Annual Groundwater Monitoring Report

Southwestern Electric Power Company

J. Robert Welsh Power Plant

Bottom Ash Storage Pond CCR Management Unit

1187 Country Road 4865

Titus County

Pittsburg, Texas

January 2020

Prepared by:
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SOUTHWESTERN ELECTRIC POWER COMPANY℠

An AEP Company

BOUNDLESS ENERGY℠

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I. Overview

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for an existing CCR unit at Southwestern Electric Power Company's, a wholly-owned subsidiary of American Electric Power Company (AEP), J. Robert Welsh Power Plant. The USEPA'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, 2020.

In general, the following activities were completed:

- Semi-Annual groundwater samples were collected and analyzed for detection monitoring Appendix III constituents, as specified in 40 CFR 257.94 *et seq.* and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater Monitoring Statistical Evaluation Reports to evaluate groundwater data were prepared in accordance with 40 CFR 257.93 and certified. The statistical process was guided by USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* ("Unified Guidance", USEPA, 2009);
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Statistically significant increases (SSI) were determined for Chloride and Sulfate in AD-4C and Chloride in AD-3.
- Successful alternate source demonstrations (ASDs) were conducted for the SSIs;
- This CCR Unit remained in Detection Monitoring during 2019.

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 CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs is included in Appendix I;
- Statistically reports are located in Appendix II;
- ASDs are located in Appendix III;

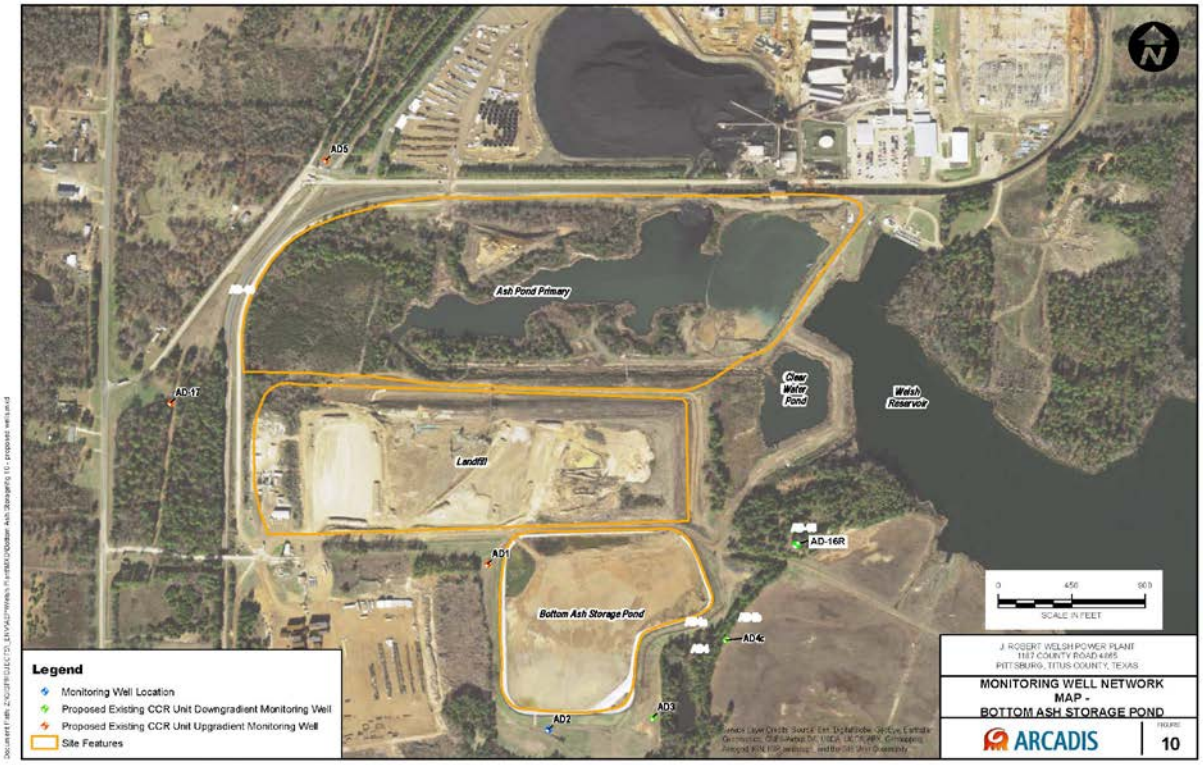
- A summary of any transition between monitoring programs or an alternate monitoring frequency, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring, in addition to notification identifying the constituents detected at a statistically significant increase over background concentrations (Appendix IV);
- Other information required to be included in the annual report such as program related notification or assessment of corrective measures, if applicable;

  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, the monitoring well locations and their corresponding identification numbers.

Bottom Ash Storage Pond Monitoring Wells	
Up Gradient	Down Gradient
AD-1	AD-3
AD-5	AD-4C
AD-17	AD-16R


AD5
Ash Pond Primary
AD-17
Clear Water Pond
Welsh Reservoir
Landfill
AD-16R
AD1
Bottom Ash Storage Pond
AD4c
AD2
AD3
0
450
900
SCALE IN FEET
Legend
Monitoring Well Location
Proposed Existing CCR Unit Downgradient Monitoring Well
Proposed Existing CCR Unit Upgradient Monitoring Well
Site Features
J. ROBERT WELSH POWER PLANT
1187 COUNTY ROAD 4085
PITTSBURG, TITUS COUNTY, TEXAS
MONITORING WELL NETWORK MAP -
BOTTOM ASH STORAGE POND
ARCADIS
FIGURE
10

III. Monitoring Wells Installed or Decommissioned

During 2019, no monitoring wells were installed or decommissioned.

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

Appendix I contains tables showing the groundwater quality data collected under 40 CFR 257.90 through 257.98. Static water elevation data from each monitoring event also are shown in Appendix I, along with the groundwater velocity, groundwater flow direction and potentiometric maps developed after each sampling event.

V. Statistical Evaluations Completed in 2018 and 2019

A SSI were determined for:

- Chloride in AD-4C during the 1st semi-annual 2018 groundwater sampling event.
- Sulfate in AD-4C during the 2nd semi-annual 2018 groundwater sampling event.
- Chloride in AD-3 during the 1st semi-annual 2019 groundwater sampling event.

The statistical evaluation for the 2nd semi-annual 2019 groundwater sampling event demonstrated no SSIs.

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.

Statistical reports are found in Appendix II.

VI. Alternate Source Demonstrations Completed in 2019

Alternate source investigations were conducted for:

- Chloride in AD-4C during the 1st semi-annual 2018 groundwater sampling event.
- Sulfate in AD-4C during the 2nd semi-annual 2018 groundwater sampling event.
- Chloride in AD-3 during the 1st semi-annual 2019 groundwater sampling event.

Successful ASDs were completed for all SSIs.

Those demonstrations are found in Appendix III.

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

As of this annual groundwater report, the CCR Unit remains in detection monitoring.

VIII. Other Information Required

The sampling frequency of twice per year will be maintained for the current monitoring program.

IX. Description of Any Problems Encountered in 2019 and Actions Taken

No significant problems were encountered.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- Detection monitoring on a twice per year schedule;
- Evaluation of the detection monitoring results from a statistical analysis viewpoint, looking for any SSIs;
- Responding to any new data received in light of CCR rule requirements;
- Preparation of the next annual groundwater report.

APPENDIX I

Tables follow, showing 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
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- CCR Units

Notes

- Monitoring well coordinates and water level data (collected on February 20-21, 2019) 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.
- AD-16 was replaced with AD-16R on 4/12/2017.

500 250 0 500 Feet

Groundwater Potentiometric Map
February 2019

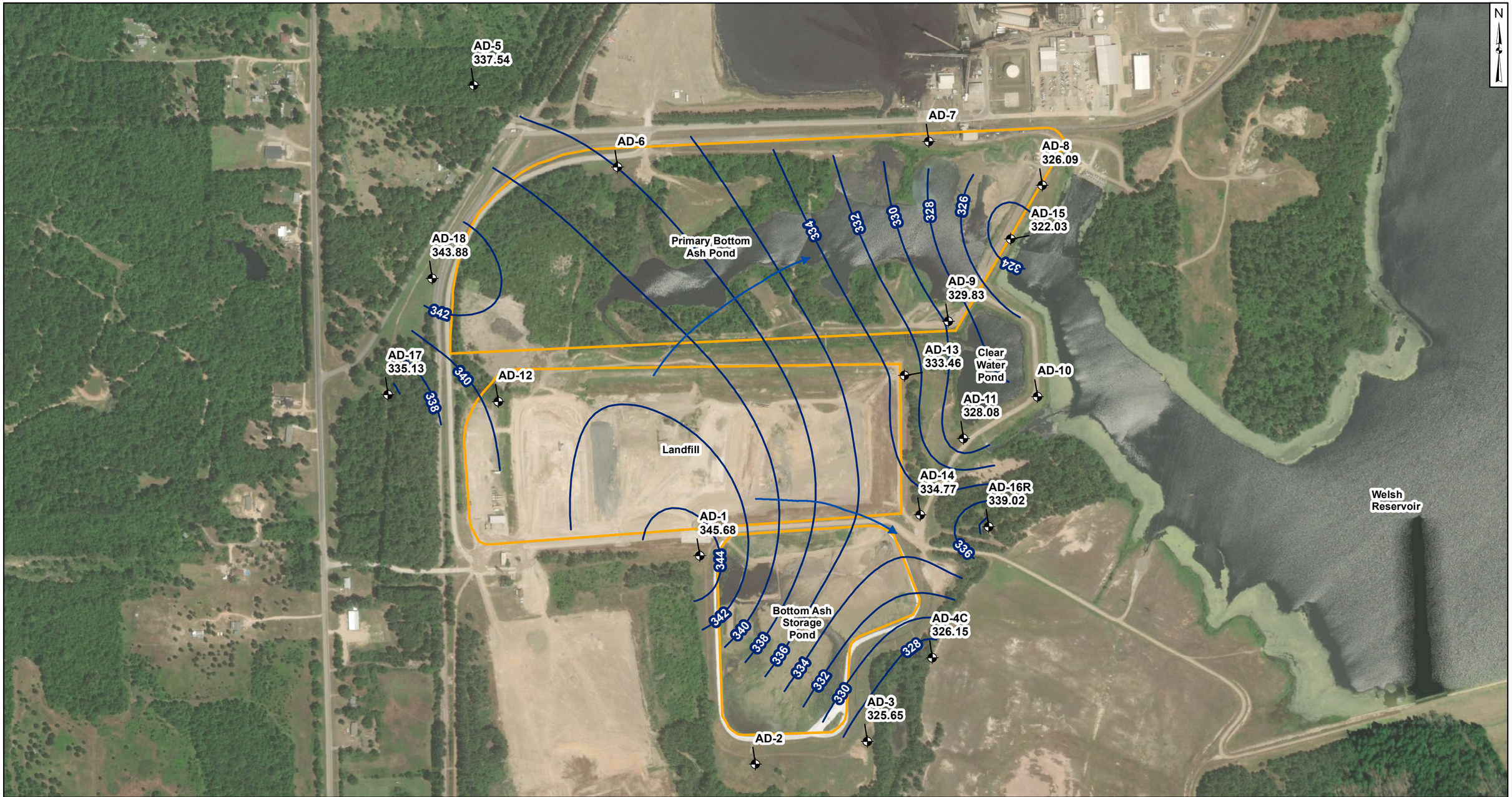
AEP Welsh Power Plant
Cason, Texas

Geosyntec consultants

Columbus, Ohio | 2020/01/22

Figure **1**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Welsh\2019\AEP-Welsh_GW_2019-20Feb.mxd. ARevezzo. 1/22/2020. CHA8423/14/08.



Legend

- Groundwater Monitoring Well
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- CCR Units

Notes

- Monitoring well coordinates and water level data (collected on May 29-30, 2019) provided by AEP.
- AD-10, AD-6, AD-7, AD-2, and AD-12 were not gauged during this event
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016).
- Groundwater elevation units are feet above mean sea level.
- AD-16 was replaced with AD-16R on 4/12/2017.

750 375 0 750 Feet

Groundwater Potentiometric Map
May 2019

AEP Welsh Power Plant
Cason, Texas

Geosyntec consultants

Columbus, Ohio | 2019/12/12

Figure **2**

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Welsh\2019\AEP-Welsh_GW_2019-05May.mxd. ARevezzo. 12/12/2019. CHA8423/14/08.

Legend

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

Notes

- Monitoring well coordinates and water level data (collected on July 23-24, 2019) provided by AEP.
-AD-12 and AD-6 were not gauged during this event.
- Site features based on information available in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016).
- Groundwater elevation units are feet above mean sea level.
- Inferred groundwater contours were ectrapolated from topographic and hydrographic information as well as previous monitoring events.

750 375 0 750
Feet

Groundwater Potentiometric Map
July 2019

AEP Welsh Power Plant
Cason, Texas

Geosyntec consultants

Columbus, Ohio | 2020/01/22

Figure 3

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Welsh\2019\AEP-Welsh_GW_2019-07July.mxd. ARevezzo. 1/22/2020. CHA8423/14/08.

Table 1: Residence Time Calculation Summary
Welsh Bottom Ash Storage Pond

Geosyntec Consultants, Inc.

CCR Management Unit	Monitoring Well	Well Diameter (inches)	2019-02		2019-04[3]		2019-05		2019-07	
			Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	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 [1]	2.0	2.7	22.4	NC	NC	5.3	11.5	4.1	14.9
	AD-3 [2]	2.0	4.9	12.4	0.5	127	5.7	10.7	5.1	11.9
	AD-4C [2]	2.0	4.0	15.3	0.5	127	5.2	11.6	4.2	14.4
	AD-5 [1]	2.0	1.5	40.2	NC	NC	2.4	25.4	2.1	29.2
	AD-16R [2]	2.0	3.7	16.3	3.7	16.4	6.5	9.4	4.6	13.3
	AD-17 [1]	2.0	8.9	6.9	NC	NC	4.7	13.0	3.5	17.5

Notes:
[1] - Upgradient Well
[2] - Downgradient Well
[3] - Upgradient wells were not gauged at the time of sampling, residence time estimates are based on available data.
NC - Not Calculated

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

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/26/2016	Background	0.346	36.5	5	<0.083 U	5.9	252	42
7/29/2016	Background	0.35	39.6	4	<0.083 U	5.3	239	36
9/30/2016	Background	0.332	15	5	<0.083 U	5.4	173	35
10/21/2016	Background	0.398	19.1	4	<0.083 U	5.2	192	42
12/14/2016	Background	0.394	8.74	4	<0.083 U	5.2	200	40
1/20/2017	Background	0.656	129	4	<0.083 U	7.1	538	68
2/24/2017	Background	0.7	147	9	<0.083 U	6.9	612	68
6/8/2017	Background	0.449	15.1	4	<0.083 U	5.1	176	42
10/6/2017	Detection	0.453	14.3	4	<0.083 U	5.3	160	40
5/24/2018	Detection	0.345	10.2	5	<0.083 U	2.2	150	43
8/14/2018	Detection	0.443	5.95	5	<0.083 U	5.2	160	44
2/20/2019	Detection	0.504	142	2.82	0.240	7.3	522	49.2
5/30/2019	*	0.689	138	1.59	0.290	6.7	588	43.3
7/24/2019	Detection	0.644	62.7	2	0.106 J	6.0	180	58

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
* Sample is not associated with a specific monitoring program but was included in the updated background dataset.

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

Geosyntec Consultants, Inc.

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	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/26/2016	Background	<0.93 U	1.39361 J	191	0.271453 J	0.213294 J	0.240267 J	1.15339 J	1.184	<0.083 U	<0.68 U	0.010	0.033	0.53149 J	1.74922 J	0.959865 J
7/29/2016	Background	<0.93 U	<1.05 U	191	0.315631 J	0.0940357 J	<0.23 U	0.615933 J	0.9952	<0.083 U	<0.68 U	0.019	0.00793 J	<0.29 U	1.81763 J	<0.86 U
9/30/2016	Background	<0.93 U	2.96797 J	141	0.382874 J	<0.07 U	5	0.850408 J	1.380	<0.083 U	3.38434 J	0.014	0.01773 J	<0.29 U	1.02629 J	<0.86 U
10/21/2016	Background	<0.93 U	<1.05 U	114	0.311247 J	<0.07 U	0.412131 J	0.649606 J	1.141	<0.083 U	<0.68 U	0.008	0.00534 J	1.39872 J	2.03168 J	1.25062 J
12/14/2016	Background	<0.93 U	<1.05 U	72	0.34133 J	<0.07 U	<0.23 U	0.424105 J	0.7190	<0.083 U	<0.68 U	0.008	0.01521 J	<0.29 U	1.85825 J	<0.86 U
1/20/2017	Background	<0.93 U	<1.05 U	410	0.0366913 J	<0.07 U	<0.23 U	0.480125 J	3.009	<0.083 U	<0.68 U	0.000275956 J	<0.005 U	<0.29 U	4.04737 J	<0.86 U
2/24/2017	Background	<0.93 U	<1.05 U	488	<0.02 U	<0.07 U	<0.23 U	0.765099 J	4.309	<0.083 U	<0.68 U	0.001	<0.005 U	<0.29 U	<0.99 U	<0.86 U
6/8/2017	Background	<0.93 U	1.14 J	93.46	0.37 J	<0.07 U	0.66 J	0.77 J	0.6760	<0.083 U	<0.68 U	0.00902	0.007 J	<0.29 U	2.1 J	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

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

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/31/2016	Background	0.02	1.41	9	<0.083 U	6.6	106	4
7/29/2016	Background	0.02	0.706	8	<0.083 U	6.7	118	5
9/30/2016	Background	0.02	< 0.5 U	9	<0.083 U	4.8	127	6
10/21/2016	Background	0.06	0.794	8	<0.083 U	3.7	112	9
12/14/2016	Background	0.02	1.05	8	<0.083 U	4.7	138	11
1/20/2017	Background	0.02	0.746	9	<0.083 U	4.6	76.0	4
2/24/2017	Background	0.02	0.573	9	<0.083 U	4.7	104	5
6/8/2017	Background	0.03326	0.543	9	0.2625 J	4.5	104	5
10/6/2017	Detection	0.02055	0.908	9	<0.083 U	5.2	114	7
5/24/2018	Detection	0.0069 J	0.545	8	<0.083 U	4.4	98.0	3
11/13/2018	Detection	0.009 J	0.684	8.0	<0.083 U	5.2	114	4.05
2/20/2019	Detection	0.01 J	0.817	9.40	0.13	4.8	110	1.9
4/30/2019	Detection	0.007	- -	9.34	- -	4.1	- -	- -
5/30/2019	*	<0.02 U	3.02	9.03	0.18	4.3	110	2.3
7/24/2019	Detection	<0.02 U	1.35	7	0.09 J	4.6	116	6

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
* Sample is not associated with a specific monitoring program but was included in the updated background dataset.

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

Geosyntec Consultants, Inc.

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	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/31/2016	Background	<0.93 U	1.56793 J	53	0.286352 J	<0.07 U	0.464721 J	1.49214 J	1.018	<0.083 U	<0.68 U	0.01	0.85	<0.29 U	0.995807 J	1.31537 J
7/29/2016	Background	3.21106 J	<1.05 U	36	0.349485 J	<0.07 U	0.515023 J	1.19046 J	0.183	<0.083 U	<0.68 U	0.024	0.589	1.43134 J	2.40188 J	<0.86 U
9/30/2016	Background	2.70729 J	2.61987 J	43	0.188596 J	0.0802799 J	0.659763 J	1.44845 J	0.552	<0.083 U	<0.68 U	0.019	0.39	<0.29 U	1.79734 J	<0.86 U
10/21/2016	Background	2.47184 J	1.97572 J	41	0.451723 J	0.277085 J	0.818782 J	1.53187 J	1.589	<0.083 U	<0.68 U	0.018	0.351	6	<0.99 U	<0.86 U
12/14/2016	Background	<0.93 U	<1.05 U	45	0.262387 J	<0.07 U	0.627352 J	1.34901 J	0.546	<0.083 U	<0.68 U	0.017	0.321	<0.29 U	<0.99 U	<0.86 U
1/20/2017	Background	<0.93 U	2.13113 J	41	0.235263 J	<0.07 U	0.647294 J	1.6345 J	0.350	<0.083 U	<0.68 U	0.014	0.504	<0.29 U	<0.99 U	<0.86 U
2/24/2017	Background	<0.93 U	<1.05 U	37	0.209151 J	<0.07 U	<0.23 U	1.1537 J	0.4592	<0.083 U	<0.68 U	0.014	0.501	<0.29 U	<0.99 U	<0.86 U
6/8/2017	Background	<0.93 U	1.91 J	38	0.24 J	0.08 J	0.75 J	1.28 J	0.459	0.2625 J	<0.68 U	0.01503	0.365	<0.29 U	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

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

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/31/2016	Background	0.05	0.798	10	<0.083 U	5.4	204	32
7/29/2016	Background	0.03	0.666	12	<0.083 U	5.5	208	35
9/30/2016	Background	0.02	<0.5 U	11	<0.083 U	5.0	212	45
10/21/2016	Background	0.04	0.578	10	<0.083 U	4.3	212	35
12/14/2016	Background	0.02	0.341	11	<0.083 U	4.6	252	36
1/20/2017	Background	0.02	0.761	10	<0.083 U	4.7	184	43
2/24/2017	Background	0.02	0.467	9	<0.083 U	5.1	196	40
6/8/2017	Background	0.03331	0.573	10	<0.083 U	4.9	228	39
10/6/2017	Detection	0.02565	0.654	11	<0.083 U	5.4	226	44
5/24/2018	Detection	0.02505	0.434	14	<0.083 U	5.2	224	42
8/14/2018	Detection	- -	- -	15	- -	5.0	- -	- -
11/13/2018	Detection	0.01 J	0.609	7.5	<0.083 U	5.8	220	56
12/18/2018	Detection	- -	- -	- -	- -	4.9	- -	58
2/20/2019	Detection	0.01 J	0.931	9.18	0.1 J	5.2	242	60.1
4/30/2019	Detection	0.014	- -	- -	- -	4.8	- -	56.2
5/30/2019	*	<0.02 U	0.564	14.8	0.16	4.6	208	52.8
7/24/2019	Detection	<0.02 U	0.586	13	<0.083 U	3.9	284	52

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
* Sample is not associated with a specific monitoring program but was included in the updated background dataset.

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

Geosyntec Consultants, Inc.

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	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/31/2016	Background	<0.93 U	<1.05 U	88	0.407928 J	<0.07 U	9	1.19093 J	1.289	<0.083 U	<0.68 U	0.004	0.191	<0.29 U	1.12526 J	<0.86 U
7/29/2016	Background	<0.93 U	<1.05 U	59	0.335947 J	<0.07 U	4	0.852951 J	0.571	<0.083 U	<0.68 U	0.015	0.185	1.09296 J	2.52271 J	<0.86 U
9/30/2016	Background	<0.93 U	1.51249 J	74	0.274296 J	<0.07 U	8	0.986752 J	2.572	<0.083 U	<0.68 U	0.006	0.16	<0.29 U	1.95938 J	<0.86 U
10/21/2016	Background	<0.93 U	1.74748 J	69	0.347477 J	0.0809157 J	9	1.08565 J	1.657	<0.083 U	<0.68 U	0.006	0.141	3.20217 J	1.18291 J	<0.86 U
12/14/2016	Background	<0.93 U	2.24683 J	21	0.133622 J	<0.07 U	0.944028 J	0.305391 J	0.685	<0.083 U	<0.68 U	0.004	0.143	<0.29 U	1.27423 J	<0.86 U
1/20/2017	Background	<0.93 U	1.85604 J	75	0.221609 J	<0.07 U	4	1.02773 J	2.045	<0.083 U	<0.68 U	0.005	0.125	<0.29 U	<0.99 U	<0.86 U
2/24/2017	Background	<0.93 U	<1.05 U	30	0.102645 J	<0.07 U	0.421354 J	0.364739 J	0.517	<0.083 U	<0.68 U	0.004	0.098	<0.29 U	<0.99 U	<0.86 U
6/8/2017	Background	<0.93 U	1.19 J	51.42	0.19 J	0.08 J	4.03	0.75 J	0.953	<0.083 U	<0.68 U	0.00482	0.147	<0.29 U	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

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

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/31/2016	Background	0.03	36.9	15	0.3469 J	6.4	337	123
7/29/2016	Background	0.04	44.7	16	<0.083 U	5.4	360	163
9/30/2016	Background	0.04	46.3	15	0.2436 J	5.3	416	190
10/21/2016	Background	0.05	50.7	14	<0.083 U	5.9	448	267
12/14/2016	Background	0.05	49.6	13	<0.083 U	6.2	484	233
1/20/2017	Background	0.04	49.8	14	<0.083 U	6.3	438	234
2/24/2017	Background	0.04	33	15	<0.083 U	5.5	286	127
6/8/2017	Background	0.05281	49.7	14	<0.083 U	6.0	300	82
10/6/2017	Detection	0.04322	33.1	16	<0.083 U	5.6	258	82
5/24/2018	Detection	0.05007	28.1	22	<0.083 U	6.2	242	60
8/15/2018	Detection	0.050	40.5	19	<0.083 U	6.2	428	240
2/21/2019	Detection	0.033	33.9	24.7	0.210	5.4	220	46.5
5/30/2019	*	0.03 J	30.0	22.3	0.290	6.3	238	51.3
7/24/2019	Detection	0.04 J	41.1	18	0.112 J	6.3	354	90

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
* Sample is not associated with a specific monitoring program but was included in the updated background dataset.

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

Geosyntec Consultants, Inc.

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	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/31/2016	Background	<0.93 U	<1.05 U	57	0.149801 J	0.0765156 J	0.555038 J	14	1.634	0.3469 J	<0.68 U	0.135	0.01135 J	<0.29 U	<0.99 U	<0.86 U
7/29/2016	Background	2.05116 J	2.90819 J	93	0.518653 J	0.502155 J	0.411466 J	15	4.750	<0.083 U	<0.68 U	0.191	0.01516 J	<0.29 U	1.08901 J	<0.86 U
9/30/2016	Background	<0.93 U	4.7609 J	87	0.251584 J	<0.07 U	0.90676 J	14	3.330	0.2436 J	<0.68 U	0.186	<0.005 U	<0.29 U	<0.99 U	<0.86 U
10/21/2016	Background	<0.93 U	<1.05 U	70	0.08781 J	0.107488 J	0.248085 J	9	2.319	<0.083 U	<0.68 U	0.225	<0.005 U	1.36984 J	<0.99 U	<0.86 U
12/14/2016	Background	<0.93 U	1.15381 J	53	0.164529 J	0.203546 J	0.747921 J	13	2.182	<0.083 U	<0.68 U	0.199	0.00802 J	<0.29 U	<0.99 U	<0.86 U
1/20/2017	Background	<0.93 U	<1.05 U	47	0.0574718 J	0.180502 J	<0.23 U	12	1.023	<0.083 U	<0.68 U	0.239	<0.005 U	<0.29 U	<0.99 U	<0.86 U
2/24/2017	Background	<0.93 U	<1.05 U	42	0.0306858 J	<0.07 U	<0.23 U	13	1.788	<0.083 U	<0.68 U	0.166	<0.005 U	<0.29 U	<0.99 U	<0.86 U
6/8/2017	Background	<0.93 U	3.85 J	87.7	0.08 J	0.39 J	0.28 J	11.93	2.320	<0.083 U	<0.68 U	0.124	<0.005 U	<0.29 U	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

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

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/8/2017	Background	0.04198	2.75	7	0.3438 J	3.7	204	54
6/28/2017	Background	0.06398	1.24	6	0.2512 J	3.9	200	55
7/7/2017	Background	0.02699	2.07	36	<0.083 U	3.4	184	52
7/14/2017	Background	0.04415	2.39	6	0.2516 J	3.5	160	44
7/24/2017	Background	0.03237	2.5	7	0.2615 J	3.5	180	54
8/1/2017	Background	0.02841	1.92	7	<0.083 U	2.8	162	48
8/2/2017	Background	0.03177	1.86	7	<0.083 U	3.0	174	49
8/11/2017	Background	0.06192	1.83	8	<0.083 U	4.1	164	44
8/18/2017	Background	0.0304	1.44	7	<0.083 U	3.4	160	46
9/1/2017	Background	0.02841	1.33	7	<0.083 U	3.9	152	63
10/6/2017	Detection	0.04672	0.896	7	<0.083 U	3.3	152	82
1/18/2018	Detection	- -	- -	- -	- -	4.0	- -	58.6
5/23/2018	Detection	0.03202	2.53	6	<0.083 U	3.8	204	67
8/14/2018	Detection	- -	- -	- -	- -	3.9	- -	44
11/13/2018	Detection	0.02 J	0.467	6.5	<0.083 U	5.6	186	54
2/20/2019	Detection	0.03 J	2.00	6.78	0.20	4.7	200	52.8
4/30/2019	Detection	0.015	- -	- -	- -	3.9	- -	- -
5/30/2019	*	<0.02 U	1.36	5.43	0.19	3.9	80	41.6
7/24/2019	Detection	0.03 J	1.50	7	0.13 J	3.6	250	70

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
* Sample is not associated with a specific monitoring program but was included in the updated background dataset.

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

Geosyntec Consultants, Inc.

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	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/8/2017	Background	<0.93 U	7.07	46.4	2.21	1.03	1.76	41.74	6.66	0.3438 J	<0.68 U	0.0293	<0.005 U	<0.29 U	1.98 J	<0.86 U
6/28/2017	Background	<0.93 U	5.28	41.43	2.16	0.92 J	0.95 J	40.87	12.11	0.2512 J	<0.68 U	0.02932	<0.005 U	<0.29 U	<0.99 U	<0.86 U
7/7/2017	Background	<0.93 U	4.13 J	44.56	2.08	0.97 J	1.44	41.75	25.16	<0.083 U	<0.68 U	0.02846	<0.005 U	<0.29 U	2.09 J	1.2 J
7/14/2017	Background	<0.93 U	6.31	54.35	2.01	1.09	0.84 J	37.88	9.12	0.2516 J	<0.68 U	0.02391	0.009 J	<0.29 U	<0.99 U	<0.86 U
7/24/2017	Background	<0.93 U	3.88 J	51.06	2.09	1.02	1.43	40.86	9.81	0.2615 J	<0.68 U	0.02653	<0.005 U	<0.29 U	1 J	<0.86 U
7/28/2017	Background	- -	- -	- -	- -	- -	- -	- -	8.52		- -	- -	- -	- -	- -	- -
8/1/2017	Background	<0.93 U	3.7	48.51	2.17	1.28	1.07	45.33	- -	<0.083 U	<0.68 U	0.02617	0.006 J	<0.29 U	1.27 J	1.43 J
8/2/2017	Background	<0.93 U	4.46 J	49.61	2.06	1.22	0.95 J	43.11	5.45	<0.083 U	<0.68 U	0.02498	<0.005 U	<0.29 U	1.74	2.02
8/11/2017	Background	<0.93 U	4.93 J	47.52	1.89	1.13	0.96 J	40.37	5.78	<0.083 U	<0.68 U	0.02347	0.008 J	<0.29 U	1.36 J	<0.86 U
8/18/2017	Background	<0.93 U	2.35 J	43.85	1.91	1.08	0.8 J	40.05	5.56	<0.083 U	<0.68 U	0.02466	0.009 J	<0.29 U	<0.99 U	0.92 J
9/1/2017	Background	<0.93 U	2.12 J	44.14	1.75	1.04	1.18	37.56	6.68	<0.083 U	<0.68 U	0.02429	0.006 J	<0.29 U	<0.99 U	<0.86 U
5/30/2019	Detection	0.02 J	1.76	72.4	0.424	0.08	0.334	4.38	4.41	<0.083 U	0.06 J	0.01 J	- -	<0.4 U	0.6	0.2 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

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

Geosyntec Consultants, Inc.

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
5/26/2016	Background	0.121	200	43	0.4023 J	7.2	1810	1166
7/29/2016	Background	0.119	195	32	0.4135 J	5.7	1576	1005
9/30/2016	Background	0.111	191	36	0.3055 J	6.2	1663	1055
10/21/2016	Background	0.124	194	32	0.583 J	6.1	1612	1163
12/14/2016	Background	0.135	196	31	0.5399 J	6.0	1560	1096
1/20/2017	Background	0.101	196	33	<0.083 U	5.9	1686	1445
2/24/2017	Background	0.135	189	30	<0.083 U	5.7	1628	1055
6/8/2017	Background	0.121	188	30	<0.083 U	5.8	1578	1105
10/6/2017	Detection	0.183	183	31	<0.083 U	5.9	1548	1090
5/24/2018	Detection	0.239	193	39	<0.083 U	6.3	1836	1067
8/15/2018	Detection	0.118	187	40	<0.083 U	5.6	1748	1168
2/21/2019	Detection	0.151	207	43.2	0.18	6.9	1722	1060
5/30/2019	*	0.158	202	41.7	<0.04 U	6.1	1546	1120
7/24/2019	Detection	0.113	216	37	0.085 J	6.0	1864	1127

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
* Sample is not associated with a specific monitoring program but was included in the updated background dataset.

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

Geosyntec Consultants, Inc.

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	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
5/26/2016	Background	<0.93 U	1.37501 J	21	0.173275 J	2	1	63	1.525	0.4023 J	<0.68 U	0.37	0.032	<0.29 U	<0.99 U	<0.86 U
7/29/2016	Background	1.13716 J	<1.05 U	20	0.307264 J	4	1	68	2.78	0.4135 J	<0.68 U	0.374	0.02133 J	1.04115 J	4.56733 J	<0.86 U
9/30/2016	Background	<0.93 U	<1.05 U	31	0.175474 J	0.848199 J	3	58	2.358	0.3055 J	<0.68 U	0.354	<0.005 U	<0.29 U	<0.99 U	<0.86 U
10/21/2016	Background	<0.93 U	<1.05 U	34	0.200656 J	2	4	65	2.224	0.583 J	<0.68 U	0.394	<0.005 U	0.322249 J	3.34422 J	<0.86 U
12/14/2016	Background	<0.93 U	<1.05 U	17	0.0498325 J	3	0.816224 J	68	2.384	0.5399 J	<0.68 U	0.323	0.01485 J	<0.29 U	<0.99 U	<0.86 U
1/20/2017	Background	<0.93 U	<1.05 U	14	0.0319852 J	3	68	68	2.436	<0.083 U	<0.68 U	0.341	<0.005 U	<0.29 U	<0.99 U	<0.86 U
2/24/2017	Background	<0.93 U	<1.05 U	20	0.0665729 J	2	1	73	2.288	<0.083 U	<0.68 U	0.331	<0.005 U	<0.29 U	<0.99 U	<0.86 U
6/8/2017	Background	<0.93 U	<1.05 U	10.3	<0.02 U	6.06	<0.23 U	74.8	1.598	<0.083 U	<0.68 U	0.329	0.013 J	<0.29 U	<0.99 U	<0.86 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

APPENDIX II

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

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Memorandum

Date:	January 11, 2019
To:	David Miller (AEP)
Copies to:	Jill Parker-Witt (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (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 257.90-257.98, "CCR rule"), the first semi-annual detection monitoring event detection at the Bottom Ash Storage Pond (BASP), an existing CCR unit at the Welsh Power Plant located in Pittsburg, Texas, was completed on May 24, 2018. Based on the results, a two-of-two verification sampling was completed on August 14, 2018.

Eight background monitoring events were conducted at the Welsh BASP prior to these detection monitoring events, 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 background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018. An alternative source demonstration (ASD) was certified on April 14, 2018 which resulted in a revision to the calculated prediction limits.

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. 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.

- Chloride concentrations exceeded the intrawell UPL of 12.6 mg/L in both the initial (14 mg/L) and second (15 mg/L) samples collected at AD-4C. Therefore, an SSI over background is concluded for chloride at AD-4C.

No other exceedances of UPLs were observed during these detection monitoring events.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). Within 90 days of identification of the above-listed SSIs, a written demonstration that a source other than the Welsh BASP caused the increases was completed in accordance with 40 CFR 257.94(e)(2). Thus, the Welsh BASP will remain in detection monitoring.

A certification of these statistics by a qualified professional engineer is provided in Attachment A.

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

Geosyntec Consultants, Inc.

Parameter	Units	Description	AD-3	AD-4C		AD-16R	
			5/24/2018	5/24/2018	8/14/2018	5/23/2018	8/14/2018
Boron	mg/L	Intrawell Background Value (UPL)	0.0333	0.0571		0.0700	
		Detection Monitoring Data	0.0069 J	0.0251	--	0.0320	--
Calcium	mg/L	Intrawell Background Value (UPL)	1.541	0.962		3.069	
		Detection Monitoring Data	0.545	0.434	--	2.53	--
Chloride	mg/L	Intrawell Background Value (UPL)	9	12.6		8.3	
		Detection Monitoring Data	8	**14**	**15**	6	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1	1		1	
		Detection Monitoring Data	<0.083	<0.083	--	<0.083	--
pH	SU	Intrawell Background Value (UPL)	7.63	5.91		4.4	
		Intrawell Background Value (LPL)	2.43	3.95		2.61	
		Detection Monitoring Data	4.38	5.17	--	3.79	--
Sulfate	mg/L	Intrawell Background Value (UPL)	12.4	49.0		64.1	
		Detection Monitoring Data	3	42	--	**67**	44
TDS	mg/L	Intrawell Background Value (UPL)	156	263		214	
		Detection Monitoring Data	98	224	--	204	--

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
J: Estimated value
<: Indicates the parameter was not detected
Bold values exceed the background value.
Background values are shaded gray.
--: sample was not collected

ATTACHMENT A

Certification by Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *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	TEXAS	01.17.19
License Number	Licensing State	Date

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Memorandum

Date:	February 16, 2019
To:	David Miller (AEP)
Copies to:	Jill Parker-Witt (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (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 detection at the Bottom Ash Storage Pond (BASP), an existing CCR unit at the Welsh Power Plant located in Pittsburg, Texas, was completed on November 13, 2018. Based on the results, a two-of-two verification sampling was completed on December 18, 2018 and January 11, 2019.

Eight to ten background monitoring events were conducted at the Welsh BASP prior to these detection monitoring events, 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 background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018. An alternative source demonstration (ASD) was certified on April 14, 2018 which resulted in a revision to the calculated prediction limits.

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. 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 49 mg/L in both the initial (56 mg/L) and second (58 mg/L) samples collected at AD-4C. Therefore, an SSI over background is concluded for Sulfate at AD-4C.

No other exceedances of UPLs were observed during these detection monitoring events.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). Within 90 days of identification of the above-listed SSIs, a written demonstration that a source other than the Welsh BASP caused the increases will be completed in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Welsh BASP will remain in detection monitoring.

A certification of these statistics by a qualified professional engineer is provided in Attachment A.

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

Geosyntec Consultants, Inc.

