cl	6.55	mg/L		0.04	0.01	CRJ	10/20/2020 15:42	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.13	mg/L		0.06	0.01	CRJ	10/20/2020 15:42	EPA 300.1-1997, Rev. 1.0
Residue, Filterable, TDS	177	mg/L		50	20	HRF	10/19/2020	SM 2540C-2011
Sulfate, SO <sub>4</sub>	49.4	mg/L		0.4	0.06	CRJ	10/20/2020 15:42	EPA 300.1-1997, Rev. 1.0

**Location: Welsh PS**

**Report Date: 10/24/2020**

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit

J: Analyte was positively identified, though the quantitation was below Reporting Limit.



**Michael Ohlinger, Chemist**

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Audinet 8-210-

**THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT WRITTEN APPROVAL OF THE LABORATORY. ALL TEST RESULTS MEET ALL OF THE REQUIREMENTS OF THE ACCREDITING AUTHORITY, UNLESS OTHERWISE NOTED.**



**AEP WATER & WASTE SAMPLE RECEIPT FORM**

<u>Package Type</u>				<u>Delivery Type</u>			
Cooler	Box	Bag	Envelope	PONY	UPS	FedEX	USPS
				Other _____			
Plant/Customer <u>Welsh</u>				Number of Plastic Containers: <u>4</u>			
Opened By <u>SM, MK</u>				Number of Glass Containers: _____			
Date/Time <u>10-16-20</u> <u>Dam</u>				Number of Mercury Containers: _____			
Were all temperatures within 0-6°C? <input checked="" type="radio"/> Y / <input type="radio"/> N or N/A Initial: <u>MK</u> <input checked="" type="radio"/> on ice / <input type="radio"/> no ice <small>(IR Gun Ser# #2 (192635988) Expir. 11/12/2021) - If No, specify each deviation: _____</small>							
Was container in good condition? <input checked="" type="radio"/> Y / <input type="radio"/> N Comments _____							
Was Chain of Custody received? <input checked="" type="radio"/> Y / <input type="radio"/> N Comments _____							
Requested turnaround: <u>Rush</u> If RUSH, who was notified? _____							
pH (15 min)	Cr <sup>+6</sup> (pres) (24 hr)	NO <sub>2</sub> or NO <sub>3</sub> (48 hr)	ortho-PO <sub>4</sub> (48 hr)	Hg-diss (pres) (48 hr)			
Was COC filled out properly? <input checked="" type="radio"/> Y / <input type="radio"/> N Comments _____							
Were samples labeled properly? <input checked="" type="radio"/> Y / <input type="radio"/> N Comments _____							
Were correct containers used? <input checked="" type="radio"/> Y / <input type="radio"/> N Comments _____							
Was pH checked & Color Coding done? <input checked="" type="radio"/> Y / <input type="radio"/> N or N/A Initial & Date: <u>10-16-20 MK</u>							
- Was Add'l Preservative needed? <input checked="" type="radio"/> Y / <input type="radio"/> N If Yes: By whom & when: _____ (See Prep Book)							
Is sample filtration requested? <input checked="" type="radio"/> Y / <input type="radio"/> N Comments _____ (See Prep Book)							
Was the customer contacted? If Yes: Person Contacted: _____							
Lab ID# <u>202980</u>				Initial & Date & Time: _____			
Comments: _____							
Logged by <u>SM</u> _____							
Reviewed by <u>MK</u> _____							

**REMINDER:** Document the pertinent sample integrity information and deviations in sample receipt (as noted above) in the "Notes" field in the LIMS to be included on the report to the customer.





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Groveport, OH 43125  
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<http://aepenv/labs>

### Water Analysis

Location: **Welsh PS**

Report Date: **11/2/2020**

**AD-3**  
Sample Number: **202990-001**      Date Collected: **10/14/2020 13:15**      Date Received: **10/19/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	< 0.02	mg/L	U	0.05	0.02	GES	10/21/2020 18:33	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	0.705	mg/L		0.3	0.1	DAM	10/22/2020 17:08	EPA 200.7-1994, Rev. 4.4
Iron, Fe	1.15	mg/L		0.1	0.02	DAM	10/22/2020 17:08	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	0.475	mg/L		0.1	0.02	DAM	10/22/2020 17:08	EPA 200.7-1994, Rev. 4.4
Potassium, K	0.5	mg/L	J	1	0.2	DAM	10/22/2020 17:08	EPA 200.7-1994, Rev. 4.4
Sodium, Na	7.32	mg/L		0.5	0.1	DAM	10/22/2020 17:08	EPA 200.7-1994, Rev. 4.4

**AD-4C**  
Sample Number: **202990-002**      Date Collected: **10/14/2020 10:59**      Date Received: **10/19/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	< 0.02	mg/L	U	0.05	0.02	GES	10/21/2020 18:38	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	0.613	mg/L		0.3	0.1	DAM	10/22/2020 16:10	EPA 200.7-1994, Rev. 4.4
Iron, Fe	0.240	mg/L		0.1	0.02	DAM	10/22/2020 16:10	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	0.396	mg/L		0.1	0.02	DAM	10/22/2020 16:10	EPA 200.7-1994, Rev. 4.4
Potassium, K	0.2	mg/L	J	1	0.2	DAM	10/22/2020 16:10	EPA 200.7-1994, Rev. 4.4
Sodium, Na	45.6	mg/L		0.5	0.1	DAM	10/22/2020 16:10	EPA 200.7-1994, Rev. 4.4

