2018 Annual Groundwater Monitoring Report

JC Weadock Power Plant
Bottom Ash Pond CCR Unit
Essexville, Michigan

January 2019

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Prepared For
Consumers Energy Company

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Executive Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) Bottom Ash Pond (BAP) at the JC Weadock (JCW) Power Plant Site (the site). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e). TRC Environmental Corporation (TRC) prepared this Annual Groundwater Monitoring Report for the JCW BAP CCR unit.

In the January 31, 2018 Annual Groundwater Monitoring Report for the JC Weadock Power Plant Bottom Ash Pond CCR Unit, covering calendar year 2017 activities, CEC reported that boron, calcium, pH, and sulfate were observed during groundwater detection monitoring at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC performed an Alternate Source Demonstration (ASD) for the aforementioned constituents and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to a source other than the coal combustion residual (CCR) unit. Therefore, CEC initiated an Assessment Monitoring Program for the JCW BAP CCR Unit pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The JCW BAP monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents in May 2018, within 90 days from the initial assessment monitoring (Appendix IV only) sampling event. The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the *Groundwater Protection Standards* technical memorandum dated October 15, 2018. Assessment monitoring data that has been collected and evaluated in 2018, including the establishment of the GWPSs, are presented in this report.

In 2019, CEC compared the assessment monitoring data to the GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs in accordance with §257.95. The statistical comparison of the May 2018 data to the GWPSs was completed on January 14, 2019, in accordance with §257.93(h)(2) and within the compliance schedule clarified by EPA in April 2018.

According to §257.95(g)(3), if the facility determines pursuant to §257.93(h), that any Appendix IV constituents were detected at a statistically significant level exceeding the GWPSs, the facility will either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days. Based on the results of the statistical evaluation CEC will be seeking to initiate an assessment of corrective measures within 90 days of the completion of the statistical analysis. CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Section 1
Introduction

1.1 Program Summary

On April 17, 2015, the United States Environmental Protection Agency (USEPA) published the final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) (the CCR Rule). The CCR Rule, which became effective on October 19, 2015, applies to the Consumers Energy Company (CEC) Bottom Ash Pond (BAP) at the former JC Weadock (JCW) Power Plant Site (the Site). Pursuant to the CCR Rule, no later than January 31, 2018, and annually thereafter, the owner or operator of a CCR unit must prepare an annual groundwater monitoring and corrective action report for the CCR unit documenting the status of groundwater monitoring and corrective action for the preceding year in accordance with §257.90(e).

In the January 31, *2018 Annual Groundwater Monitoring Report for the JC Weadock Power Plant Bottom Ash Pond CCR Unit*, covering calendar year 2017 activities, CEC reported that Appendix III constituents boron, calcium, pH, and sulfate were observed during groundwater detection monitoring at one or more downgradient monitoring well(s) with potential statistically significant increases (SSIs) above background concentration levels. TRC performed an Alternate Source Demonstration (ASD) for the aforementioned constituents and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to a source other than the CCR unit. Therefore, CEC initiated an Assessment Monitoring Program for the JCW BAP CCR Unit pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV.

The results from the initial assessment monitoring sampling event were used to establish groundwater protection standards (GWPSs) for the Appendix IV constituents in accordance with §257.95(h), as presented in the *Groundwater Protection Standards* technical memorandum dated October 15, 2018 (Appendix B) (TRC, October 2018). The JCW BAP monitoring system was subsequently sampled for the Appendix III and Appendix IV constituents within 90 days from the initial Appendix IV sampling event. Assessment monitoring data that has been collected and evaluated in 2018 are presented in this report.

1.2 Site Overview

The JC Weadock (JCW) coal-fired Power Plant site (the site) is located south of the DE Karn Power Plant site (DEK site), east of the Saginaw River, west of Underwood Drain and Saginaw

Bay, and north of Tacey Drain and agricultural land (Figure 1). A discharge channel separates the site from the DEK site to the north. The plant, located on the western edge of the property, began generating electricity in 1940. Six power generating units were in operation from 1940 until they were retired in 1980. In 1958 and 1959, two additional units were added. JC Weadock ceased generating electricity on April 15, 2016.

The area authorized for disposal of solid waste is located east of the JCW plant (Figure 2). The JCW Solid Waste Disposal Area is a 292-acre Type III low hazard industrial waste landfill, permitted for construction in 1992, and is governed by the Part 115 Solid Waste Disposal Area Operating License No. 9440 dated June 26, 2015.

The landfill is being monitored in accordance with the MDEQ-approved Part 115 *Hydrogeological Monitoring Plan Rev. 2: JC Weadock Solid Waste Disposal Area* (June 5, 2015). This existing CCR Landfill is delineated by the acreage of the solid waste disposal area permitted for the vertical expansion and bounded by a soil-bentonite slurry wall constructed along the centerline of the perimeter embankment dike to a depth that it is keyed in the competent confining clay underlying the unit.

An additional unit subject to the CCR rule is the JCW BAP, which is located immediately west of the historic pond/landfill area and outside of the soil-bentonite slurry wall. The bottom ash pond is the primary settling/detention structure for the NPDES Treatment System prior to discharge and characterized as an existing CCR surface impoundment. This report focuses on the JCW BAP.

1.3 Geology/Hydrogeology

The majority of JCW BAP area is comprised of surficial CCR and sand fill. USGS topographic maps and aerial photographs dating back to 1938, in addition to field descriptions of subsurface soil at the site, indicate that the site was largely developed by reclaiming low-lands through construction of perimeter dikes and subsequent ash filling.