Parameter	Units	Description	AD-3		AD-4C		AD-16R	
			11/13/2018	12/18/2018	11/13/2018	12/18/2018	11/13/2018	1/11/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.033		0.057		0.070	
		Detection Monitoring Result	0.009	-	0.010	-	0.020	-
Calcium	mg/L	Intrawell Background Value (UPL)	1.54		0.962		3.07	
		Detection Monitoring Result	0.684	-	0.609	-	0.467	-
Chloride	mg/L	Intrawell Background Value (UPL)	9.0		12.6		8.3	
		Detection Monitoring Result	8.0	-	7.5	-	6.5	-
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		1.00		1.00	
		Detection Monitoring Result	<0.083	-	<0.083	-	<0.083	-
pH	SU	Intrawell Background Value (UPL)	7.63		5.91		4.40	
		Intrawell Background Value (LPL)	2.43		3.95		2.61	
		Detection Monitoring Result	5.19	-	5.79	-	**5.57**	2.66
Sulfate	mg/L	Intrawell Background Value (UPL)	12.4		49		64	
		Detection Monitoring Result	4.05	-	**56**	**58**	54	-
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	156		263		214	
		Detection Monitoring Result	114	-	220	-	186	-

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
-: Not Sampled
Bold values exceed the background value.
Background values are shaded gray.
Based on a 1-of-2 resampling, a statistically significant increase (SSI) is only identified when both samples in the detection monitoring period are above the calculated background

ATTACHMENT A
Certification by Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *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	TEXAS	03.15.19
License Number	Licensing State	Date

Geosyntec consultants

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Memorandum

Date:	June 26, 2019
To:	David Miller (AEP)
Copies to:	Jill Parker-Witt (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (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 first 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 February 20, 2019. Based on the results, a two-of-two verification sampling was completed on April 30, 2019.

Eight to ten background monitoring events were conducted at the Welsh BASP prior to these detection monitoring events, 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 background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018. An alternative source demonstration (ASD) was certified on April 14, 2018 which resulted in a revision to the calculated prediction limits. The calculated prediction limit for sulfate at AD-4C was also revised during a subsequent ASD which was certified on May 17, 2019. While another ASD was certified on January 7, 2019, the calculated prediction limits were not revised as part of that demonstration.

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.

- Chloride concentrations exceeded the intrawell UPL of 9.00 mg/L in both the initial (9.40 mg/L) and second (9.34 mg/L) samples collected at AD-3. Therefore, an SSI over background is concluded for chloride at AD-3.

No other exceedances of UPLs were observed during these detection monitoring events.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). Within 90 days of identification of the above-listed SSIs, a written demonstration that a source other than the Welsh BASP caused the increases will be completed in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Welsh BASP will remain in detection monitoring.

A certification of these statistics by a qualified professional engineer is provided in Attachment A.

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

Geosyntec Consultants, Inc.

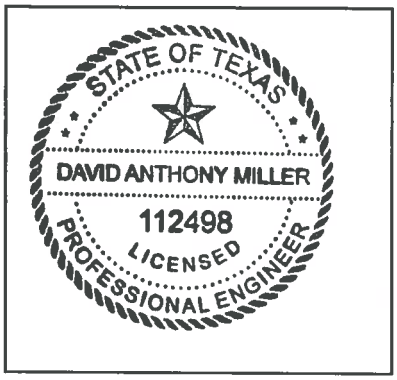
Parameter	Units	Description	AD-3		AD-4C		AD-16R	
			2/20/2019	4/30/2019	2/20/2019	4/30/2019	2/20/2019	4/30/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.0333		0.0571		0.0700	
		Detection Monitoring Data	0.01 J	0.0070	0.01 J	0.0140	0.03 J	**0.0150**
Calcium	mg/L	Intrawell Background Value (UPL)	1.54		0.962		3.07	
		Detection Monitoring Data	0.817	--	0.931	--	2.00	-
Chloride	mg/L	Intrawell Background Value (UPL)	9.00		12.6		8.30	
		Detection Monitoring Data	**9.40**	**9.34**	9.18	--	6.78	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1.0		1.0		1.0	
		Detection Monitoring Data	0.13	--	0.10	--	0.20	--
pH	SU	Intrawell Background Value (UPL)	7.6		5.9		4.4	
		Intrawell Background Value (LPL)	2.4		3.9		2.6	
		Detection Monitoring Data	4.8	4.1	5.2	4.8	**4.7**	3.9
Sulfate	mg/L	Intrawell Background Value (UPL)	12.4		59.1		64.1	
		Detection Monitoring Data	1.90	--	**60.1**	56.2	52.8	--
TDS	mg/L	Intrawell Background Value (UPL)	156		263		214	
		Detection Monitoring Data	110	--	242	--	200	--

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A
Certification by Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *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	TEXAS	06.26.19
License Number	Licensing State	Date

Geosyntec consultants

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Memorandum

Date:	December 23, 2019
To:	David Miller (AEP)
Copies to:	Jill Parker-Witt (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (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 July 24, 2019. Based on the results, a two-of-two verification sampling was completed on November 25, 2019 and on December 19, 2019.

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. 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 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 Evalation
Welsh Plant - Bottom Ash Storage Pond

Geosyntec Consultants, Inc.

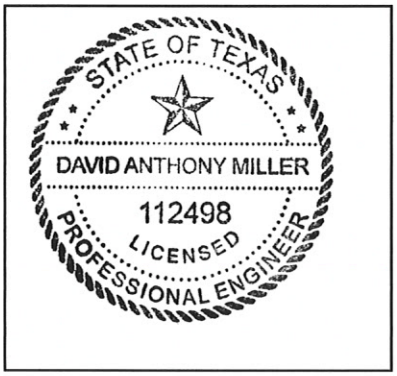
Parameter	Unit	Description	AD-16R		AD-3		AD-4C	
			7/24/2019	12/19/2019	7/24/2019	11/25/2019	7/24/2019	12/19/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.0638		0.0580		0.0529	
		Detection Monitoring Result	0.0300	-	0.0200	-	0.0200	-
Calcium	mg/L	Intrawell Background Value (UPL)	3.15		1.32		0.961	
		Detection Monitoring Result	1.50	-	**1.35**	0.734	0.586	-
Chloride	mg/L	Intrawell Background Value (UPL)	8.02		9.40		15.6	
		Detection Monitoring Result	7.00	-	7.00	-	13.0	-
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00		1.000		1.000	
		Detection Monitoring Result	0.130	-	0.0900	-	0.0830	-
pH	SU	Intrawell Background Value (UPL)	5.0		6.6		5.8	
		Intrawell Background Value (LPL)	2.6		3.1		4.2	
		Detection Monitoring Result	3.6	-	4.6	-	**3.9**	4.7 on 11/25/19
Sulfate	mg/L	Intrawell Background Value (UPL)	73.2		10.6		63.7	
		Detection Monitoring Result	70.0	-	6.00	-	52.0	-
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	221		140		255	
		Detection Monitoring Result	**250**	134	116	-	**284**	226

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A
Certification by Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *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	TEXAS	01.21.2020
License Number	Licensing State	Date

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

Submitted to

1 Riverside Plaza
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Submitted by

Geosyntec consultants

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December 10, 2019

CHA847

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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
CFR	Code of Federal Regulations
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
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

EXECUTIVE SUMMARY

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 257.90-257.98, "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.

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. Four semiannual detection monitoring events were conducted between October 2017 and May 2019. Data from these four events, including both initial and verification results, and an additional event conducted in May 2019 were 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, with no values removed prior to updating upper prediction limits (UPLs) for each Appendix III parameter to represent background values. Oversight on the use of statistical calculations was provided by Dr. Jim Loftis, Professor Emeritus of Civil & Environmental Engineering at Colorado State University and Senior Advisor to Groundwater Stats Consulting.

SECTION 2

BOTTOM ASH STORAGE POND EVALUATION

2.1 Previous Background Calculations

Eight to ten 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. Interwell prediction limits were selected for all parameters with a one-of-two resampling plan. 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 were previously documented in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018b).

2.2 Data Validation & QA/QC

Since October 2017, four semiannual detection monitoring events have been conducted at the BASP. 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 were collected from each compliance well. A summary of data collected during these detection monitoring events may be found in Table 1. Results for an additional event conducted in May 2019, which was also included in the update to background levels, is 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.9.6.23 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 January 2017 *Statistical*

Analysis Plan (AEP, 2017), except where noted below. The complete statistical analysis results are included in Attachment A.

Time series plots of Appendix III parameters are included in Attachment A 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 A).

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 $= \tilde{x}_{0.75} - \tilde{x}_{0.25}$

No potential outliers were identified in the data collected for the four most recent detection monitoring events.

2.3.2 Establishment of Updated Background Levels

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 - September 2017) to the new compliance samples (October 2017 – May 2019).

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 Appendix B. Significant differences were found between the two groups for chloride in upgradient well AD-5. However, because AD-5 is an upgradient monitoring well and more recent data are similar to background and better represent the groundwater quality upgradient of the facility, the background dataset was updated to include the compliance data for chloride at AD-5.

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-Francía 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 A.

2.3.3 Updated Prediction Limits

Intrawell UPLs were updated using all the historical data through May 2019 to represent background values. Intrawell LPLs were also generated for pH. The updated prediction limits are summarized in Table 2.

The intrawell UPLs 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, then it can be concluded that an SSI has not occurred. In practice, where the initial result did not exceed the UPL, a second sample was not collected. The retesting procedures allowed 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. An additional event completed in May 2019 was 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

American Electric Power (AEP). 2017. Statistical Analysis Plan – J. Robert Welsh Plant. January 2017.

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

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

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 - Bottom Ash Storage Pond

Parameter	Unit	AD-1					AD-3					
		10/6/2017	5/24/2018	8/14/2018	2/20/2019	5/30/2019	10/6/2017	5/24/2018	11/13/2018	2/20/2019	4/30/2019	5/30/2019
		2017-D1	2018-D1	2018-D1-R1	2019-D1	*	2017-D1	2018-D1	2018-D2	2019-D1	2019-D1-R1	*
Boron	mg/L	0.453	0.345	0.443	0.504	0.689	0.021	0.007 J	0.009 J	0.010 J	0.007	0.100 U
Calcium	mg/L	14.3	10.2	5.95	142	138	0.908	0.545	0.684	0.817		3.02
Chloride	mg/L	4.00	4.00	5.00	2.82	1.59	9.00	8.00	8.00	9.40	9.34	9.03
Fluoride	mg/L	1.00 U	1.00 U	1.00 U	0.240	0.290	1.00 U	1.00 U	1.00 U	0.130	-	0.180
Total Dissolved Solids	mg/L	160	150	160	522	588	114	98.0	114	110	-	110
Sulfate	mg/L	40.0	43.0	44.0	49.2	43.3	7.00	3.00	4.05	1.90	-	2.30
pH	SU	5.3	2.2	5.2	7.3	6.7	5.2	4.4	5.2	4.8	4.1	4.3

Parameter	Unit	AD-4C							
		10/6/2017	5/24/2018	8/14/2018	11/13/2018	12/18/2018	2/20/2019	4/30/2019	5/29/2019
		2017-D1	2018-D1	2018-D1-R1	2018-D2	2018-D2-R1	2019-D1	2019-D1-R1	*
Boron	mg/L	0.026	0.025	-	0.010 J	-	0.010 J	0.014	0.100 U
Calcium	mg/L	0.654	0.434	-	0.609	-	0.931	-	0.564
Chloride	mg/L	11.0	14.0	15.0	7.50	-	9.18	-	14.8
Fluoride	mg/L	1.00 U	1.00 U	-	1.00 U	-	0.100 J	-	0.160
Total Dissolved Solids	mg/L	226	224	-	220	-	242	-	208
Sulfate	mg/L	44.0	42.0	-	56.0	58.0	60.1	56.2	52.8
pH	SU	5.4	5.2	5.0	5.8	4.9	5.2	4.8	4.6

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
*May 2019 data are not associated with any semiannual detection monitoring events but were included in the background update.

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

Parameter	Unit	AD-5					AD-16R						
		10/6/2017	5/24/2018	8/15/2018	2/21/2019	5/30/2019	10/6/2017	5/23/2018	8/14/2018	11/13/2018	2/20/2019	4/30/2019	5/30/2019
		2017-D1	2018-D1	2018-D1-R1	2019-D1	*	2017-D1	2018-D1	2018-D1-R1	2018-D2	2019-D1	2019-D1-R1	*
Boron	mg/L	0.043	0.050	0.050	0.033	0.030 J	0.047	0.032	-	0.020 J	0.030 J	0.015	0.100 U
Calcium	mg/L	33.1	28.1	40.5	33.9	30.0	0.896	2.53	-	0.467	2.00	-	1.36
Chloride	mg/L	16.0	22.0	19.0	24.7	22.3	7.00	6.00	-	6.50	6.78	-	5.43
Fluoride	mg/L	1.00 U	1.00 U	1.00 U	0.210	0.290	1.00 U	1.00 U	-	1.00 U	0.2	-	0.190
Total Dissolved Solids	mg/L	258	242	428	220	238	152	204	-	186	200	-	80.0
Sulfate	mg/L	82.0	60.0	240	46.5	51.3	82.0	67.0	44.0	54.0	52.8	-	41.6
pH	SU	5.6	6.2	6.2	5.4	6.3	3.3	3.8	3.9	5.6	4.7	3.9	3.9

Parameter	Unit	AD-17				
		10/6/2017	5/24/2018	8/15/2018	2/21/2019	5/30/2019
		2017-D1	2018-D1	2018-D1-R1	2019-D1	*
Boron	mg/L	0.183	0.239	0.118	0.151	0.158
Calcium	mg/L	183	193	187	207	202
Chloride	mg/L	31.0	39.0	-	43.2	41.7
Fluoride	mg/L	1.00 U	1.00 U	-	0.180	0.200 U
Total Dissolved Solids	mg/L	1550	1840	-	1720	1550
Sulfate	mg/L	1090	1070	-	1060	1120
pH	SU	5.9	6.3	5.6	6.9	6.1

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
*May 2019 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

Parameter	Unit	Description	AD-16R	AD-3	AD-4C
Boron	mg/L	Intrawell Background Value (UPL)	0.0638	0.0580	0.0529
Calcium	mg/L	Intrawell Background Value (UPL)	3.15	1.32	0.961
Chloride	mg/L	Intrawell Background Value (UPL)	8.02	9.40	15.6
Fluoride	mg/L	Intrawell Background Value (UPL)	1.00	1.00	1.00
pH	SU	Intrawell Background Value (UPL)	5.0	6.6	5.8
		Intrawell Background Value (LPL)	2.6	3.1	4.2
Sulfate	mg/L	Intrawell Background Value (UPL)	73.2	10.6	63.7
Solids	mg/L	Intrawell Background Value (UPL)	221	140	255

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit

ATTACHMENT A
Statistical Analysis Output

November 12, 2019

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

Re: Welsh BASP
Background Update - 2019

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the screening and statistical analysis of background groundwater data for American Electric Power's Welsh BASP. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling began at Welsh BASP for the CCR program in 2016, and at least 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; and
- **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 Dr. Jim Loftis, Civil & Environmental Engineering professor emeritus at Colorado State University and Senior Advisor to 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 for these parameters 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). 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). 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.

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 to demonstrate that the selected statistical methods for Appendix III parameters comply with the USEPA Unified Guidance recommendations as discussed below.

Summary of Statistical Method:

1) 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 nondetects, 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% nondetects (USEPA Unified Guidance, 2009, Chapter 6).

- When data contain <15% nondetects in background, simple substitution of one-half the reporting limit is utilized in the statistical analysis. The reporting limit utilized for nondetects is the practical quantification limit (PQL) as reported by the laboratory.
- When data contain between 15-50% nondetects, the Kaplan-Meier nondetect 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% nondetects.

Historical Summary of 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. A substitution of the most recent reporting limit was applied when varying detection limits existed in data. The results were submitted with the previous background screening report.

No true 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. It was noted that for each constituent evaluated, the highest concentrations are reported in the upgradient wells.

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 as may be seen on the Trend Test Summary table. 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. The ANOVA identified variation for all Appendix III parameters except for pH. 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.

All available data through September 2017 at each well were used to establish intrawell background limits for the parameters identified above based on a 1-of-2 resample plan that will be used for future comparisons. Future compliance measurements will be compared to these background limits during each subsequent semi-annual sampling event.

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.

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. A summary table of the background prediction limits follows the previous letter.

Background Update - September 2019

Prior to updating background data, samples are re-evaluated for all wells for intrawell parameters and all upgradient wells for interwell parameters using Tukey's outlier test and visual screening on all historical data through May 2019. Tukey's outlier test noted high values for chloride in wells AD-1 and AD-16R; and for sulfate in well AD-17 that were flagged in the database, and may be seen on the Outlier Summary Table and accompanying graphs. A low value was flagged for chloride in well AD-1, but when Tukey's outlier test detects an outlier for the most recent sample, it will not be flagged in the event that the data precede a trend that is more representative of current concentrations. 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 outliers follows this letter.

For constituents requiring intrawell prediction limits, the Mann-Whitney (Wilcoxon Rank Sum) test was used to compare the medians of historical data through September 2017 to the new compliance samples at each well through May 2019 to evaluate whether the groups are significantly different at the 99% confidence level. When no differences are identified, the background data may be updated with compliance data (Figure D). The only exception to this is sulfate in well AD-4C, which uses historical data through December 2018.

Statistically significant differences were found between the two groups for chloride in upgradient well AD-5. Typically, when the test concludes that the medians of the two groups are significantly different, particularly in the downgradient wells, the background are not updated to include the newer data but will be reconsidered in the future. However, because the differences for chloride in well AD-5 occurred in an upgradient well and more recent data are fairly similar to background and better represent the groundwater quality upgradient of the facility, the background data set was updated. A

summary of these results follows this letter and the test results are included with the Mann Whitney test section at the end of this report. Additionally, a summary of well/constituent pairs using a truncated portion of their records follows this letter (Figure E).

Intrawell prediction limits using all historical data through May 2019, combined with a 1-of-2 resample plan, were constructed and a summary of the updated limits follows this letter (Figure F).

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.

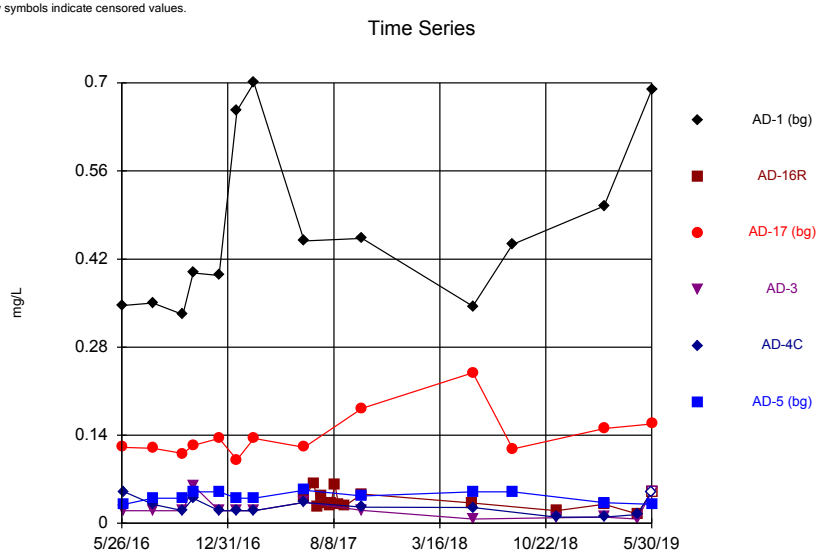
For Groundwater Stats Consulting,

Andrew T. Collins
Groundwater Analyst

Kristina L. Rayner
Groundwater Statistician

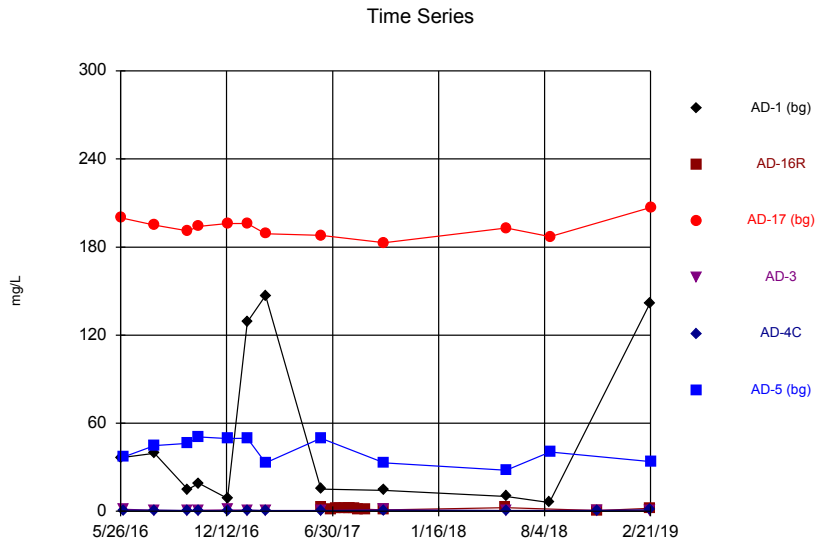
Figure A. Time Series

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Boron Analysis Run 11/7/2019 10:05 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



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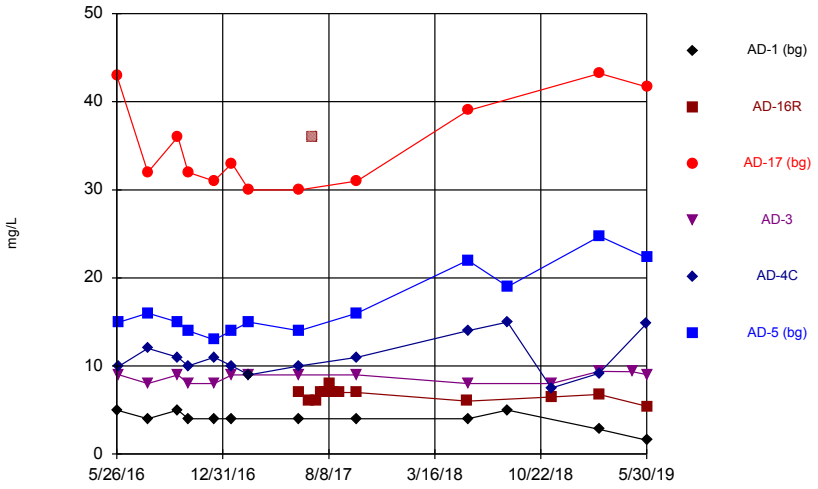
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG



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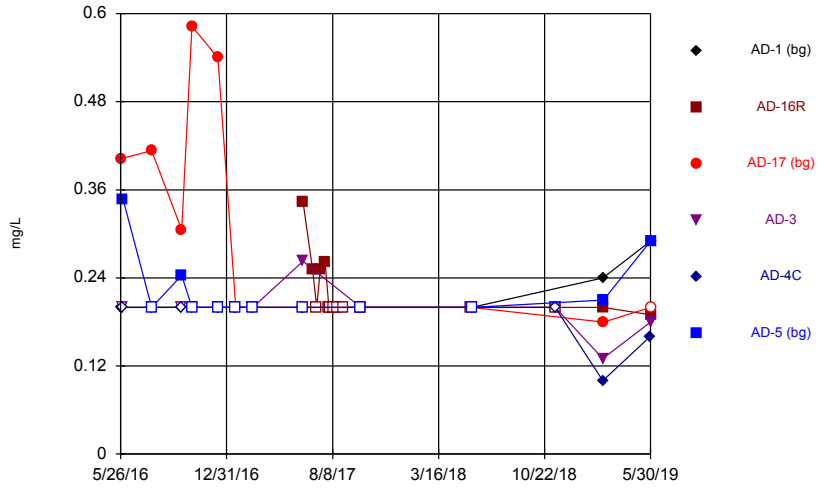
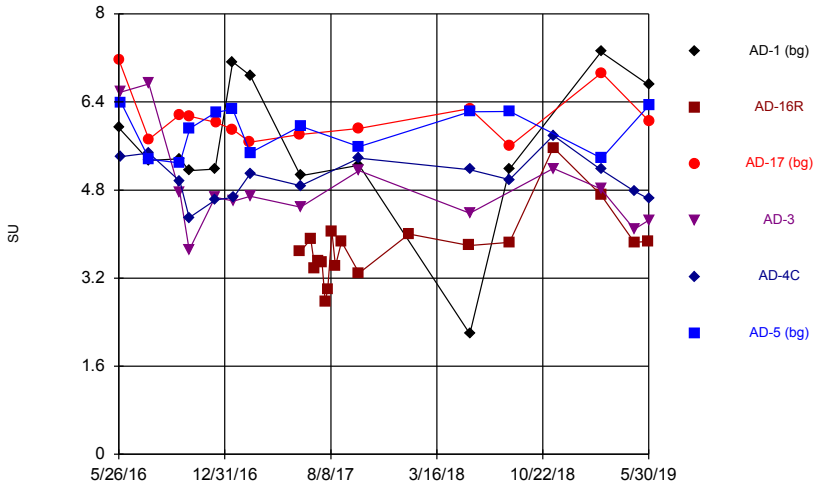
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Fluoride Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

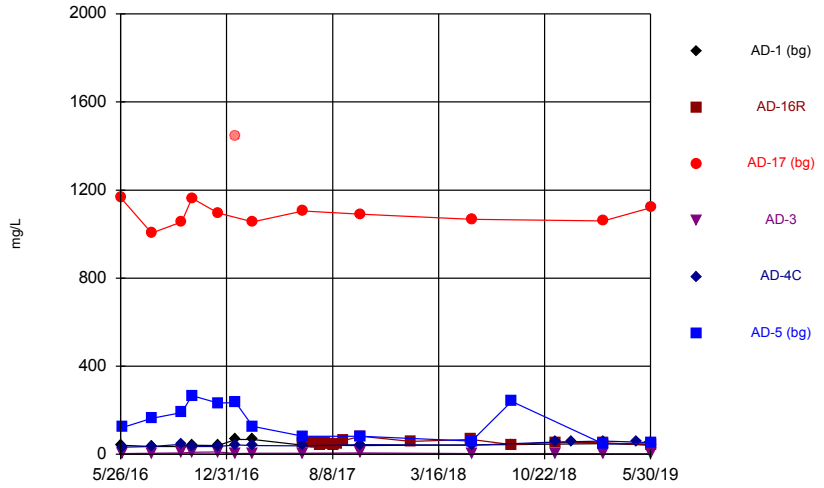
Time Series



Constituent: pH, field Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

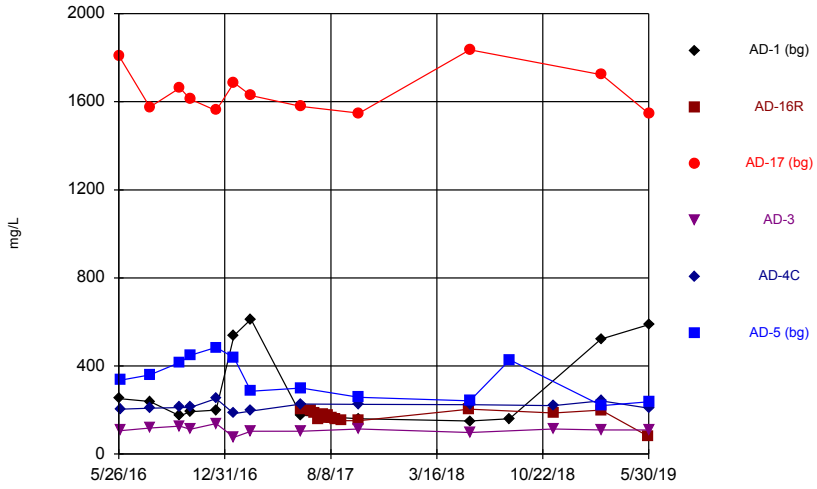
Time Series



Constituent: Sulfate Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Time Series

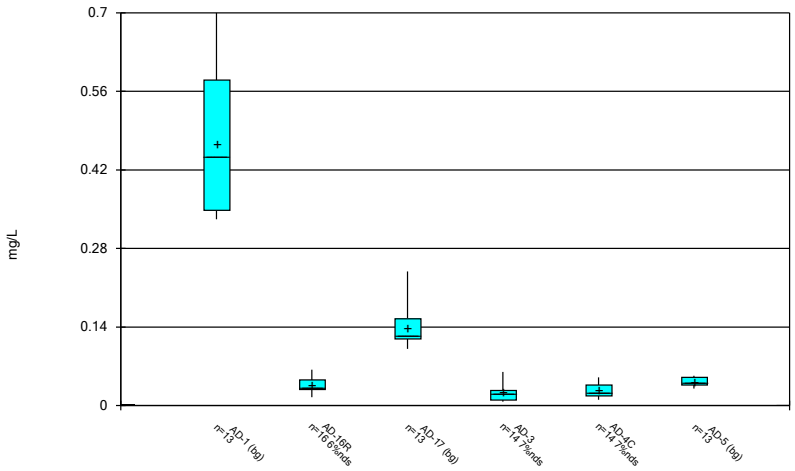


Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Figure B. Box Plots

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

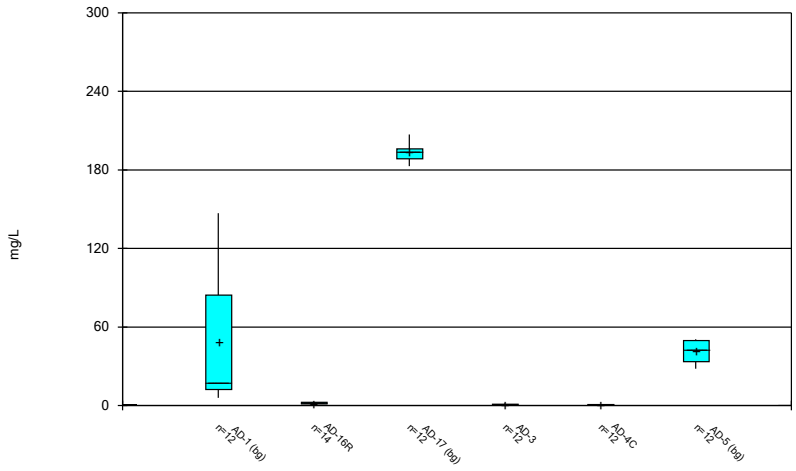
Box & Whiskers Plot



Constituent: Boron Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

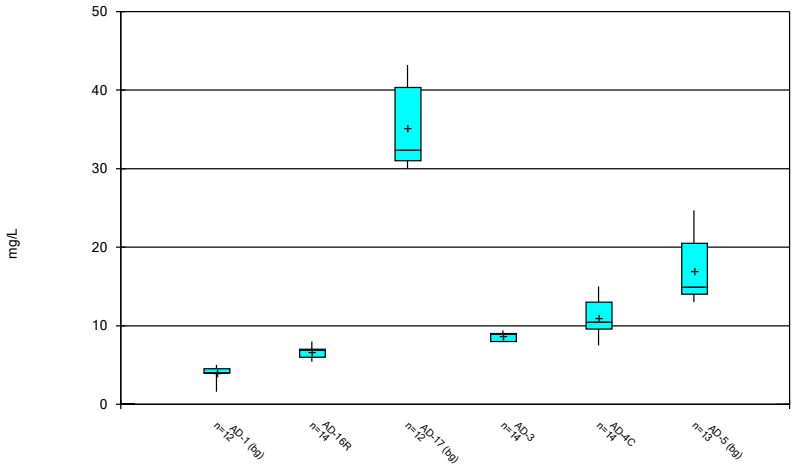
Box & Whiskers Plot



Constituent: Calcium Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

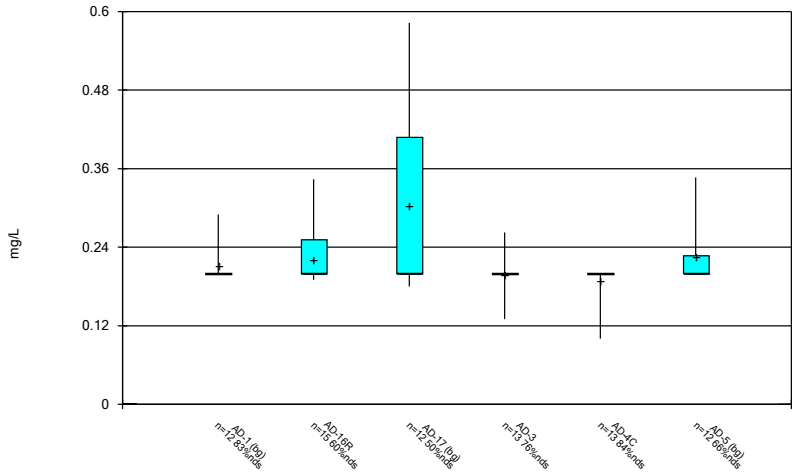
Box & Whiskers Plot



Constituent: Chloride Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

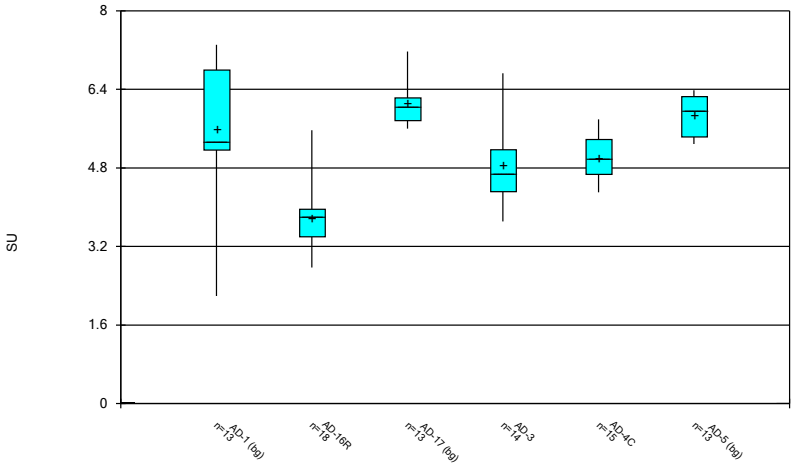
Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Fluoride Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

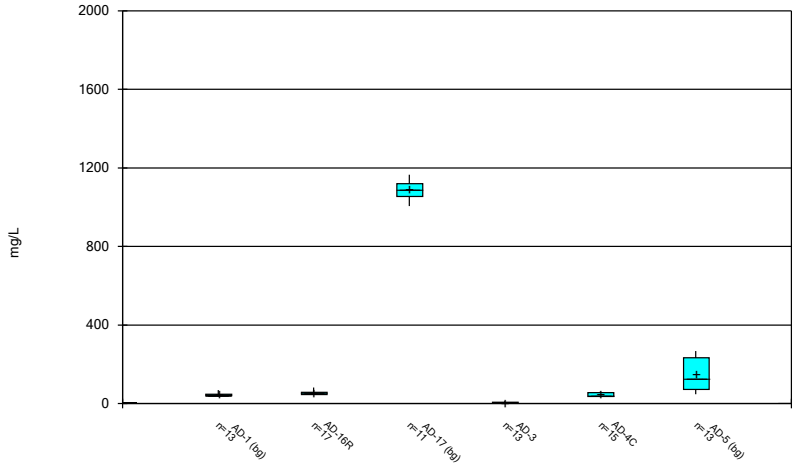
Box & Whiskers Plot



Constituent: pH, field Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

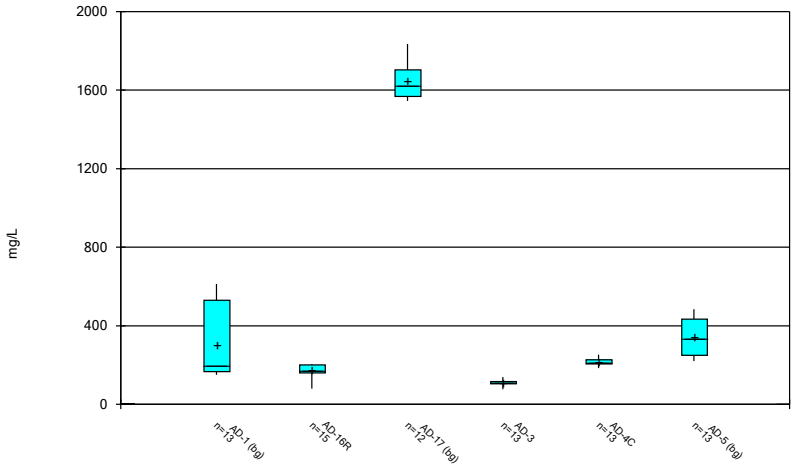
Box & Whiskers Plot



Constituent: Sulfate Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Box & Whiskers Plot



Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:06 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Figure C. Outlier Summary

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/7/2019, 10:05 AM

	AD-1 Chloride (mg/L)	AD-16R Chloride (mg/L)	AD-17 Sulfate (mg/L)
1/20/2017			1445 (o)
2/24/2017	9 (o)		
7/7/2017		36 (o)	

Figure D. Welch's t-test/Mann-Whitney - Significant Results

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/7/2019, 10:37 AM

Constituent	Well	Calc.	0.01	Method
Chloride (mg/L)	**AD-5 (bg)**	**2.816**	**Yes**	**Mann-W**

Figure D. Welch's t-test/Mann-Whitney - All Results

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/7/2019, 10:37 AM

Constituent	Well	Calc.	0.01	Method
Boron (mg/L)	AD-1 (bg)	0.6587	No	Mann-W
Boron (mg/L)	AD-16R	-0.7055	No	Mann-W
Boron (mg/L)	AD-17 (bg)	1.982	No	Mann-W
Boron (mg/L)	AD-3	-1.545	No	Mann-W
Boron (mg/L)	AD-4C	-1.111	No	Mann-W
Boron (mg/L)	AD-5 (bg)	-0.1495	No	Mann-W
Calcium (mg/L)	AD-1 (bg)	-1.274	No	Mann-W
Calcium (mg/L)	AD-16R	-0.7778	No	Mann-W
Calcium (mg/L)	AD-17 (bg)	-0.9358	No	Mann-W
Calcium (mg/L)	AD-3	0.08492	No	Mann-W
Calcium (mg/L)	AD-4C	0.4246	No	Mann-W
Calcium (mg/L)	AD-5 (bg)	-2.123	No	Mann-W
Chloride (mg/L)	AD-1 (bg)	-1.279	No	Mann-W
Chloride (mg/L)	AD-16R	-1.86	No	Mann-W
Chloride (mg/L)	AD-17 (bg)	1.366	No	Mann-W
Chloride (mg/L)	AD-3	1.102	No	Mann-W
Chloride (mg/L)	AD-4C	0.8524	No	Mann-W
Chloride (mg/L)	**AD-5 (bg)**	**2.816**	**Yes**	**Mann-W**
Fluoride (mg/L)	AD-1 (bg)	-2.219	No	Mann-W
Fluoride (mg/L)	AD-16R	-0.6218	No	Mann-W
Fluoride (mg/L)	AD-17 (bg)	-2.176	No	Mann-W
Fluoride (mg/L)	AD-3	-1.386	No	Mann-W
Fluoride (mg/L)	AD-4C	-1.978	No	Mann-W
Fluoride (mg/L)	AD-5 (bg)	-1.112	No	Mann-W
pH, field (SU)	AD-1 (bg)	-0.1466	No	Mann-W
pH, field (SU)	AD-16R	1.734	No	Mann-W
pH, field (SU)	AD-17 (bg)	0.366	No	Mann-W
pH, field (SU)	AD-3	-0.4518	No	Mann-W
pH, field (SU)	AD-4C	0.8687	No	Mann-W
pH, field (SU)	AD-5 (bg)	0.5123	No	Mann-W
Sulfate (mg/L)	AD-1 (bg)	0.8856	No	Mann-W
Sulfate (mg/L)	AD-16R	0.7355	No	Mann-W
Sulfate (mg/L)	AD-17 (bg)	-0.09471	No	Mann-W
Sulfate (mg/L)	AD-3	-1.843	No	Mann-W
Sulfate (mg/L)	AD-4C	2.095	No	Mann-W
Sulfate (mg/L)	AD-5 (bg)	-1.906	No	Mann-W
Total Dissolved Solids (mg/L)	AD-1 (bg)	-1.099	No	Mann-W
Total Dissolved Solids (mg/L)	AD-16R	0.1229	No	Mann-W
Total Dissolved Solids (mg/L)	AD-17 (bg)	-0.2548	No	Mann-W
Total Dissolved Solids (mg/L)	AD-3	-0.2205	No	Mann-W
Total Dissolved Solids (mg/L)	AD-4C	1.174	No	Mann-W
Total Dissolved Solids (mg/L)	AD-5 (bg)	-2.269	No	Mann-W