**AD-16R**  
Sample Number: **202990-003**      Date Collected: **10/14/2020 10:26**      Date Received: **10/19/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	0.02	mg/L	J	0.05	0.02	GES	10/21/2020 18:43	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	0.550	mg/L		0.3	0.1	DAM	10/22/2020 17:12	EPA 200.7-1994, Rev. 4.4
Iron, Fe	1.79	mg/L		0.1	0.02	DAM	10/22/2020 17:12	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	1.28	mg/L		0.1	0.02	DAM	10/22/2020 17:12	EPA 200.7-1994, Rev. 4.4
Potassium, K	3.73	mg/L		1	0.2	DAM	10/22/2020 17:12	EPA 200.7-1994, Rev. 4.4
Sodium, Na	5.85	mg/L		0.5	0.1	DAM	10/22/2020 17:12	EPA 200.7-1994, Rev. 4.4

**Duplicate BASP**

Sample Number: **202990-004**

Date Collected: **10/14/2020 10:26**

Date Received: **10/19/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	0.02	mg/L	J	0.05	0.02	GES	10/21/2020 18:48	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	0.548	mg/L		0.3	0.1	DAM	10/22/2020 17:16	EPA 200.7-1994, Rev. 4.4
Iron, Fe	1.78	mg/L		0.1	0.02	DAM	10/22/2020 17:16	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	1.27	mg/L		0.1	0.02	DAM	10/22/2020 17:16	EPA 200.7-1994, Rev. 4.4
Potassium, K	3.73	mg/L		1	0.2	DAM	10/22/2020 17:16	EPA 200.7-1994, Rev. 4.4
Sodium, Na	5.80	mg/L		0.5	0.1	DAM	10/22/2020 17:16	EPA 200.7-1994, Rev. 4.4

**Equipment Blank BASP**

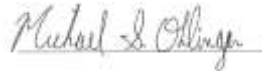
Sample Number: **202990-005**

Date Collected: **10/14/2020 10:32**

Date Received: **10/19/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	0.03	mg/L	J	0.05	0.02	GES	10/21/2020 18:54	EPA 200.8-1994, Rev. 5.4
Calcium, Ca	0.359	mg/L		0.3	0.1	DAM	10/22/2020 17:20	EPA 200.7-1994, Rev. 4.4
Iron, Fe	< 0.02	mg/L	U	0.1	0.02	DAM	10/22/2020 17:20	EPA 200.7-1994, Rev. 4.4
Magnesium, Mg	0.09	mg/L	J	0.1	0.02	DAM	10/22/2020 17:20	EPA 200.7-1994, Rev. 4.4
Potassium, K	0.4	mg/L	J	1	0.2	DAM	10/22/2020 17:20	EPA 200.7-1994, Rev. 4.4
Sodium, Na	3.22	mg/L		0.5	0.1	DAM	10/22/2020 17:20	EPA 200.7-1994, Rev. 4.4

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit  
 J: Analyte was positively identified, though the quantitation was below Reporting Limit.



**Michael Ohlinger, Chemist**

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**AEP WATER & WASTE SAMPLE RECEIPT FORM**

<u>Package Type</u>		<u>Delivery Type</u>			
<input checked="" type="radio"/> Cooler	<input type="radio"/> Box	<input type="radio"/> Bag	<input type="radio"/> Envelope	<input type="radio"/> PONY	<input type="radio"/> UPS
				<input type="radio"/> FedEX	<input type="radio"/> USPS
				Other _____	
Plant/Customer <u>Welsh</u>		Number of Plastic Containers: <u>5</u>			
Opened By <u>MSO</u>		Number of Glass Containers: _____			
Date/Time <u>10/19/20 120pm</u>		Number of Mercury Containers: _____			
Were all temperatures within 0-6°C? Y / N or <input checked="" type="radio"/> N/A Initial: _____ on ice / no ice (IR Gun Ser# #2 (192635988), Expir. 11/12/2021) - If No, specify each deviation: _____					
Was container in good condition? <input checked="" type="radio"/> Y / N Comments _____					
Was Chain of Custody received? <input checked="" type="radio"/> Y / N Comments _____					
Requested turnaround <u>2 weeks</u> If RUSH, who was notified? _____					
pH (15 min)	Cr <sup>6+</sup> (pres) (24 hr)	NO <sub>2</sub> or NO <sub>3</sub> (48 hr)	ortho-PO <sub>4</sub> (48 hr)	Hg-diss (pres) (48 hr)	

Was COC filled out properly?  Y / N Comments \_\_\_\_\_

Were samples labeled properly?  Y / N Comments \_\_\_\_\_

Were correct containers used?  Y / N Comments \_\_\_\_\_

Was pH checked & Color Coding done?  Y / N or N/A Initial & Date: SM 10-19-20

- Was Add'l Preservative needed? Y /  N If Yes: By whom & when: \_\_\_\_\_ (See Prep Book)

Is sample filtration requested? Y /  N Comments \_\_\_\_\_ (See Prep Book)

Was the customer contacted? If Yes: Person Contacted: \_\_\_\_\_

Lab ID# 902990 Initial & Date & Time: \_\_\_\_\_

Logged by MSO Comments: \_\_\_\_\_

Reviewed by SM \_\_\_\_\_

SM Lot # pH paper X000RWDG21  
**REMINDER:** Document the pertinent sample integrity information and deviations in sample receipt (as noted above) in the "Notes" field in the LIMS to be included on the report to the customer.



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<http://aepenv/labs>

### Water Analysis

**Location: Welsh PS**

**Report Date: 12/21/2020**

**AD-4C**  
**Sample Number: 203454-001**                      **Date Collected: 12/10/2020 10:57**                      **Date Received: 12/11/2020**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Residue, Filterable, TDS	288	mg/L		50	20	SDW	12/15/2020	SM 2540C-2011
Sulfate, SO4	78.2	mg/L		1	0.2	CRJ	12/15/2020 12:06	EPA 300.1-1997, Rev. 1.0

U: Analyte was analyzed and not detected at or above adjusted Method Detection Limit  
J: Analyte was positively identified, though the quantitation was below Reporting Limit.

**Michael Ohlinger, Chemist**

Email [msohlinger@aep.com](mailto:msohlinger@aep.com) Tel.