The surficial fill consists of a mixture of varying percentages of ash, sand, and clay-rich fill ranging from 5 to 15 feet thick. Below the surficial fill, native alluvium and lacustrine soils are present at varying depths. Generally, there is a well graded sand unit present to depths of 10-30 feet below ground surface (ft bgs) overlying a clay till which is observed at depths ranging from 25 to 75 ft bgs. A sandstone unit, which is part of the Saginaw formation, was generally encountered at 80-90 ft bgs.

The site is bound by several surface water features (Figure 1): the Saginaw River to the west, a discharge channel and Saginaw Bay (Lake Huron) to the north, Underwood Drain to the east, and Tacey Drain to the south. Groundwater flow in the upper aquifer is largely controlled by

the surface water elevations of Saginaw River and Saginaw Bay. In general, shallow groundwater is encountered at a similar or slightly higher elevation relative to the surrounding surface water features. The shallow groundwater flow direction in the vicinity of the JCW BAP is to the north toward the discharge channel and to the east toward the Saginaw River.

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, CEC established a groundwater monitoring system for the JCW BAP unit, which consists of eight monitoring wells (four background monitoring wells and four downgradient monitoring wells) that are screened in the uppermost aquifer. The monitoring well locations are shown on Figure 2.

Four monitoring wells located south of the JCW BAP provide data on background groundwater quality that has not been affected by the CCR unit (MW-15002, MW-15008, MW-15016, and MW-15019). Due to the site hydrogeology and operational history of the site, a hydraulically upgradient location was not available to monitor this CCR unit. The area where background wells are located, while not upgradient, is not affected by any CCR units and therefore meets the requirements of § 257.91(a)(1). Background groundwater quality data from these four background wells are additionally used for groundwater monitoring program for the JCW landfill CCR unit as well as the DEK BAP unit.

In the vicinity of the JCW BAP CCR unit, historical groundwater flow was generally radial, flowing outward from the pond area toward the surrounding surface water bodies (Figure 3 and 4). Therefore, the four wells downgradient of the JCW BAP encircle the CCR unit (JCW-MW-15007, JCW-MW-15009, JCW-MW-15010, and JCW-MW-15028).

2.2 Preliminary Assessment Monitoring

CEC reported in the 2017 Annual Report that the Appendix III constituents boron, calcium, pH, and sulfate were observed within groundwater at one or more downgradient monitoring well(s) with potential SSIs above background concentration levels. TRC performed an ASD for the constituents and did not find strong enough evidence within 90 days to determine the observation of constituents above background was attributable to a source other than the CCR unit. Therefore, CEC initiated an Assessment Monitoring Program for the Bottom Ash Pond CCR Unit pursuant to §257.95 of the CCR Rule that included sampling and analyzing groundwater within the groundwater monitoring system for all constituents listed in Appendix IV. The monitoring was performed in accordance with the *DE Karn Monitoring Program Sample Analysis Plan* (SAP) (ARCADIS, May 2016).

2.2.1 Data Summary

The preliminary Appendix IV only assessment monitoring event (per §257.95(b)) was performed on April 9 through April 12, 2018. Downgradient monitoring wells JCW-MW-15007, JCW-MW-15009, JCW-MW-15010, and JCW-MW-15028 and background monitoring wells MW-15002, MW-15008, MW-15016, and MW-15019 were sampled during this monitoring event.

Static water elevation measurements were collected at all monitoring well locations. Static water elevation data are summarized in Table 1 and groundwater elevation data are shown on Figure 2. Monitoring wells were purged with peristaltic pumps or submersible pumps utilizing low-flow sampling methodology. Field parameters were stabilized at each monitoring well prior to collecting groundwater samples. Field parameters for each monitoring well are summarized in Table 2.

The groundwater samples were analyzed by Pace Analytical Services, LLC (Pace) for Appendix IV constituents during the preliminary assessment monitoring event in accordance with the SAP. The analytical results are summarized in Table 3.

2.2.2 Data Quality Review

Data from each round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program. The data quality reviews are summarized in Appendix A.

2.2.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the April 2018 assessment monitoring sampling event were generally similar to data collected previously in the background and detection monitoring events.

Groundwater elevations at the site are generally within the range of 580 to 584 feet above mean sea level (ft AMSL) and groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. Groundwater elevations measured during the April 2018 sampling event are provided on Table 1 and were used to construct groundwater contour map (Figure 3).

The figure shows that groundwater continues to flow to the north toward the discharge channel and to the west near the Saginaw River. The general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the

downgradient wells are appropriately positioned to detect the presence of Appendix IV constituents that could potentially migrate from the JCW BAP CCR unit. The average hydraulic gradient throughout the JCW BAP CCR unit area during these events is estimated at 0.0041 ft/ft. The gradient was calculated using the well pairs JCW-MW-15028/JCW-MW-15009, JCW-MW-15007/JCW-MW-15010, and JCW-MW-15016/JCW-MW-15002. Using the mean hydraulic conductivity of 16 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity was approximately 0.22 ft/day or 80 ft/year, which is consistent with previous estimates.

2.3 Semiannual Groundwater Monitoring

Per §257.95(d), within 90 days of the preliminary assessment monitoring event and semiannually thereafter, all wells must be resampled and analyzed for all constituents from Appendix III and for those constituents in Appendix IV of the CCR Rule that were detected during prior sampling. In addition to the Appendix III and IV indicator constituents, field parameters including dissolved oxygen, oxidation reduction potential, specific conductivity, temperature, and turbidity were collected at each well. Samples were collected and analyzed according to the SAP.

2.3.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2018 was performed on May 21 to May 24, 2018, by TRC personnel and samples were analyzed by Pace in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the four background monitoring wells and four downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. A summary of the groundwater data collected during the May 2018 event is provided on Table 1 (static groundwater elevation data), Table 2 (field parameters), and Table 3 (analytical results).