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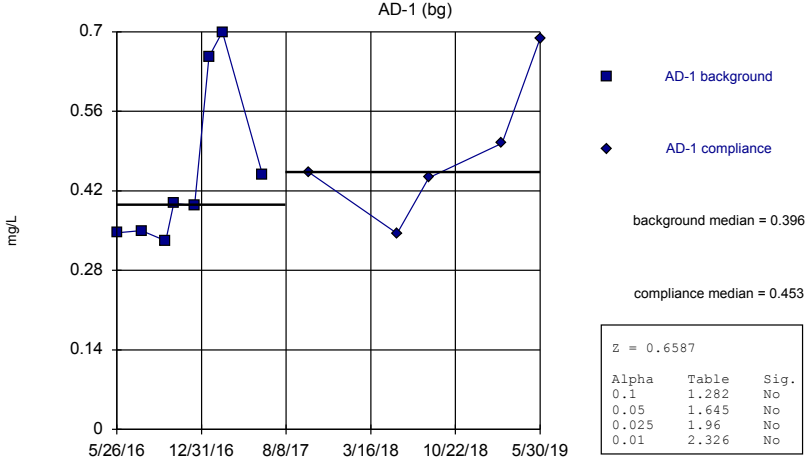
Mann-Whitney (Wilcoxon Rank Sum)

AD-1 (bg)



AD-1 background

AD-1 compliance

background median = 0.396

compliance median = 0.453

Z = 0.6587

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Boron Analysis Run 11/7/2019 10:35 AM

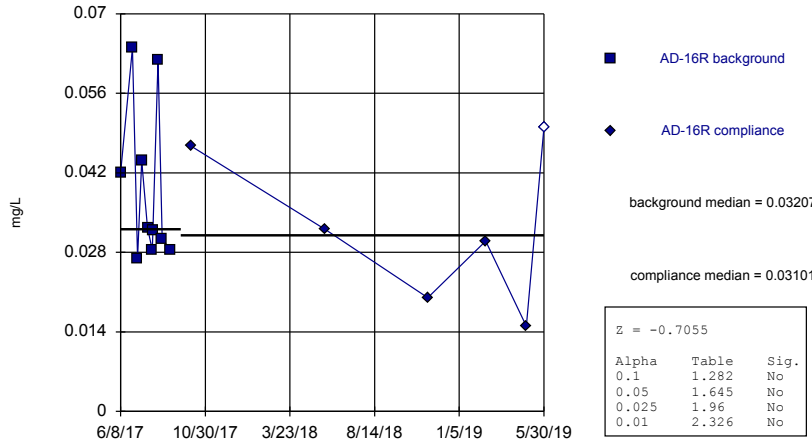
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-16R



AD-16R background

AD-16R compliance

background median = 0.03207

compliance median = 0.03101

Z = -0.7055

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

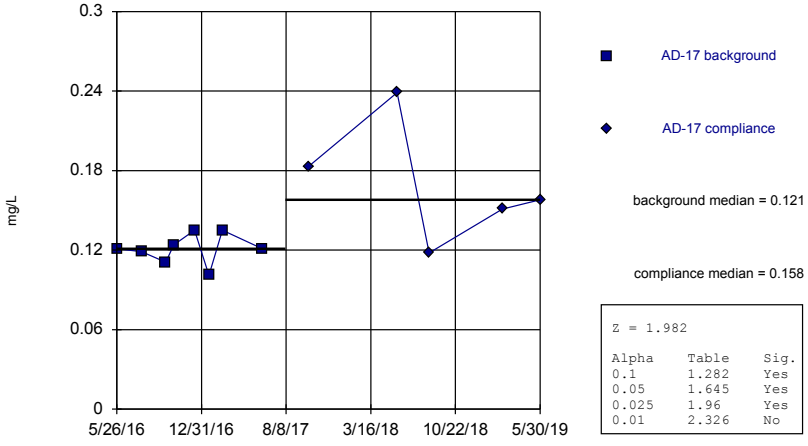
Constituent: Boron Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-17 (bg)



AD-17 background

AD-17 compliance

background median = 0.121

compliance median = 0.158

Z = 1.982

Alpha	Table	Sig.
0.1	1.282	Yes
0.05	1.645	Yes
0.025	1.96	Yes
0.01	2.326	No

Constituent: Boron Analysis Run 11/7/2019 10:35 AM

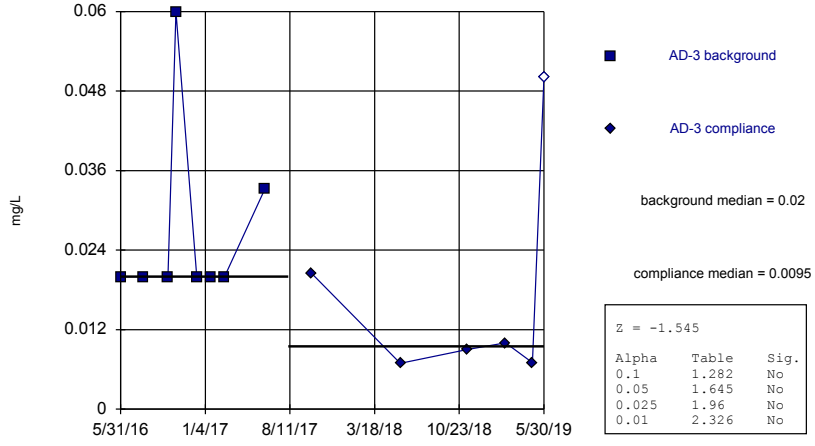
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-3



AD-3 background

AD-3 compliance

background median = 0.02

compliance median = 0.0095

Z = -1.545

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

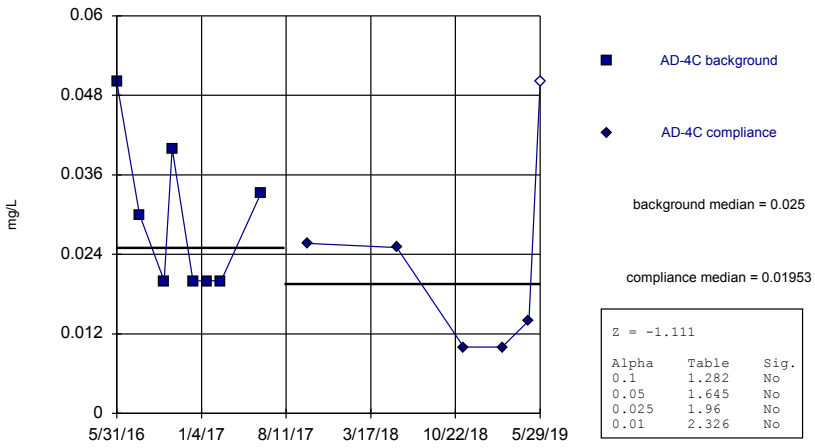
Constituent: Boron Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-4C

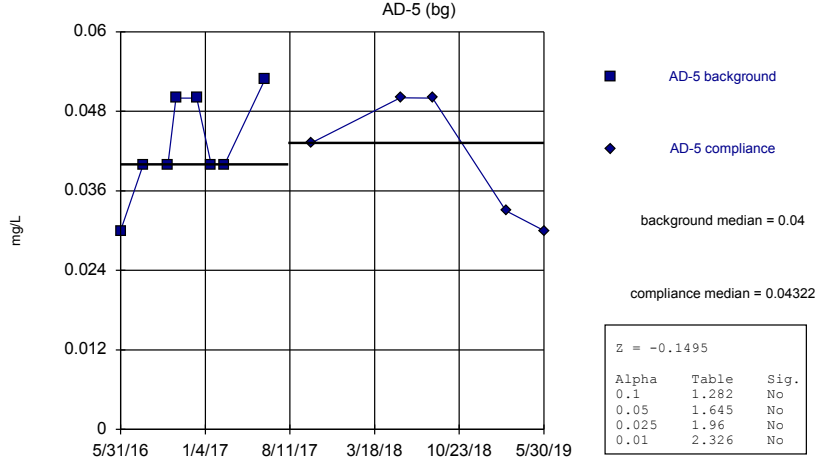


Constituent: Boron Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-5 (bg)

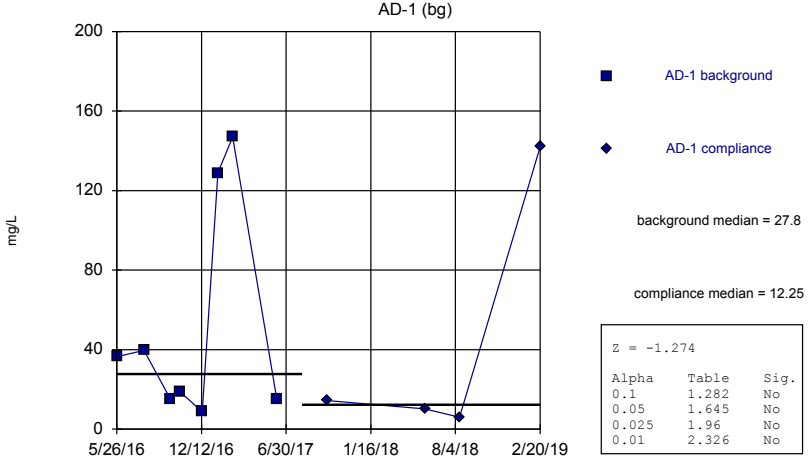


Constituent: Boron Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-1 (bg)

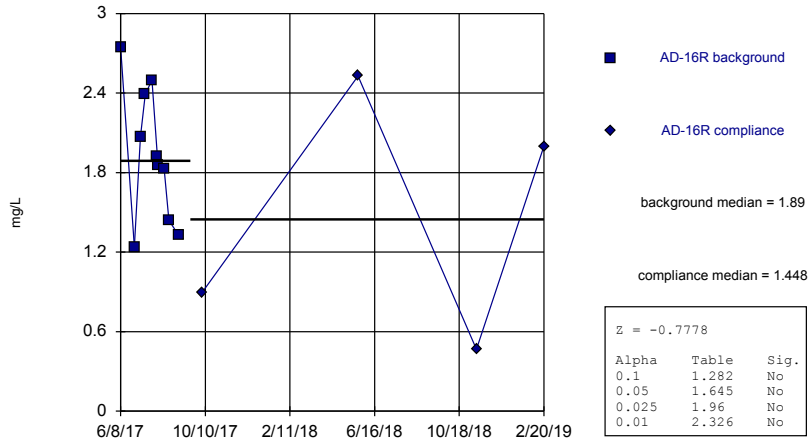


Constituent: Calcium Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-16R

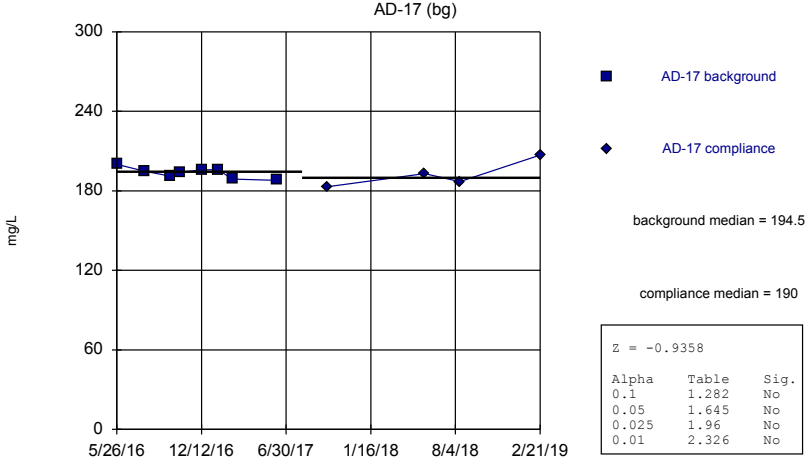


Constituent: Calcium Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-17 (bg)



background median = 194.5

compliance median = 190

Z = -0.9358

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

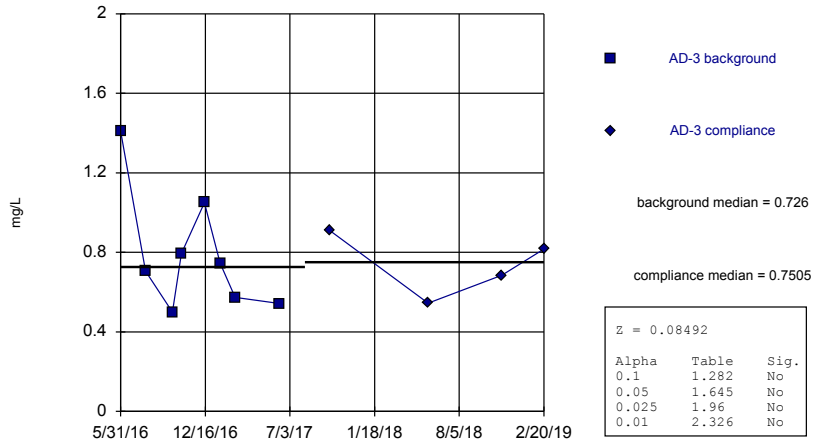
Constituent: Calcium Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-3



background median = 0.726

compliance median = 0.7505

Z = 0.08492

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

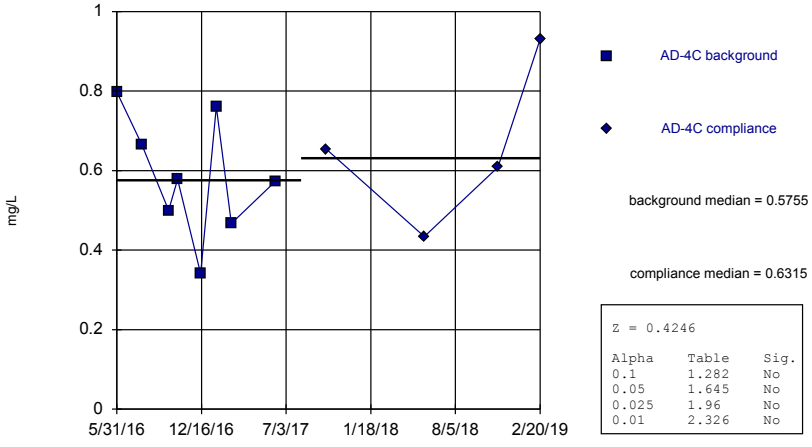
Constituent: Calcium Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-4C



background median = 0.5755

compliance median = 0.6315

Z = 0.4246

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

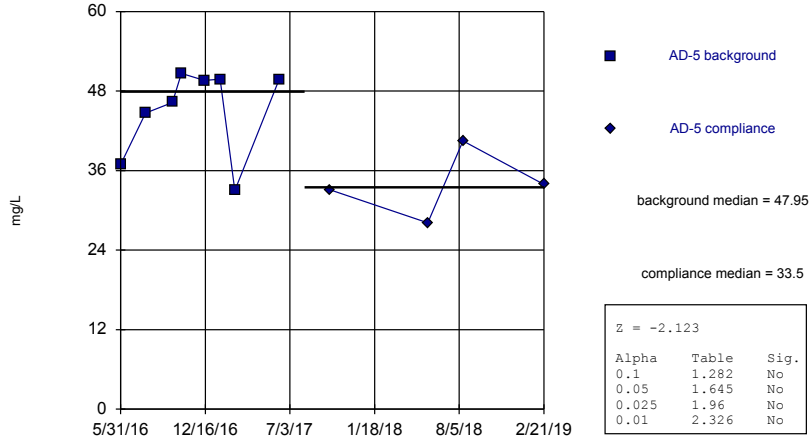
Constituent: Calcium Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-5 (bg)



background median = 47.95

compliance median = 33.5

Z = -2.123

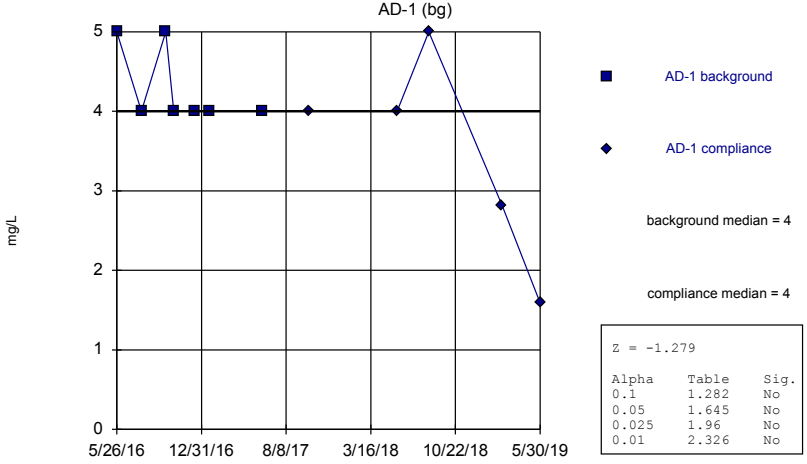
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Calcium Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-1 (bg)



Z = -1.279

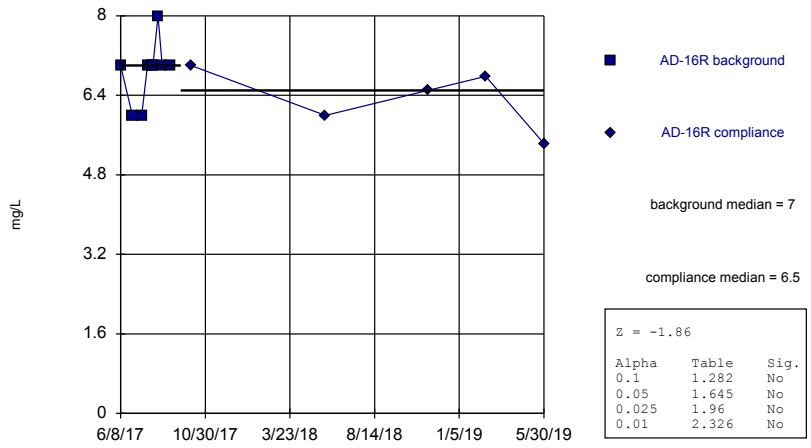
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Chloride Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-16R



Z = -1.86

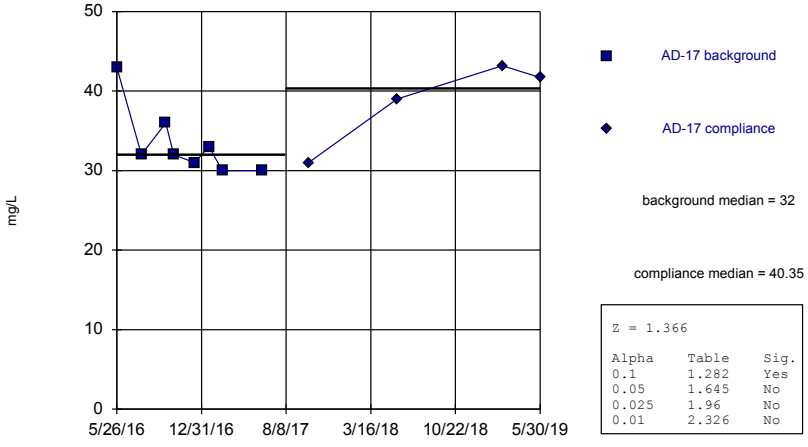
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Chloride Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-17 (bg)



Z = 1.366

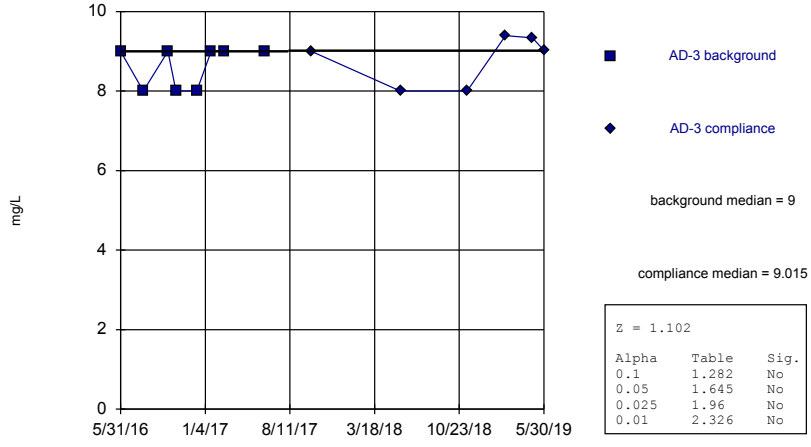
Alpha	Table	Sig.
0.1	1.282	Yes
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Chloride Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-3



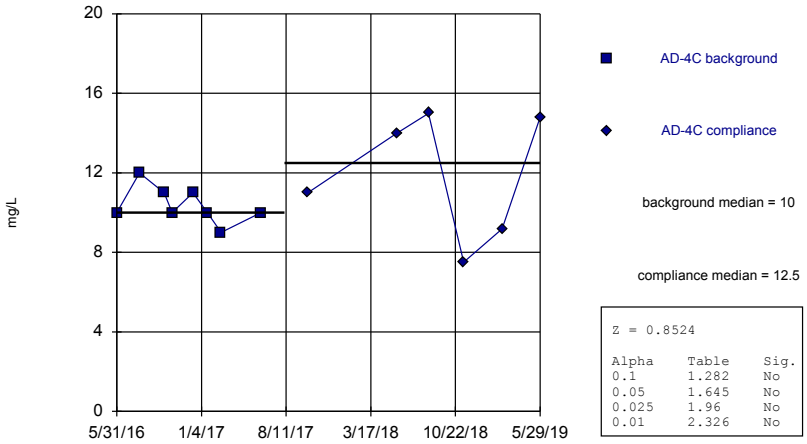
Z = 1.102

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Chloride Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-4C



Z = 0.8524

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

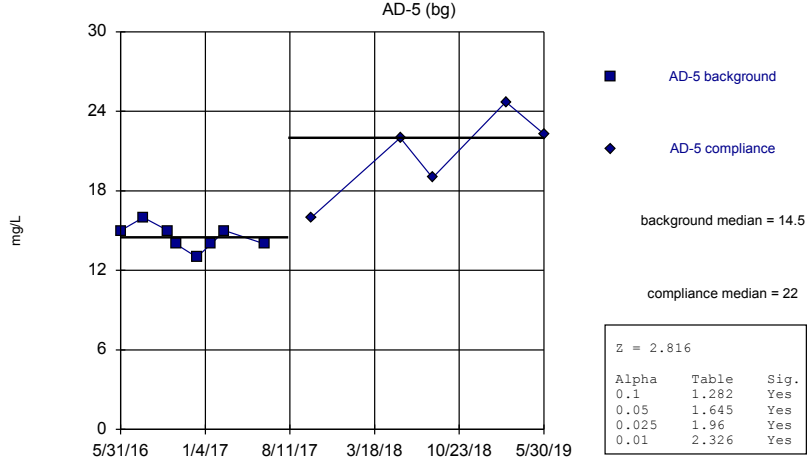
Constituent: Chloride Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-5 (bg)



Z = 2.816

Alpha	Table	Sig.
0.1	1.282	Yes
0.05	1.645	Yes
0.025	1.96	Yes
0.01	2.326	Yes

Constituent: Chloride Analysis Run 11/7/2019 10:35 AM

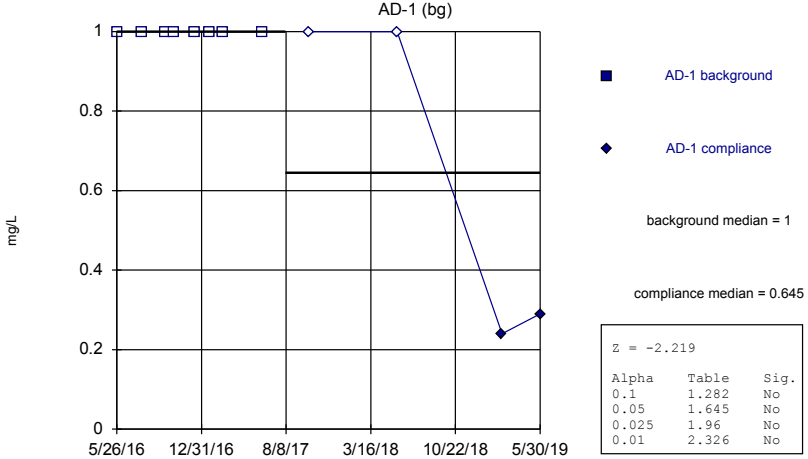
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-1 (bg)



Z = -2.219

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Fluoride Analysis Run 11/7/2019 10:35 AM

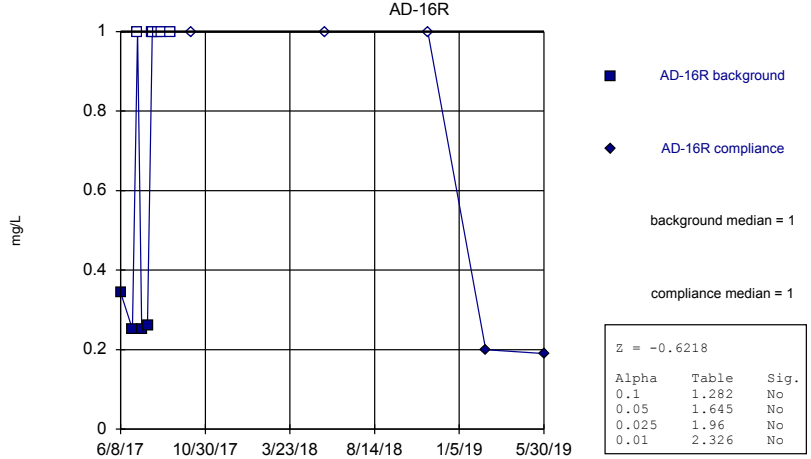
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-16R



Z = -0.6218

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

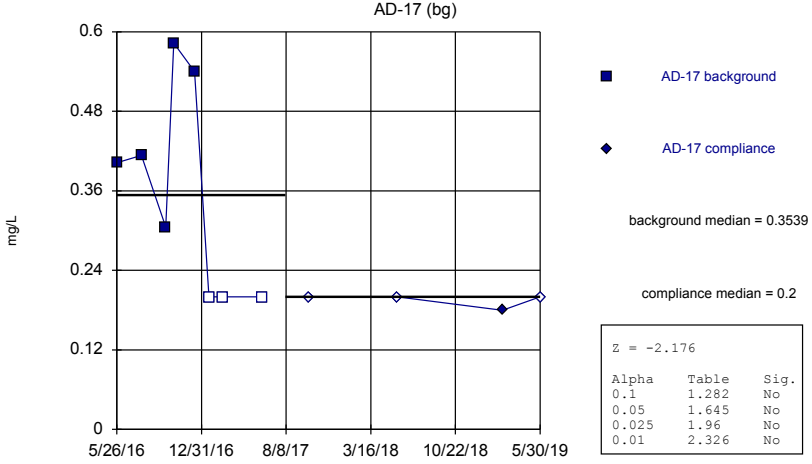
Constituent: Fluoride Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-17 (bg)



Z = -2.176

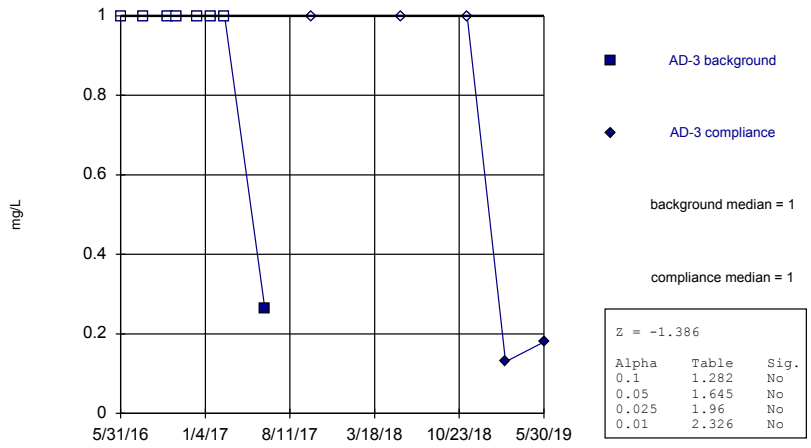
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Fluoride Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-3



Z = -1.386

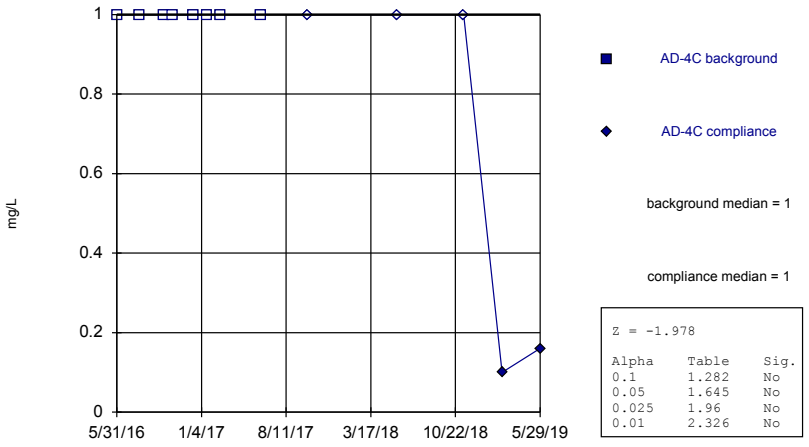
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Fluoride Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-4C



Z = -1.978

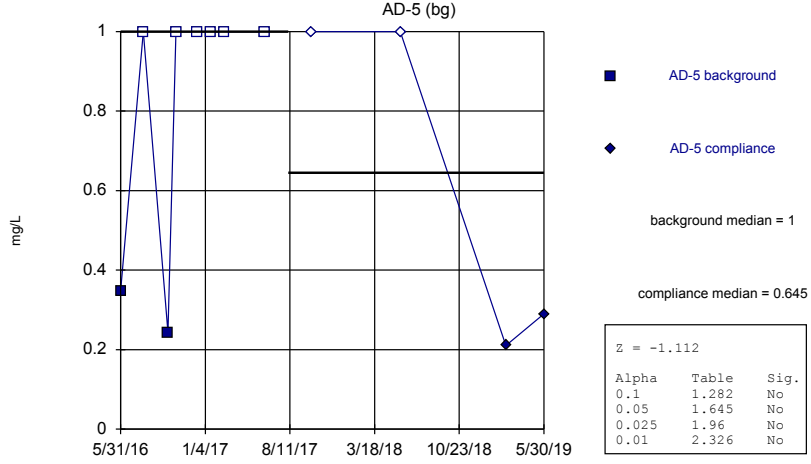
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Fluoride Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Mann-Whitney (Wilcoxon Rank Sum)

AD-5 (bg)



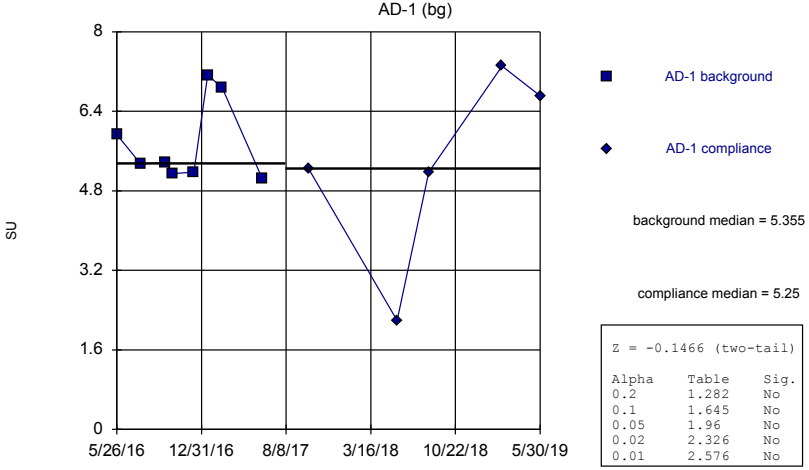
Z = -1.112

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Fluoride Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-1 (bg)



background median = 5.355

compliance median = 5.25

Z = -0.1466 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

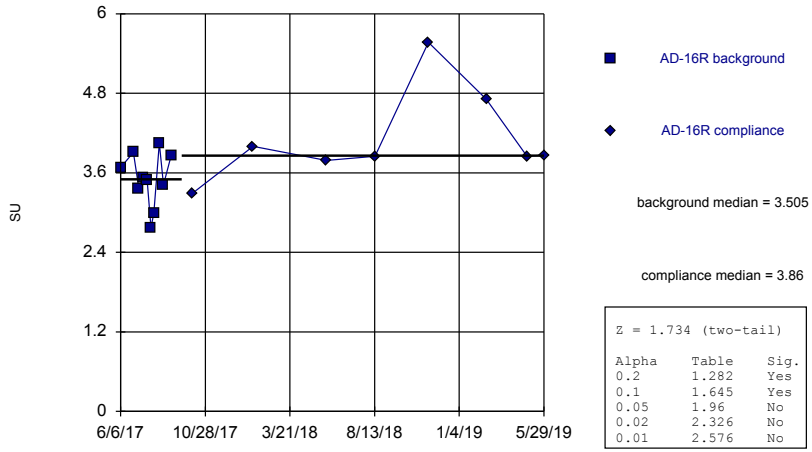
Constituent: pH, field Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-16R



background median = 3.505

compliance median = 3.86

Z = 1.734 (two-tail)

Alpha	Table	Sig.
0.2	1.282	Yes
0.1	1.645	Yes
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

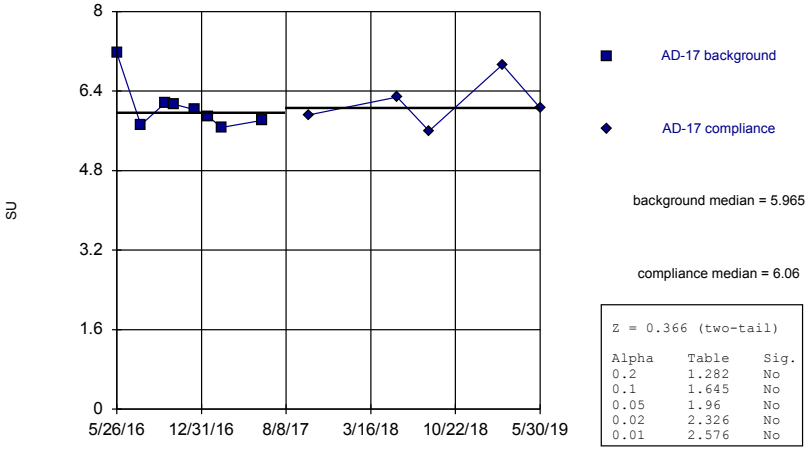
Constituent: pH, field Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-17 (bg)



background median = 5.965

compliance median = 6.06

Z = 0.366 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

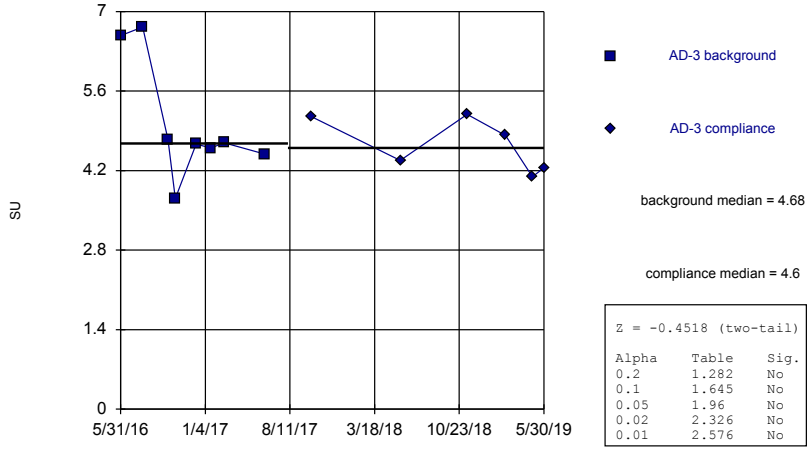
Constituent: pH, field Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-3



background median = 4.68

compliance median = 4.6

Z = -0.4518 (two-tail)

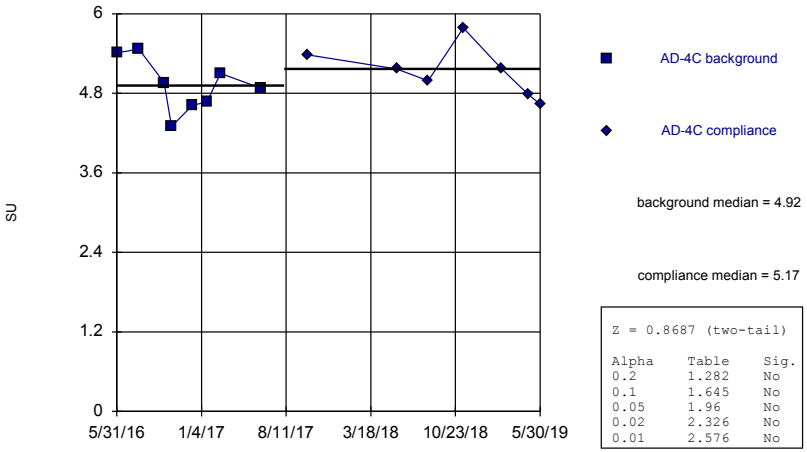
Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

Constituent: pH, field Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-4C



background median = 4.92

compliance median = 5.17

Z = 0.8687 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

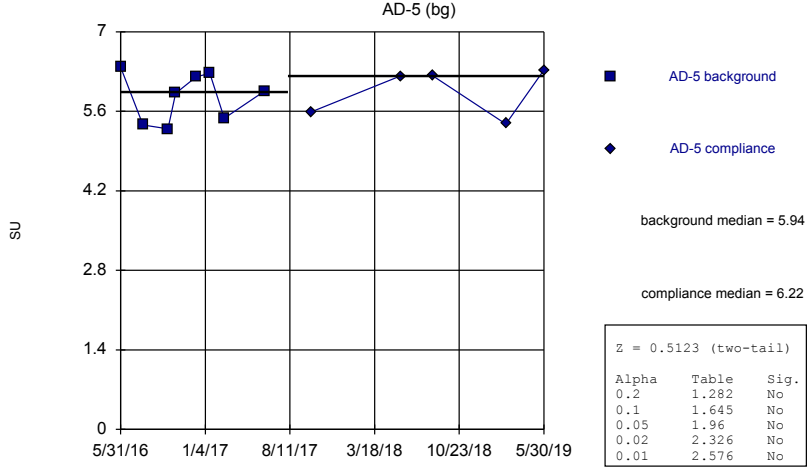
Constituent: pH, field Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-5 (bg)



background median = 5.94

compliance median = 6.22

Z = 0.5123 (two-tail)

Alpha	Table	Sig.
0.2	1.282	No
0.1	1.645	No
0.05	1.96	No
0.02	2.326	No
0.01	2.576	No