Fax 614-836-4168 Audinet 8-210-

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**AEP WATER & WASTE SAMPLE RECEIPT FORM**

<u>Package Type</u>				<u>Delivery Type</u>			
Cooler	Box	Bag	Envelope	PONY	UPS	FedEX	USPS
				Other _____			
Plant/Customer <u>Welsh</u>				Number of Plastic Containers: <u>1</u>			
Opened By <u>SY</u>				Number of Glass Containers: <u>-</u>			
Date/Time <u>12-11-20 11:30</u>				Number of Mercury Containers: <u>-</u>			
Were all temperatures within 0-6°C? <input checked="" type="radio"/> Y / N or N/A Initial: <u>SM</u> <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">on ice / no ice</span>							
(IR Gun Ser# <u>192635987</u> , Expir. <u>12-11-21</u> ) - If No, specify each deviation: _____							
Was container in good condition? <input checked="" type="radio"/> Y / N Comments _____							
Was Chain of Custody received? <input checked="" type="radio"/> Y / N Comments _____							
Requested turnaround: <u>Routine</u> If RUSH, who was notified? _____							
pH (15 min)	Cr <sup>6</sup> (pres ) (24 hr)	NO <sub>2</sub> or NO <sub>3</sub> (48 hr)	ortho-PO <sub>4</sub> (48 hr)	Hg-diss (pres ) (48 hr)			

Was COC filled out properly?  Y / N Comments \_\_\_\_\_

Were samples labeled properly?  Y / N Comments \_\_\_\_\_

Were correct containers used?  Y / N Comments \_\_\_\_\_

Was pH checked & Color Coding done? Y / N or N/A Initial & Date: \_\_\_\_\_

**pH paper (circle one):** MQuant,PN1.09535.0001,LOT# \_\_\_\_\_ [OR] Lab Rat,PN4801,LOT# X000RWDG21

- Was Add'l Preservative needed? Y /  N If Yes: By whom & when: \_\_\_\_\_ (See Prep Book)

Is sample filtration requested? Y /  N Comments \_\_\_\_\_ (See Prep Book)

Was the customer contacted? If Yes: Person Contacted: \_\_\_\_\_

Lab ID# 203454 Initial & Date & Time : \_\_\_\_\_

Comments: \_\_\_\_\_

Logged by MSO \_\_\_\_\_

Reviewed by gAB \_\_\_\_\_

**REMINDER:** Document the pertinent sample integrity information and deviations in sample receipt (as noted above) in the "Notes" field in the LIMS to be included on the report to the customer.



# Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215109

Customer: Welsh Power Station

Date Reported: 07/02/2021

Customer Sample ID:

Customer Description:

Lab Number: 215109-001

Sampling Point: AD-3

Date Collected: 06/02/2021

Date Received: 06/04/2021

Preparation:

## Ion Chromatography

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Chloride	7.98	mg/L	2	0.04	0.01		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0
Fluoride	0.18	mg/L	2	0.06	0.01		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0
Sulfate	3.38	mg/L	2	0.40	0.06		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0

## Wet Chemistry

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
TDS, Filterable Residue	110	mg/L	1	50	20		SDW	06/07/2021	SM 2540C-2011

Customer Sample ID:

Customer Description:

Lab Number: 215109-002

Sampling Point: AD-4c

Date Collected: 06/02/2021

Date Received: 06/04/2021

Preparation:

## Ion Chromatography

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Chloride	13.3	mg/L	2	0.04	0.01		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0
Fluoride	0.16	mg/L	2	0.06	0.01		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0
Sulfate	82.4	mg/L	2	0.40	0.06		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0

## Wet Chemistry

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
TDS, Filterable Residue	280	mg/L	1	50	20		SDW	06/07/2021	SM 2540C-2011





# Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215109

Customer: Welsh Power Station

Date Reported: 07/02/2021

Customer Sample ID:	Customer Description:
Lab Number: 215109-003	Sampling Point: AD-16R
Date Collected: 06/02/2021	Date Received: 06/04/2021
Preparation:	

## Ion Chromatography

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Chloride	7.02	mg/L	2	0.04	0.01		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0
Fluoride	0.28	mg/L	2	0.06	0.01		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0
Sulfate	65.4	mg/L	2	0.40	0.06		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0

## Wet Chemistry

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
TDS, Filterable Residue	190	mg/L	1	50	20		SDW	06/07/2021	SM 2540C-2011

Customer Sample ID: Duplicate BASP	Customer Description:
Lab Number: 215109-004	Sampling Point:
Date Collected: 06/02/2021	Date Received: 06/04/2021
Preparation:	

## Ion Chromatography

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Chloride	8.00	mg/L	2	0.04	0.01		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0
Fluoride	0.17	mg/L	2	0.06	0.01		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0
Sulfate	3.26	mg/L	2	0.40	0.06		CRJ	06/07/2021	EPA 300.1 -1997, Rev. 1.0

## Wet Chemistry

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
TDS, Filterable Residue	110	mg/L	1	50	20		SDW	06/07/2021	SM 2540C-2011



## Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215109

Customer: Welsh Power Station

Date Reported: 07/02/2021

### Report Verification

This report and the above data have been confirmed by the following analyst.

A handwritten signature in cursive script that reads "Michael S. Ohlinger". The signature is written in black ink and is positioned above a horizontal line.