The second semiannual groundwater assessment monitoring event for 2018 was performed on November 5 through November 9, 2018 by TRC personnel and samples were analyzed by Pace in accordance with the SAP. Static water elevation data were collected at all monitoring well locations. Groundwater samples were collected from the four background monitoring wells and four downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. As of the writing of this report, lab analysis and data quality review are ongoing. Therefore, a summary of groundwater data will be provided under separate cover after laboratory analysis is complete and results have been reviewed for usability. Consumers Energy will enter this information into the operating record as soon as it is available and include it in the 2019 Annual Groundwater Monitoring and Corrective Action Report.

2.3.2 Data Quality Review

Data from each round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The data were found to be complete and usable for the purposes of the CCR monitoring program. The data quality reviews are summarized in Appendix A.

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the May 2018 assessment monitoring sampling events were generally similar to data collected previously in the background and detection monitoring events.

Groundwater elevations at the site are generally within the range of 580 to 584 feet above mean sea level (ft AMSL) and groundwater is typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features. Groundwater elevations measured during the May 2018 sampling events are provided on Table 1 and were used to construct groundwater contour map (Figure 4).

The figure shows that groundwater continues to flow to the north toward the discharge channel and to the west near the Saginaw River. The general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix IV constituents that could potentially migrate from the JCW BAP CCR unit. The average hydraulic gradient throughout the JCW BAP CCR unit area during these events is estimated at 0.0029 ft/ft. The gradient was calculated using the same well pairs as the aforementioned April 2018 event. Using the mean hydraulic conductivity of 16 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity was approximately 0.15 ft/day or 60 ft/year, which is consistent with previous estimates.

The general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix IV constituents that could potentially migrate from the JCW BAP CCR unit.

Section 3
Statistical Evaluation

3.1 Establishing Groundwater Protection Standards

In accordance with §257.95(h) and the *Groundwater Statistical Evaluation Plan* (Stats Plan) (TRC, October 2017), groundwater protection standards (GWPSs) were established for the Appendix IV constituents following the preliminary assessment monitoring event using nine rounds of data collected from the background monitoring wells MW-15002, MW-15008, MW-15016, and MW-15019 (December 2015 through April 2018). The calculation of the GWPSs is documented in the *Groundwater Protection Standards* technical memorandum included in Appendix B of this annual report (TRC, October 2018). The GWPS is established as the higher of the EPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the EPA Regional Screening Levels (RSLs) or background level for constituents with RSLs. The Appendix IV GWPSs will be used to assess whether groundwater has been impacted from the JCW BAP CCR unit by statistically comparing concentrations in the downgradient wells to the GWPSs for each Appendix IV constituent.

3.2 Data Comparison to Groundwater Protection Standards

Consistent with the *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (Unified Guidance) (USEPA, 2009), the preferred method for comparisons to a fixed standard are confidence limits. An exceedance of the standard occurs when the 99 percent lower confidence level of the downgradient data exceeds the GWPS. The statistical data comparison was reported on January 14, 2019, within 90 days of establishing the GWPSs in accordance with §257.93(h)(2) and within the compliance schedule clarified by the USEPA in a letter dated April 30, 2018 (USEPA, April 2018).

The statistical evaluation report has been entered into operating record by CEC on January 14, 2019 in accordance with §257.105(h)(8). Notification of the statistical analysis of the assessment monitoring data compared to the GWPS, if necessary, will be made in accordance with §257.106(h) and posting such notification to the publicly accessible compliance website in accordance with §257.107(h) will be completed within 30 days of the completion of the statistical analysis. This evaluation will be included in the 2019 Annual Groundwater Monitoring and Corrective Action Report since it was completed in calendar year 2019.

Subsequently, following receipt of final laboratory reports for all Appendix IV constituents and completion of data quality review, the results from the November 2018 semiannual sampling event will also be statistically compared to the GWPSs using the same approach as the initial

event. It is anticipated that the statistical comparison of the second semiannual 2018 event will be completed in March/April 2019. Consumers Energy will enter this information into the operating record as soon as it is available and will include it in the 2019 Annual Groundwater Monitoring and Corrective Action Report.

Section 4
Conclusions and Recommendations

Semiannually after triggering assessment monitoring, groundwater samples will be collected from the groundwater monitoring system wells and analyzed for Appendix III and Appendix IV constituents pursuant to §257.95(d). In accordance with §257.93(h)(2) and within the compliance schedule clarified by the EPA in April 2018, the first round of semiannual assessment monitoring data were statistically evaluated against the GWPSs as reported on January 14, 2019. CEC has placed this analysis in the operating record in accordance with §257.105(h)(8) on January 14, 2019. Notification that one or more Appendix IV constituents have been detected at statistically significant levels above the GWPS will be submitted, if necessary, in accordance with §257.106(h) and posting such notifications to the publicly accessible compliance website in accordance with §257.107(h) will be completed within 30 days of days of the completion of the statistical analysis. This evaluation will be included in the 2019 Annual Groundwater Monitoring and Corrective Action Report since it was completed in calendar year 2019.

According to §257.95(g)(3), if the facility determines pursuant to §257.93(h), that any Appendix IV constituents were detected at a statistically significant level exceeding the GWPSs, the facility will either conduct an alternate source demonstration or initiate an assessment of corrective measures according to §257.96 within 90 days. Based on the results of the statistical evaluation CEC will be seeking to initiate an assessment of corrective measures within 90 days of the completion of the statistical analysis. CEC will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

In addition, the statistical evaluation of the second semiannual 2018 monitoring event is anticipated to be completed in March/April 2019 and will be posted to the public website within 30 days of being finalized. Consumers Energy will enter this information into the operating record as soon as it is available and will include it in in the forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report.