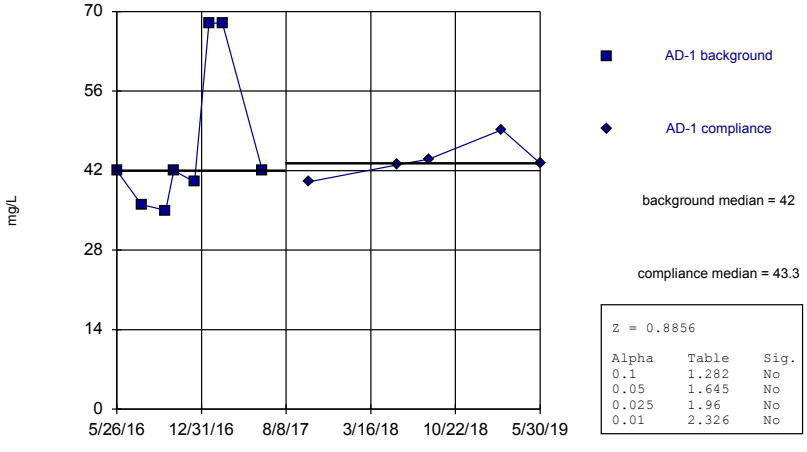
Constituent: pH, field Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-1 (bg)



background median = 42

compliance median = 43.3

Z = 0.8856

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

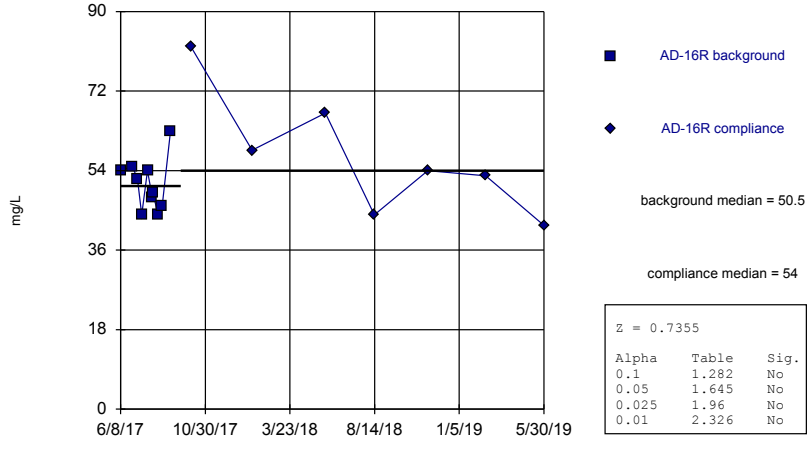
Constituent: Sulfate Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-16R



background median = 50.5

compliance median = 54

Z = 0.7355

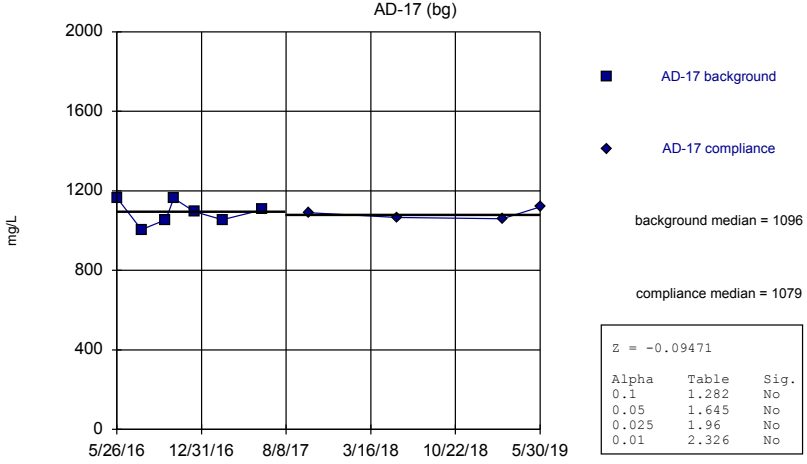
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Sulfate Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-17 (bg)

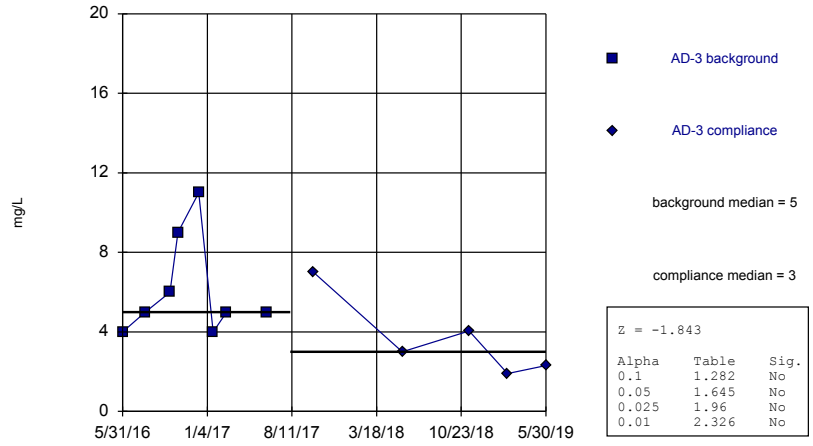


Constituent: Sulfate Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-3

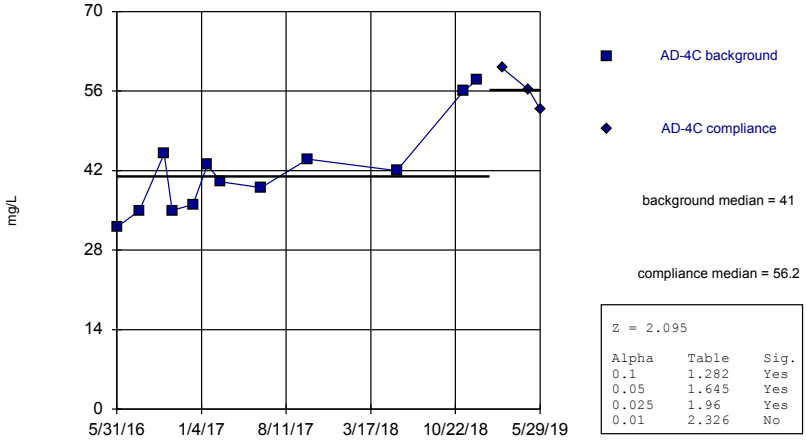


Constituent: Sulfate Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-4C

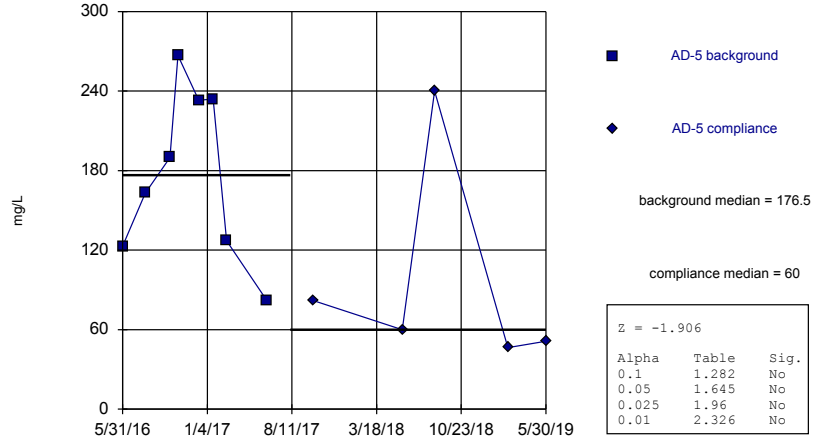


Constituent: Sulfate Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

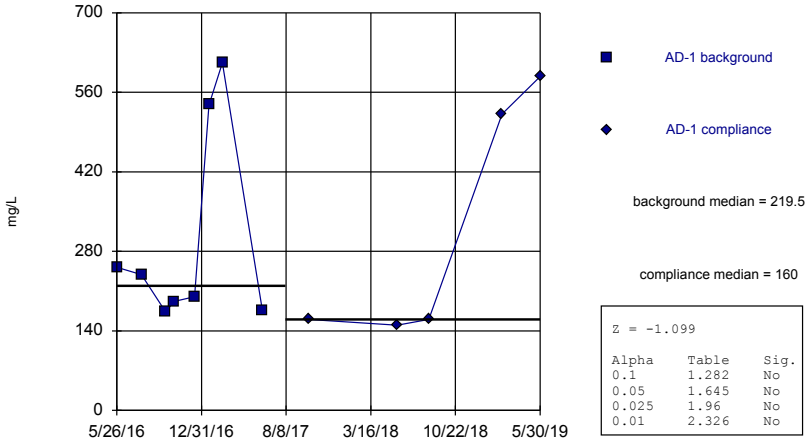
AD-5 (bg)



Constituent: Sulfate Analysis Run 11/7/2019 10:35 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-1 (bg)



Z = -1.099

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

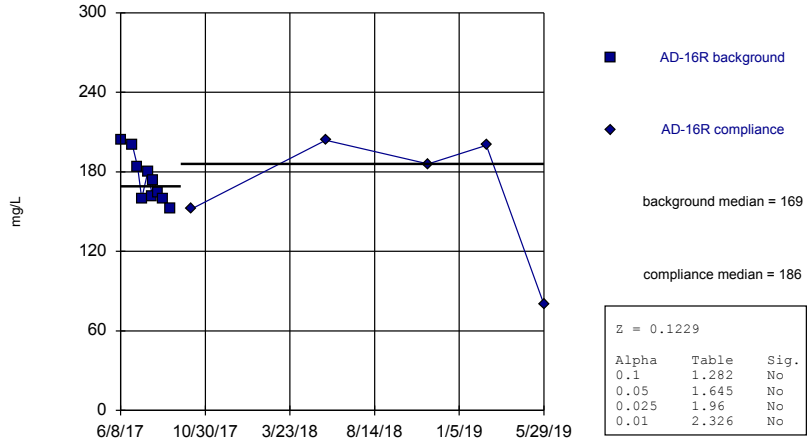
Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-16R



Z = 0.1229

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

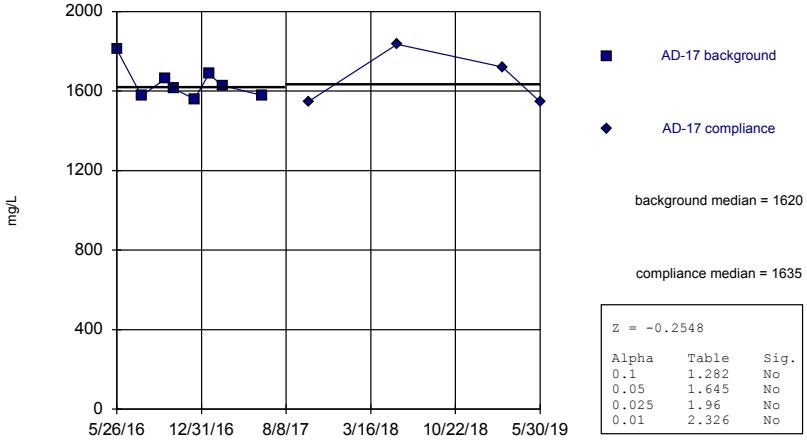
Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-17 (bg)



Z = -0.2548

Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

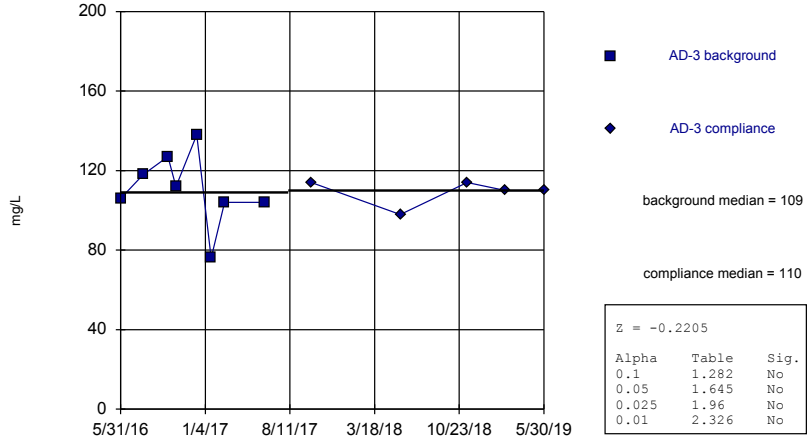
Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-3



Z = -0.2205

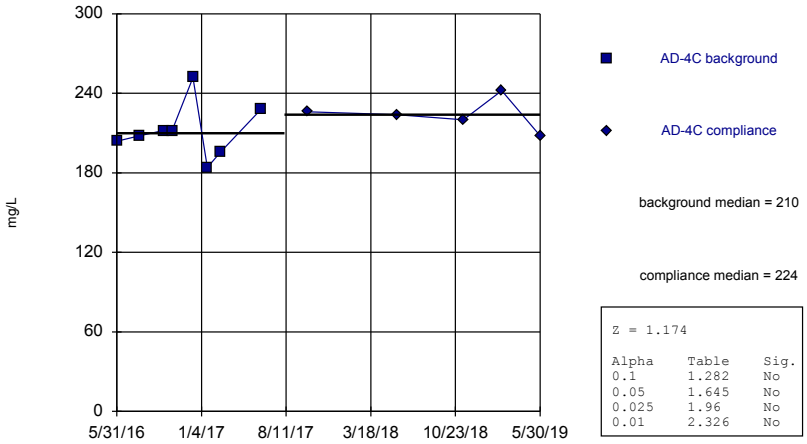
Alpha	Table	Sig.
0.1	1.282	No
0.05	1.645	No
0.025	1.96	No
0.01	2.326	No

Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Mann-Whitney (Wilcoxon Rank Sum)

AD-4C



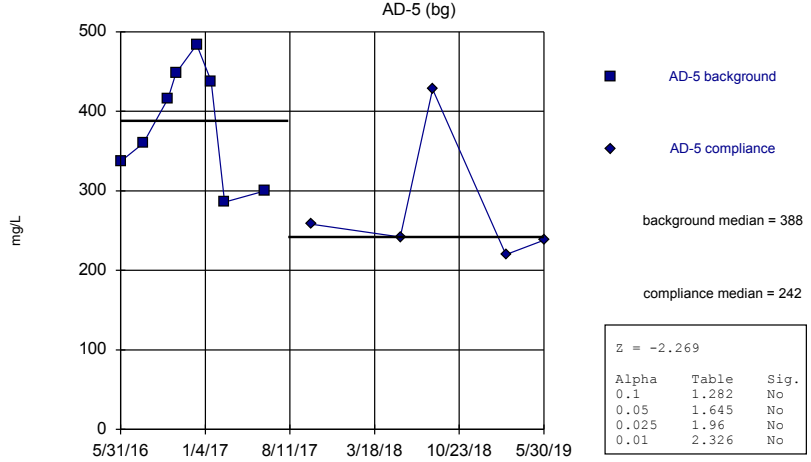
Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Mann-Whitney (Wilcoxon Rank Sum)

AD-5 (bg)



Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:35 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Figure E. Date Ranges

Date: 11/7/2019 10:33 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sulfate (mg/L)

AD-4C background:5/26/2016-12/18/2018

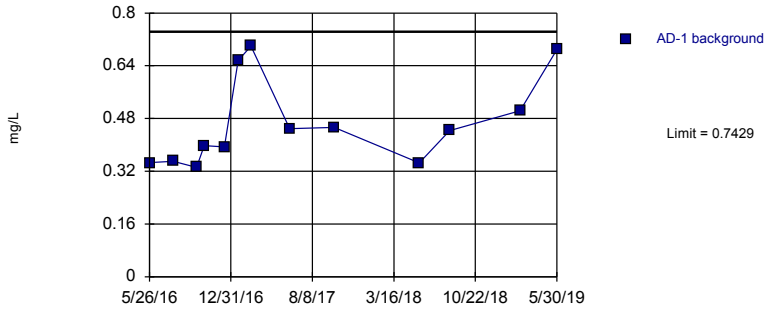
Figure F. Intrawell Prediction Limit Summary Table - All Results

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 11/7/2019, 10:39 AM

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	0.7429	n/a	n/a	1 future	n/a	13	0.4661	0.1333	0	None	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-16R	0.06376	n/a	n/a	1 future	n/a	16	0.03651	0.01384	6.25	None	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-17	0.2176	n/a	n/a	1 future	n/a	13	0.3711	0.0459	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-3	0.05798	n/a	n/a	1 future	n/a	14	0.1432	0.04783	7.143	None	sqrt(x)	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-4C	0.05294	n/a	n/a	1 future	n/a	14	0.02629	0.01306	7.143	None	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-5	0.05876	n/a	n/a	1 future	n/a	13	0.04224	0.007957	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-1	206	n/a	n/a	1 future	n/a	12	3.196	1.283	0	None	x^(1/3)	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-16R	3.149	n/a	n/a	1 future	n/a	14	1.802	0.66	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-17	206.7	n/a	n/a	1 future	n/a	12	193.3	6.384	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-3	1.319	n/a	n/a	1 future	n/a	12	0.773	0.2586	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-4C	0.9607	n/a	n/a	1 future	n/a	12	0.6093	0.1664	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-5	58.47	n/a	n/a	1 future	n/a	12	41.36	8.1	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-1	5.523	n/a	n/a	1 future	n/a	12	16.46	6.652	0	None	x^2	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-16R	8.015	n/a	n/a	1 future	n/a	14	6.694	0.6474	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-17	46.13	n/a	n/a	1 future	n/a	12	35.16	5.195	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-3	9.4	n/a	n/a	1 future	n/a	14	n/a	n/a	0	n/a	n/a	0.008612	NP Intra (normality) 1 of 2
Chloride (mg/L)	AD-4C	15.56	n/a	n/a	1 future	n/a	14	11.03	2.219	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-5	24.81	n/a	n/a	1 future	n/a	13	16.92	3.8	0	None	No	0.002505	Param Intra 1 of 2
Fluoride (mg/L)	AD-1	1	n/a	n/a	1 future	n/a	12	n/a	n/a	83.33	n/a	n/a	0.01077	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-16R	1	n/a	n/a	1 future	n/a	15	n/a	n/a	60	n/a	n/a	0.007533	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-17	0.583	n/a	n/a	1 future	n/a	12	n/a	n/a	50	n/a	n/a	0.01077	NP Intra (normality) 1 of 2
Fluoride (mg/L)	AD-3	1	n/a	n/a	1 future	n/a	13	n/a	n/a	76.92	n/a	n/a	0.009692	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-4C	1	n/a	n/a	1 future	n/a	13	n/a	n/a	84.62	n/a	n/a	0.009692	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-5	1	n/a	n/a	1 future	n/a	12	n/a	n/a	66.67	n/a	n/a	0.01077	NP Intra (NDs) 1 of 2
pH, field (SU)	AD-1	8.335	2.846	n/a	1 future	n/a	13	5.591	1.322	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-16R	4.977	2.578	n/a	1 future	n/a	18	3.778	0.6212	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-17	7.077	5.138	n/a	1 future	n/a	13	6.108	0.4667	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-3	6.604	3.124	n/a	1 future	n/a	14	4.864	0.8526	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-4C	5.809	4.235	n/a	1 future	n/a	15	5.022	0.3924	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-5	6.756	5.031	n/a	1 future	n/a	13	5.894	0.4153	0	None	No	0.001253	Param Intra 1 of 2
Sulfate (mg/L)	AD-1	68	n/a	n/a	1 future	n/a	13	n/a	n/a	0	n/a	n/a	0.009692	NP Intra (normality) 1 of 2
Sulfate (mg/L)	AD-16R	73.19	n/a	n/a	1 future	n/a	17	53.47	10.11	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-17	1194	n/a	n/a	1 future	n/a	11	1089	48.34	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-3	10.55	n/a	n/a	1 future	n/a	13	5.173	2.589	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-4C	63.73	n/a	n/a	1 future	n/a	15	44.94	9.37	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-5	311.7	n/a	n/a	1 future	n/a	13	146.1	79.77	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	13	n/a	n/a	0	n/a	n/a	0.009692	NP Intra (normality) 1 of 2
Total Dissolved Solids (mg/L)	AD-16R	221	n/a	n/a	1 future	n/a	15	30087	9358	0	None	x^2	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-17	1857	n/a	n/a	1 future	n/a	12	1647	99.38	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-3	140.4	n/a	n/a	1 future	n/a	13	110.1	14.61	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-4C	254.6	n/a	n/a	1 future	n/a	13	216.6	18.3	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-5	533.7	n/a	n/a	1 future	n/a	13	342.7	91.96	0	None	No	0.002505	Param Intra 1 of 2

Prediction Limit

Intrawell Parametric, AD-1 (bg)



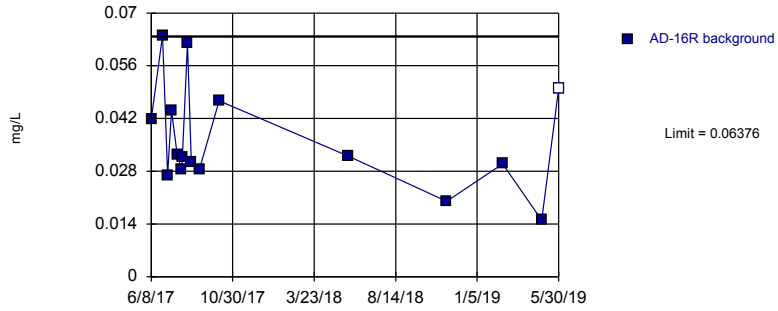
Background Data Summary: Mean=0.4661, Std. Dev.=0.1333, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8345, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-16R



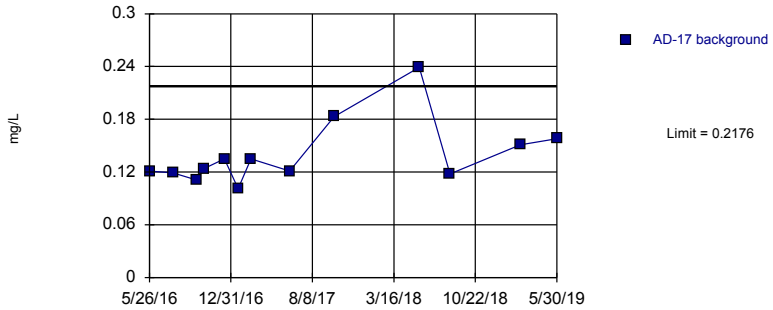
Background Data Summary: Mean=0.03651, Std. Dev.=0.01384, n=16, 6.25% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9241, critical = 0.844. Kappa = 1.97 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-17 (bg)



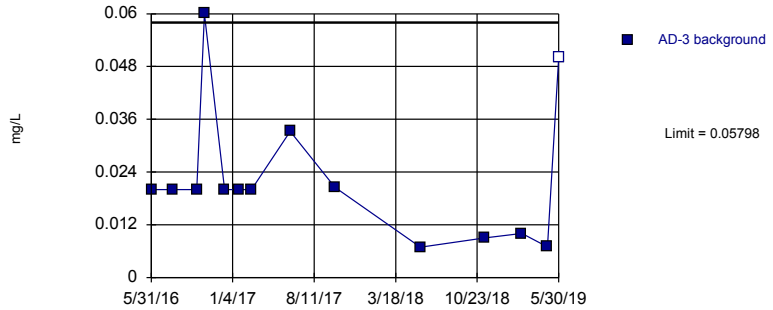
Background Data Summary (based on square root transformation): Mean=0.3711, Std. Dev.=0.0459, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8526, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-3



Background Data Summary (based on square root transformation): Mean=0.1432, Std. Dev.=0.04783, n=14, 7.143% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8693, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

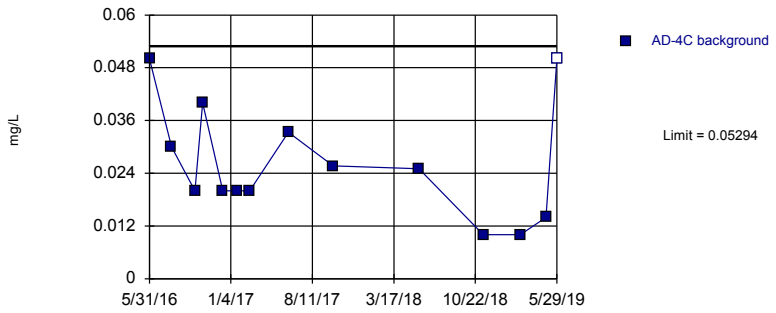
Constituent: Boron Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Hollow symbols indicate censored values.

Prediction Limit

Intrawell Parametric, AD-4C



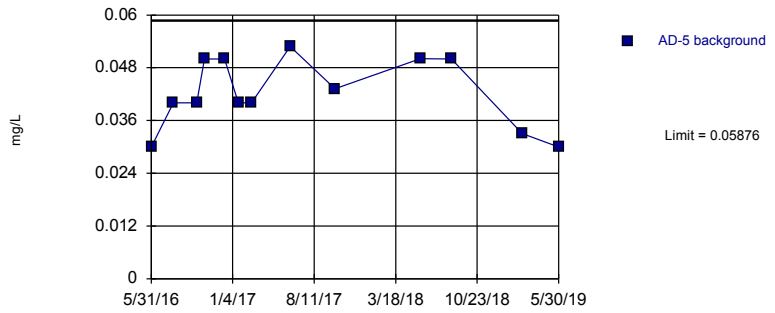
Background Data Summary: Mean=0.02629, Std. Dev.=0.01306, n=14, 7.143% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9069, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-5 (bg)



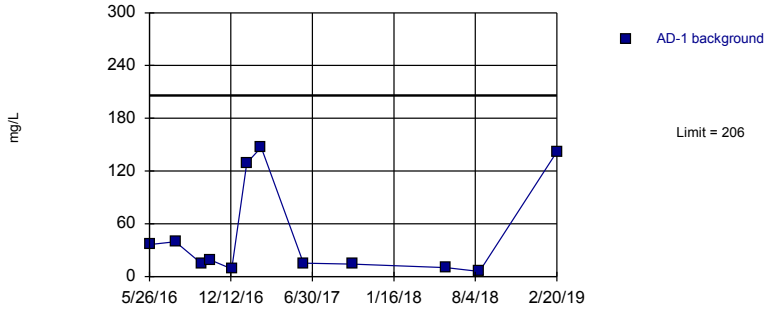
Background Data Summary: Mean=0.04224, Std. Dev.=0.007957, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8882, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-1 (bg)



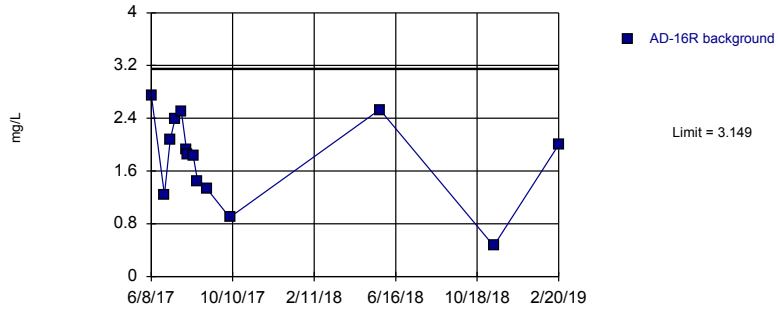
Background Data Summary (based on cube root transformation): Mean=3.196, Std. Dev.=1.283, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8246, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-16R



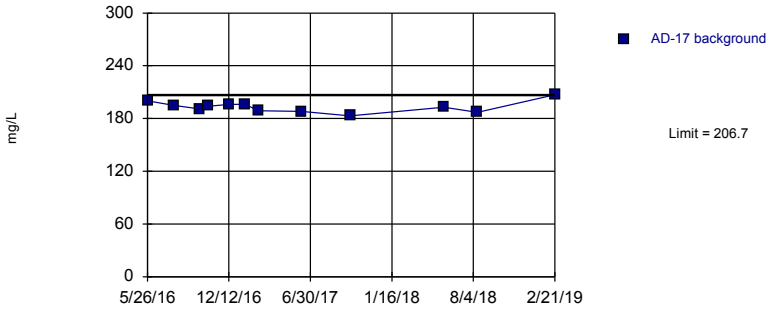
Background Data Summary: Mean=1.802, Std. Dev.=0.66, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9618, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-17 (bg)



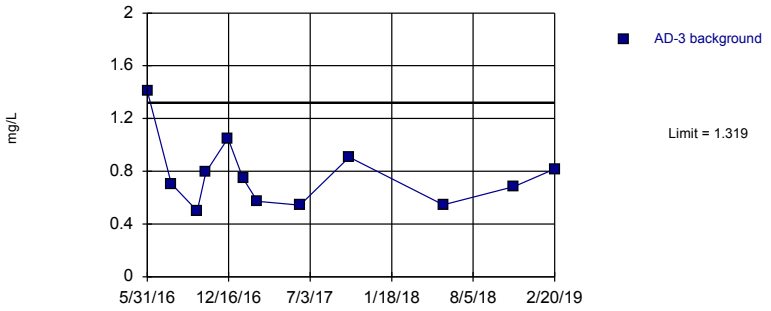
Background Data Summary: Mean=193.3, Std. Dev.=6.384, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9698, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-3



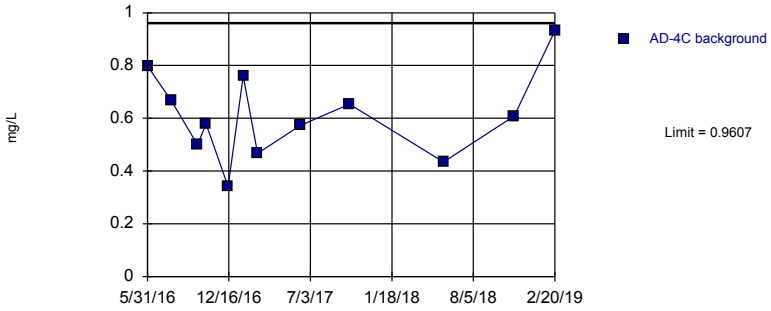
Background Data Summary: Mean=0.773, Std. Dev.=0.2586, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8744, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-4C



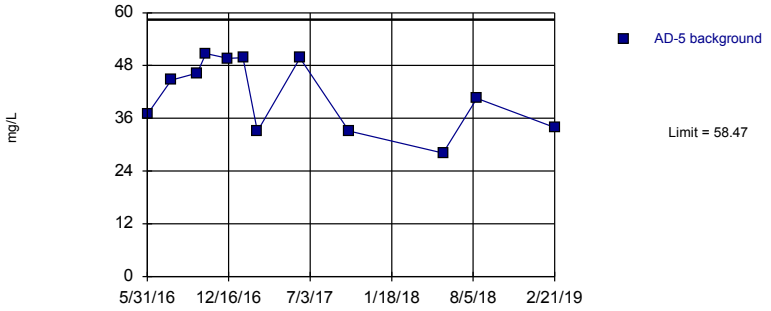
Background Data Summary: Mean=0.6093, Std. Dev.=0.1664, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9854, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-5 (bg)



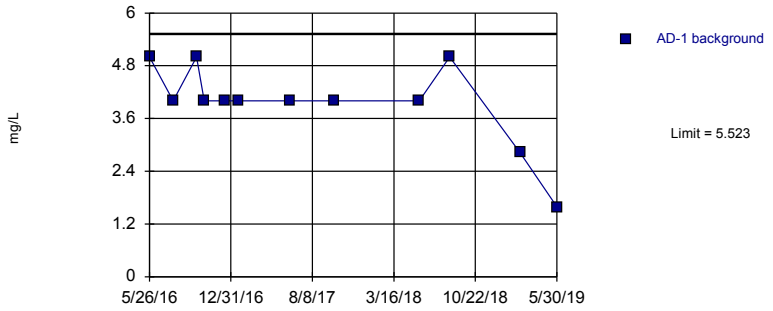
Background Data Summary: Mean=41.36, Std. Dev.=8.1, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8897, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-1 (bg)



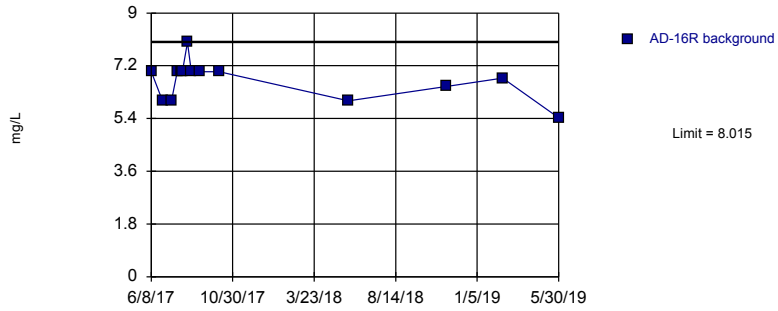
Background Data Summary (based on square transformation): Mean=16.46, Std. Dev.=6.652, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8287, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-16R



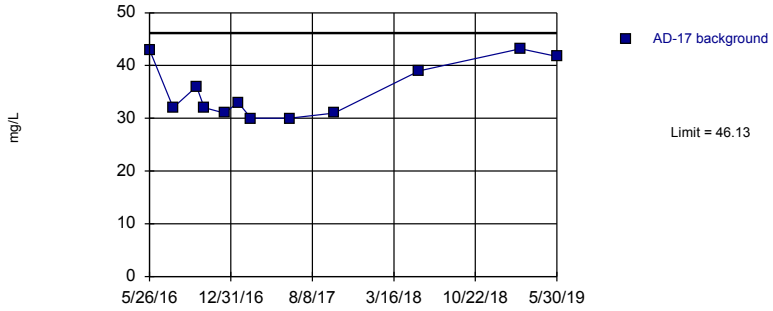
Background Data Summary: Mean=6.694, Std. Dev.=0.6474, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8766, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-17 (bg)



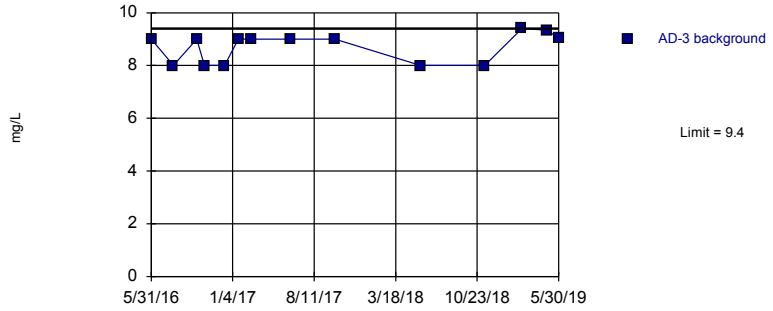
Background Data Summary: Mean=35.16, Std. Dev.=5.195, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8334, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Non-parametric, AD-3



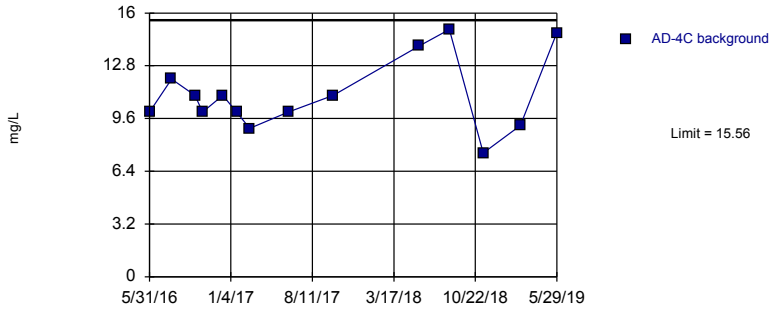
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 14 background values. Well-constituent pair annual alpha = 0.01715. Individual comparison alpha = 0.008612 (1 of 2). Assumes 1 future value.

Constituent: Chloride Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-4C



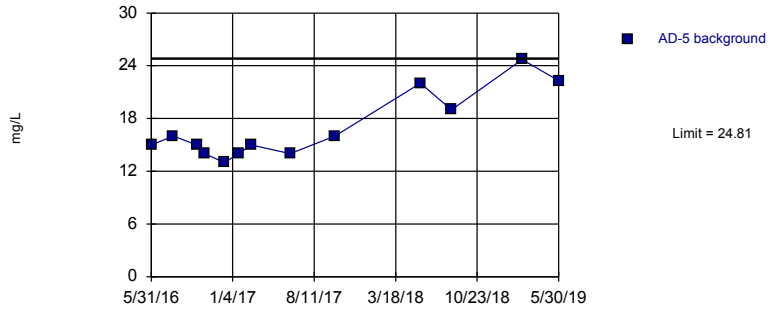
Background Data Summary: Mean=11.03, Std. Dev.=2.219, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9097, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-5 (bg)



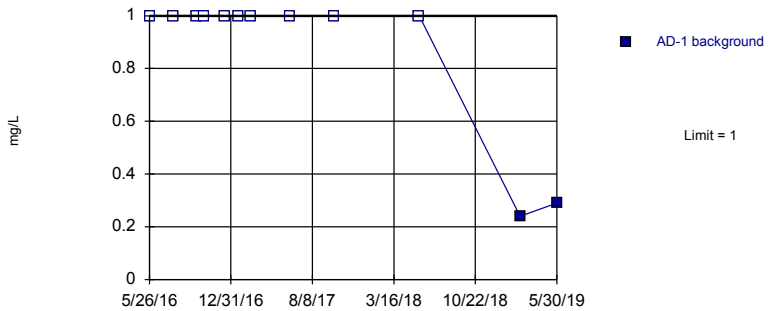
Background Data Summary: Mean=16.92, Std. Dev.=3.8, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8277, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Non-parametric, AD-1 (bg)



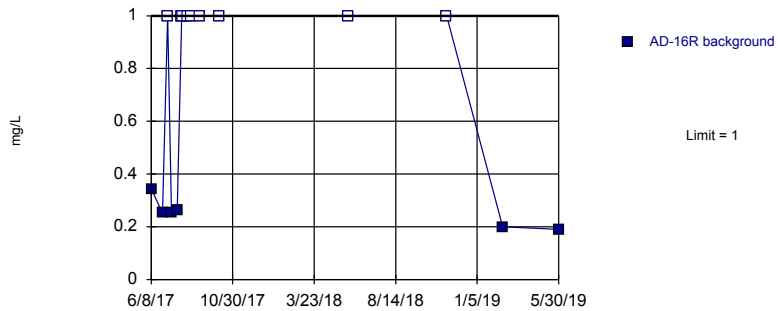
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 12 background values. 83.33% NDs. Well-constituent pair annual alpha = 0.02143. Individual comparison alpha = 0.01077 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Non-parametric, AD-16R



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 15 background values. 60% NDs. Well-constituent pair annual alpha = 0.01501. Individual comparison alpha = 0.007533 (1 of 2). Assumes 1 future value.