Michael Ohlinger, Chemist

Email: msohlinger@aep.com

Phone: 614-836-4184

Audinet: 8-210-4184

**THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT WRITTEN APPROVAL OF THE LABORATORY. ALL TEST RESULTS MEET ALL OF THE REQUIREMENTS OF THE ACCREDITING AUTHORITY, UNLESS OTHERWISE NOTED.**



## Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215109

Customer: Welsh Power Station

Date Reported: 07/02/2021

### Data Qualifier Legend

B1	Analyte detected in method blank (MB) at or above the method criteria.
B2	Analyte detected in initial calibration blank (ICB) at or above the method criteria.
B3	Analyte detected in continuing calibration blank (CCB) at or above the method criteria.
B4	The interference check standard (ICS) exceeded the method criteria on this parameter.
H1	Sample was received past holding time.
H2	Sample analysis performed past holding time.
J1	Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
J2	Concentration estimated. Analyte exceeded calibration range.
L1	The associated laboratory control sample (LCS) or laboratory control sample duplicate (LCSD) recovery was outside acceptance limits.
M1	The associated matrix spike (MS) or matrix spike duplicate (MSD) recovery was outside acceptance limits.
M2	Analyzed by method of standard additions (MSA).
O1	The reporting limit for oil and grease is directly affected by the collected sample volume.
O2	Client did not provide additional bottles; therefore, the MS and duplicate are missing in this batch.
O3	Client did not provide additional bottles; therefore, the duplicate is missing in this batch.
O4	Sample was transferred to a different bottle due to excess fine particulate. The particulate was rinsed with hexane, and the hexane layer was transferred to the corresponding bottle. The hexane rinse was completed three times.
P1	The precision between duplicate results was above acceptance limits.
P2	The precision on the laboratory control sample duplicate (LCSD) was above acceptance limits.
P3	The precision on the matrix spike duplicate (MSD) was above acceptance limits.
P4	The field duplicate was used as a sample duplicate.
P5	The precision on the inorganic efficiency check (IEC) exceeded the method criteria.
Q1	Sample received in inappropriate sample container.
Q2	Sample was received damaged. The sample was recoverable.
Q3	Sample container was received damaged. Unable to recover the sample.
Q4	Sample was received outside of thermal preservation range.
Q5	Sample was received with improper chemical preservation.
Q6	Insufficient sample was received by the laboratory to perform the requested analysis.
Q7	Insufficient sample was received to meet method QC requirements.
Q8	Sample was received with head space.
Q9	Due to instrument malfunction, sample was invalidated.
Q10	Analysis was performed by a contracted laboratory. See attached report.
Q11	Sample contains free liquid.
Q12	Sample does not contain free liquid.
Q13	Sample did not ignite.
Q14	This analyte and method are not included on the primary Laboratory Scope of TNI Accreditation.
R1	Surrogate recovery was outside acceptance limits.
R2	Carrier recovery was outside acceptance limits.
R3	Internal standard recovery was outside acceptance limits.
R4	The recovery of the reduction efficiency checks (REC) for nitrate or nitrite exceeded the method criteria.
R5	The back calculation recovery of one or more calibration points exceeded the method criteria.
S1	Residue weight is above or below the method criteria and needs to be re-analyzed at a different dilution.



## Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

**Job ID: 215109**

**Customer: Welsh Power Station**

**Date Reported: 07/02/2021**

- S2 Residue weight is above the method criteria but was already analyzed with the highest dilution factor.
- S3 Residue weight is below the method criteria but was already analyzed with 1000mL.
- S4 Sample and duplicate results vary due to large amounts of solids present.
- S5 Filtration time exceeds ten minutes.
- S6 Insufficient sample was received to meet the minimum volume of the method. Residue weight is below the method criteria and was analyzed with less than 1000mL.
- S7 Sample did not achieve constant weight.
- S8 Sample with low residue was selected for duplicate analysis.
- S9 Based on history, the sample residue was only measured twice and did not achieve constant weight.
- U1 Not detected at or above method detection limit (MDL).
- V1 The associated initial calibration verification (ICV) recovery was outside acceptance limits.
- V2 The associated continuing calibration verification (CCV) recovery was outside acceptance limits.

Dolan Chemical Laboratory (DCL)  
4001 Bixby Road  
Groveport, Ohio 43125

### Chain of Custody Record

Program: Coal Combustion Residuals (CCR)

Contacts: Michael Ohlinger (614-836-4184)

Project Name: Weish BASP

Contact Name: Jill Parker-Witt

Contact Phone: (318) 673-3816

Sampler(s): Matt Hamilton Kenny McDonald

Site Contact: \_\_\_\_\_ Date: \_\_\_\_\_

For Lab Use Only:  
COC/Order #: 215109

Analysis Turnaround Time (in Calendar Days)  
Routine (28 days)

Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.
6/2/2021	1008	G	GW	1
6/2/2021	1123	G	GW	1
6/2/2021	1049	G	GW	1
6/2/2021	1008	G	GW	1
DUPLICATE - BASP				

Sampler(s) Initials	250 mL bottle, pH<2, HNO <sub>3</sub>	500 mL bottle, pH<2, HNO <sub>3</sub>	1 L bottle, Cool, 0-6°C	Three (six every 10th) L bottles, pH<2, HNO <sub>3</sub>	40 mL Glass vial or 250 mL PTFE lined bottle, HCL, PH <sub>2</sub>	filter 500 mL bottle, then pH<2, HNO <sub>3</sub>	Sample Specific Notes:
	Ba, Ca	Ba, Ca, Li, Sr, As, Pb, Mo, Se, Tl	TDS, F, Cl, SO <sub>4</sub>	Ra-226, Ra-228	Hg	dissolved Fe and Mn	
			X				
			X				
			X				
			X				

Preservation Used: 1= Ice, 2= HCl; 3= H<sub>2</sub>SO<sub>4</sub>; 4= HNO<sub>3</sub>; 5= NaOH; 6= Other ; F= filter in field ; F4

\* Six 1L Bottles must be collected for Radium for every 10th sample.