The next semiannual monitoring event is tentatively scheduled for the second calendar quarter of 2019.

Section 5
References

ARCADIS. May 13, 2016. Summary of Monitoring Well Design, Installation, and Development. JC Weadock Electric Generation Facility – Essexville, Michigan. Prepared for Consumers Energy Company.

ARCADIS. May 18, 2016. Electric Generation Facilities RCRA CCR Detection Monitoring Program. JC Weadock Monitoring Program Sample Analysis Plan, Essexville, Michigan. Prepared for Consumers Energy Company.

Consumers Energy Company. June 9, 2015. Hydrogeological Monitoring Plan Rev. 2: JC Weadock Solid Waste Disposal Area.

TRC. October 2017. Groundwater Statistical Evaluation Plan – JC Weadock Power Plant, Bottom Ash Pond, Essexville, Michigan. Prepared for Consumers Energy Company.

TRC. October 15, 2018. Groundwater Protection Standards, Consumers Energy, JC Weadock Site, Bottom Ash Pond CCR Unit, technical memorandum prepared for Consumers Energy Company.

TRC Environmental Corporation. January 2018. Annual Groundwater Monitoring Report – JC Weadock Power Plant, Bottom Ash Pond CCR Unit. Prepared for Consumers Energy Company.

USEPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance. Office of Conservation and Recovery. EPA 530/R-09-007.

USEPA. April 2015. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. 80 Federal Register 74 (April 17, 2015), pp. 21301-21501 (80 FR 21301).

USEPA. July 2018. 40 CFR Part 257. Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals from Electric Utilities; Amendments to the National Minimum Criteria (Phase One, Part One); Final Rule. 83 Federal Register 146 (July 30, 2018), pp. 36435-36456 (83 FR 36435).

USEPA. April 2018. Barnes Johnson (Office of Resource Conservation and Recovery) to James Roewer (c/o Edison Electric Institute) and Douglas Green, Margaret Fawal (Venable LLP). Re: Coal Combustion Residuals Rule Groundwater Monitoring Requirements. April 30, 2018. United States Environmental Protection Agency, Washington, D.C. 20460. Office of Solid Waste and Emergency Response, now the Office of Land and Emergency Management.

Tables

Table 1
Summary of Groundwater Elevation Data
DE Karn and JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Well Location	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			April 9, 2018		May 14, 2018	
						Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background									
MW-15002	587.71	Sand	580.9	to	570.9	6.65	581.06	6.57	581.14
MW-15008	585.36	Sand with clay	578.7	to	568.7	4.38	580.98	4.15	581.21
MW-15016	586.49	Sand	581.2	to	578.2	4.06	582.43	4.34	582.15
MW-15018	586.42	Sand	580.6	to	576.6	5.07	581.35	5.33	581.09
MW-15019	586.17	Sand and Sand/Clay	579.5	to	569.5	5.21	580.96	5.13	581.04
MW-15020	585.95	Sand	578.5	to	568.5	5.08	580.87	4.81	581.14
MW-15024	586.56	Sand	579.7	to	569.7	5.80	580.76	5.50	581.06
MW-15027	586.25	Sand	578.2	to	568.2	5.37	580.88	5.11	581.14
DEK Bottom Ash Pond									
DEK-MW-15001(1)	594.64	Sand	576.1	to	575.1	11.44	583.20	--	--
DEK-MW-18001(1)	593.47	Sand	579.2	to	574.2	--	--	8.49	584.98
DEK-MW-15002	590.87	Sand	578.3	to	575.3	4.57	586.30	4.41	586.46
DEK-MW-15003	602.80	Sand	578.8	to	574.8	14.24	588.56	14.11	588.69
DEK-MW-15004	611.05	Sand	576.6	to	571.6	22.91	588.14	22.87	588.18
DEK-MW-15005	589.72	Sand	572.3	to	567.3	9.10	580.62	8.67	581.05
DEK-MW-15006	589.24	Sand	573.0	to	568.0	8.60	580.64	8.20	581.04
JCW Bottom Ash Pond									
JCW-MW-15007	587.40	Sand	582.7	to	579.2	3.69	583.71	3.89	583.51
JCW-MW-15009	589.64	Sand	581.9	to	576.9	8.48	581.16	8.09	581.55
JCW-MW-15010	597.76	Sand	579.7	to	578.2	16.37	581.39	15.55	582.21
JCW-MW-15028	589.37	Sand	567.7	to	564.7	6.93	582.44	6.84	582.53
JCW Landfill									
JCW-MW-15011	597.07	Sand	582.4	to	578.9	14.36	582.71	13.59	583.48
JCW-MW-15012	595.07	Sand and Clay	581.4	to	576.4	14.48	580.59	13.75	581.32
JCW-MW-15023	595.32	Sand	579.7	to	574.7	13.36	581.96	12.66	582.66

Notes:

Survey data from: Rowe Professional Services Company (Nov. 2015) and Consumers Energy Company drawings: SG-21733, Sheet 1, Rev. G (Karn, 11/27/18); and SG-21733, Sheet 2, Rev. C (Weadock, 11/27/18).

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BTOC: Feet below top of well casing.

--: Not measured.

(1) - DEK-MW-15001 was decommissioned on April 18, 2018 due to the installation of the new Karn Lined Impoundment. DEK-MW-18001 was installed on May 21, 2018.