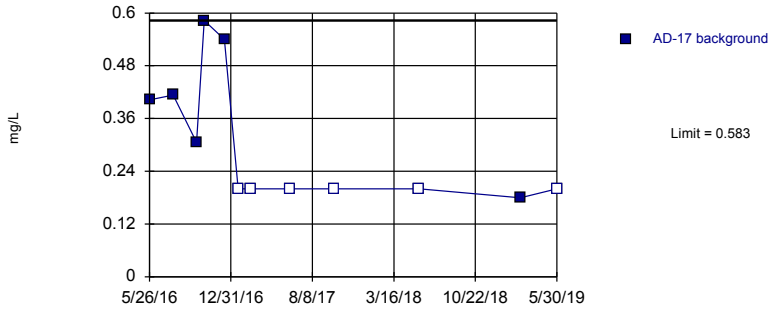
Constituent: Fluoride Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, AD-17 (bg)



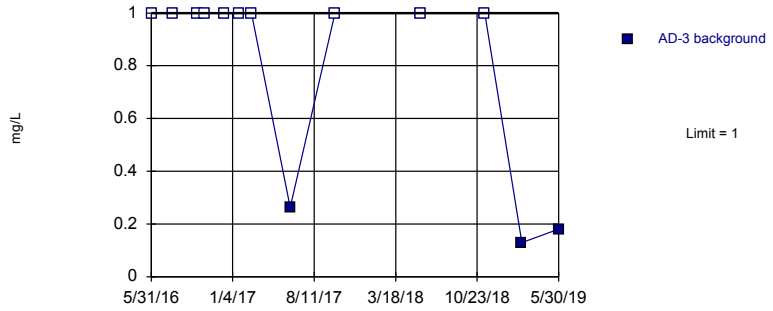
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 12 background values. 50% NDs. Well-constituent pair annual alpha = 0.02143. Individual comparison alpha = 0.01077 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 11/7/2019 10:38 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, AD-3



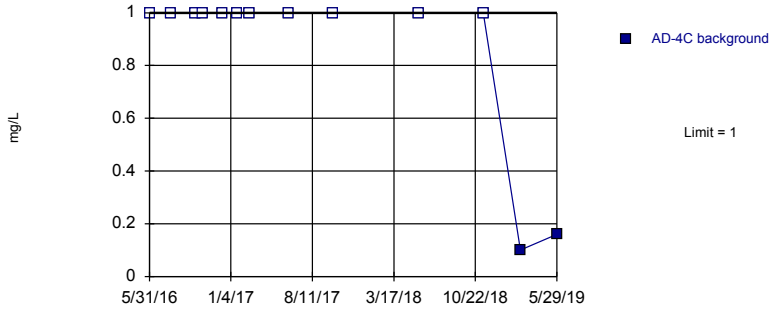
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 13 background values. 76.92% NDs. Well-constituent pair annual alpha = 0.01929. Individual comparison alpha = 0.009692 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 11/7/2019 10:38 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, AD-4C



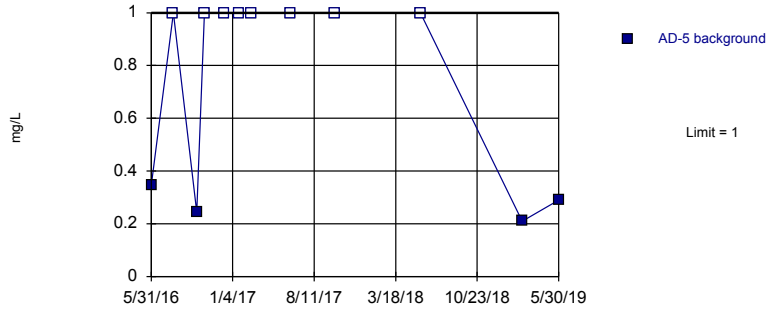
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 13 background values. 84.62% NDs. Well-constituent pair annual alpha = 0.01929. Individual comparison alpha = 0.009692 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 11/7/2019 10:38 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, AD-5 (bg)

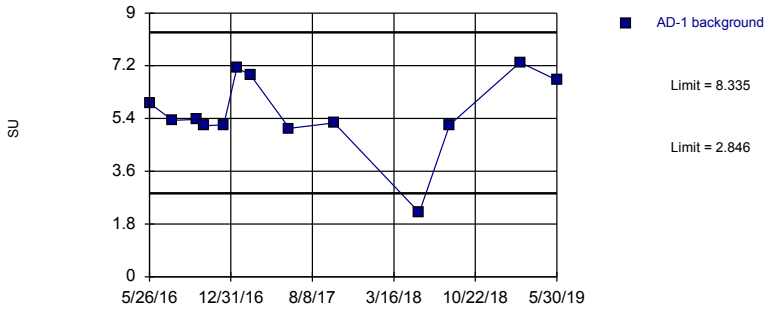


Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 12 background values. 66.67% NDs. Well-constituent pair annual alpha = 0.02143. Individual comparison alpha = 0.01077 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 11/7/2019 10:38 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-1 (bg)



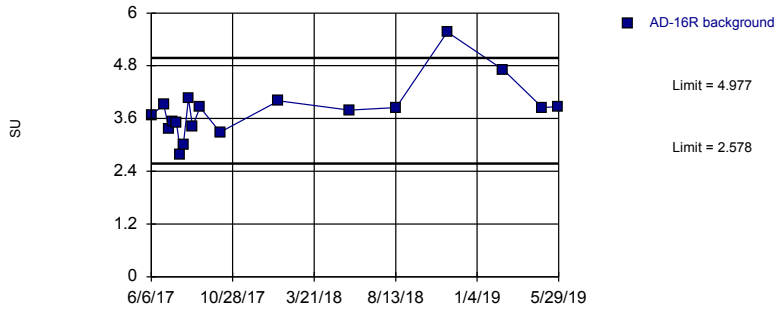
Background Data Summary: Mean=5.591, Std. Dev.=1.322, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8413, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-16R



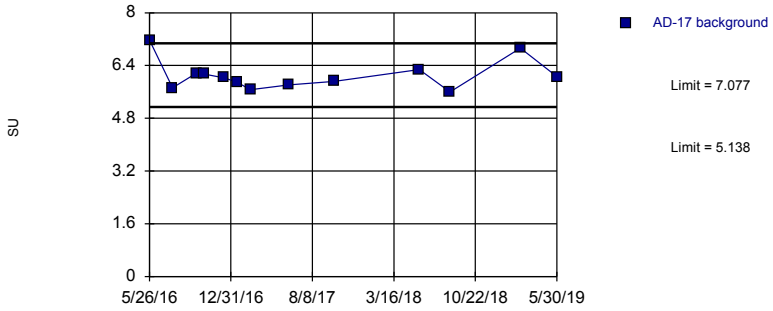
Background Data Summary: Mean=3.778, Std. Dev.=0.6212, n=18. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8834, critical = 0.858. Kappa = 1.931 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-17 (bg)



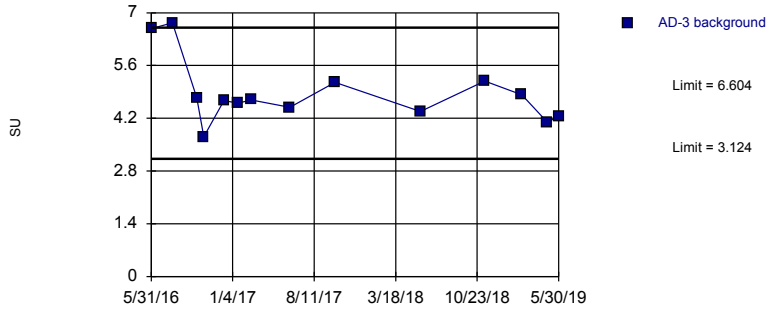
Background Data Summary: Mean=6.108, Std. Dev.=0.4667, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8501, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-3



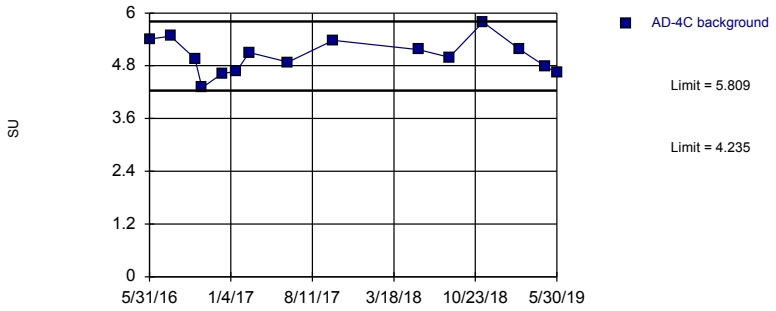
Background Data Summary: Mean=4.864, Std. Dev.=0.8526, n=14. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8501, critical = 0.825. Kappa = 2.041 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-4C



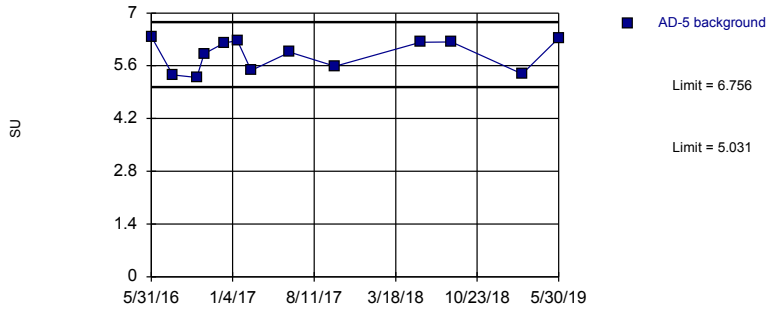
Background Data Summary: Mean=5.022, Std. Dev.=0.3924, n=15. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9865, critical = 0.835. Kappa = 2.006 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/7/2019 10:38 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-5 (bg)



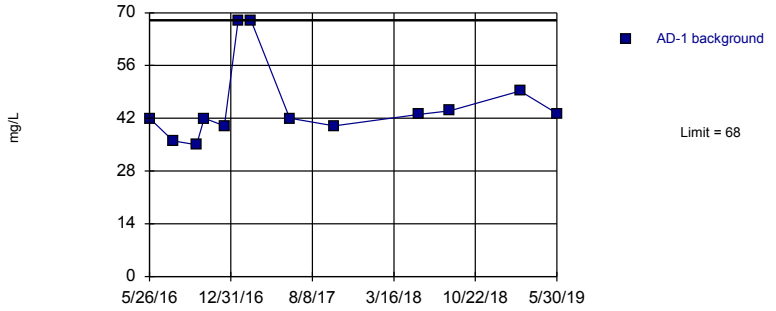
Background Data Summary: Mean=5.894, Std. Dev.=0.4153, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8601, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 11/7/2019 10:38 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, AD-1 (bg)



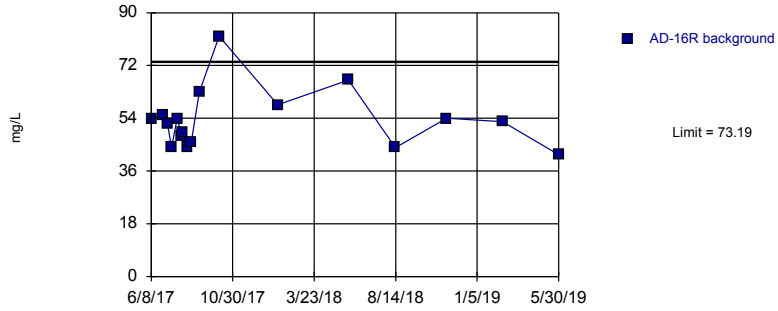
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 13 background values. Well-constituent pair annual alpha = 0.01929. Individual comparison alpha = 0.009692 (1 of 2). Assumes 1 future value.

Constituent: Sulfate Analysis Run 11/7/2019 10:38 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-16R

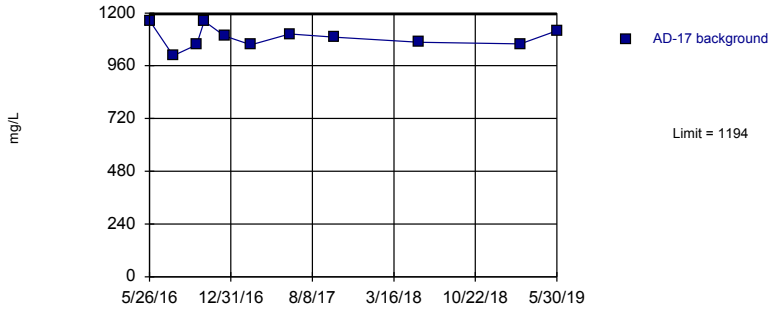


Background Data Summary: Mean=53.47, Std. Dev.=10.11, n=17. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8735, critical = 0.851. Kappa = 1.951 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 11/7/2019 10:38 AM
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-17 (bg)



Background Data Summary: Mean=1089, Std. Dev.=48.34, n=11. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9517, critical = 0.792. Kappa = 2.175 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

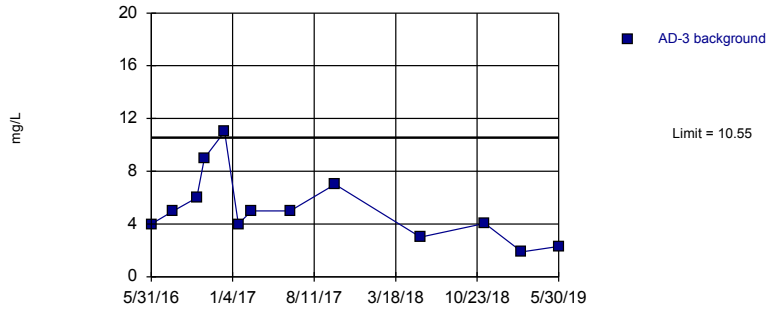
Constituent: Sulfate Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-3



Background Data Summary: Mean=5.173, Std. Dev.=2.589, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9137, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

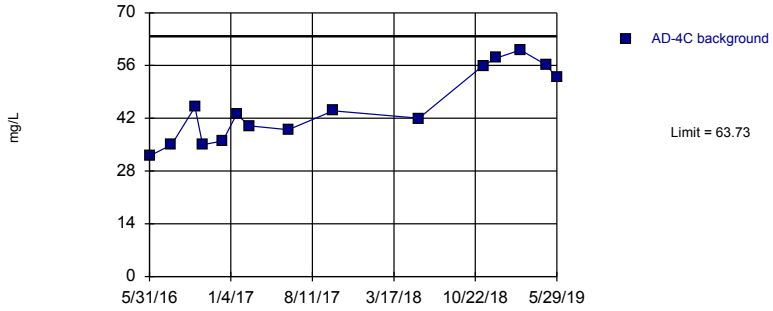
Constituent: Sulfate Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-4C



Background Data Summary: Mean=44.94, Std. Dev.=9.37, n=15. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9138, critical = 0.835. Kappa = 2.006 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

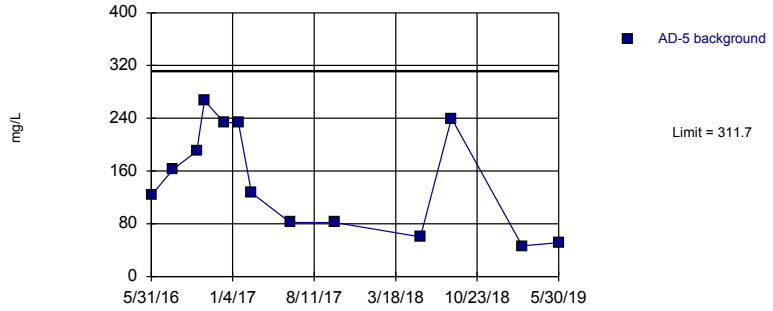
Constituent: Sulfate Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-5 (bg)



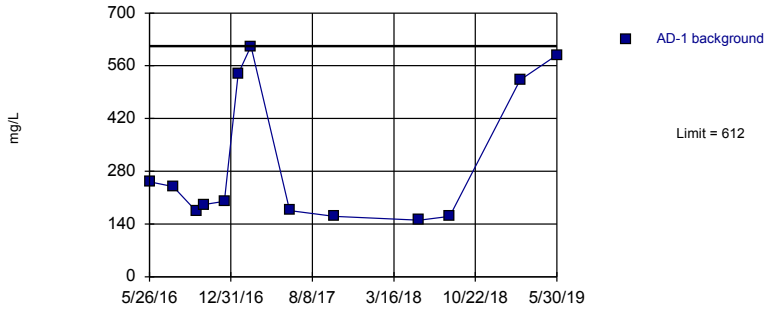
Background Data Summary: Mean=146.1, Std. Dev.=79.77, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9036, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Non-parametric, AD-1 (bg)



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 13 background values. Well-constituent pair annual alpha = 0.01929. Individual comparison alpha = 0.009692 (1 of 2). Assumes 1 future value.

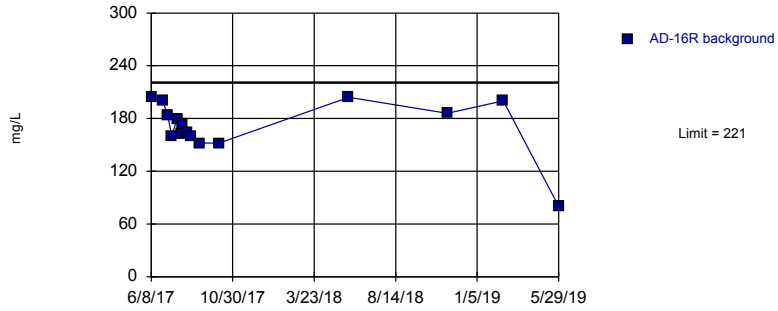
Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-16R



Background Data Summary (based on square transformation): Mean=30087, Std. Dev.=9358, n=15. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9045, critical = 0.835. Kappa = 2.006 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

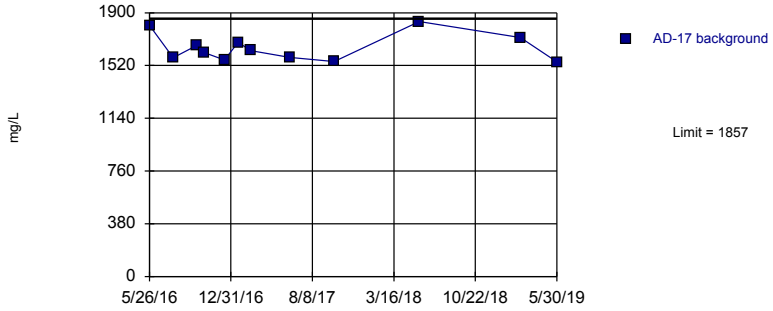
Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-17 (bg)



Background Data Summary: Mean=1647, Std. Dev.=99.38, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8827, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

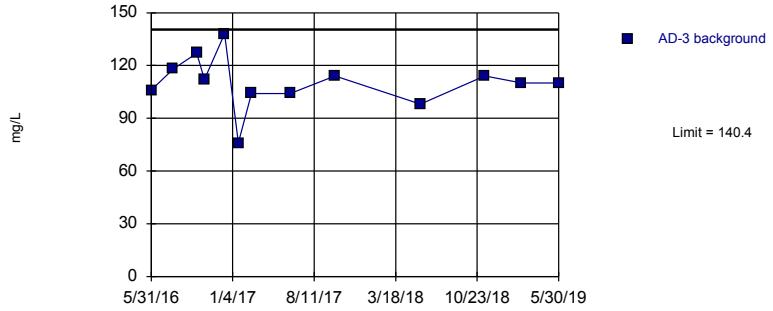
Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-3



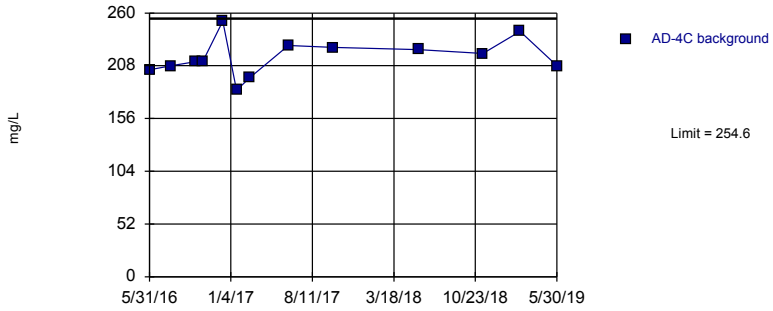
Background Data Summary: Mean=110.1, Std. Dev.=14.61, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9352, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-4C



Background Data Summary: Mean=216.6, Std. Dev.=18.3, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9809, critical = 0.814. Kappa = 2.077 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

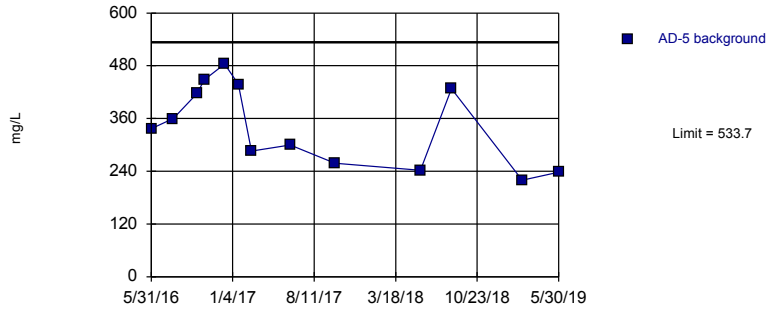
Constituent: Total Dissolved Solids Analysis Run 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.23 Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-5 (bg)



Background Data Summary: Mean=342.7, Std. Dev.=91.96, n=13. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9173, critical = 0.814. Kappa = 2.077 (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 11/7/2019 10:38 AM

Welsh BASP Client: Geosyntec Data: Welsh BASP

APPENDIX III

Alternate source demonstrations are 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
Pittsburg, Texas

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

94 Chatham Lane
Suite 103
Columbus, Ohio 43221

January 7, 2019

CHA8462

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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
LPL	Lower Prediction Limit
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

Eight to ten background monitoring events were conducted at the Welsh Bottom Ash Storage Pond (BASP), and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. A lower prediction limit (LPL) was also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceeds the UPL. In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed. Following two detection monitoring events at the BASP, an SSI for chloride at well AD-4C was identified by intrawell analysis.

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

In accordance with the United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments, Rule 40 CFR 257.94(e)(2) states the following:

> *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.*

Two detection monitoring events were conducted on May 23-24, 2018 and August 14, 2018 at the Welsh BASP to identify SSIs over background limits. The CCR Rule allows the owner or operator 90 days from the determination of an SSI to demonstrate that the SSI resulted from a source other than the regulated CCR unit, such as an error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

Pursuant to the Rule, Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report, which documents that the SSIs cited above should not be attributed to the Welsh BASP.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which identified SSIs could be attributed. Alternative sources were identified amongst five types, based on methodology provided by 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 show that the increases in constituent concentrations were based on a Type IV cause and not by a release from the Welsh BASP.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The CCR Rule allows the owner or operator 90 days from the determination of an SSI to demonstrate that a source other than the CCR unit caused the SSI. Identified SSIs, evaluation methodology, and the proposed alternative source are described below.

2.1 Proposed Alternative Source

Initial review of site geochemistry, site historical data, and laboratory QA/QC did not identify ASDs due to Type I or Type II issues. A review of the statistical analyses did not identify any Type III issues. An initial review of site geochemistry revealed natural variation as a source of the observed chloride SSI at well AD-4C.

A site map showing well locations is presented in Figure 1. Groundwater flow beneath the BASP is typically to the southeast, as shown in Figure 2. Wells of interest to this ASD include AD-1, which lies upgradient of the BASP and downgradient wells AD-3 and AD-4C.

Figure 3 summarizes groundwater composition at the wells of interest using a Schoeller diagram. The Schoeller diagram shows that downgradient wells AD-4C and AD-3 are deficient in calcium, magnesium and bicarbonate (collectively known as hardness species), relative to AD-1. Contrary to the hardness species, the concentrations of sodium and chloride are identical between AD-1 and AD-4C. During two sampling events AD-1 groundwater is in equilibrium with calcite, a major mineral in limestone, whereas both AD-3 and AD-4C are significantly undersaturated based on the calculated saturation indices (Table 2). Both AD-3 and AD-4C strongly resemble storm water due to the near absence of calcium and magnesium (both were less than 1 mg/L during the sampling event).

AD-4C could be susceptible to surface water or rainwater intrusion due to its shallow construction. The filter pack extends to four feet below ground surface (ft bgs) and the screened interval is from 5-15 ft bgs (Arcadis, 2018). Figure 4 shows an inverse relationship between groundwater elevation and chloride concentration over time. These results suggest that as groundwater rises, likely due to infiltration from surface water, the chloride concentration in the groundwater is diluted. The groundwater elevation at AD-4C appears to be trending downwards since January 2017, with an increasing trend for chloride observed. Despite recent increases, the concentrations remain consistent with historical values at the well.

The second semi-annual detection monitoring event for 2018 was completed in November 2018, with a reported chloride concentration of 7.5 milligrams per liter (mg/L), which is below the UPL of 14 mg/L. The decline in chloride concentrations at AD-4C suggest that the SSI was due to a temporary variation in groundwater conditions and is an additional line of evidence that the chloride SSI should not be attributed to a release from the BASP.

2.2 Sampling Requirements

As the ASD described above supports the position that the identified SSIs are not due to a release from the Welsh BASP, the unit will remain in the detection monitoring program. Groundwater at the unit will 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 SSIs in Appendix III detection monitoring constituents are not due to a release from the Welsh BASP during the May and August 2018 sampling events. The identified SSI for chloride at well AD-4C was attributed to natural variation, and concentrations have since declined below the upper prediction limit. 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, 2018. Bottom Ash Storage Pond – CCR Groundwater Monitoring Well Network Evaluation. February 2018.

EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Site. 3002010920. October

U.S. EPA, 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 Plant - Bottom Ash Storage Pond

Geosyntec Consultants, Inc.

Parameter	Units	Description	AD-3	AD-4C		AD-16R	
			5/24/2018	5/24/2018	8/14/2018	5/23/2018	8/14/2018
Boron	mg/L	Intrawell Background Value (UPL)	0.0333	0.0571		0.0700	
		Detection Monitoring Data	0.0069 J	0.0251	--	0.0320	--
Calcium	mg/L	Intrawell Background Value (UPL)	1.541	0.962		3.069	
		Detection Monitoring Data	0.545	0.434	--	2.53	--
Chloride	mg/L	Intrawell Background Value (UPL)	9	12.6		8.3	
		Detection Monitoring Data	8	**14**	**15**	6	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1	1		1	
		Detection Monitoring Data	<0.083	<0.083	--	<0.083	--
pH	SU	Intrawell Background Value (UPL)	7.63	5.91		4.4	
		Intrawell Background Value (LPL)	2.43	3.95		2.61	
		Detection Monitoring Data	4.38	5.17	--	3.79	--
Sulfate	mg/L	Intrawell Background Value (UPL)	12.4	49.0		64.1	
		Detection Monitoring Data	3	42	--	**67**	44
TDS	mg/L	Intrawell Background Value (UPL)	156	263		214	
		Detection Monitoring Data	98	224	--	204	--

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
J: Estimated value
<: Indicates the parameter was not detected
Bold values exceed the background value.
Background values are shaded gray.
--: sample was not collected

Table 2: Calculated Calcite Saturation Indices
Welsh Bottom Ash Storage Pond

Well ID	Date	Calcite ($CaCO_3$) Saturation Index
AD-1	10/21/2016	-3.12
	01/20/2017	0.22
	02/24/2017	0.19
	06/08/2017	-3.48
AD-3	10/21/2016	-6.37
	01/20/2017	-6.04
	02/24/2017	-6.04
	06/08/2017	-6.15
AD-4	10/21/2016	-5.97
	01/20/2017	-5.82
	02/24/2017	-5.73
	06/08/2017	-5.77

Notes:
Calculated SIs greater than -0.2 suggest saturation of the mineral and are shaded red in red text.

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 avilable in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016).

500 250 0 500 Feet

Site Layout
Bottom Ash Storage Pond

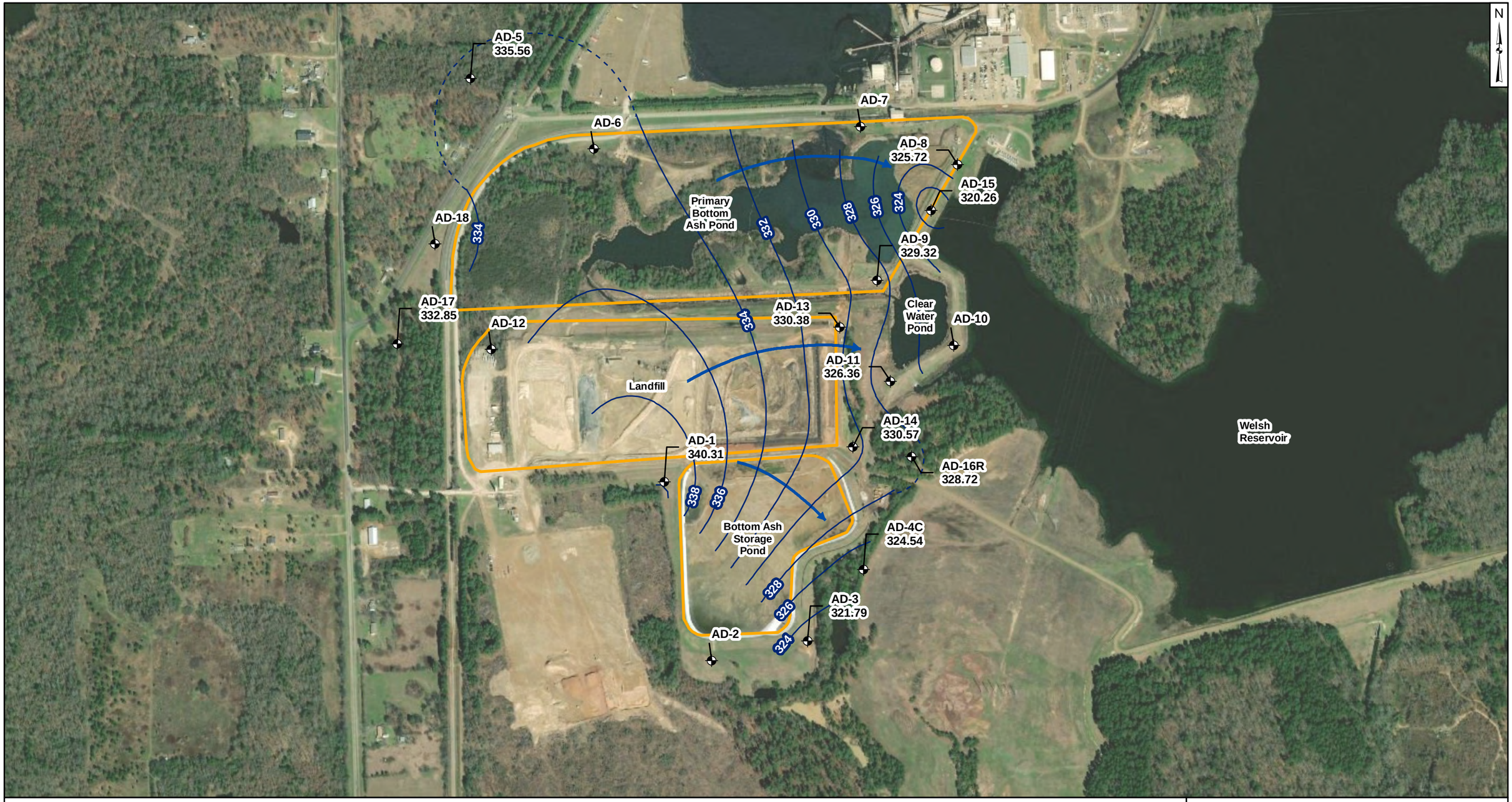
AEP Welsh Power Plant
Cason, Texas

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure **1**

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Welsh\MXDs\AEP-Welsh_BASP_Site_Layout.mxd. MMuenich. 1/26/2018. CHA8423/14/08.



Legend

- Groundwater Monitoring Well
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- CCR Units

Notes

- Monitoring well coordinates and water level data (collected on May 23, 2018) provided by AEP.
- Site features based on information avilable in CCR Groundwater Monitoring Well Network Evaluations (Arcadis, 2016).
- Groundwater elevation units are feet above mean sea level.
- Inferred groundwater contours were extrapolated from topgraphic and hydrographic information as well as previous monitoring events.
- AD-16 was replaced with AD-16R on 4/12/2017.
- Wells AD-2, -6, -7, -10 ,-12, and -18 were not gauged during the May 2018 sampling event.

750 375 0 750 Feet

Groundwater Potentiometric Map
May 2018

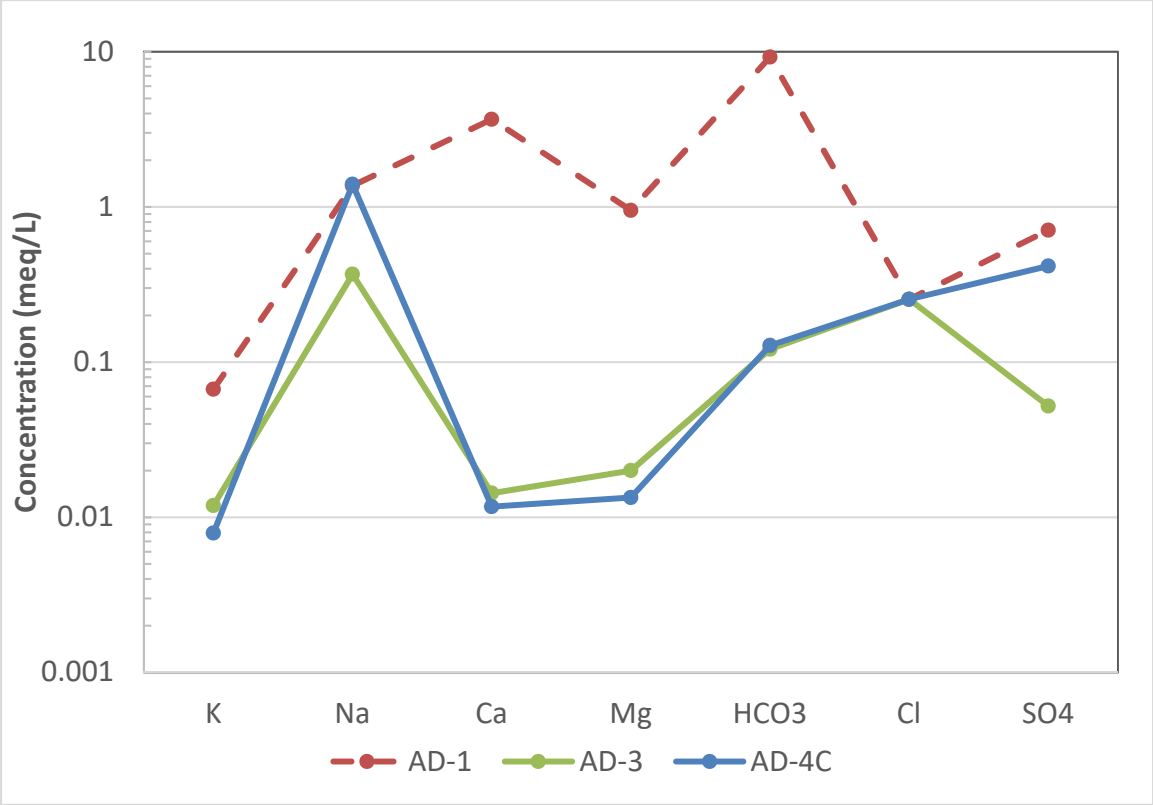
AEP Welsh Power Plant
Cason, Texas

Geosyntec consultants

Columbus, Ohio | 2018/10/24

Figure 2

\\annarbor-01\data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Welsh\2018\AEP-Welsh_GW_2018-05May.mxd. SKaroly. 10/24/2018. CHA8423/14/08.



Notes: Schoeller diagram for BASP upgradient well AD-1 and downgradient wells based on February 24, 2017 groundwater sampling event.

Schoeller Diagram
Welsh Bottom Ash Storage Pond

Geosyntec consultants

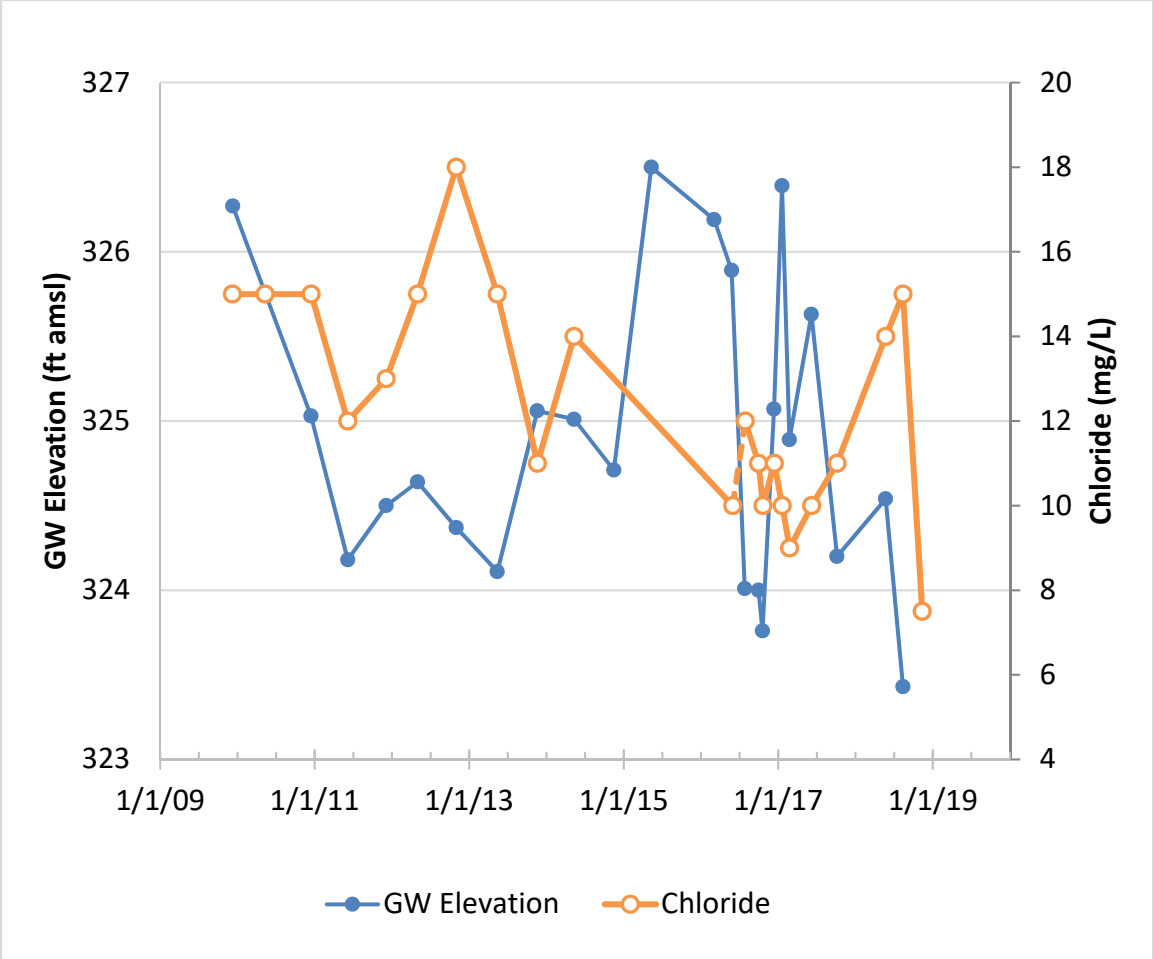
AMERICAN ELECTRIC POWER

Figure **3**

Columbus, Ohio

4-JAN-2019

internal info: path, date revised, author



Notes: Chloride data includes both historic data and data collected for CCR Rule compliance.

AD-4C Time Series Graph
Welsh Bottom Ash Storage Pond

Geosyntec consultants | AMERICAN ELECTRIC POWER

Columbus, Ohio | 4-JAN-2019

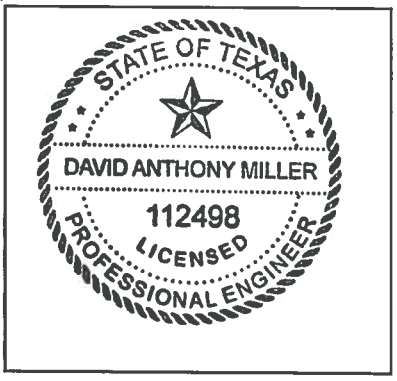
Figure **4**

internal info: path, date revised, author

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 40 CFR 257.94(e)(2) have been met.



DAVID ANTHONY MILLER
Printed Name of Licensed Professional Engineer

David Anthony Miller
Signature

112498	TEXAS	01.07.19
License Number	Licensing State	Date

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

J. Robert Welsh Plant
Bottom Ash Storage Pond
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1 Riverside Plaza
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Submitted by

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May 17, 2019

CHA8462

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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
LPL	Lower Prediction Limit
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

Eight to ten background monitoring events were conducted at the Welsh Bottom Ash Storage Pond (BASP). Upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. A lower prediction limit (LPL) was also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceeds the UPL and for pH exceeds the LPL. In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

The second semi-annual detection monitoring event was performed in November 2018 (initial sampling event) and December 2018 (re-sampling event), and the results were compared to the calculated prediction limits. An SSI was identified for sulfate at well AD-4C by intrawell analysis. 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 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.*

Sulfate concentrations of 56 mg/L and 58 mg/L were reported for the sampling and re-sampling events on November 13, 2018 and December 18, 2018, respectively. Both concentrations exceeded the UPL value for sulfate of 49 mg/L. Pursuant to 40 CFR 257.94(e)(2) of the CCR Rule (40 CFR 257), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report, which documents that the SSI for sulfate at AD-4C should not be attributed to the Welsh BASP.