Special Instructions/QC Requirements & Comments:

Relinquished by: *Kenneth* Date/Time: 06/03/21 1400  
 Relinquished by: *FA66* Date/Time: \_\_\_\_\_  
 Relinquished by: *S. H. H. H.* Date/Time: 6.4.21 12p

**AEP WATER & WASTE SAMPLE RECEIPT FORM**

<u>Package Type</u>		<u>Delivery Type</u>					
Cooler	Box	Bag	Envelope	PONY	UPS	FedEX	USPS
				Other _____			
Plant/Customer <u>Welsh</u>			Number of Plastic Containers: <u>4</u>				
Opened By <u>SM, JWB</u>			Number of Glass Containers: _____				
Date/Time <u>6-4-21 12pm</u>			Number of Mercury Containers: _____				
Were all temperatures within 0-6°C? <input checked="" type="radio"/> Y / <input type="radio"/> N or N/A Initial: <u>SM</u> <input checked="" type="radio"/> on ice / <input type="radio"/> no ice							
1(IR Gun Ser# <u>200700311</u> , Expir. <u>06-11-22</u> ) - If No, specify each deviation: _____							
Was container in good condition? <input checked="" type="radio"/> Y / <input type="radio"/> N Comments _____							
Was Chain of Custody received? <input checked="" type="radio"/> Y / <input type="radio"/> N Comments _____							
Requested turnaround: <u>Routine</u> If RUSH, who was notified? _____							
pH (15 min)	Cr <sup>6</sup> (pres) (24 hr)	NO <sub>2</sub> or NO <sub>3</sub> (48 hr)	ortho-PO <sub>4</sub> (48 hr)	Hg-diss (pres) (48 hr)			

Was COC filled out properly?  Y /  N Comments \_\_\_\_\_

Were samples labeled properly?  Y /  N Comments \_\_\_\_\_

Were correct containers used?  Y /  N Comments \_\_\_\_\_

Was pH checked & Color Coding done?  Y /  N or N/A Initial & Date: JWB 6-4-21

**pH paper (circle one):** MQuant,PN1.09535.0001,LOT# HC904495 [OR] Lab Rat,PN4801,LOT# X000RWDG21

- Was Add'l Preservative needed? Y /  N If Yes: By whom & when: \_\_\_\_\_ (See Prep Book)

Is sample filtration requested? Y /  N Comments \_\_\_\_\_ (See Prep Book)

Was the customer contacted? If Yes: Person Contacted: \_\_\_\_\_

Lab ID# 215109 Initial & Date & Time : \_\_\_\_\_

Logged by MSJ Comments: \_\_\_\_\_

Reviewed by SM \_\_\_\_\_

\_\_\_\_\_

**REMINDER:** Document the pertinent sample integrity information and deviations in sample receipt (as noted above) in the "Notes" field in the LIMS to be included on the report to the customer.



# Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215115

Customer: Welsh Power Station

Date Reported: 07/02/2021

Customer Sample ID:

Customer Description:

Lab Number: 215115-001

Sampling Point: AD-3

Date Collected: 06/02/2021

Date Received: 06/07/2021

Preparation:

## Metals

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Antimony	<0.02	µg/L	1	0.10	0.02	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Arsenic	0.32	µg/L	1	0.10	0.03		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Barium	32.9	µg/L	1	0.20	0.05		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Beryllium	0.137	µg/L	1	0.050	0.007		GES	06/10/2021	EPA 200.8-1994, Rev. 5.4
Boron	0.036	mg/L	1	0.050	0.009	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cadmium	0.035	µg/L	1	0.020	0.004		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Calcium	0.7	mg/L	1	0.3	0.1		DAM	06/10/2021	EPA 200.7-1994, Rev. 4.4
Chromium	0.49	µg/L	1	0.20	0.04		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cobalt	1.07	µg/L	1	0.020	0.003		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lead	0.34	µg/L	1	0.20	0.05		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lithium	0.00803	mg/L	1	0.00020	0.00005		GES	06/10/2021	EPA 200.8-1994, Rev. 5.4
Mercury	220	ng/L	10	50	20		JAB	06/18/2021	EPA 245.7 -2005, Rev. 2.0
Molybdenum	0.6	µg/L	1	0.5	0.1		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Selenium	0.13	µg/L	1	0.50	0.09	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Thallium	<0.04	µg/L	1	0.20	0.04	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4

## Radiochemistry

Parameter	Result	Units	UNC*(+/-)	MDA*	Data Qualifiers	Analyst	Analysis Date	Method
Radium-226	0.26	pCi/L	0.06	0.09		TTP	06/28/2021	SW-846 9315-1986, Rev. 0
Carrier Recovery	112	%						
Radium-228	6.06	pCi/L	0.22	0.51		TTP	06/24/2021	SW-846 9320-2014, Rev. 1.0
Carrier Recovery	77.0	%						

\* The Required Detection Limit (RDL) is equivalent to the RL and for Radium-226 and Radium-228, the RDL is calculated to be 1.0 pCi/L. The Minimal Detectable Activity (MDA) listed with these results is sample specific and empirical. The combined standard uncertainty (UNC) is a counting uncertainty representing "one-sigma" which has the same units of measurement as the result.



# Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215115

Customer: Welsh Power Station

Date Reported: 07/02/2021

Customer Sample ID:	Customer Description:
Lab Number: 215115-002	Sampling Point: AD-4c
Date Collected: 06/02/2021	Date Received: 06/07/2021
Preparation:	

## Metals

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Antimony	<0.02	µg/L	1	0.10	0.02	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Arsenic	0.37	µg/L	1	0.10	0.03		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Barium	55.8	µg/L	1	0.20	0.05		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Beryllium	0.14	µg/L	2	0.10	0.01		GES	06/10/2021	EPA 200.8-1994, Rev. 5.4
Boron	0.038	mg/L	1	0.050	0.009	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cadmium	0.025	µg/L	1	0.020	0.004		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Calcium	1.1	mg/L	1	0.3	0.1		DAM	06/10/2021	EPA 200.7-1994, Rev. 4.4
Chromium	0.37	µg/L	1	0.20	0.04		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cobalt	0.508	µg/L	1	0.020	0.003		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lead	<0.05	µg/L	1	0.20	0.05	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lithium	0.0045	mg/L	2	0.0004	0.0001		GES	06/10/2021	EPA 200.8-1994, Rev. 5.4
Mercury	150	ng/L	10	50	20		JAB	06/18/2021	EPA 245.7 -2005, Rev. 2.0
Molybdenum	0.2	µg/L	1	0.5	0.1	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Selenium	0.14	µg/L	1	0.50	0.09	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Thallium	<0.04	µg/L	1	0.20	0.04	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4