Table 2
Summary of Field Parameter Results – April and May 2018
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
MW-15002	4/9/2018	0.31	23.4	6.7	9,267	7.4	2.3
	5/22/2018	0.32	-29.7	7.0	6,259	11.0	4.8
MW-15008	4/10/2018	0.19	-5.6	6.6	1,507	6.4	4.9
	5/22/2018	0.24	-33.8	6.8	1,456	9.4	4.6
MW-15016	4/10/2018	1.33	45.7	7.3	1,675	4.7	3.8
	5/22/2018	0.34	45.4	7.3	1,547	13.3	1.7
MW-15019	4/9/2018	0.25	-58.1	6.8	2,091	5.9	3.8
	5/22/2018	0.23	-53.1	6.9	2,030	9.4	3.9
Bottom Ash Pond							
JCW-MW-15007	4/10/2018	0.20	-18.4	7.1	5,685	6.4	3.0
	5/23/2018	0.29	-12.8	7.2	6,050	13.4	6.6
JCW-MW-15009	4/10/2018	0.21	69.7	4.7	2,624	9.2	6.5
	5/23/2018	0.34	-9.4	4.9	2,504	11.4	8.3
JCW-MW-15010	4/10/2018	1.81	-76.3	7.3	919	11.3	6.4
	5/22/2018	0.23	-233.6	7.5	839	12.6	3.1
JCW-MW-15028	4/11/2018	0.20	93.7	7.8	1,383	9.7	< 1.0
	5/23/2018	0.24	-34.0	8.0	1,520	13.3	0.5

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard units.
umhos/cm - Micromhos per centimeter.
°C - Degrees Celcius
NTU - Nephelometric Turbidity Unit.

Table 3
Summary of Groundwater Sampling Results (Analytical) – April and May 2018
JC Weadock Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	JCW-MW-15007		JCW-MW-15009		JCW-MW-15010		JCW-MW-15028	
					Sample Date:	4/10/2018	5/23/2018	4/10/2018	5/23/2018	4/10/2018	5/22/2018	4/11/2018	5/23/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient							
Appendix III													
Boron	ug/L	NC	**500**	**500**	4,000	--	308	--	297	--	**1,330**	--	444
Calcium	mg/L	NC	NC	NC	**500**	--	145	--	**530**	--	78.3	--	125
Chloride	mg/L	**250****	**250**	**250**	**50**	--	**1,660**	--	41.0	--	**99.8**	--	**69.5**
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.1	7.2	**4.7**	**4.9**	7.3	7.5	7.8	8.0
Sulfate	mg/L	**250****	**250**	**250**	**500**	--	19.6	--	**1,690**	--	24.3	--	32.2
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	--	**3,210**	--	**2,510**	--	458	--	**1,030**
Appendix IV													
Antimony	ug/L	6	6	6	2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	**16.7**	**25.6**	1.6	1.4	**12.5**	**11.4**	1.2	< 1.0
Barium	ug/L	2,000	2,000	2,000	1,200	957	941	12.3	14.4	121	123	148	148
Beryllium	ug/L	**4**	**4**	**4**	25	< 1.0	< 1.0	**7.1**	**6.5**	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	2.5	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chromium	ug/L	100	100	100	11	< 1.0	< 1.0	1.4	1.4	< 1.0	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	NC	40	100	100	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	14	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	**170**	350	440	80	88	**210**	**190**	77	72	48	48
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	73	210	120	6.4	7.6	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	0.878	0.239	< 0.703	< 0.723	< 0.831	< 0.618	< 0.934	< 0.739
Radium-226/228	pCi/L	5	NC	NC	NC	1.64	1.03	< 1.37	< 1.37	< 2.04	< 1.36	1.65	< 1.42
Radium-228	pCi/L	NC	NC	NC	NC	0.761	0.795	0.707	1.11	1.39	< 0.741	0.988	< 0.676
Selenium	ug/L	50	50	50	**5**	1.2	< 1.0	**14.2**	**5.2**	< 1.0	1.0	< 1.0	< 1.0
Thallium	ug/L	2	2	2	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.

NC - no criteria.

* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.

** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.

^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}

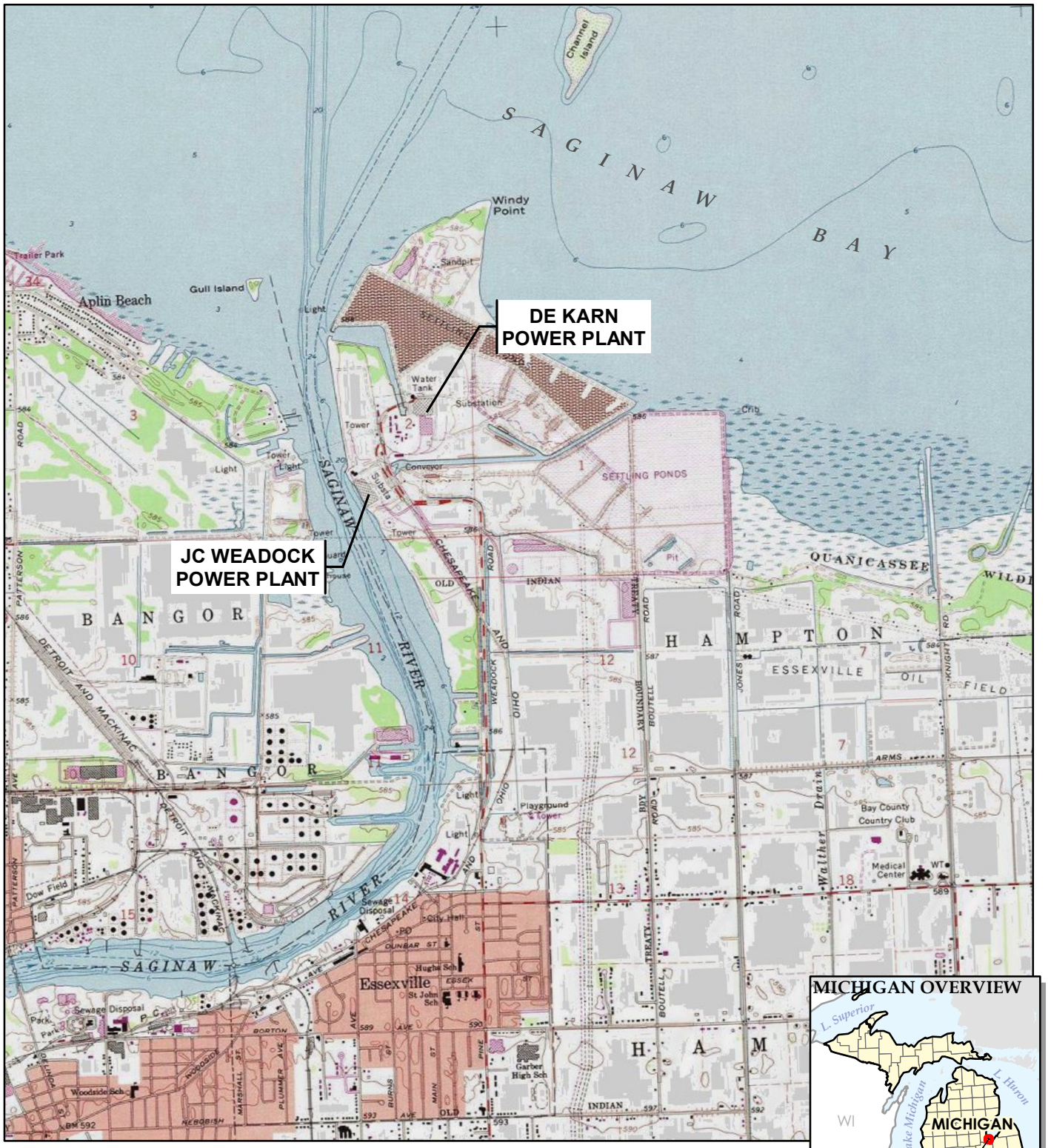
- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and MDEQ policy and procedure 09-014 dated June 20, 2012.

BOLD value indicates an exceedance of one or more of the listed criteria.

RED value indicates an exceedance of the MCL.

All metals were analyzed as total unless otherwise specified.

Figures



BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

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1 " = 3,000 '
1:36,000

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FEET

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
DE KARN AND JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	D. LITZ
APPROVED BY:	G. CROCKFORD
DATE:	OCTOBER 2017
PROJ. NO.:	269767-002/3
FILE:	269767-002_3-007SLM.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\269767-002_3-007SLM.mxd -- Saved By: SMAJOR on 10/12/2017, 08:42:53 AM

LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- DEK LINED IMPOUNDMENT MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- SURFACE WATER GAUGING STATION
- SLURRY WALL (APPROXIMATE)
- EXTENT OF GEOSYNTHETICS (KARN LINED IMPOUNDMENT)

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).

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PROJECT:

CONSUMERS ENERGY COMPANY
DE KARN AND JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:

SITE PLAN

DRAWN BY:	S. MAJOR	PROJ NO.:	290805-001
CHECKED BY:	D. LITZ		
APPROVED BY:	G. CROCKFORD		**FIGURE 2**
DATE:	JANUARY 2019		

TRC
1540 Eisenhower Place
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Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 290805-001-018.mxd

Plot Date: 1/24/2019, 12:08:13 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\Consumers\Energy\CCR GW\2017 269767\290805-001-018.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

TRC - GIS

Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
Plot Date: 1/24/2019, 12:10:02 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290805-001-017.mxd

LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING
- DECOMMISSIONED MONITORING
- JCW BOTTOM ASH POND MONITORING
- JCW LANDFILL MONITORING
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- SLURRY WALL (APPROXIMATE)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).
4. MONITORING WELL DEK- MW-18001 INSTALLED IN MAY 2018. SURVEY DATA NOT YET AVAILABLE.

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1 " = 1,000 '
1:12,000

PROJECT:
CONSUMERS ENERGY COMPANY
DE KARN AND JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:
SHALLOW GROUNDWATER CONTOUR MAP APRIL 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	290805-001
CHECKED BY:	D. LITZ		
APPROVED BY:	G. CROCKFORD		**FIGURE 3**
DATE:	JANUARY 2019		

TRC
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FILE NO.: 290805-001-017.mxd

LEGEND

- BACKGROUND MONITORING WELL
- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- JCW BOTTOM ASH POND MONITORING WELL
- JCW LANDFILL MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- GROUNDWATER ELEVATION CONTOUR (2' INTERVAL, DASHED WHERE INFERRED)
- SLURRY WALL (APPROXIMATE)
- *(580.85)* GROUNDWATER ELEVATION (FEET, MSL)

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016 .
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).

0 1,000 2,000 Feet

1 " = 1,000 '
1:12,000

PROJECT:
CONSUMERS ENERGY COMPANY
DE KARN AND JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:
SHALLOW GROUNDWATER CONTOUR MAP MAY 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	290805-001
CHECKED BY:	D. LITZ		
APPROVED BY:	G. CROCKFORD		**FIGURE 4**
DATE:	JANUARY 2019		

TRC
1540 Eisenhower Place
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FILE NO.: 290805-001-019.mxd

Plot Date: 1/24/2019, 12:05:43 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\290805-001-019.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
TRC - GIS

Appendix A
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Monitoring Event April 2018
CEC DE Karn and JC Weadock Background Wells

Groundwater samples were collected by TRC for the April 2018 sampling event. Samples were analyzed for anions and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4610843 and 4610844.