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 amongst five types, based on methodology provided by 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 show that the increases in constituent concentrations were based on either a Type IV or Type V cause and not by a release from the Welsh BASP.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The method used to assess possible alternative sources of the SSI for sulfate at AD-4C and the proposed alternative source are described below. In addition, the statistical revision of the background concentration for sulfate at AD-4C and the future sampling requirements for the Welsh BASP are presented.

2.1 Proposed Alternative Source

An initial review of field forms, site geochemistry, and laboratory QA/QC data did not identify alternative sources due to Type I or Type II issues. A review of the statistical analyses of the groundwater data for sulfate did not identify any Type III issues. However, a review of site geochemistry and historic operations revealed a change in chemistry at an upgradient well, due to either Type IV or Type V causes, as a potential source of the observed sulfate SSI at well AD-4C.

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

The two exceedances for sulfate at AD-4C in November and December 2018 are shown in a time-series graph (Figure 3), where the dashed line represents the intrawell UPL for sulfate (49 mg/L). Overall, the concentration of sulfate appears to be increasing. Also shown are the sulfate concentrations at background well AD-1, which is the background well closest to AD-4C. The sulfate concentrations at AD-1 are commensurate with those of AD-4C in eight of the ten background monitoring events. In January and February 2017, sulfate at AD-1 was 68 mg/L, which was considerably higher than the other eight results for AD-1 as well as the results for AD-4C.

A Schoeller diagram was prepared for AD-1 to illustrate major constituent behavior for the four background sampling events where all data were available (Figure 4). Note that concentration units were converted to milli-equivalents per liter (meq/L), which allows the major cations and anions to be compared on a charge-equivalent basis. The rule of charge balance also requires that the sum of the major cations (potassium + sodium + calcium + magnesium) must be equal to the sum of the major anions (chloride + sulfate + bicarbonate + carbonate [if pH > 10]), when expressed in meq/L units. Calcium, magnesium and bicarbonate (collectively known as hardness species) were up to an order of magnitude higher in January and February 2017 compared to October 2016 and June 2017. In contrast, the concentration of sulfate increased approximately 50%, while sodium and chloride changed very little. Thus, while the sulfate concentration changed during these events, the magnitude of change in its concentration was much smaller than the charge in hardness species during the same time period.

A geochemical model (PHREEQC) was used to help explain the significance of species concentrations with respect to equilibrium with aquifer minerals. Calculated mineral saturation indices for calcite and gypsum for background well AD-1 and compliance wells AD-3 and AD-4C, which are located downgradient of AD-1, are presented in Table 2. Mineral saturation indices with a numerical value of zero (±0.2) indicate that the represented minerals are in equilibrium with the groundwater. Values less than -0.2 indicate undersaturation, implying that the represented minerals are not present in the aquifer. Model results show that AD-1 groundwater was in equilibrium with the mineral calcite ($CaCO_3$) during January and February 2017. However, the groundwater was undersaturated with respect to both calcite and gypsum in the October 2016 and June 2017 events. All AD-3 and AD-4C samples were significantly undersaturated with respect to calcite, as indicated by the large negative values in Table 2. Modeling results indicate that groundwater in wells AD-1, AD-3 and AD-4C is undersaturated with respect to gypsum ($CaSO_4 \cdot 2H_2O$) at all sampling events. Calcite crystals are known to precipitate and dissolve quickly as groundwater conditions either become conducive to calcite formation or disfavor it (Sanjuan and Girard, 1996). However, it is infeasible for the mineralogy of an entire aquifer to change in a matter of months. Therefore, the model results suggest that calcite is typically not present in the aquifer. The situation at AD-1, where the groundwater became saturated with respect to calcite in January and February 2017, appears to be transient and caused by a rapid increase in calcium and alkalinity, along with other subtle changes in composition (Figure 4). At other times (e.g., October 2016 and June 2017) the unidentified source of calcium and alkalinity is not active, and groundwater no longer appears to be in equilibrium with calcite.

Concentrations of sulfate at upgradient well AD-1 have been even higher in the past than the values observed in 2017 during the CCR Rule background monitoring period. Prior to establishing the groundwater monitoring network for the BASP, the Plant monitored wells AD-1 and AD-4C for sulfate and other groundwater constituents. Sulfate concentrations at AD-4C were typically around 25-30 mg/L between 2009 and 2014, which is lower than the concentrations observed during the background monitoring period (35-45 mg/L, as shown in Figure 3). Prior to 2009, sulfate concentrations at AD-1 were generally much higher and subject to significant upward swings, including a peak value of 616 mg/L sulfate on in June 2007 (Figure 5).

Sulfate concentrations are also high at other locations across the Site. Upgradient well AD-17, which is located further northwest from the BASP than AD-1, had sulfate concentrations above 1,000 mg/L for the entire background monitoring period (Figure 6). Groundwater samples collected from borings advanced in 2009 approximately 0.5 miles to the north of the BASP to evaluate background conditions identified a maximum sulfate concentration of 156 mg/L (Geosyntec, 2009). These results suggest either sulfate is naturally highly variable or groundwater concentrations are fluctuating in response to a variety of possible sources (such as site activities) across the site.

While the source of upgradient impacts to AD-1, and thus the increase in sulfate at AD-4C cannot be identified, it does not appear to be caused by a release from the pond. No other Appendix III species have a similar increase, which would be expected if there was a release (Figure 7). This includes several species which are more conservative than sulfate and have relatively higher

concentrations in the pond water than in groundwater, such as potassium and sodium (Figure 8), suggesting that no mixing is occurring between the pond water and groundwater at AD-4C.

The recent SSI for sulfate at AD-4C is best attributed to variations in the groundwater chemistry that are observed at multiple locations. The source of the perturbations in groundwater is not known and could include either natural variability or plant activities, such as site construction or pond management, which could affect groundwater quality. Additionally, the lack of increase in other constituent concentrations suggests that the sulfate SSI should not be attributed to a release from the BASP.

2.2 Statistical Revision

When historical data is included with results collected under the CCR Rule, an upward trend is observed for sulfate at AD-4C (Figure 9). This trend may be representative of higher sulfate concentrations observed across the site, including at upgradient locations AD-1 and AD-17. As the increase in sulfate does not appear to be related to a release from the BASP, the background dataset was revised to include the four most recent sampling events (October 2017, 44 mg/L; May 2018, 42 mg/L; November 2018, 56 mg/L; December 2018, 58 mg/L). The intrawell UPL at AD-4C for sulfate was recalculated as 59.1 mg/L. This value will be used in detection monitoring events going forward until the background dataset is revised following the collection of at least four additional samples. The revised statistics are provided in Attachment A.

2.3 Sampling Requirements

As the ASD described above supports the position that the identified SSIs are not due to a release from the Welsh BASP, the unit will remain in the detection monitoring program. Groundwater at the unit will 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 SSIs in Appendix III detection monitoring constituents are not due to a release from the Welsh BASP during the November and December 2018 sampling events. The identified SSI for sulfate at well AD-4C was attributed to either natural variation or anthropogenic impacts, which may be related to the sulfate perturbation that was detected at AD-1. 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 B.

SECTION 4

REFERENCES

Arcadis, 2018. Bottom Ash Storage Pond – CCR Groundwater Monitoring Well Network Evaluation. February.

EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites. 3002010920. October.

Geosyntec, 2009. Geology and Hydrogeology Report for Proposed Metal Cleaning Waste Pond. October.

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U.S. EPA, 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 Plant - Bottom Ash Storage Pond

Geosyntec Consultants, Inc.

Parameter	Units	Description	AD-3		AD-4C		AD-16R	
			11/13/2018	12/18/2018	11/13/2018	12/18/2018	11/13/2018	1/11/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.033		0.057		0.070	
		Detection Monitoring Result	0.009	-	0.01	-	0.02	-
Calcium	mg/L	Intrawell Background Value (UPL)	1.54		0.962		3.07	
		Detection Monitoring Result	0.684	-	0.609	-	0.467	-
Chloride	mg/L	Intrawell Background Value (UPL)	9.0		12.6		8.3	
		Detection Monitoring Result	8	-	7.5	-	6.5	-
Fluoride	mg/L	Intrawell Background Value (UPL)	1		1		1	
		Detection Monitoring Result	<0.083	-	<0.083	-	<0.083	-
pH	SU	Intrawell Background Value (UPL)	7.63		5.91		4.40	
		Intrawell Background Value (LPL)	2.43		3.95		2.61	
		Detection Monitoring Result	5.19	-	5.79	-	**5.57**	2.66
Sulfate	mg/L	Intrawell Background Value (UPL)	12.4		49.0		64.1	
		Detection Monitoring Result	4.05	-	**56**	**58**	54	-
Total Dissolved Solids	mg/L	Intrawell Background Value (UPL)	156		263		214	
		Detection Monitoring Result	114	-	220	-	186	-

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
-: Not Sampled
Bold values exceed the background value.
Background values are shaded gray.
Based on a 1-of-2 resampling, a statistically significant increase (SSI) is only identified when both samples in the detection monitoring period are above the calculated background

Table 2: Calculated Mineral Saturation Indices *Geosyntec Consultants*
Welsh Bottom Ash Storage Pond

Well ID	Sampling Date	Calcite	Gypsum
AD-1	1/20/2017	0.2	-1.6
	2/24/2017	0.2	-1.6
	6/8/2017	-3.5	-2.4
	10/21/2016	-3.1	-2.4
AD-3	1/20/2017	-6.0	-4.6
	2/24/2017	-6.0	-4.6
	6/8/2017	-6.2	-4.7
	10/21/2016	-6.4	-4.3
AD-4C	1/20/2017	-5.8	-3.7
	2/24/2017	-5.7	-3.9
	6/8/2017	-5.8	-3.8
	10/21/2016	-6.0	-3.9

Note:
Values between -0.2 and 0.2 indicate the mineral is in equilibrium with groundwater.
Results with values indicating equilibrium are highlighted in red.

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 Evaluation (Arcadis, 2016).

500 250 0 500 Feet

Site Layout
Bottom Ash Storage Pond

AEP Welsh Power Plant
Cason, Texas

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure **1**

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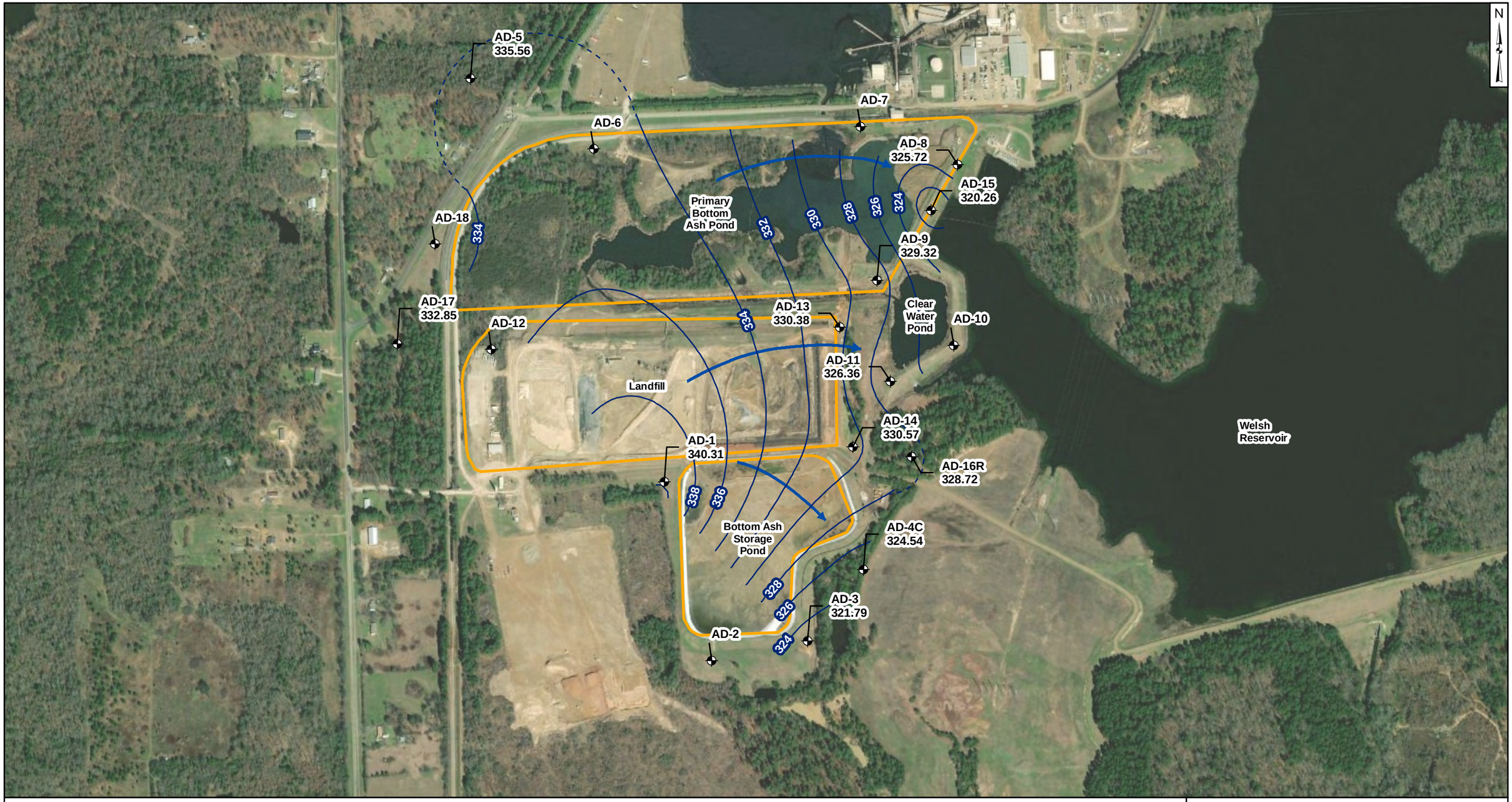


Legend

- Groundwater Monitoring Well
- Approximate Groundwater Flow Direction
- Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- CCR Units

Notes

- Monitoring well coordinates and water level data (collected on May 23, 2018) provided by AEP.
- Site features based on information avilable in CCR Groundwater Monitoring Well Network Evaluation (Arcadis, 2016).
- Groundwater elevation units are feet above mean sea level.
- Inferred groundwater contours were extrapolated from topographic and hydrographic information as well as previous monitoring events.
- AD-16 was replaced with AD-16R on 4/12/2017.
- Wells AD-2, -6, -7, -10 ,-12, and -18 were not gauged during the May 2018 sampling event.

750 375 0 750 Feet

Groundwater Potentiometric Map
May 2018

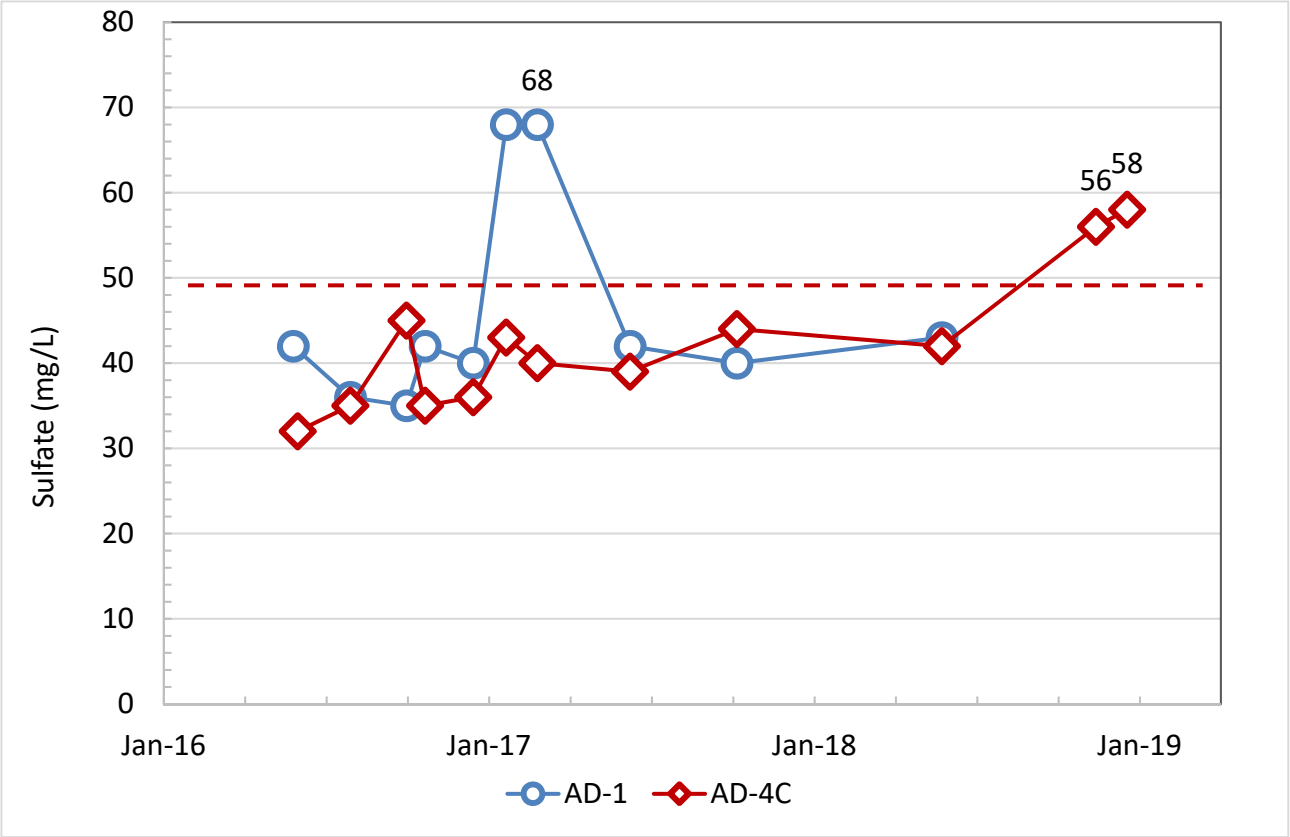
AEP Welsh Power Plant
Cason, Texas

Geosyntec consultants

Columbus, Ohio | 2018/10/24

Figure 2

\\annarbor-01\data\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Welsh\2018\AEP-Welsh_GW_2018-05May.mxd. SKaroly. 10/24/2018. CHA8423/14/08.



Notes: Sulfate time series diagram for BASP upgradient well AD-1 and downgradient well AD-4C under the CCR Rule program. The dashed line represents the intrawell UPL for sulfate at AD-4C (49 mg/L).

Sulfate Time Series Graph
Welsh Bottom Ash Storage Pond

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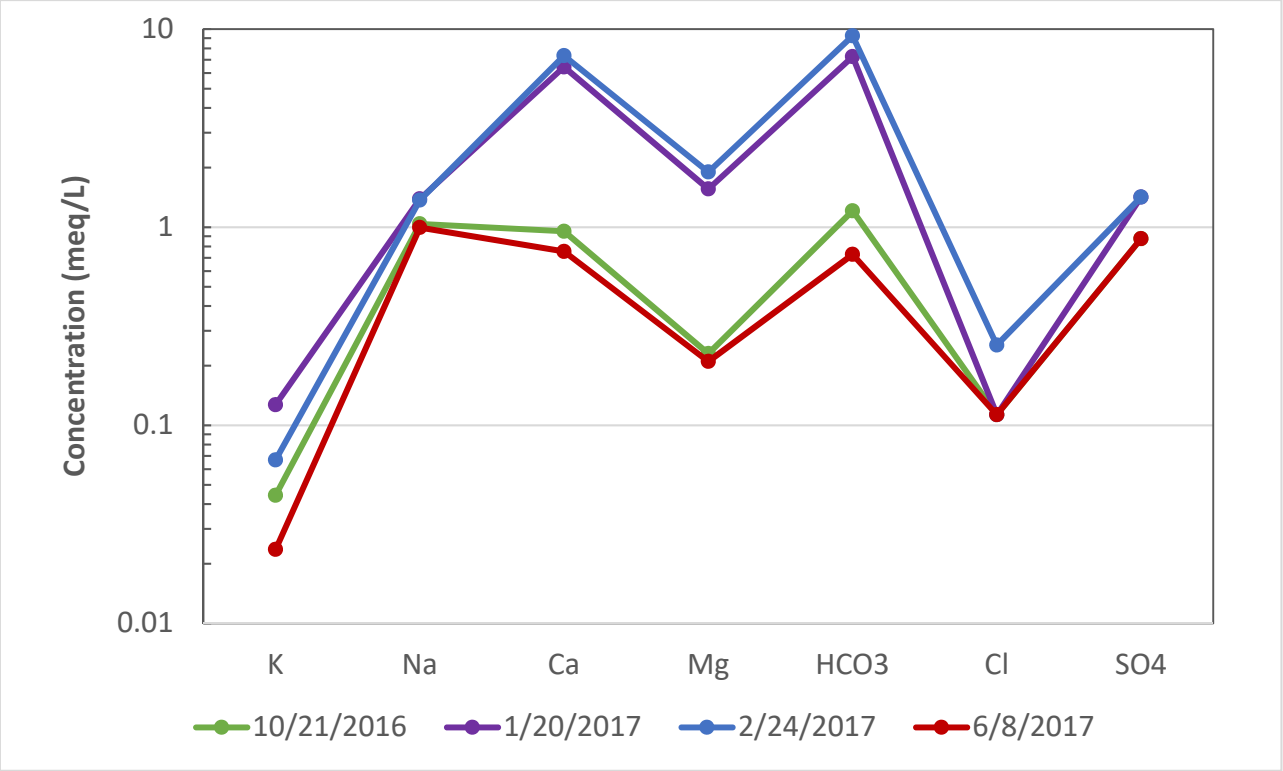
Columbus, Ohio | 14-FEB-2019

Figure **3**

internal info: path, date revised, author



Notes: Schoeller diagram for BASP upgradient well AD-1 for four groundwater sampling events where data for all major constituents was available.

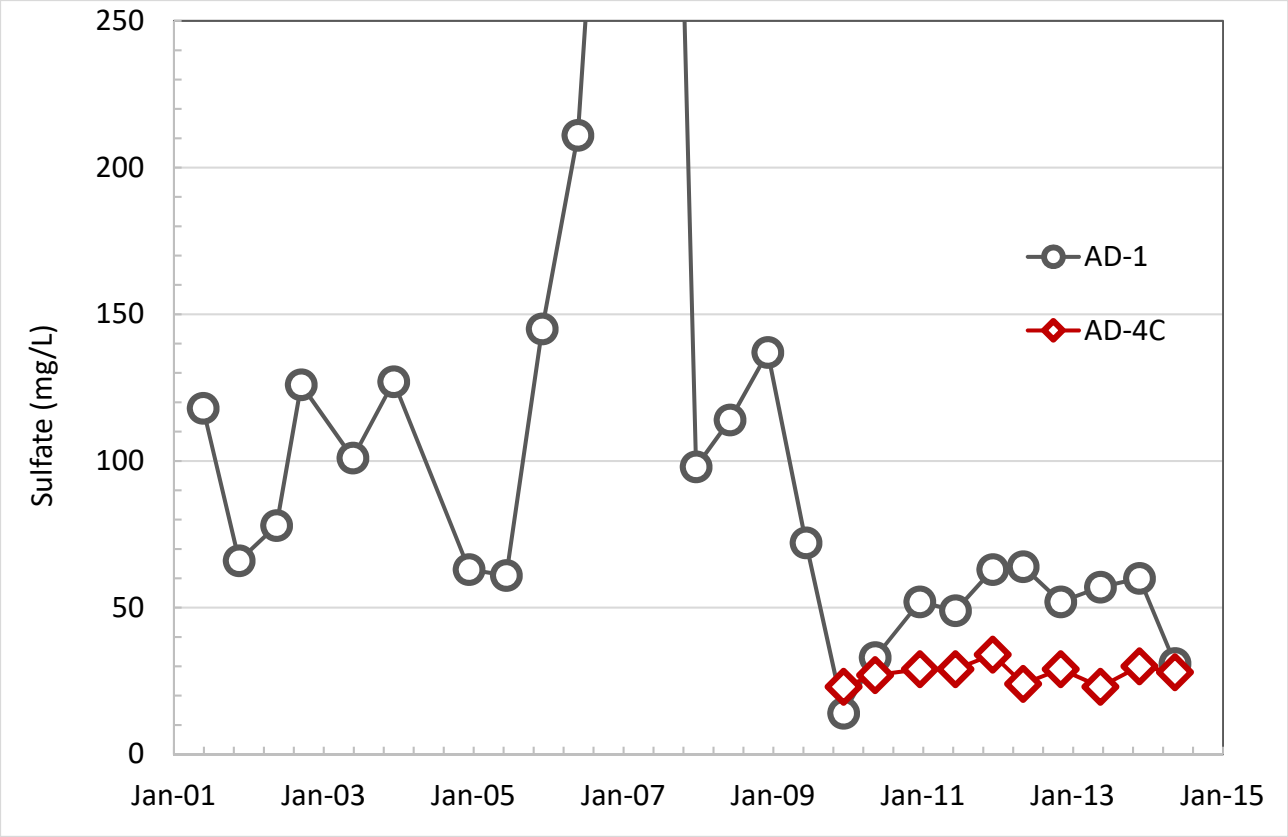
AD-1 Schoeller Diagram
Welsh Bottom Ash Storage Pond

Geosyntec consultants | AMERICAN ELECTRIC POWER

Columbus, Ohio | 4-JAN-2019

Figure **4**

internal info: path, date revised, author



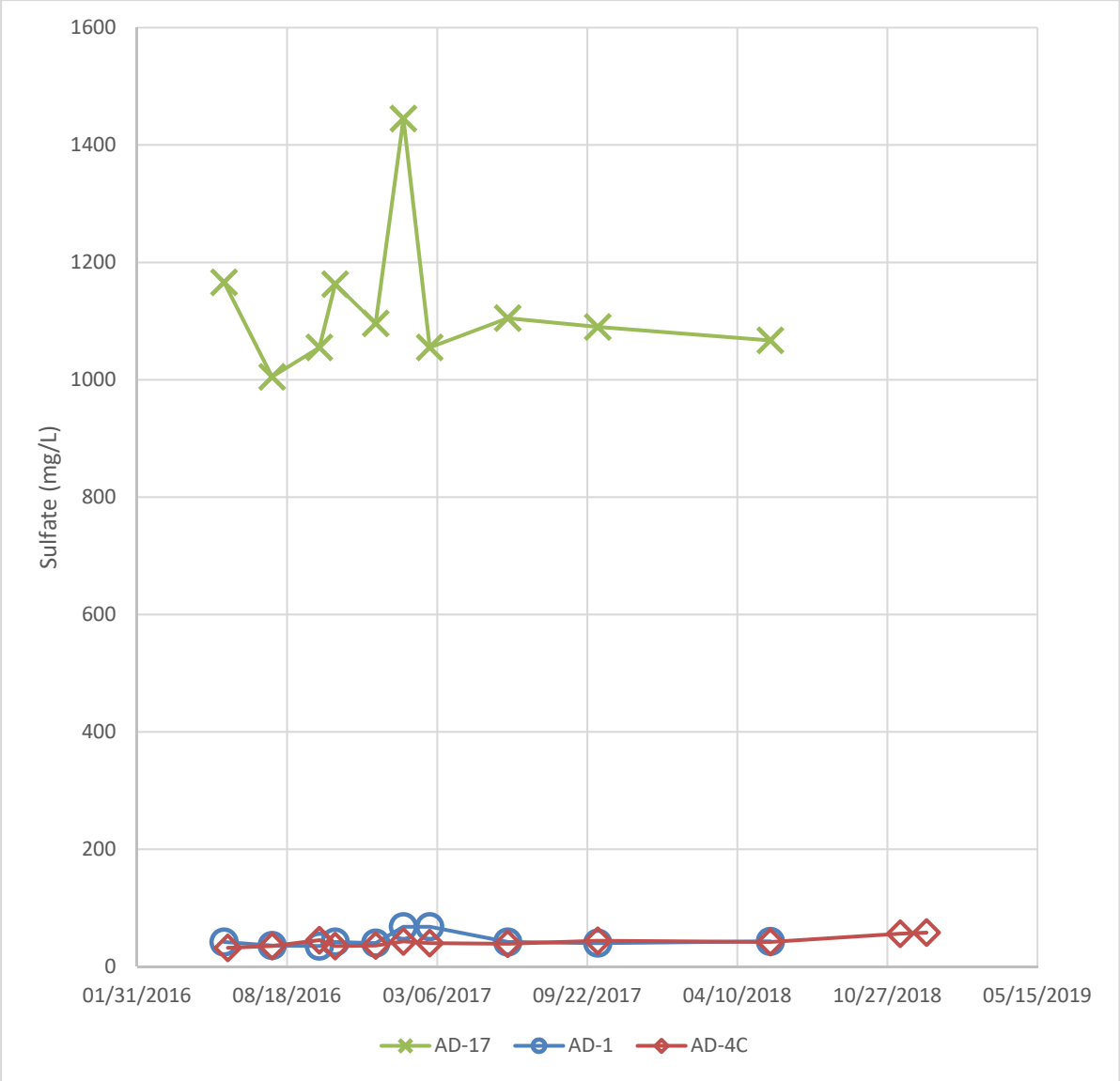
Notes: Concentrations of sulfate at AD-1 and AD-4C, based on samples that were collected for compliance with state regulations. Sulfate at AD-1 (off scale) was 616 mg/L on 6/13/2007.

Historical Sulfate Concentrations
Welsh Bottom Ash Storage Pond

Geosyntec consultants | AMERICAN ELECTRIC POWER | Figure **5**

Columbus, Ohio | 4-JAN-2019

internal info: path, date revised, author



Notes: Data were collected as part of the background monitoring period for the Federal CCR Rule.

AD-17 Sulfate Time Series Graph
Welsh Bottom Ash Storage Pond

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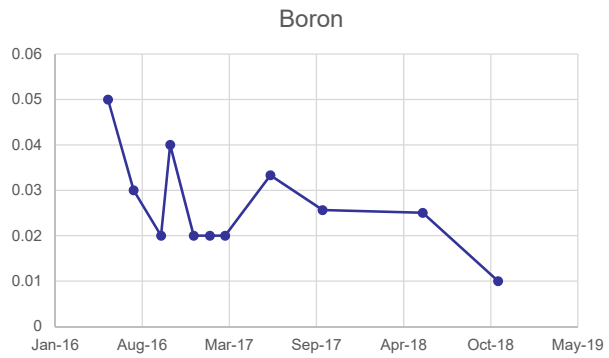
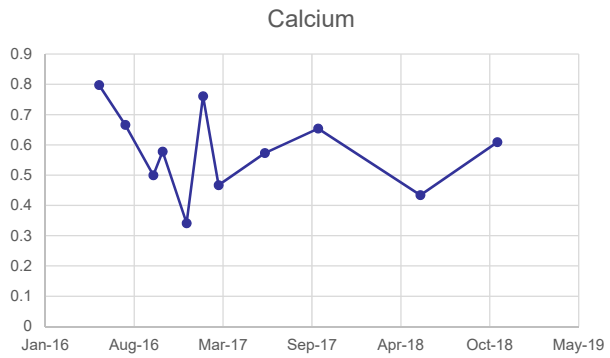
Figure **6**

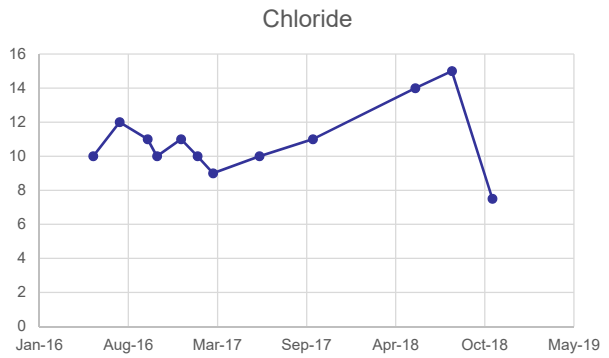
Columbus, Ohio

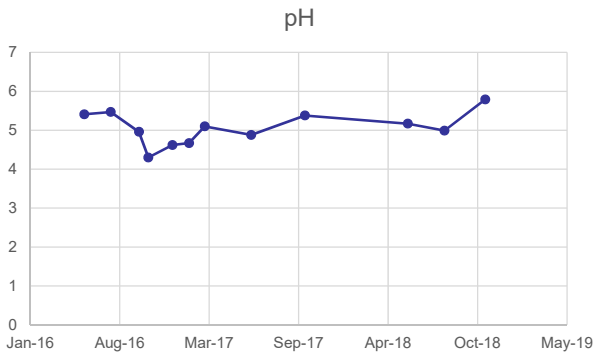
08-Apr-2019

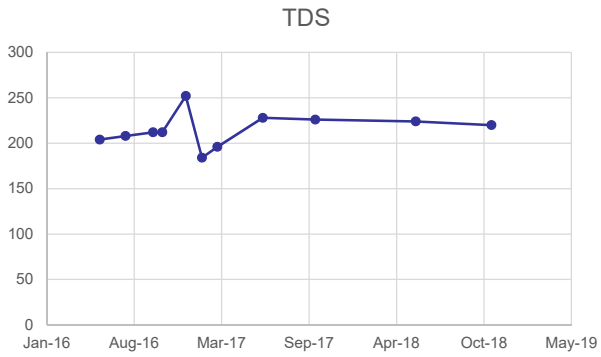
internal info: path, date revised, author

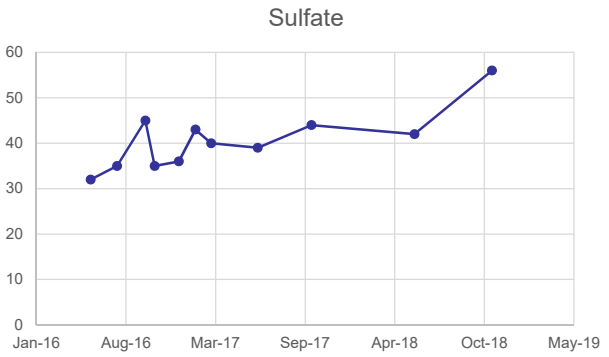












Notes: Fluoride was not detected in any sample above the reporting limit of 0.083 mg/L. All parameters except pH reported as milligrams per liter (mg/L). pH reported as specific units (SU)

Appendix III Time Series Graphs
Welsh Bottom Ash Storage Pond

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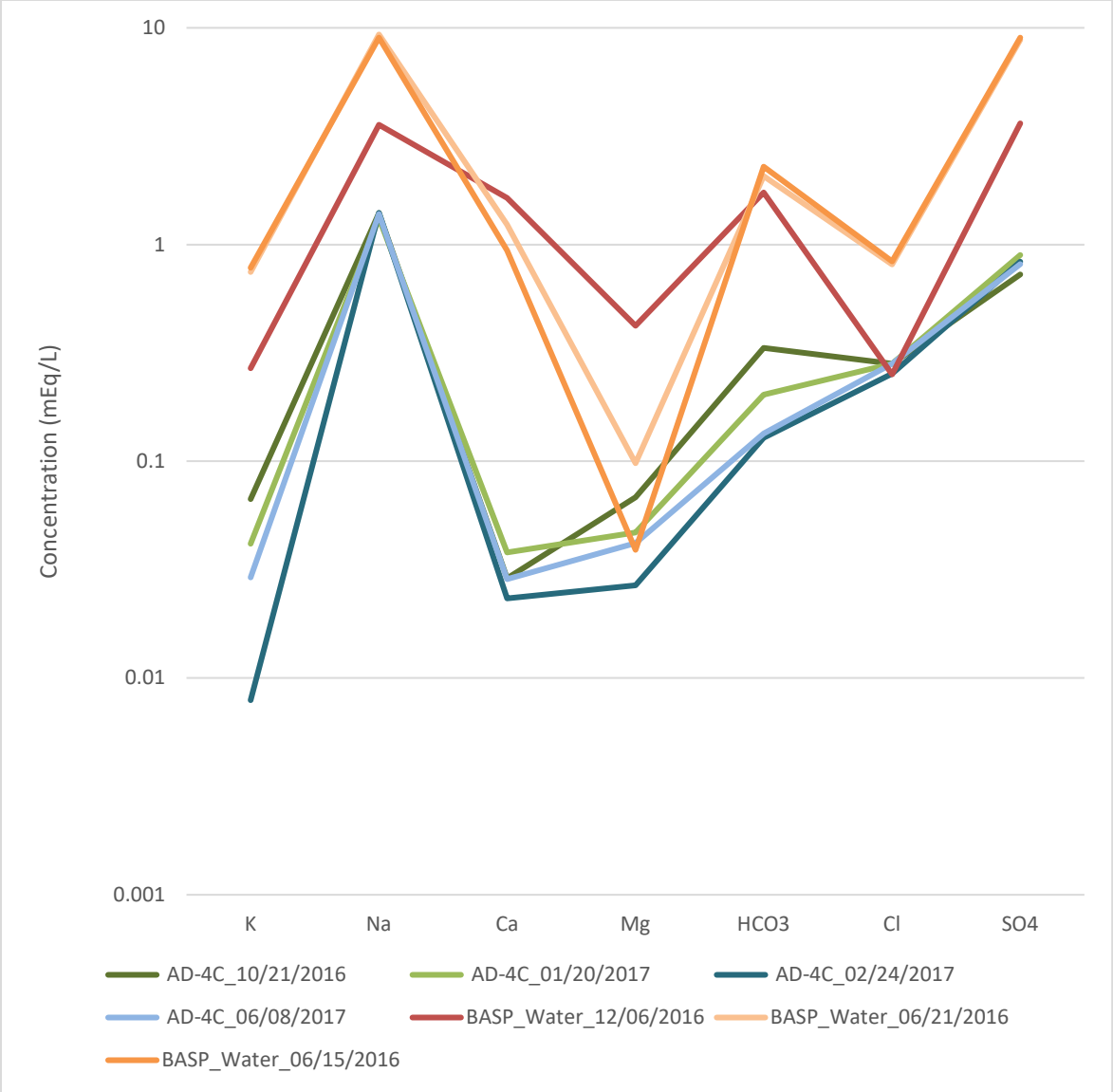
Columbus, OH | 11-Apr-2019

Figure **7**



Notes: BASP water samples were collected as part of a water balance study (AECOM, 2017).