## Radiochemistry

Parameter	Result	Units	UNC*(+/-)	MDA*	Data Qualifiers	Analyst	Analysis Date	Method
Radium-226	0.48	pCi/L	0.09	0.11		TTP	06/28/2021	SW-846 9315-1986, Rev. 0
Carrier Recovery	92.2	%						
Radium-228	-0.09	pCi/L	0.23	0.78		TTP	06/24/2021	SW-846 9320-2014, Rev. 1.0
Carrier Recovery	69.3	%						

\* The Required Detection Limit (RDL) is equivalent to the RL and for Radium-226 and Radium-228, the RDL is calculated to be 1.0 pCi/L. The Minimal Detectable Activity (MDA) listed with these results is sample specific and empirical. The combined standard uncertainty (UNC) is a counting uncertainty representing "one-sigma" which has the same units of measurement as the result.





# Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinnet: 210-4221

Job ID: 215115

Customer: Welsh Power Station

Date Reported: 07/02/2021

Customer Sample ID:

Customer Description:

Lab Number: 215115-003

Sampling Point: AD-16R

Date Collected: 06/02/2021

Date Received: 06/07/2021

Preparation:

## Metals

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Antimony	<0.02	µg/L	1	0.10	0.02	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Arsenic	1.70	µg/L	1	0.10	0.03		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Barium	40.3	µg/L	1	0.20	0.05		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Beryllium	1.49	µg/L	2	0.10	0.01		GES	06/10/2021	EPA 200.8-1994, Rev. 5.4
Boron	0.028	mg/L	1	0.050	0.009	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cadmium	0.667	µg/L	1	0.020	0.004		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Calcium	1.0	mg/L	1	0.3	0.1		DAM	06/10/2021	EPA 200.7-1994, Rev. 4.4
Chromium	0.89	µg/L	1	0.20	0.04		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cobalt	33.9	µg/L	1	0.020	0.003		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lead	0.10	µg/L	1	0.20	0.05	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lithium	0.0202	mg/L	2	0.0004	0.0001		GES	06/10/2021	EPA 200.8-1994, Rev. 5.4
Mercury	21	ng/L	1	5	2		JAB	06/18/2021	EPA 245.7 -2005, Rev. 2.0
Molybdenum	<0.1	µg/L	1	0.5	0.1	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Selenium	1.63	µg/L	1	0.50	0.09		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Thallium	0.47	µg/L	1	0.20	0.04		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4

## Radiochemistry

Parameter	Result	Units	UNC*(+/-)	MDA*	Data Qualifiers	Analyst	Analysis Date	Method
Radium-226	1.81	pCi/L	0.18	0.15		TTP	06/28/2021	SW-846 9315-1986, Rev. 0
Carrier Recovery	98.9	%						
Radium-228	1.17	pCi/L	0.22	0.71		TTP	06/24/2021	SW-846 9320-2014, Rev. 1.0
Carrier Recovery	78.5	%						

\* The Required Detection Limit (RDL) is equivalent to the RL and for Radium-226 and Radium-228, the RDL is calculated to be 1.0 pCi/L. The Minimal Detectable Activity (MDA) listed with these results is sample specific and empirical. The combined standard uncertainty (UNC) is a counting uncertainty representing "one-sigma" which has the same units of measurement as the result.



# Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215115

Customer: Welsh Power Station

Date Reported: 07/02/2021

Customer Sample ID: Duplicate-BASP

Customer Description:

Lab Number: 215115-004

Sampling Point:

Date Collected: 06/02/2021

Date Received: 06/07/2021

Preparation:

## Metals

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Antimony	<0.02	µg/L	1	0.10	0.02	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Arsenic	0.27	µg/L	1	0.10	0.03		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Barium	33.1	µg/L	1	0.20	0.05		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Beryllium	0.152	µg/L	1	0.050	0.007		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Boron	0.013	mg/L	1	0.050	0.009	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cadmium	0.033	µg/L	1	0.020	0.004		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Calcium	0.6	mg/L	1	0.3	0.1		DAM	06/10/2021	EPA 200.7-1994, Rev. 4.4
Chromium	0.49	µg/L	1	0.20	0.04		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cobalt	1.08	µg/L	1	0.020	0.003		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lead	0.12	µg/L	1	0.20	0.05	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lithium	0.00927	mg/L	1	0.00020	0.00005		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Mercury	220	ng/L	10	50	20		JAB	06/18/2021	EPA 245.7 -2005, Rev. 2.0
Molybdenum	<0.1	µg/L	1	0.5	0.1	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Selenium	0.14	µg/L	1	0.50	0.09	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Thallium	<0.04	µg/L	1	0.20	0.04	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4



# Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215115

Customer: Welsh Power Station

Date Reported: 07/02/2021

Customer Sample ID: Equipment Blank BASP

Customer Description:

Lab Number: 215115-005

Sampling Point:

Date Collected: 06/02/2021

Date Received: 06/07/2021

Preparation:

## Metals

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Antimony	<0.02	µg/L	1	0.10	0.02	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Arsenic	<0.03	µg/L	1	0.10	0.03	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Barium	0.09	µg/L	1	0.20	0.05	J1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Beryllium	<0.007	µg/L	1	0.050	0.007	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Boron	<0.009	mg/L	1	0.050	0.009	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cadmium	<0.004	µg/L	1	0.020	0.004	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Calcium	<0.1	mg/L	1	0.3	0.1	U1	DAM	06/10/2021	EPA 200.7-1994, Rev. 4.4
Chromium	0.25	µg/L	1	0.20	0.04		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Cobalt	0.036	µg/L	1	0.020	0.003		GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lead	<0.05	µg/L	1	0.20	0.05	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Lithium	<0.00005	mg/L	1	0.00020	0.00005	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Mercury	<2	ng/L	1	5	2	U1	JAB	06/18/2021	EPA 245.7 -2005, Rev. 2.0
Molybdenum	<0.1	µg/L	1	0.5	0.1	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Selenium	<0.09	µg/L	1	0.50	0.09	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4
Thallium	<0.04	µg/L	1	0.20	0.04	U1	GES	06/09/2021	EPA 200.8-1994, Rev. 5.4



## Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215115

Customer: Welsh Power Station

Date Reported: 07/02/2021

### Report Verification

This report and the above data have been confirmed by the following analyst.