During the April 2018 sampling event, a groundwater sample was collected from each of the following wells:

- MW-15002
- MW-15008
- MW-15016
- MW-15019

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix; Tables

- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch; no analytes were detected in the blank samples.
- The LCS recoveries for all analytes were within QC limits.
- A field blank (FB-20180410) was collected; no analytes were detected in the blank samples.
- Dup_20180410 corresponds to MW-15008_20180410; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicates analyses were performed on non-project samples; RPDs were within QC limits.
- MS/MSD analyses were performed on non-project samples.

Laboratory Data Quality Review
Groundwater Monitoring Event May 2018
CEC DE Karn and JC Weadock Background Wells

Groundwater samples were collected by TRC for the May 2018 sampling event. Samples were analyzed for anions, total dissolved solids, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4612624 and 4612625.

During the May 2018 sampling event, a groundwater sample was collected from each of the following wells:

- MW-15002
- MW-15008
- MW-15016
- MW-15019

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;

- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation are noted below.

- Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch; no analytes were detected in the blank samples.
- The LCS recoveries for all analytes were within QC limits.
- A field blank (FB_20180522) was collected; no analytes were detected in the blank samples.
- The field duplicate pair samples were Dup_20180522 with MW-15019_20180522; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits (20%), with the exception of sulfate (25%). Potential uncertainty exists for sulfate results for the field duplicate pair (see attached Table); however, the concentrations of sulfate detected in both the duplicate and primary sample were within the range of historical sulfate concentrations observed in MW-15019.

- Laboratory duplicates analyses were performed on non-project samples; thus, these QC samples were not evaluated.
- MS/MSD analyses were performed on non-project samples; thus, these QC samples were not evaluated.

Attachment A
Summary of Data Non-Conformances for Background Groundwater Analytical Data
DE Karn & JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
Dup_20180522	5/22/2018	Sulfate	RPD for the field duplicate pair exceeded the 20% acceptance limit. Potential uncertainty exists for sulfate results due to the field duplicate variability; however, concentrations are within range of historical sulfate concentrations. Data deemed usable for intended purpose.
MW-15019_20180522	5/22/2018		

Laboratory Data Quality Review
Groundwater Monitoring Event April 2018
CEC JC Weadock Bottom Ash Pond

Groundwater samples were collected by TRC for the April 2018 sampling event. Samples were analyzed for anions and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4610841 and 4610842.

During the April 2018 sampling event, a groundwater sample was collected from each of the following wells:

- JCW-MW-15007
- JCW-MW-15009
- JCW-MW-15010
- JCW-MW-15028

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;

- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch; no analytes were detected in the blank samples.
- One equipment blank (EB-1) and one field blank (FB-1) were collected; no analytes were detected in the blank samples.
- The LCS recoveries for all analytes were within QC limits.
- MS/MSD analyses were performed on samples JCW-MW-15009 for anions, metals, and radium.
    - The selenium recoveries in the MS/MSD performed on sample JCW-MW-15009 in batch 21033 were below the lower laboratory control limits. Selenium results for samples analyzed in the same batch may be biased low (see attached table); however, the concentrations of selenium in the batch 21033 samples were within the

range of historical selenium concentrations, with the exception of JCW-MW-15009. The selenium concentration observed at JCW-MW-15009 was above the range of historical results.

- Dup-1 corresponds to JCW-MW-15028; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were performed on sample JCW-MW-15009 for fluoride; the RPD was within the QC limit.

Attachment A
Summary of Data Non-Conformances for Bottom Ash Pond Groundwater Analytical Data
JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
JCW-MW-15007_20180410	4/10/2018	Selenium	MS/MSD recoveries were below the lower control limit. Sample result may be biased low; however, the concentrations of selenium were within the range of historical concentrations, with the exception of JCW-MW-15009. The selenium concentration observed at JCW-MW-15009 was above the range of historical results.
JCW-MW-15009_20180410	4/10/2018		
JCW-MW-15010_20180410	4/10/2018		
JCW-MW-15028_20180411	4/11/2018		
DUP-1_20180411	4/11/2018		
EB-1_20180411	4/11/2018		
FB-1_20180410	4/10/2018		

Laboratory Data Quality Review
Groundwater Monitoring Event May 2018
CEC JC Weadock Bottom Ash Pond

Groundwater samples were collected by TRC for the May 2018 sampling event. Samples were analyzed for anions, total dissolved solids, and total metals by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and for radium by Pace located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory reports 4612766 and 4612776.

During the May 2018 sampling event, a groundwater sample was collected from each of the following wells:

- JCW-MW-15007
- JCW-MW-15009
- JCW-MW-15010
- JCW-MW-15028

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C-11
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Radium (Radium-226, Radium-228, Total Radium)	EPA 903.1, EPA 904.0

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using the USEPA National Functional Guidelines for Inorganic Superfund Methods Data Review (USEPA, 2017) and the Department of Energy Evaluation of Radiochemical Data Usability (USDOE, 1997). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field blanks are used to assess potential contamination arising from field procedures;

- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when available. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

The data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Appendix III and IV constituents will be utilized for the purposes of an assessment monitoring program.
- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- A method blank was analyzed with each analytical batch; no analytes were detected in the blank samples.
- One equipment blank (EB-1) and one field blank (FB-1) were collected; no analytes were detected in the blank samples.
- The LCS recoveries for all analytes were within QC limits.
- MS/MSD analyses were performed on samples JCW-MW-15009 for anions, metals, and radium.
    - The recovery of fluoride in the MSD in batch 24594 was above the upper laboratory control limit. Fluoride was not detected in any sample analyzed in this batch, therefore, data usability was not affected.