Pond Water Chemistry
Welsh Bottom Ash Storage Pond

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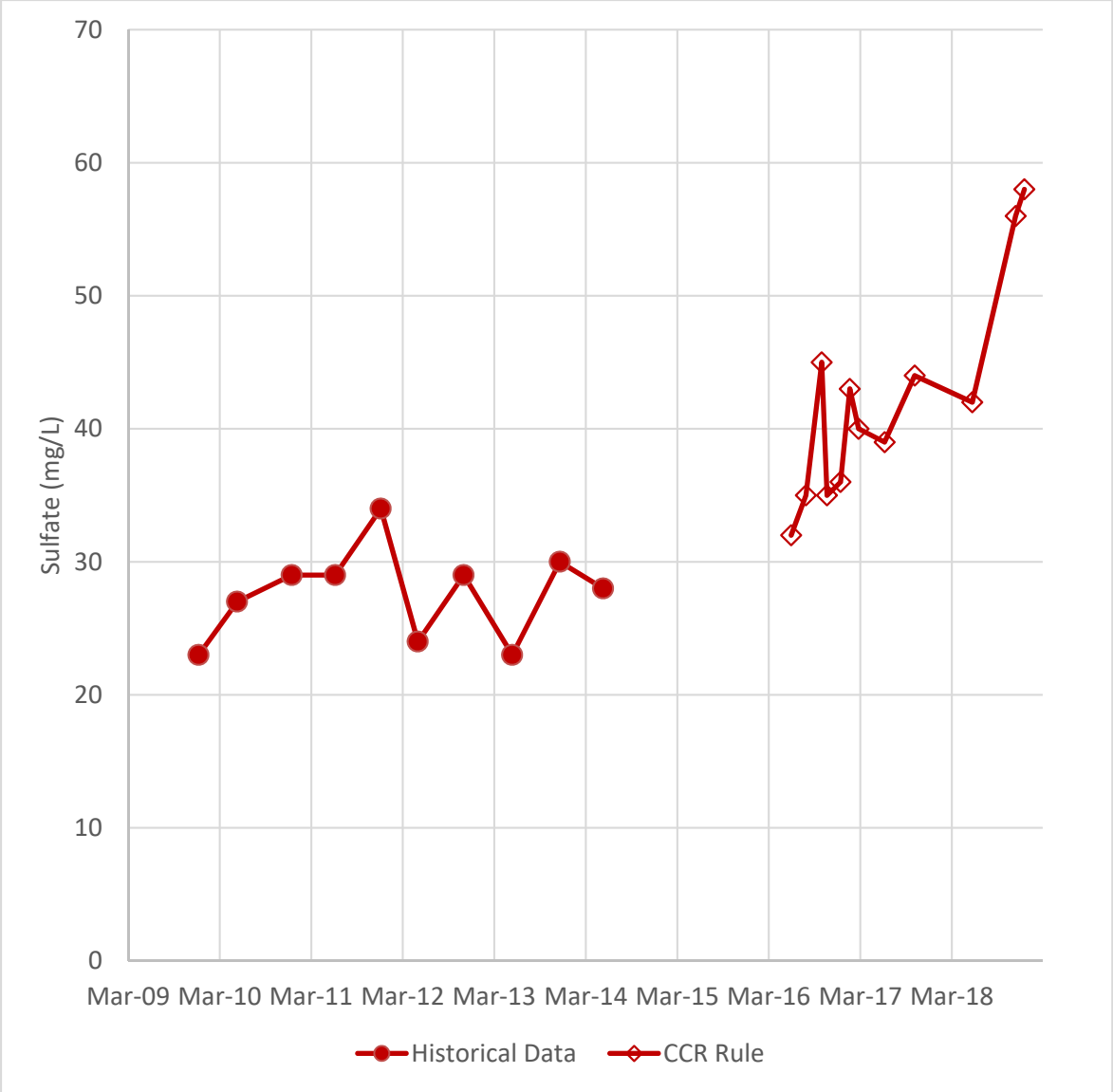
Figure **8**

Columbus, Ohio

24-Apr-2019

internal info: path, date revised, author



Notes: Historical data were not collected under the CCR Rule.

AD-4C Sulfate Time Series Graph
Welsh Bottom Ash Storage Pond

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Columbus, Ohio | 5-MAY-2019

internal info: path, date revised, author

ATTACHMENT A
Revised Statistical Analysis Output

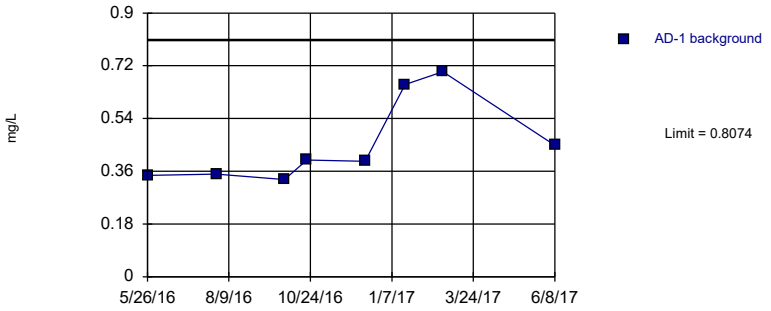
Intrawell Prediction Limit Summary

Welsh BASP Client: Geosyntec Data: Welsh BASP Printed 5/9/2019, 1:03 PM

Constituent	Well	Upper Lim.	Lower Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron (mg/L)	AD-1	0.8074	n/a	8	0.4531	0.1441	0	None	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-5	0.06141	n/a	8	0.04285	0.00755	0	None	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-17	0.1488	n/a	8	0.1209	0.01137	0	None	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-3	0.03326	n/a	7	n/a	n/a	0	n/a	n/a	0.02765	NP Intra (normality) 1 of 2
Boron (mg/L)	AD-4C	0.05712	n/a	8	0.02916	0.01137	0	None	No	0.002505	Param Intra 1 of 2
Boron (mg/L)	AD-16R	0.07001	n/a	10	0.03904	0.01384	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-1	224.6	n/a	8	6.363	3.508	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-5	61.45	n/a	8	45.09	6.656	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-17	203.5	n/a	8	193.6	4.033	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-3	1.541	n/a	8	0.7903	0.3055	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-4C	0.9615	n/a	8	0.5855	0.153	0	None	No	0.002505	Param Intra 1 of 2
Calcium (mg/L)	AD-16R	3.069	n/a	10	1.933	0.5077	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-1	9	n/a	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Chloride (mg/L)	AD-5	16.78	n/a	8	14.5	0.9258	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-17	44.04	n/a	8	33.38	4.34	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-3	9	n/a	8	n/a	n/a	0	n/a	n/a	0.02144	NP Intra (normality) 1 of 2
Chloride (mg/L)	AD-4C	12.63	n/a	8	10.38	0.9161	0	None	No	0.002505	Param Intra 1 of 2
Chloride (mg/L)	AD-16R	8.3	n/a	9	6.889	0.6009	0	None	No	0.002505	Param Intra 1 of 2
Fluoride (mg/L)	AD-1	1	n/a	8	n/a	n/a	100	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-5	1	n/a	8	n/a	n/a	75	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-17	0.6953	n/a	8	0.4488	0.1003	37.5	Kaplan-Meier	No	0.002505	Param Intra 1 of 2
Fluoride (mg/L)	AD-3	1	n/a	8	n/a	n/a	87.5	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-4C	1	n/a	8	n/a	n/a	100	n/a	n/a	0.02144	NP Intra (NDs) 1 of 2
Fluoride (mg/L)	AD-16R	1	n/a	10	n/a	n/a	60	n/a	n/a	0.01476	NP Intra (NDs) 1 of 2
pH, field (SU)	AD-1	7.766	3.744	8	5.755	0.8183	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-5	6.916	4.802	8	5.859	0.4299	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-17	7.253	4.899	8	6.076	0.4789	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-3	7.628	2.427	8	5.028	1.058	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-4C	5.907	3.945	8	4.926	0.3991	0	None	No	0.001253	Param Intra 1 of 2
pH, field (SU)	AD-16R	4.402	2.612	10	3.507	0.3998	0	None	No	0.001253	Param Intra 1 of 2
Sulfate (mg/L)	AD-1	82.3	n/a	8	6.772	0.9358	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-5	336.4	n/a	8	177.4	64.69	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-17	1471	n/a	8	1136	136.3	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-3	12.35	n/a	8	6.125	2.532	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-4C	59.09	n/a	12	42.08	8.051	0	None	No	0.002505	Param Intra 1 of 2
Sulfate (mg/L)	AD-16R	64.14	n/a	10	50.9	5.915	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-1	784.8	n/a	8	16.71	4.598	0	None	sqrt(x)	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-5	563.5	n/a	8	383.6	73.17	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-17	1840	n/a	8	1639	81.77	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-3	156	n/a	8	110.6	18.45	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-4C	262.7	n/a	8	212	20.62	0	None	No	0.002505	Param Intra 1 of 2
Total Dissolved Solids (mg/L)	AD-16R	213.7	n/a	10	174	17.74	0	None	No	0.002505	Param Intra 1 of 2

Prediction Limit

Intrawell Parametric, AD-1 (bg)

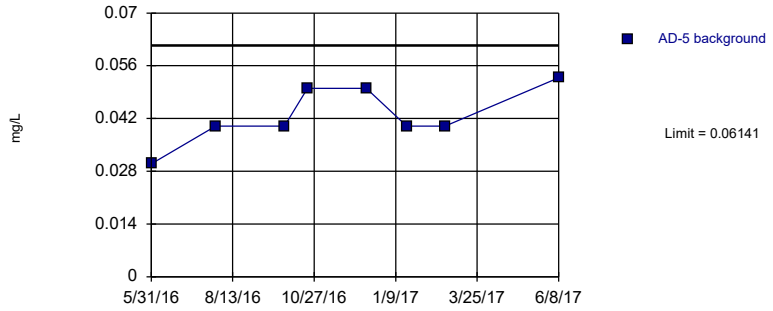


Background Data Summary: Mean=0.4531, Std. Dev.=0.1441, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7868, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-5 (bg)

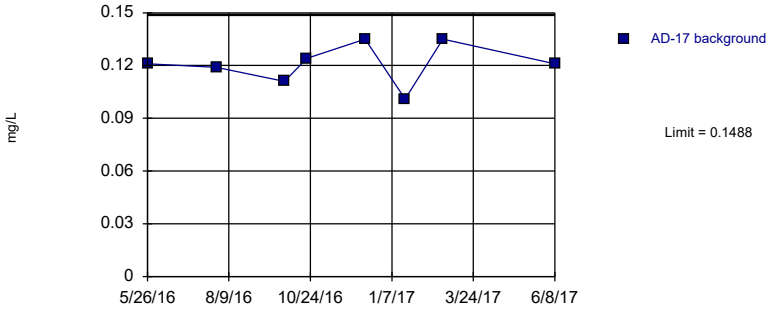


Background Data Summary: Mean=0.04285, Std. Dev.=0.00755, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8774, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-17 (bg)

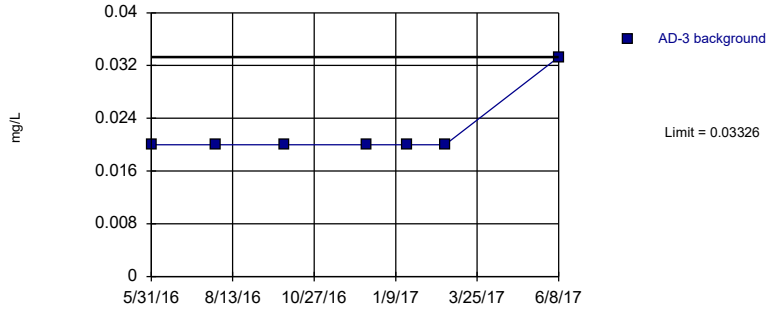


Background Data Summary: Mean=0.1209, Std. Dev.=0.01137, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9321, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Non-parametric, AD-3

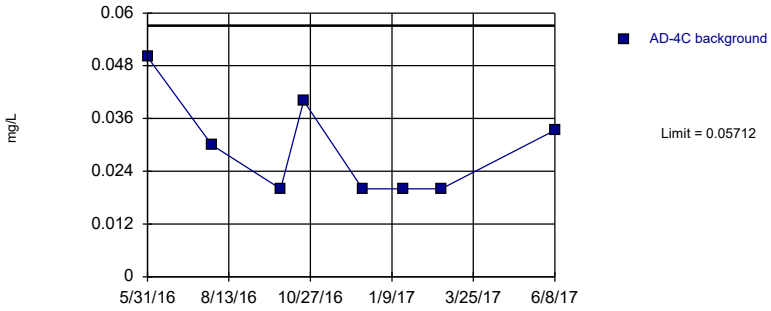


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 7 background values. Well-constituent pair annual alpha = 0.05455. Individual comparison alpha = 0.02765 (1 of 2). Assumes 1 future value.

Constituent: Boron Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-4C



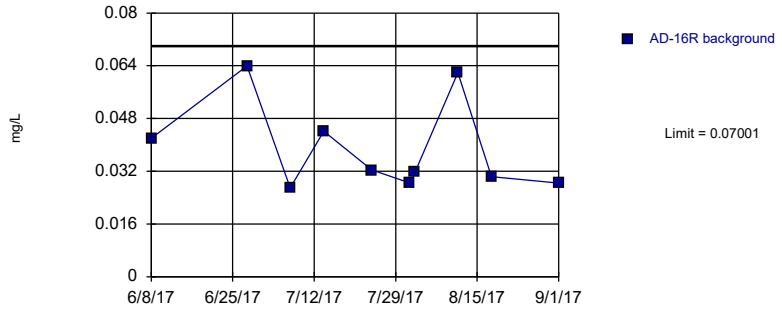
Background Data Summary: Mean=0.02916, Std. Dev.=0.01137, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8271, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-16R



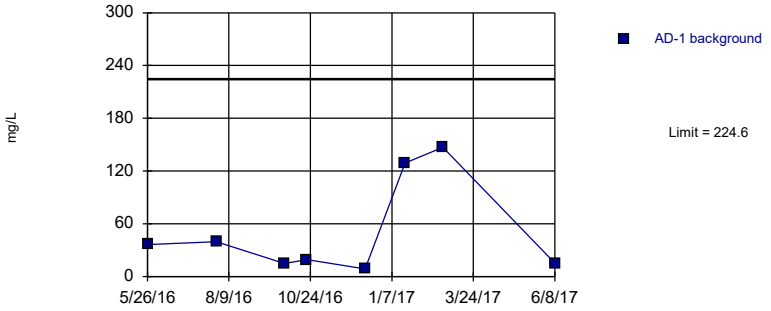
Background Data Summary: Mean=0.03904, Std. Dev.=0.01384, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7973, critical = 0.781. Kappa = 2.238 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Boron Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-1 (bg)



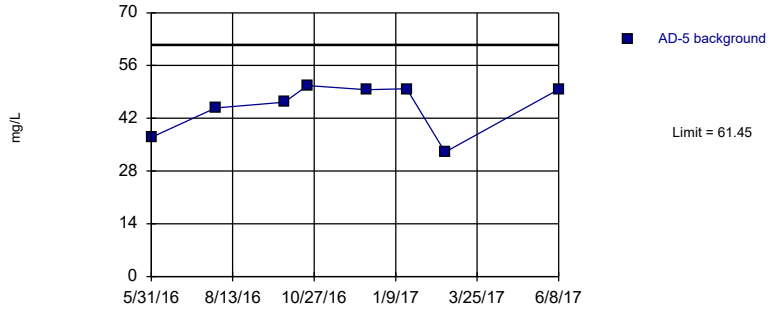
Background Data Summary (based on square root transformation): Mean=6.363, Std. Dev.=3.508, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8248, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-5 (bg)

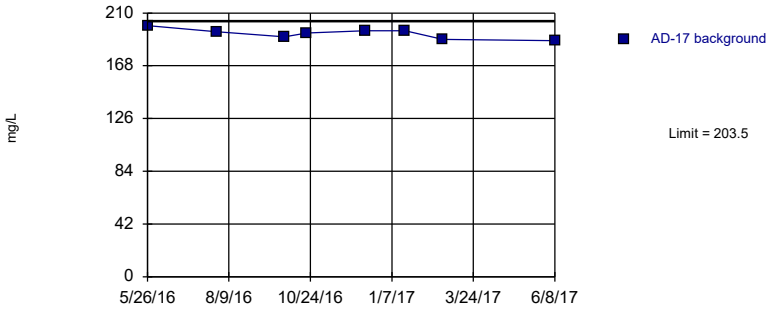


Background Data Summary: Mean=45.09, Std. Dev.=6.656, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8101, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-17 (bg)



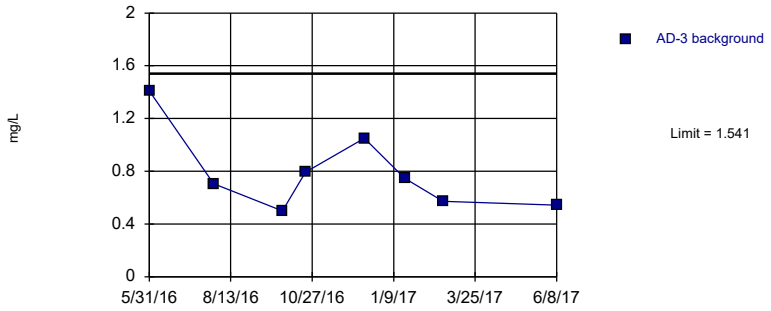
Background Data Summary: Mean=193.6, Std. Dev.=4.033, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9507, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-3



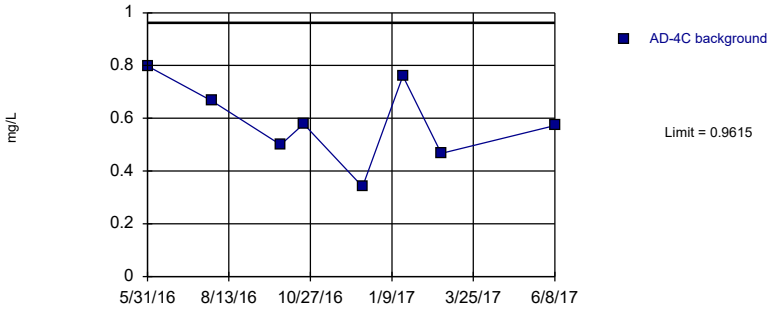
Background Data Summary: Mean=0.7903, Std. Dev.=0.3055, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8655, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-4C



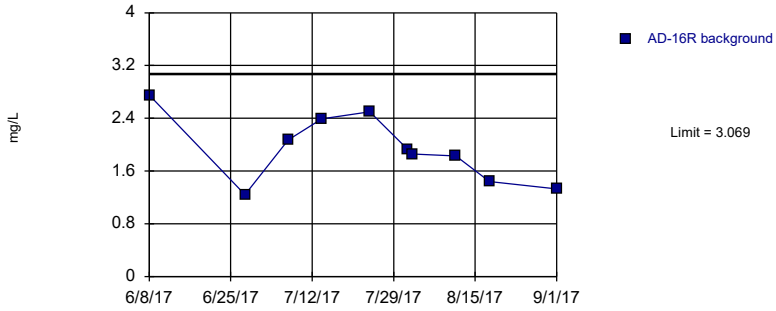
Background Data Summary: Mean=0.5855, Std. Dev.=0.153, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9711, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-16R

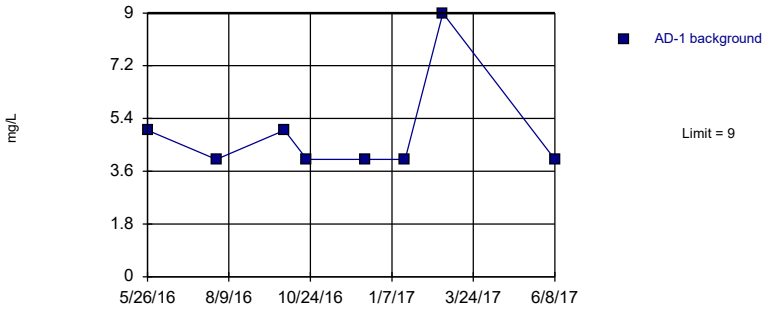


Background Data Summary: Mean=1.933, Std. Dev.=0.5077, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.953, critical = 0.781. Kappa = 2.238 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Calcium Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Non-parametric, AD-1 (bg)



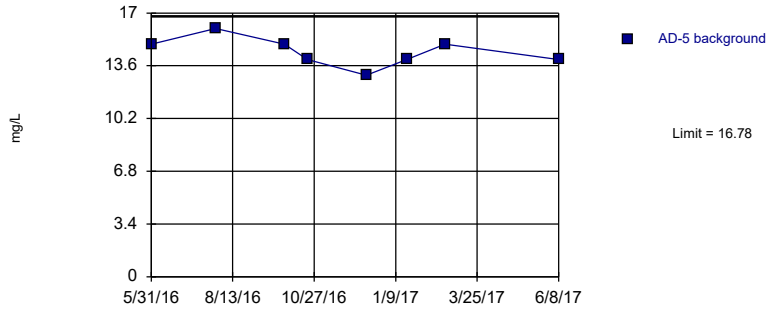
Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2). Assumes 1 future value.

Constituent: Chloride Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-5 (bg)



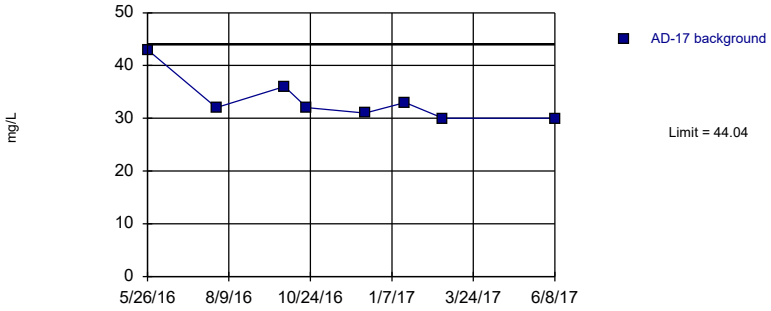
Background Data Summary: Mean=14.5, Std. Dev.=0.9258, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9302, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-17 (bg)



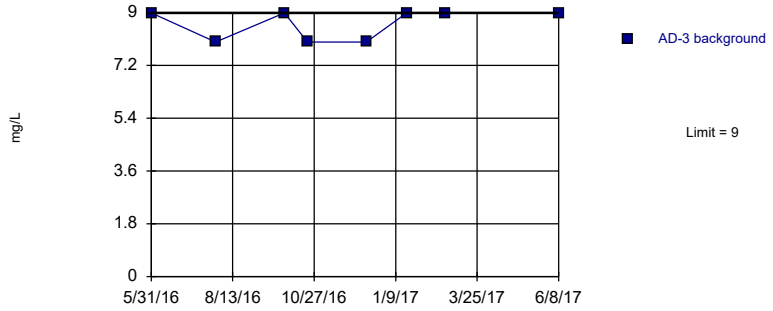
Background Data Summary: Mean=33.38, Std. Dev.=4.34, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7758, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Non-parametric, AD-3

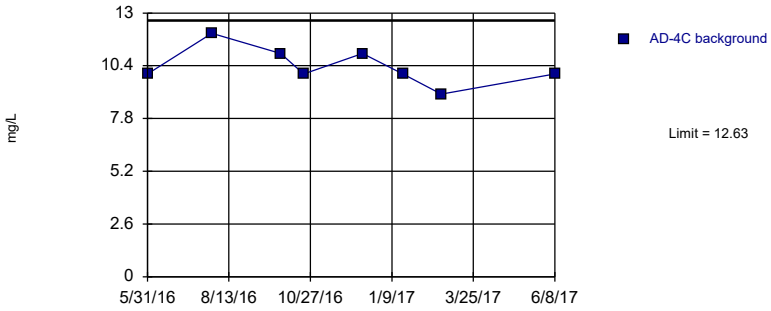


Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2). Assumes 1 future value.

Constituent: Chloride Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-4C

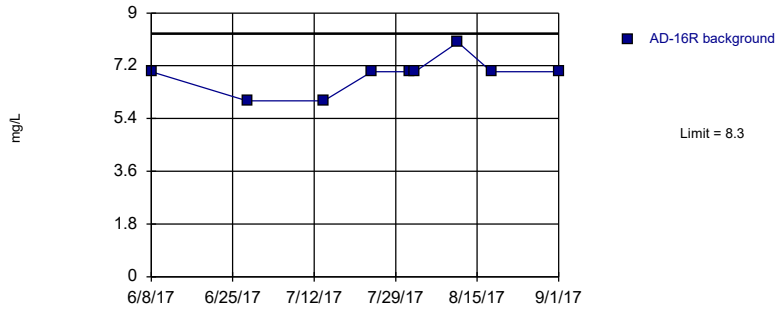


Background Data Summary: Mean=10.38, Std. Dev.=0.9161, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9054, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 5/9/2019 1:00 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-16R



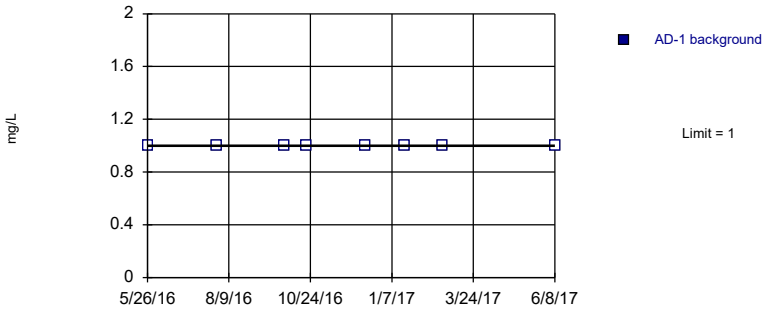
Background Data Summary: Mean=6.889, Std. Dev.=0.6009, n=9. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7809, critical = 0.764. Kappa = 2.348 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Chloride Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, AD-1 (bg)



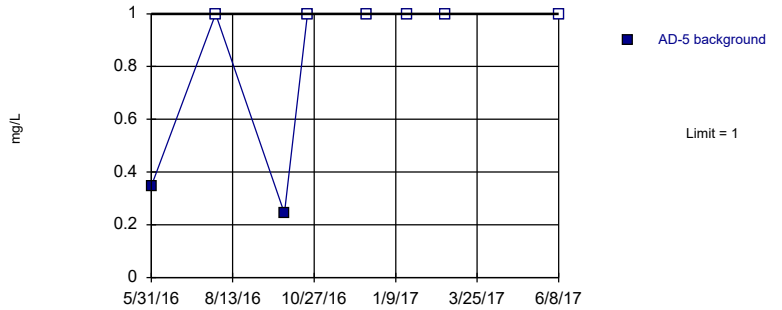
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 8) were censored; limit is most recent reporting limit. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, AD-5 (bg)



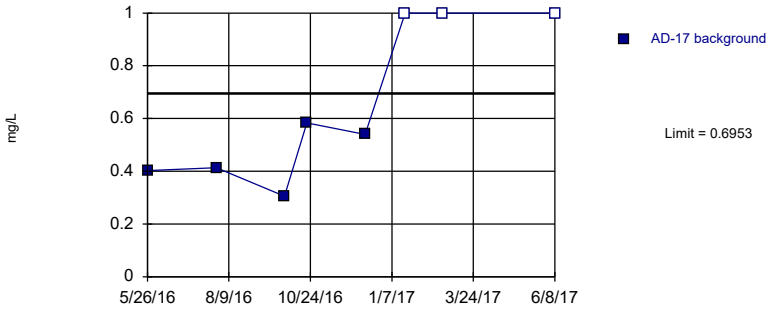
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 75% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Parametric, AD-17 (bg)



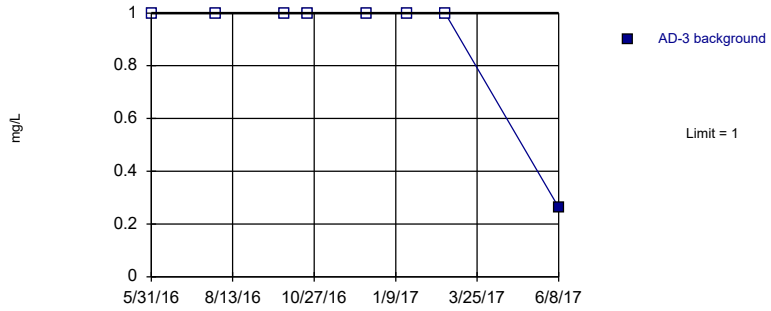
Background Data Summary (after Kaplan-Meier Adjustment): Mean=0.4488, Std. Dev.=0.1003, n=8, 37.5% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8226, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Fluoride Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, AD-3



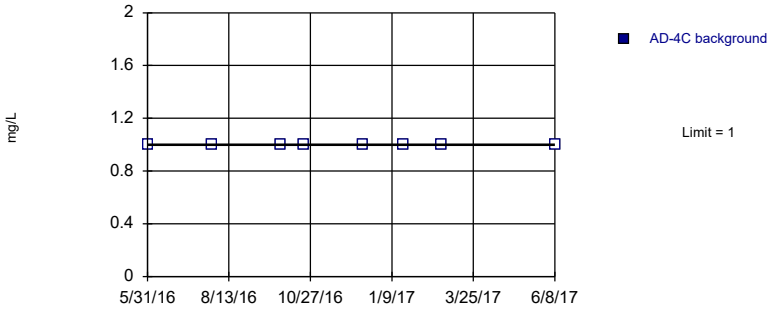
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 87.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, AD-4C



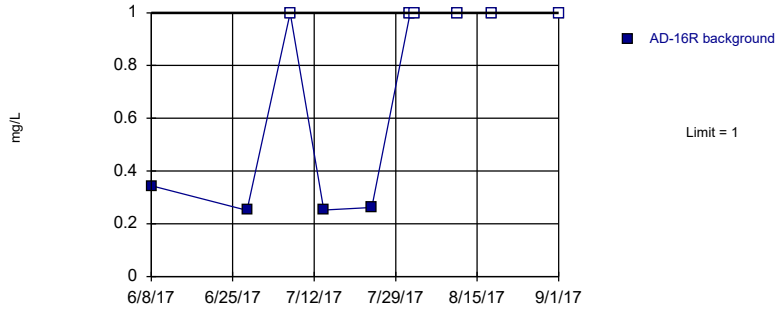
Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 8) were censored; limit is most recent reporting limit. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Prediction Limit

Intrawell Non-parametric, AD-16R

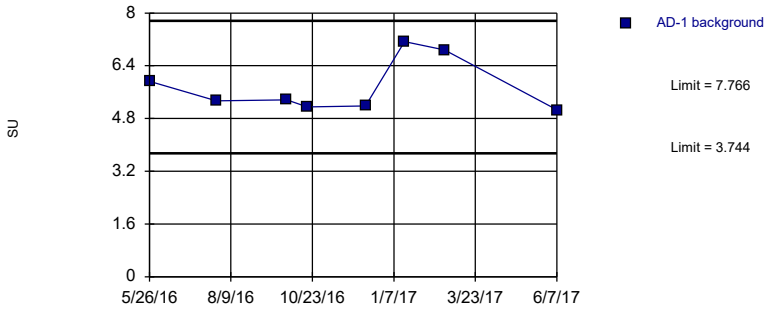


Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 10 background values. 60% NDs. Well-constituent pair annual alpha = 0.0293. Individual comparison alpha = 0.01476 (1 of 2). Assumes 1 future value.

Constituent: Fluoride Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-1 (bg)



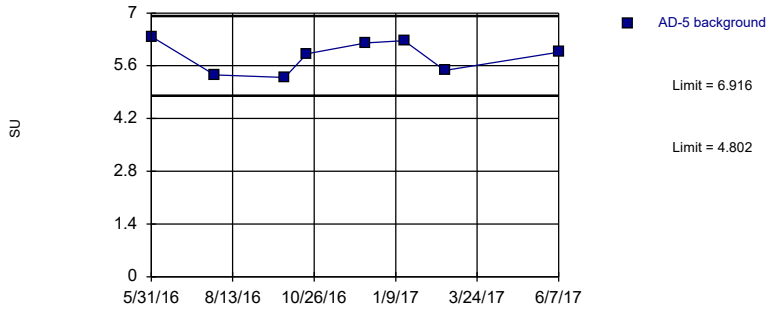
Background Data Summary: Mean=5.755, Std. Dev.=0.8183, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7968, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-5 (bg)



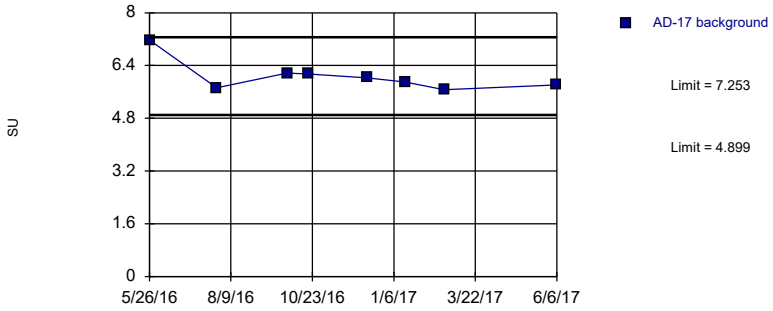
Background Data Summary: Mean=5.859, Std. Dev.=0.4299, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8966, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-17 (bg)



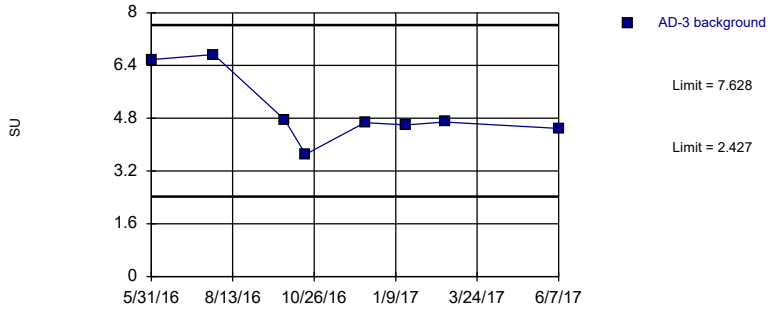
Background Data Summary: Mean=6.076, Std. Dev.=0.4789, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7745, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-3

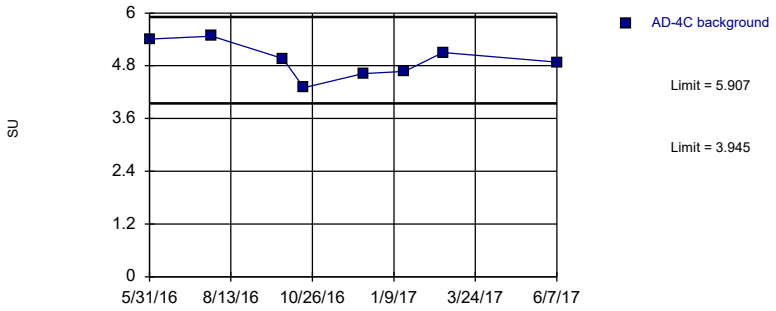


Background Data Summary: Mean=5.028, Std. Dev.=1.058, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8081, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-4C



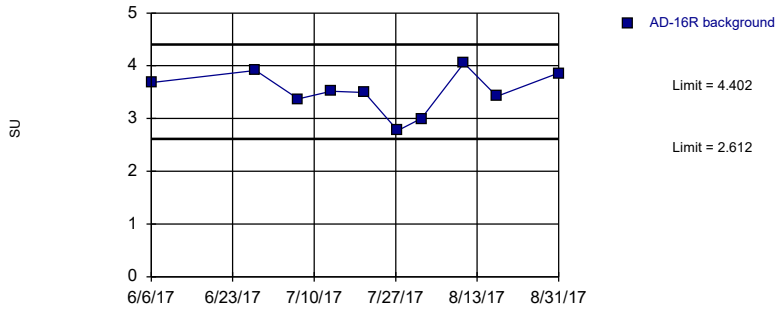
Background Data Summary: Mean=4.926, Std. Dev.=0.3991, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9655, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-16R



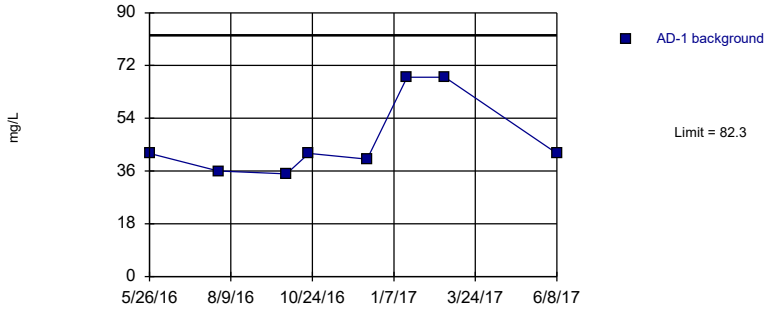
Background Data Summary: Mean=3.507, Std. Dev.=0.3998, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9547, critical = 0.781. Kappa = 2.238 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: pH, field Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-1 (bg)



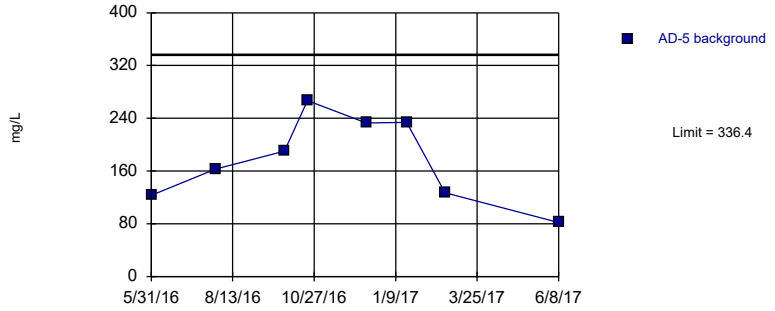
Background Data Summary (based on square root transformation): Mean=6.772, Std. Dev.=0.9358, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7528, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-5 (bg)

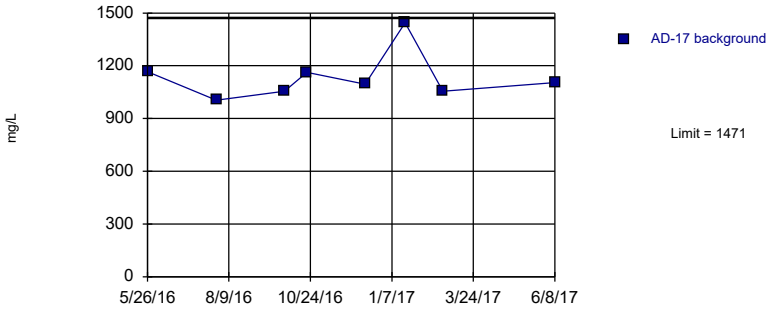


Background Data Summary: Mean=177.4, Std. Dev.=64.69, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.953, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-17 (bg)



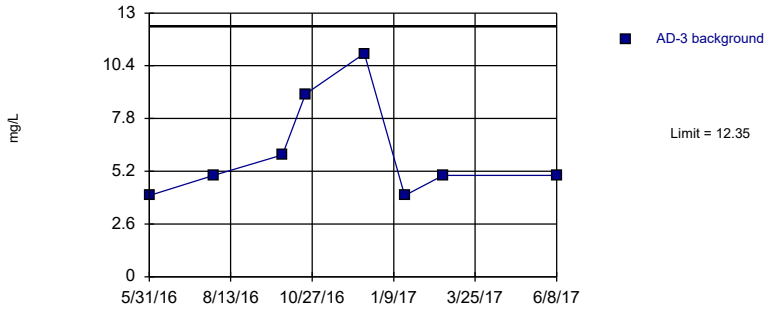
Background Data Summary: Mean=1136, Std. Dev.=136.3, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7916, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-3



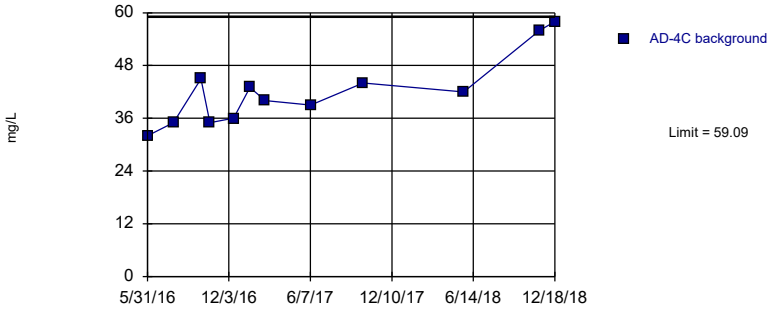
Background Data Summary: Mean=6.125, Std. Dev.=2.532, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8003, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-4C



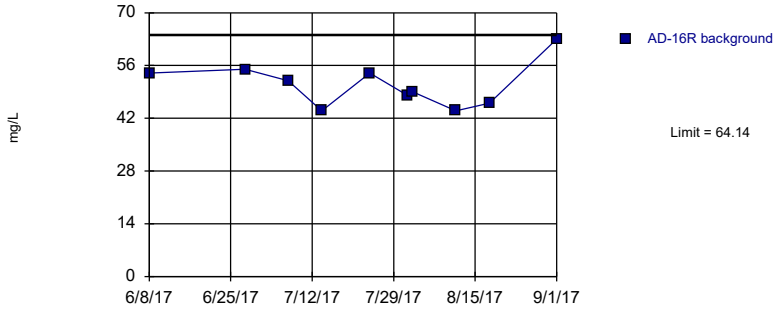
Background Data Summary: Mean=42.08, Std. Dev.=8.051, n=12. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8952, critical = 0.805. Kappa = 2.112 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-16R