A handwritten signature in cursive script that reads "Michael S. Ohlinger". The signature is written in black ink and is positioned above a horizontal line.

Michael Ohlinger, Chemist

Email: msohlinger@aep.com

Phone: 614-836-4184

Audinet: 8-210-4184

**THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT WRITTEN APPROVAL OF THE LABORATORY. ALL TEST RESULTS MEET ALL OF THE REQUIREMENTS OF THE ACCREDITING AUTHORITY, UNLESS OTHERWISE NOTED.**



## Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215115

Customer: Welsh Power Station

Date Reported: 07/02/2021

### Data Qualifier Legend

B1	Analyte detected in method blank (MB) at or above the method criteria.
B2	Analyte detected in initial calibration blank (ICB) at or above the method criteria.
B3	Analyte detected in continuing calibration blank (CCB) at or above the method criteria.
B4	The interference check standard (ICS) exceeded the method criteria on this parameter.
H1	Sample was received past holding time.
H2	Sample analysis performed past holding time.
J1	Concentration estimated. Analyte was detected between the method detection limit and the reporting limit.
J2	Concentration estimated. Analyte exceeded calibration range.
L1	The associated laboratory control sample (LCS) or laboratory control sample duplicate (LCSD) recovery was outside acceptance limits.
M1	The associated matrix spike (MS) or matrix spike duplicate (MSD) recovery was outside acceptance limits.
M2	Analyzed by method of standard additions (MSA).
O1	The reporting limit for oil and grease is directly affected by the collected sample volume.
O2	Client did not provide additional bottles; therefore, the MS and duplicate are missing in this batch.
O3	Client did not provide additional bottles; therefore, the duplicate is missing in this batch.
O4	Sample was transferred to a different bottle due to excess fine particulate. The particulate was rinsed with hexane, and the hexane layer was transferred to the corresponding bottle. The hexane rinse was completed three times.
P1	The precision between duplicate results was above acceptance limits.
P2	The precision on the laboratory control sample duplicate (LCSD) was above acceptance limits.
P3	The precision on the matrix spike duplicate (MSD) was above acceptance limits.
P4	The field duplicate was used as a sample duplicate.
P5	The precision on the inorganic efficiency check (IEC) exceeded the method criteria.
Q1	Sample received in inappropriate sample container.
Q2	Sample was received damaged. The sample was recoverable.
Q3	Sample container was received damaged. Unable to recover the sample.
Q4	Sample was received outside of thermal preservation range.
Q5	Sample was received with improper chemical preservation.
Q6	Insufficient sample was received by the laboratory to perform the requested analysis.
Q7	Insufficient sample was received to meet method QC requirements.
Q8	Sample was received with head space.
Q9	Due to instrument malfunction, sample was invalidated.
Q10	Analysis was performed by a contracted laboratory. See attached report.
Q11	Sample contains free liquid.
Q12	Sample does not contain free liquid.
Q13	Sample did not ignite.
Q14	This analyte and method are not included on the primary Laboratory Scope of TNI Accreditation.
R1	Surrogate recovery was outside acceptance limits.
R2	Carrier recovery was outside acceptance limits.
R3	Internal standard recovery was outside acceptance limits.
R4	The recovery of the reduction efficiency checks (REC) for nitrate or nitrite exceeded the method criteria.
R5	The back calculation recovery of one or more calibration points exceeded the method criteria.
S1	Residue weight is above or below the method criteria and needs to be re-analyzed at a different dilution.



## Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

**Job ID: 215115**

**Customer: Welsh Power Station**

**Date Reported: 07/02/2021**

- S2 Residue weight is above the method criteria but was already analyzed with the highest dilution factor.
- S3 Residue weight is below the method criteria but was already analyzed with 1000mL.
- S4 Sample and duplicate results vary due to large amounts of solids present.
- S5 Filtration time exceeds ten minutes.
- S6 Insufficient sample was received to meet the minimum volume of the method. Residue weight is below the method criteria and was analyzed with less than 1000mL.
- S7 Sample did not achieve constant weight.
- S8 Sample with low residue was selected for duplicate analysis.
- S9 Based on history, the sample residue was only measured twice and did not achieve constant weight.
- U1 Not detected at or above method detection limit (MDL).
- V1 The associated initial calibration verification (ICV) recovery was outside acceptance limits.
- V2 The associated continuing calibration verification (CCV) recovery was outside acceptance limits.