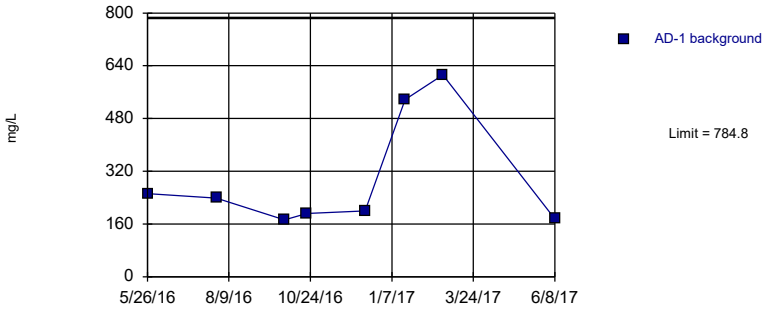


Background Data Summary: Mean=50.9, Std. Dev.=5.915, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9276, critical = 0.781. Kappa = 2.238 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Sulfate Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-1 (bg)



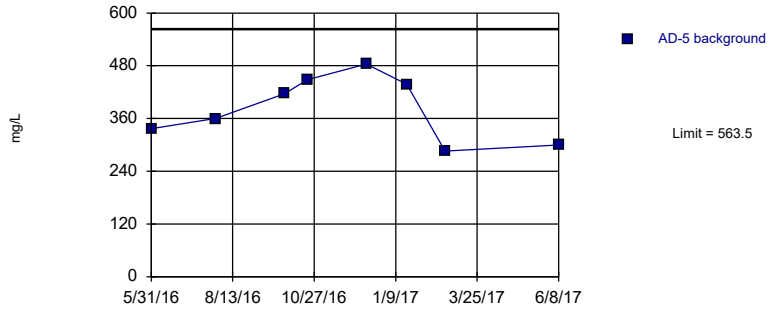
Background Data Summary (based on square root transformation): Mean=16.71, Std. Dev.=4.598, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.756, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-5 (bg)



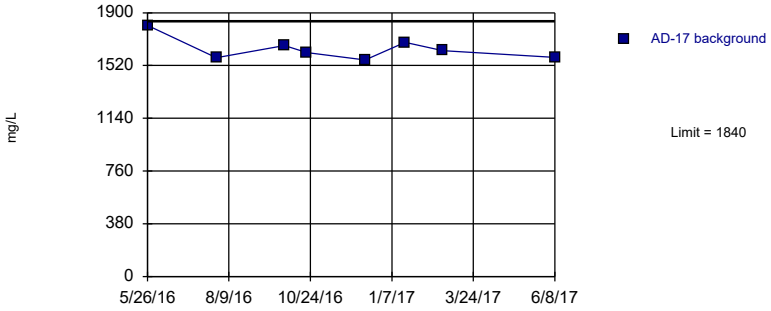
Background Data Summary: Mean=383.6, Std. Dev.=73.17, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.937, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-17 (bg)



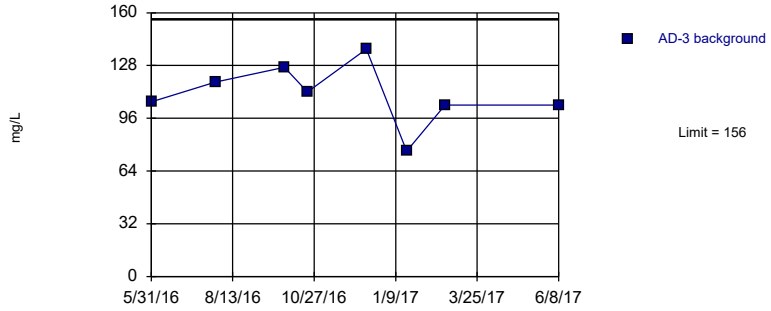
Background Data Summary: Mean=1639, Std. Dev.=81.77, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8702, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-3

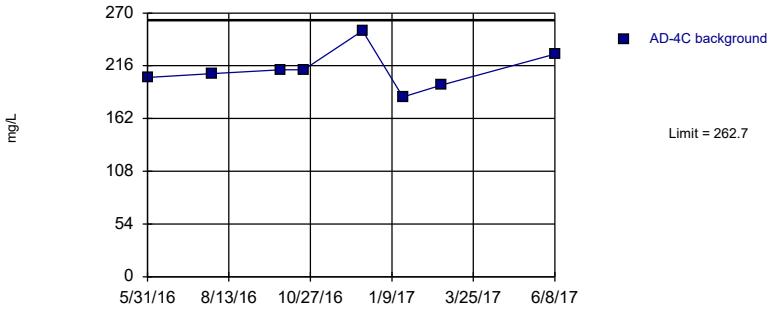


Background Data Summary: Mean=110.6, Std. Dev.=18.45, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9503, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell
Welsh BASP Client: Geosyntec Data: Welsh BASP

Prediction Limit

Intrawell Parametric, AD-4C



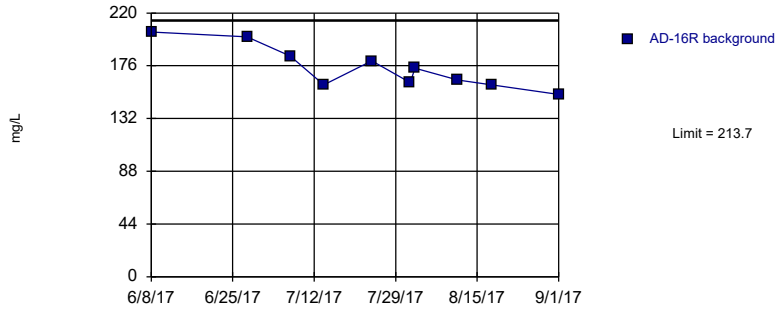
Background Data Summary: Mean=212, Std. Dev.=20.62, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9402, critical = 0.749. Kappa = 2.458 (c=7, w=3, 1 of 2, event alpha = 0.05132). Report alpha = 0.002505. Assumes 1 future value.

Constituent: Total Dissolved Solids Analysis Run 5/9/2019 1:01 PM View: PL's - Intrawell Welsh BASP Client: Geosyntec Data: Welsh BASP

Sanitas™ v.9.6.12h Sanitas software utilized by Groundwater Stats Consulting. UG

Prediction Limit

Intrawell Parametric, AD-16R



Background Data Summary: Mean=174, Std. Dev.=17.74, n=10. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9094, critical = 0.781. Kappa = 2.238 (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 5/9/2019 1:01 PM View: PL's - Intrawell Welsh BASP Client: Geosyntec Data: Welsh BASP

ATTACHMENT B
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 40 CFR 257.94(e)(2) have been met.

Beth Ann Gross
Printed Name of Licensed Professional Engineer

Beth Gross
Signature

Geosyntec Consultants
8217 Shoal Creek Blvd., Suite 200
Austin, TX 78757

Texas Registered Engineering Firm
No. F-1182

79864	Texas	5/17/2019
License Number	Licensing State	Date

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

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

Submitted to

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

August 22, 2019

CHA8462

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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
LPL	Lower Prediction Limit
QA	Quality Assurance
QC	Quality Control
SSI	Statistically Significant Increase
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

Eight to ten background monitoring events were conducted at the Welsh Bottom Ash Storage Pond (BASP). Upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. A lower prediction limit (LPL) was also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is concluded only if both samples in a series of two exceeds the UPL and for pH exceeds the LPL. In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

The first semi-annual detection monitoring event of 2019 was performed in February 2019 (initial sampling event) and April 2019 (re-sampling event), and the results were compared to the calculated prediction limits. An SSI was identified for chloride at well AD-3 by intrawell analysis. 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 (U.S. EPA) 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.*

Chloride concentrations of 9.40 milligrams per liter (mg/L) and 9.34 mg/L were reported for the sampling and re-sampling events on February 20, 2019 and April 30, 2019, respectively. Both concentrations exceeded the UPL value for chloride of 9 mg/L. Pursuant to 40 CFR 257.94(e)(2) of the CCR Rule (40 CFR 257), Geosyntec Consultants, Inc. (Geosyntec) has prepared this Alternative Source Demonstration (ASD) report, which documents that the SSI for chloride at AD-3 should not be attributed to the Welsh BASP.

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 amongst five types, based on methodology provided by 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 show that the increases in constituent concentrations were based on a Type II cause and not by a release from the Welsh BASP.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The method used to assess possible alternative sources of the SSI for chloride at AD-3 and the proposed alternative source are described below. In addition, the future sampling requirements for the Welsh BASP are presented.

2.1 Proposed Alternative Source

Initial review of field forms, site geochemistry, and site historical data did not identify alternative sources due to a Type I issue (sampling causes). Review of the laboratory results, however, identified a variation in the number of significant figures used in reported results that explains the SSI. This Type II issue is described below.

The eight samples collected from AD-3 during the background monitoring period were analyzed by AEP Analytical Chemistry Services in Shreveport, Louisiana using USEPA Method 300.0 and reported to the nearest 1 mg/L. Three background sample results for chloride were reported at 8 mg/L and five background results for chloride were 9 mg/L (Attachment A). Given the limited variability in the background dataset, the UPL for chloride at AD-3 was calculated non-parametrically as 9 mg/L, which is the highest value in the set of background data was used.

The samples for the first semi-annual detection monitoring event in 2019 were analyzed by AEP's Dolan Chemical Laboratory in Groveport, Ohio and reported to the nearest 0.01 mg/L. The initial and verification results for chloride were 9.40 mg/L and 9.34 mg/L respectively (Attachment B). These results are only above the UPL due to the additional significant figures provided by the laboratory. If the 2019 sample results had been reported to the same precision as the background samples, i.e., to the nearest 1 mg/L, they would be equal to the UPL and would not have triggered an SSI.

Furthermore, the detection monitoring samples were analyzed using USEPA Method 300.1, which prescribes ±15% variation as the quality control sample acceptance criteria (USEPA, 1999). Because both reported concentrations are within 15% (4.3% and 3.6% respectively) of the UPL, the differences observed are within acceptable variation in the analytical procedure.

Following completion of the first semi-annual CCR detection monitoring event, additional sampling was conducted at the BASP on May 30, 2019 for compliance with another regulatory program. The analysis was completed by AEP's Dolan Chemical Laboratory using USEPA Method 300.1. The reported chloride concentration for the sample from well AD-3 was 7.97 mg/L, which is below the UPL (Attachment C). Based on all results for AD-3 during the 2019 groundwater monitoring events, a positive trend is not demonstrated for chloride (Figure 1). Additionally, no other Appendix III exceedances were observed for AD-3 during the first semi-annual event of 2019. Thus, the observed chloride concentrations during the first semi-annual event are not considered indicative of a release from the BASP.

2.2 Sampling Requirements

The ASD described above supports the position that the identified SSI is not due to a release from the Welsh BASP. Therefore, the unit will remain in the detection monitoring. Groundwater at the unit will be sampled for Appendix III parameters on a semi-annual basis. In subsequent sampling events, results will be reported to the appropriate number of significant figures based on laboratory quality control protocols. As this detection monitoring event represent the fourth monitoring event since the initial background dataset was established, the results of the detection monitoring events will be compared to the existing background dataset and added to the dataset as appropriate and as recommended by the Unified Guidance (USEPA, 2009).

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 SSIs in Appendix III detection monitoring constituents are not due to a release from the Welsh BASP during the February and April 2019 sampling events. The identified SSI for chloride at well AD-3 was attributed to differences in laboratory reporting practices. 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 D.

SECTION 4

REFERENCES

EPRI, 2017. Guidelines for Development of Alternative Source Demonstrations at Coal Combustion Residual Sites. 3002010920. October.

Geosyntec, 2019. Alternative Source Demonstration Report – Federal CCR Rule. J. Robert Welsh Plant. January.

USEPA, 1999. Method 300.1 Determination of Inorganic Anions in Drinking Water by Ion Chromatography. Revision 1.0. Office of Research and Development. Cincinnati, OH.

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

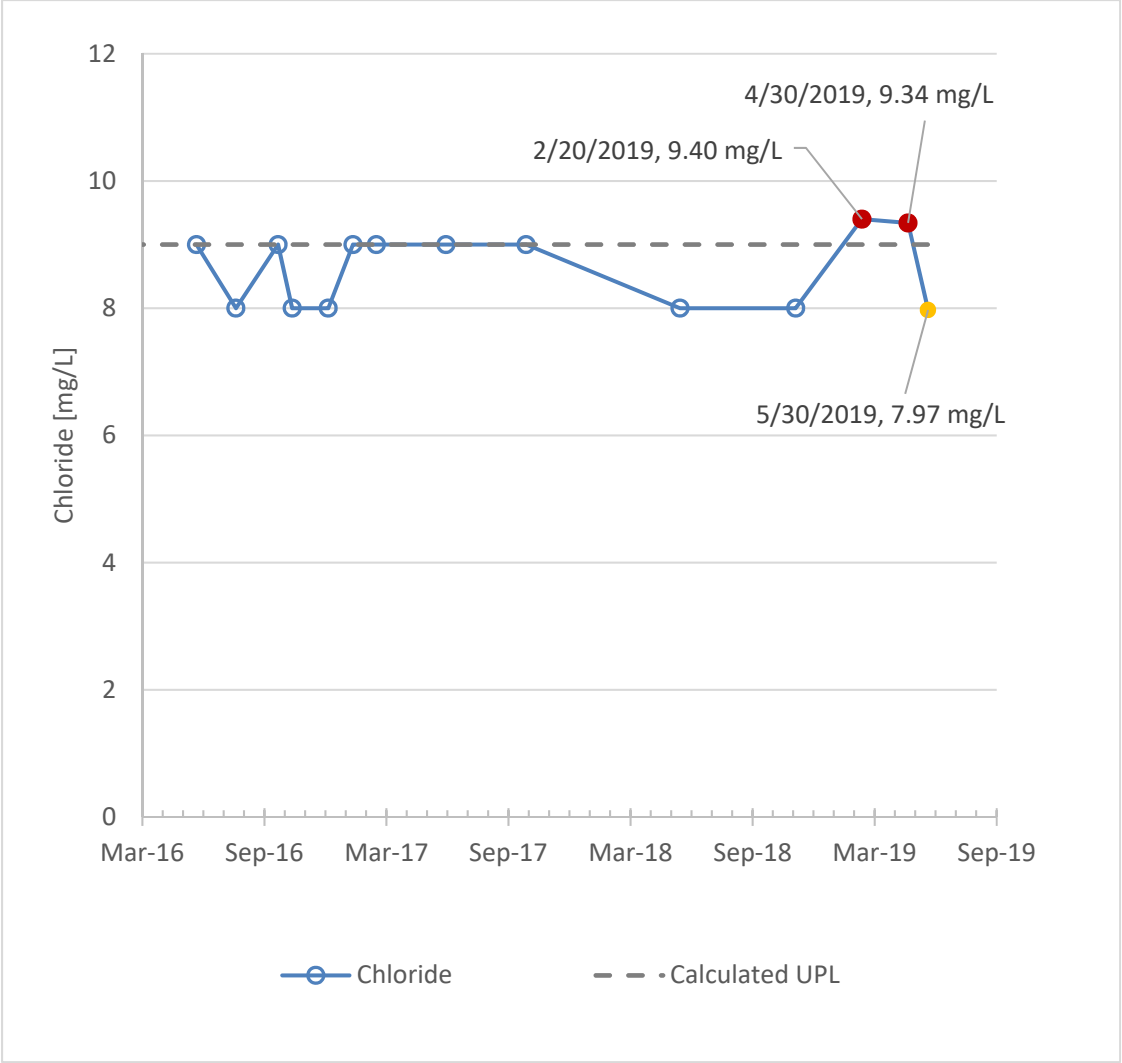
Table 1: Detection Monitoring Data Evaluation
Welsh Plant - Bottom Ash Storage Pond

Geosyntec Consultants, Inc.

Parameter	Units	Description	AD-3		AD-4C		AD-16R	
			2/20/2019	4/30/2019	2/20/2019	4/30/2019	2/20/2019	4/30/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.0333		0.0571		0.0700	
		Detection Monitoring Data	0.01 J	0.0070	0.01 J	0.0140	0.03 J	**0.0150**
Calcium	mg/L	Intrawell Background Value (UPL)	1.54		0.962		3.07	
		Detection Monitoring Data	0.817	--	0.931	--	2.00	-
Chloride	mg/L	Intrawell Background Value (UPL)	9		12.6		8.30	
		Detection Monitoring Data	**9.40**	**9.34**	9.18	--	6.78	--
Fluoride	mg/L	Intrawell Background Value (UPL)	1.0		1.0		1.0	
		Detection Monitoring Data	0.13	--	0.10	--	0.20	--
pH	SU	Intrawell Background Value (UPL)	7.6		5.9		4.4	
		Intrawell Background Value (LPL)	2.4		3.9		2.6	
		Detection Monitoring Data	4.8	4.1	5.2	4.8	**4.7**	3.9
Sulfate	mg/L	Intrawell Background Value (UPL)	12.4		59.1		64.1	
		Detection Monitoring Data	1.90	--	**60.1**	56.2	52.8	--
TDS	mg/L	Intrawell Background Value (UPL)	156		263		214	
		Detection Monitoring Data	110	--	242	--	200	--

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
Bold values exceed the background value.
Background values are shaded gray.

FIGURES



Notes: Initial sampling for the first semi-annual detection monitoring event of 2019 occurred on 02/20/2019. Verification sampling for the first semi-annual event occurred on 04/30/2019. These events are shown with red symbols. Sampling for another program occurred on 5/30/2019 (yellow symbol). The upper prediction limit (UPL) was calculated using intrawell analyses.

Chloride Time Series Graph at AD-3
Welsh BASP

Geosyntec consultants | AMERICAN ELECTRIC POWER

Columbus, Ohio | 18-Jul-2019

Figure **1**

internal info: path, date revised, author

ATTACHMENT A

Background Monitoring Data Laboratory Reports

502 North Allen Ave.
Shreveport, LA 71101
Phone: (318) 673-3802
Fax: (318) 673-3960

AEP ANALYTICAL CHEMISTRY SERVICES

Analysis Report

Report ID : 33094
Date Received: 06/01/2016

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 196453
Cust Sample ID:
Sample Desc.: AD- 3

Collected Date: 05/31/2016
Location: Welsh Power Plant CCR

By: MH
Matrix: Water

Metals (196453)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Antimony	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Arsenic	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Barium	0.053	mg/L	0.001	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Beryllium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Boron	0.02	mg/L	0.01	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Cadmium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Calcium	1.41	mg/L	0.01	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Chromium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Cobalt	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Lead	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Lithium	0.01	mg/L	0.001	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Mercury	0.00085	mg/L	0.000025	1	EPA 7470A 1994	06/17/2016 15:24		JDB
Molybdenum	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Selenium	< 0.005	mg/L	0.005	1	EPA 6010B 1996	07/06/2016 17:09		JDB
Thallium	< 0.002	mg/L	0.002	1	EPA 6010B 1996	07/06/2016 17:09		JDB

Water (196453)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Chloride	9	mg/L	1	1	EPA 300.0	06/01/2016 14:55		GB
Fluoride	< 1	mg/L	1	1	EPA 300.0	06/01/2016 14:55		GB
Solids, Total Dissolved (TDS)	106	mg/L	5	1	SM 2540 C-2011	06/02/2016 15:45		JTM
Sulfate	4	mg/L	1	1	EPA 300.0	06/01/2016 14:55		GB

502 North Allen Ave.
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Phone: (318) 673-3802
Fax: (318) 673-3960

AEP ANALYTICAL CHEMISTRY SERVICES
Analysis Report

Report ID : 33451
Date Received: 07/29/2016

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 197834
Cust Sample ID:
Sample Desc.: AD-3

Collected Date: 07/27/2016
Location: Welsh Power Plant

By: MH/KM
Matrix: Water

Metals (197834)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Antimony	< 0.005	mg/L	0.005	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Arsenic	< 0.005	mg/L	0.005	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Barium	0.036	mg/L	0.001	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Beryllium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Boron	0.02	mg/L	0.01	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Cadmium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Calcium	0.706	mg/L	0.01	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Chromium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Cobalt	< 0.005	mg/L	0.005	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Lead	< 0.005	mg/L	0.005	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Lithium	0.024	mg/L	0.001	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Mercury	0.000589	mg/L	0.000025	1	EPA 7470A 1994	08/18/2016 12:22		JDB
Molybdenum	< 0.005	mg/L	0.005	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Selenium	< 0.005	mg/L	0.005	1	EPA 6010B 1996	09/09/2016 10:09		JDB
Thallium	< 0.002	mg/L	0.002	1	EPA 6010B 1996	09/13/2016 17:50		JDB

Water (197834)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Chloride	8	mg/L	1	1	EPA 300.0	07/31/2016 11:43		GB
Fluoride	< 1	mg/L	1	1	EPA 300.0	07/31/2016 11:43		GB
Solids, Total Dissolved (TDS)	118	mg/L	5	1	SM 2540 C-2011	08/02/2016 16:15		JTM
Sulfate	5	mg/L	1	1	EPA 300.0	07/31/2016 11:43		GB

502 North Allen Ave.
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AEP ANALYTICAL CHEMISTRY SERVICES
Analysis Report

Report ID : 33888
Date Received: 09/30/2016

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 199549
Cust Sample ID:
Sample Desc.: AD-3

Collected Date: 09/30/2016
Location: Welsh P.S.

By: MH/KM
Matrix: Water

Metals (199549)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Antimony	< 0.005	mg/L	0.005	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Arsenic	< 0.005	mg/L	0.005	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Barium	0.043	mg/L	0.001	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Beryllium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Boron	0.02	mg/L	0.01	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Cadmium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Calcium	< 0.5	mg/L	0.5	1:50	EPA 6010B 1996	10/26/2016 17:28		JDB
Chromium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Cobalt	< 0.005	mg/L	0.005	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Lead	< 0.005	mg/L	0.005	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Lithium	0.019	mg/L	0.001	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Mercury	0.00039	mg/L	0.000025	1	EPA 7470A 1994	10/06/2016 10:06		LNM
Molybdenum	< 0.005	mg/L	0.005	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Selenium	< 0.005	mg/L	0.005	1	EPA 6010B 1996	10/26/2016 20:53		JDB
Thallium	< 0.002	mg/L	0.002	1	EPA 6010B 1996	10/26/2016 20:53		JDB

Water (199549)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Chloride	9	mg/L	1	1	EPA 300.0	10/05/2016 17:04		GB
Fluoride	< 1	mg/L	1	1	EPA 300.0	10/05/2016 17:04		GB
Solids, Total Dissolved (TDS)	127	mg/L	5	1	SM 2540 C-2011	10/03/2016 16:30		JTM
Sulfate	6	mg/L	1	1	EPA 300.0	10/05/2016 17:04		GB

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AEP ANALYTICAL CHEMISTRY SERVICES

Analysis Report

Report ID : 34036
Date Received: 10/21/2016

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 200428
Cust Sample ID:
Sample Desc.: AD-3

Collected Date: 10/19/2016
Location: Welsh P.S.

By: MH/KM
Matrix: Water

Metals (200428)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Antimony	< 0.005	mg/L	0.005	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Arsenic	< 0.005	mg/L	0.005	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Barium	0.041	mg/L	0.001	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Beryllium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Boron	0.06	mg/L	0.01	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Cadmium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Calcium	0.794	mg/L	0.01	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Chromium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Cobalt	< 0.005	mg/L	0.005	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Lead	< 0.005	mg/L	0.005	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Lithium	0.018	mg/L	0.001	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Mercury	0.000351	mg/L	0.000025	1	EPA 7470A 1994	10/27/2016 10:57		LNM
Molybdenum	0.006	mg/L	0.005	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Selenium	< 0.005	mg/L	0.005	1	EPA 6010B 1996	12/20/2016 1:25		JDB
Thallium	< 0.002	mg/L	0.002	1	EPA 6010B 1996	12/21/2016 21:04		JDB

Water (200428)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Chloride	8	mg/L	1	1	EPA 300.0	10/29/2016 22:09		GB
Fluoride	< 1	mg/L	1	1	EPA 300.0	10/29/2019 22:09		GB
Solids, Total Dissolved (TDS)	112	mg/L	5	1	SM 2540 C-2011	10/24/2016 16:30		JTM
Sulfate	9	mg/L	1	1	EPA 300.0	10/29/2016 22:09		GB

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AEP ANALYTICAL CHEMISTRY SERVICES
Analysis Report

Report ID : 34314
Date Received: 12/14/2016

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 202088
Cust Sample ID:
Sample Desc.: AD-3

Collected Date: 12/12/2016
Location: Welsh Power Plant

By: MH/KM
Matrix: Water

Metals (202088)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Antimony	< 0.005	mg/L	0.005	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Arsenic	< 0.005	mg/L	0.005	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Barium	0.045	mg/L	0.001	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Beryllium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Boron	0.02	mg/L	0.01	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Cadmium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Calcium	1.05	mg/L	0.01	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Chromium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Cobalt	< 0.005	mg/L	0.005	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Lead	< 0.005	mg/L	0.005	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Lithium	0.017	mg/L	0.001	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Mercury	0.000321	mg/L	0.000025	1	EPA 7470A 1994	12/28/2016 12:52		LNM
Molybdenum	< 0.005	mg/L	0.005	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Selenium	< 0.005	mg/L	0.005	1	EPA 6010B 1996	01/31/2017 3:59		JDB
Thallium	< 0.002	mg/L	0.002	1	EPA 6010B 1996	01/31/2017 3:59		JDB

Water (202088)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Chloride	8	mg/L	1	1	EPA 300.0	12/21/2016 17:10		GB
Fluoride	< 1	mg/L	1	1	EPA 300.0	12/21/2016 17:10		GB
Solids, Total Dissolved (TDS)	138	mg/L	5	1	SM 2540 C-2011	12/18/2016 14:45		JTM
Sulfate	11	mg/L	1	1	EPA 300.0	12/21/2016 17:10		GB

502 North Allen Ave.
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AEP ANALYTICAL CHEMISTRY SERVICES

Analysis Report

Report ID : 34517
Date Received: 01/20/2017

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 202906
Cust Sample ID: AD-3
Sample Desc.:

Collected Date: 01/19/2017
Location: Welsh P.P.

By: MH
Matrix: Water

Metals (202906)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Antimony	< 0.005	mg/L	0.005	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Arsenic	< 0.005	mg/L	0.005	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Barium	0.041	mg/L	0.001	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Beryllium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Boron	0.02	mg/L	0.01	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Cadmium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Calcium	0.746	mg/L	0.01	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Chromium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Cobalt	< 0.005	mg/L	0.005	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Lead	< 0.005	mg/L	0.005	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Lithium	0.014	mg/L	0.001	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Magnesium	0.49	mg/L	0.01	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Mercury	0.000504	mg/L	0.000025	1	EPA 7470A 1994	01/24/2017 14:37		LNM
Molybdenum	< 0.005	mg/L	0.005	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Potassium	0.585	mg/L	0.01	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Selenium	< 0.005	mg/L	0.005	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Sodium	7.77	mg/L	0.01	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Strontium	0.013	mg/L	0.001	1	EPA 6010B 1996	02/11/2017 0:42		JDB
Thallium	< 0.002	mg/L	0.002	1	EPA 6010B 1996	02/11/2017 0:42		JDB

Water (202906)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Alkalinity, Total	< 5	mg/L	5	1	SM 2320 B-2011	01/24/2017 17:30		JID
Bromide	< 1.0	mg/L	1.0	1	EPA 300.0	01/27/2017 12:21		GB
Chloride	9	mg/L	1	1	EPA 300.0	01/27/2017 12:21		GB
Fluoride	< 1	mg/L	1	1	EPA 300.0	01/27/2017 12:21		GB
Solids, Total Dissolved (TDS)	76	mg/L	5	1	SM 2540 C-2011	01/21/2017 14:00		JID

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AEP ANALYTICAL CHEMISTRY SERVICES

Analysis Report

Report ID : 34799
Date Received: 02/24/2017

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 204458
Cust Sample ID: AD-3
Sample Desc.: Coal Combustion Residuals

Collected Date: 02/23/2017
Location: Welsh P.S.

By: MH
Matrix: Water

Metals (204458)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Antimony	< 0.005	mg/L	0.005	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Arsenic	< 0.005	mg/L	0.005	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Barium	0.037	mg/L	0.001	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Beryllium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Boron	0.02	mg/L	0.01	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Cadmium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Calcium	0.573	mg/L	0.01	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Chromium	< 0.001	mg/L	0.001	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Cobalt	< 0.005	mg/L	0.005	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Lead	< 0.005	mg/L	0.005	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Lithium	0.014	mg/L	0.001	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Magnesium	0.485	mg/L	0.01	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Mercury	0.000501	mg/L	0.000025	1	EPA 7470A 1994	03/01/2017 12:03	H1	LNM
Molybdenum	< 0.005	mg/L	0.005	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Potassium	0.464	mg/L	0.01	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Selenium	< 0.005	mg/L	0.005	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Sodium	8.45	mg/L	0.01	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Strontium	0.013	mg/L	0.001	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB
Thallium	< 0.002	mg/L	0.002	1	EPA 6010B 1996	03/01/2017 23:52	H1	JDB

Water (204458)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Alkalinity, Total	< 5	mg/L	5	1	SM 2320 B-2011	02/27/2017 9:56	H1	JID
Bromide	< 1.0	mg/L	1.0	1	EPA 300.0	02/28/2017 5:11	H1	GB
Chloride	9	mg/L	1	1	EPA 300.0	02/28/2017 5:11	H1	GB
Fluoride	< 1	mg/L	1	1	EPA 300.0	02/28/2017 5:11	H1	GB
Solids, Total Dissolved (TDS)	104	mg/L	5	1	SM 2540 C-2011	03/02/2017 9:00	H1	JKL

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AEP ANALYTICAL CHEMISTRY SERVICES
Analysis Report

Report ID : 35500
Date Received: 06/08/2017

Company: SEP - Environmental (JP-W)
Contact: Jill Parker-Witt
Phone: (318) 673-3816

Address: 502 N. Allen Avenue
Shreveport, LA 71101
Fax: (318) 673-3960

AEP Sample ID : 207456
Cust Sample ID: AD-3
Sample Desc.: Coal Combustion Residuals (CCR)

Collected Date: 06/07/2017
Location: Welsh P.S.

By: MH
Matrix: Water

Metals (207456)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Antimony	< 0.00093	mg/L	0.00093	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Arsenic	0.00191	mg/L	0.00105	1	EPA 6010B 1996	07/20/2017 8:43	J	JDB
Barium	0.038	mg/L	0.00015	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Beryllium	0.00024	mg/L	0.00002	1	EPA 6010B 1996	07/20/2017 8:43	J	JDB
Boron	0.03326	mg/L	0.00028	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Cadmium	0.00008	mg/L	0.00007	1	EPA 6010B 1996	07/20/2017 8:43	J	JDB
Calcium	0.543	mg/L	0.0096	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Chromium	0.00075	mg/L	0.00023	1	EPA 6010B 1996	07/20/2017 8:43	J	JDB
Cobalt	0.00128	mg/L	0.00014	1	EPA 6010B 1996	07/20/2017 8:43	J	JDB
Lead	< 0.00068	mg/L	0.00068	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Lithium	0.01503	mg/L	0.00013	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Magnesium	0.489	mg/L	0.01	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Mercury	0.000365	mg/L	0.000005	1	EPA 7470A 1994	06/23/2017 12:19		LNM
Molybdenum	< 0.00029	mg/L	0.00029	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Potassium	0.532	mg/L	0.01	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Selenium	< 0.00099	mg/L	0.00099	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Sodium	8.27	mg/L	0.01	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Strontium	0.012	mg/L	0.001	1	EPA 6010B 1996	07/20/2017 8:43		JDB
Thallium	< 0.00086	mg/L	0.00086	1	EPA 6010B 1996	07/20/2017 8:43		JDB

Water (207456)

Parameter	Value	Unit	Det. Limit	Dil./Conc.	Method	Analysis Date/Time	Codes	Tech
Alkalinity, Total	< 5	mg/L	5	1	SM 2320 B-2011	06/12/2017 10:43		JID
Bromide	< 1.0	mg/L	1.0	1	EPA 300.0	06/21/2017 13:18		GB
Chloride	9	mg/L	0.219	1	EPA 300.0	06/21/2017 13:18		GB
Fluoride	0.2625	mg/L	0.083	1	EPA 300.0	06/21/2017 13:18	J	GB
Solids, Total Dissolved (TDS)	104	mg/L	2	1	SM 2540 C-2011	06/12/2017 16:30	L4	JAR

ATTACHMENT B

Detection Monitoring Event Laboratory Reports

Form REP-703
Rev. 1, 11/2013

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: 2/28/2019***

AD-3

Sample Number: 190680-001 **Date Collected: 02/20/2019 12:02** **Date Received: 2/27/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Chloride, Cl	9.40	mg/L		0.04	0.01	CRJ	02/28/2019	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.13	mg/L		0.06	0.01	CRJ	02/28/2019	EPA 300.1-1997, Rev. 1.0
Sulfate, SO4	1.9	mg/L		0.4	0.06	CRJ	02/28/2019	EPA 300.1-1997, Rev. 1.0

AD-4C

Sample Number: 190680-002 **Date Collected: 02/20/2019 11:13** **Date Received: 2/27/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Chloride, Cl	9.18	mg/L		0.1	0.03	CRJ	02/27/2019	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.1	mg/L	J	0.2	0.04	CRJ	02/27/2019	EPA 300.1-1997, Rev. 1.0
Sulfate, SO4	60.1	mg/L		1	0.2	CRJ	02/27/2019	EPA 300.1-1997, Rev. 1.0

AD-16R

Sample Number: 190680-003 **Date Collected: 02/20/2019 12:50** **Date Received: 2/27/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Chloride, Cl	6.78	mg/L		0.1	0.03	CRJ	02/27/2019	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.20	mg/L		0.2	0.04	CRJ	02/27/2019	EPA 300.1-1997, Rev. 1.0
Sulfate, SO4	52.8	mg/L		1	0.2	CRJ	02/27/2019	EPA 300.1-1997, Rev. 1.0

Duplicate BASP

Sample Number: 190680-004 **Date Collected: 02/20/2019 12:02** **Date Received: 2/27/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Chloride, Cl	9.42	mg/L		0.04	0.01	CRJ	02/28/2019	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.13	mg/L		0.06	0.01	CRJ	02/28/2019	EPA 300.1-1997, Rev. 1.0
Sulfate, SO4	1.9	mg/L		0.4	0.06	CRJ	02/28/2019	EPA 300.1-1997, Rev. 1.0

Form REP-703
Rev. 1, 11/2013

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: 6/3/2019***

AD-3

Sample Number: 191516-001 **Date Collected: 04/30/2019 10:27** **Date Received: 5/2/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	0.007	mg/L		0.005	0.0009	GES	05/21/2019 13:35	EPA 200.8-1994, Rev. 5.4
Chloride, Cl	9.34	mg/L		0.04	0.01	CRJ	05/15/2019 15:58	EPA 300.1-1997, Rev. 1.0

AD-4C

Sample Number: 191516-002 **Date Collected: 04/30/2019 11:02** **Date Received: 5/2/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	0.014	mg/L		0.005	0.0009	GES	05/21/2019 13:40	EPA 200.8-1994, Rev. 5.4
Sulfate, SO4	56.2	mg/L		1	0.2	CRJ	05/15/2019 16:21	EPA 300.1-1997, Rev. 1.0

AD-16R

Sample Number: 191516-003 **Date Collected: 04/30/2019 11:32** **Date Received: 5/2/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	0.015	mg/L		0.005	0.0009	GES	05/21/2019 15:20	EPA 200.8-1994, Rev. 5.4

AD-8

Sample Number: 191516-004 **Date Collected: 04/30/2019 10:22** **Date Received: 5/2/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	1.21	mg/L		0.005	0.0009	GES	05/21/2019 15:25	EPA 200.8-1994, Rev. 5.4

AD-9

Sample Number: 191516-005 **Date Collected: 04/30/2019 10:57** **Date Received: 5/2/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	0.070	mg/L		0.005	0.0009	GES	05/21/2019 15:30	EPA 200.8-1994, Rev. 5.4

AD-11

Sample Number: 191516-006 **Date Collected: 04/30/2019 11:32** **Date Received: 5/2/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Boron, B	1.34	mg/L		0.005	0.0009	GES	05/21/2019 15:35	EPA 200.8-1994, Rev. 5.4

ATTACHMENT C

May 2019 Sampling Laboratory Report

Duplicate Background

Sample Number: 191926-005 **Date Collected: 05/30/2019 10:32** **Date Received: 6/4/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Chloride, Cl	1.50	mg/L		0.1	0.03	CRJ	06/17/2019 20:28	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.31	mg/L		0.2	0.04	CRJ	06/17/2019 20:28	EPA 300.1-1997, Rev. 1.0
Sulfate, SO4	43.1	mg/L		1	0.2	CRJ	06/17/2019 20:28	EPA 300.1-1997, Rev. 1.0

AD-3

Sample Number: 191926-006 **Date Collected: 05/30/2019 11:49** **Date Received: 6/4/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Chloride, Cl	7.97	mg/L		0.04	0.01	CRJ	06/17/2019 21:14	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.21	mg/L		0.06	0.01	CRJ	06/17/2019 21:14	EPA 300.1-1997, Rev. 1.0
Sulfate, SO4	2.6	mg/L		0.4	0.06	CRJ	06/17/2019 21:14	EPA 300.1-1997, Rev. 1.0

AD-4C

Sample Number: 191926-007 **Date Collected: 05/30/2019 10:52** **Date Received: 6/4/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Chloride, Cl	14.6	mg/L		0.04	0.01	CRJ	06/17/2019 21:37	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.15	mg/L		0.06	0.01	CRJ	06/17/2019 21:37	EPA 300.1-1997, Rev. 1.0
Sulfate, SO4	52.6	mg/L		0.4	0.06	CRJ	06/17/2019 21:37	EPA 300.1-1997, Rev. 1.0

AD-16R

Sample Number: 191926-008 **Date Collected: 05/29/2019 12:37** **Date Received: 6/4/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Chloride, Cl	5.29	mg/L		0.04	0.01	CRJ	06/17/2019 23:55	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.18	mg/L		0.06	0.01	CRJ	06/17/2019 23:55	EPA 300.1-1997, Rev. 1.0
Sulfate, SO4	41.6	mg/L		0.4	0.06	CRJ	06/17/2019 23:55	EPA 300.1-1997, Rev. 1.0

Duplicate BASP

Sample Number: 191926-009 **Date Collected: 05/30/2019 10:52** **Date Received: 6/4/2019**

Parameter	Result	Units	Data Qual	RL	MDL	Analysis By	Analysis Date/Time	Method
Chloride, Cl	14.6	mg/L		0.04	0.01	CRJ	06/18/2019 00:18	EPA 300.1-1997, Rev. 1.0
Fluoride, F	0.15	mg/L		0.06	0.01	CRJ	06/18/2019 00:18	EPA 300.1-1997, Rev. 1.0
Sulfate, SO4	52.8	mg/L		0.4	0.06	CRJ	06/18/2019 00:18	EPA 300.1-1997, Rev. 1.0

ATTACHMENT D

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
8217 Shoal Creek Blvd., Suite 200
Austin, TX 78757

Texas Registered Engineering Firm
No. F-1182

79864	Texas	9/2/19
License Number	Licensing State	Date