**WATER & WASTE SAMPLE RECEIPT FORM**

<u>Package Type</u>				<u>Delivery Type</u>			
Cooler	Box	Bag	Envelope	PONY	UPS	FedEX	USPS
				Other _____			
Plant/Customer <u>Welsh</u>				Number of Plastic Containers: <u>17</u>			
Opened By <u>SM</u>				Number of Glass Containers: _____			
Date/Time <u>6-7-21 1p</u>				Number of Mercury Containers: <u>5</u>			
Were all temperatures within 0-6°C? Y / N or <u>(N/A)</u> Initial: <u>SM</u> on ice/ <u>(no ice)</u>							
1(IR Gun Ser# <u>200700311</u> , Expir. <u>06-11-22</u> ) - If No, specify each deviation: _____							
Was container in good condition? <u>(Y)</u> / N Comments _____							
Was Chain of Custody received? <u>(Y)</u> / N Comments _____							
Requested turnaround: <u>20 min</u> If <b>RUSH</b> , who was notified? _____							
pH (15 min)	Cr <sup>+6</sup> (pres) (24 hr)	NO <sub>2</sub> or NO <sub>3</sub> (48 hr)	ortho-PO <sub>4</sub> (48 hr)	Hg-diss (pres) (48 hr)			

Was COC filled out properly? (Y) / N Comments \_\_\_\_\_

Were samples labeled properly? (Y) / N Comments \_\_\_\_\_

Were correct containers used? (Y) / N Comments \_\_\_\_\_

Was pH checked & Color Coding done? (Y) / N or N/A Initial & Date: SM 6-7-21

**pH paper (circle one):** MQuant,PN1.09535.0001,LOT# HC904495 [OR] Lab Rat,PN4801,LOT# X000RWDG21

- Was Add'l Preservative needed? (Y) / N If Yes: By whom & when: Hg Lab (See Prep Book)

Is sample filtration requested? (Y) / N Comments \_\_\_\_\_ (See Prep Book)

Was the customer contacted? If Yes: Person Contacted: \_\_\_\_\_

Lab ID# 215115 Initial & Date & Time : \_\_\_\_\_

Logged by SM Comments: \_\_\_\_\_

Reviewed by MSO \_\_\_\_\_

**REMINDER:** Document the pertinent sample integrity information and deviations in sample receipt (as noted above) in the "Notes" field in the LIMS to be included on the report to the customer.





# Water Analysis Report

Dolan Chemical Laboratory  
4001 Bixby Road  
Groveport, OH 43125  
Phone: 614-836-4221  
Audinet: 210-4221

Job ID: 215425

Customer: Welsh Power Station

Date Reported: 09/08/2021

Customer Sample ID: AD-4c

Customer Description:

Lab Number: 215425-001

Preparation:

Date Collected: 07/26/2021 11:02

Date Received: 07/29/2021 11:05

## Ion Chromatography

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Sulfate	71.9	mg/L	5	1.0	0.2		CRJ	07/30/2021 15:23	EPA 300.1 -1997, Rev. 1.0

## Metals

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
Calcium	1.4	mg/L	1	0.3	0.1		SH	08/05/2021 13:12	EPA 200.7-1994, Rev. 4.4

## Wet Chemistry

Parameter	Result	Units	Dilution	RL	MDL	Data Qualifiers	Analyst	Analysis Date	Method
TDS, Filterable Residue	280	mg/L	1	50	20		SDW	07/29/2021 12:13	SM 2540C-2011

215425

Job Comments:

The report was reissued 9/8/21 with a corrected EDD file.

## Report Verification

This report and the above data have been confirmed by the following analyst.

Michael Ohlinger, Chemist

Email: msohlinger@aep.com

Phone: 614-836-4184

Audinet: 8-210-4184

**THIS TEST REPORT RELATES ONLY TO THE ITEMS TESTED AND SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT WRITTEN APPROVAL OF THE LABORATORY. ALL TEST RESULTS MEET ALL OF THE REQUIREMENTS OF THE ACCREDITING AUTHORITY, UNLESS OTHERWISE NOTED.**



**AEP WATER & WASTE SAMPLE RECEIPT FORM**

<p><u>Package Type</u></p> <p>Cooler    Box    Bag    Envelope</p>	<p><u>Delivery Type</u></p> <p>PONY    UPS    FedEx    USPS</p> <p>Other _____</p>
<p>Plant/Customer <u>Welsh</u></p>	<p>Number of Plastic Containers: <u>2</u></p>
<p>Opened By <u>SM</u></p>	<p>Number of Glass Containers: _____</p>
<p>Date/Time <u>7.29.21 10:55</u></p>	<p>Number of Mercury Containers: _____</p>
<p>Were all temperatures within 0-6°C? <u>Y</u>/N or N/A Initial: <u>SM</u> <u>on ice</u> / no ice</p> <p>1(IR Gun Ser# <u>200700311</u>, Expir. <u>06-11-22</u>) - If No, specify each deviation: _____</p>	
<p>Was container in good condition? <u>Y</u>/N Comments _____</p>	
<p>Was Chain of Custody received? <u>Y</u>/N Comments _____</p>	
<p>Requested turnaround: <u>10:00</u> If RUSH, who was notified? _____</p>	
<p>pH (15 min)    Cr<sup>6</sup> (pres) (24 hr)    NO<sub>2</sub> or NO<sub>3</sub> (48 hr)    ortho-PO<sub>4</sub> (48 hr)    Hg-diss (pres) (48 hr)</p>	

Was COC filled out properly? Y/N Comments \_\_\_\_\_

Were samples labeled properly? Y/N Comments \_\_\_\_\_

Were correct containers used? Y/N Comments \_\_\_\_\_

Was pH checked & Color Coding done? Y/N or N/A Initial & Date: SM 7.29.21

pH paper (circle one): MQuant,PN1.09535.0001,LOT# HC904495 [OR] Lab Rat,PN4801,LOT# X000RWDG21

- Was Add'l Preservative needed? Y/N If Yes: By whom & when: \_\_\_\_\_ (See Prep Book)

Is sample filtration requested? Y/N Comments \_\_\_\_\_ (See Prep Book)

Was the customer contacted? If Yes: Person Contacted: \_\_\_\_\_

Lab ID# 215425 Initial & Date & Time: \_\_\_\_\_

Logged by SM Comments: \_\_\_\_\_

Reviewed by Mso \_\_\_\_\_

**REMINDER:** Document the pertinent sample integrity information and deviations in sample receipt (as noted above) in the "Notes" field in the LIMS to be included on the report to the customer.