- The recoveries of calcium in the MS/MSD in batch 25032 were above the upper laboratory control limit. The calcium concentration in the parent sample was >4x the spike concentration; therefore, the laboratory control limits are not applicable. Data usability was not affected.
- The recoveries for boron in the MS/MSD and relative percent difference (RPD) in batch 25051 were outside the laboratory control limits; however, the parent sample boron concentration was >4x the spike concentration. Therefore, the laboratory control limits are not applicable. Data usability was not affected.
- The arsenic, chromium, and selenium RPDs for the MS/MSD in batch 25051 were above the laboratory control limit. Potential uncertainty exists for arsenic, chromium, and selenium results for samples analyzed in this batch (see attached Table); however, the concentrations for arsenic, chromium, and selenium were within the range of historic concentrations for each sample in batch 25051.

- The field duplicate pair samples were Dup-1 and JCW-MW-15010; RPDs between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were performed on sample JCW-MW-15009 for anions and total dissolved solids; the RPDs were within the QC limits.

Attachment A
Summary of Data Non-Conformances for Bottom Ash Pond Groundwater Analytical Data
JC Weadock – RCRA CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
DUP-01-20180522	5/22/2018	Arsenic	RPD for the MS/MSD was above the laboratory control limits. Potential uncertainty exists for the results as a result of the duplicate variability; however, data were within range of historical concentrations.
EB-01-20180523	5/23/2018		
FB-01-20180523	5/23/2018		
JCW-MW-15007-20180523	5/23/2018		
JCW-MW-15009-20180523	5/23/2018		
JCW-MW-15010-20180522	5/22/2018		
JCW-MW-15028-20180523	5/23/2018		
DUP-01-20180522	5/22/2018	Chromium	RPD for the MS/MSD was above the laboratory control limits. Potential uncertainty exists for the results as a result of the duplicate variability; however, data were within range of historical concentrations.
EB-01-20180523	5/23/2018		
FB-01-20180523	5/23/2018		
JCW-MW-15007-20180523	5/23/2018		
JCW-MW-15009-20180523	5/23/2018		
JCW-MW-15010-20180522	5/22/2018		
JCW-MW-15028-20180523	5/23/2018		
DUP-01-20180522	5/22/2018	Selenium	RPD for the MS/MSD was above the laboratory control limits. Potential uncertainty exists for the results as a result of the duplicate variability; however, data were within range of historical concentrations.
EB-01-20180523	5/23/2018		
FB-01-20180523	5/23/2018		
JCW-MW-15007-20180523	5/23/2018		
JCW-MW-15009-20180523	5/23/2018		
JCW-MW-15010-20180522	5/22/2018		
JCW-MW-15028-20180523	5/23/2018		

Appendix B
Groundwater Protection Standards

Technical Memorandum

Date:	October 15, 2018; Revised December 7, 2018
To:	J.R. Register, CEC Brad Runkel, CEC
From:	Darby Litz, TRC Sarah Holmstrom, TRC Joyce Peterson, TRC
Project No.:	290805.0000 Phase 001, Task 002
Subject:	Groundwater Protection Standards – Consumers Energy, JC Weadock Site, Bottom Ash Pond

Pursuant to the United States Environmental Protection Agency's (U.S. EPA's) Resource Conservation and Recovery Act (RCRA) Coal Combustion Residual rule ("CCR Rule") promulgated on April 17, 2015, the owner or operator of a CCR Unit must collect a minimum of eight rounds of background groundwater data to initiate a detection monitoring program and evaluate statistically significant increases above background (40 CFR §257.94). The first detection monitoring event for the Consumers Energy Company (CEC) JC Weadock Power Plant (JCW site) in Essexville, Michigan, was conducted on September 18 and 19, 2017. During this event several Appendix III constituents were observed in downgradient monitoring wells at concentrations constituting statistically significant increases (SSIs) over the background concentrations established for the site (2017 Annual Report). Alternative Source Demonstrations (ASDs) were unsuccessful for one or more SSI, thereby triggering the requirement for establishing an Assessment Monitoring Program in accordance with 40 CFR §257.95. Groundwater samples were collected on April 10 through 12, 2018, that were analyzed for Appendix IV parameters pursuant to §257.95(b). In compliance with §257.95(d), additional groundwater samples were collected on May 21, through 24 2018, and were analyzed for Appendix III and IV parameters. Analytical data collected from the background monitoring wells are presented in attached Table A1.

If assessment monitoring is triggered pursuant to §257.94(e)(1), data are compared to Groundwater Protection Standards (GWPSs). The CCR Rule [§257.95(h)] requires GWPSs to be established for Appendix IV constituents that have been detected during baseline sampling. Per §257.95(h)[1], the MCLs will be the GWPSs for those constituents that have established MCLs. For Appendix IV constituents

[1] As amended per Phase One, Part One of the CCR Rule (83 FR 36435).

that do not have established MCLs, the GWPSs are based upon the EPA Regional Screening Levels (RSLs). For constituents that have statistically derived background levels higher than the MCL and/or RSL, the GWPS becomes the background level.

This memorandum presents the background statistical limits and GWPS derived for the Appendix IV parameters for the JC Weadock site using the aforementioned approach pursuant to §257.95(h). However, it should be noted that in the future, risk-based standards may be used in place of the GWPSs presented in this memorandum based on promulgated rule changes and/or authorization for the state of Michigan to administer and enforce compliance with the CCR Rule.

Following the Appendix IV baseline data collection period (December 2015 through April 2018), the Appendix IV background data were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). The June 2018 data were not included in the baseline dataset and were not used to establish background limits. The background groundwater data are maintained within a database accessible through Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in U.S. EPA's Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (Unified Guidance; UG). Within the Sanitas™ statistical program (and the UG), tolerance limits were selected to perform the statistical calculation for background limits. Use of tolerance limits is a streamlined approach that offers adequate statistical power under the current, initial stage of establishing background and developing the monitoring program. Additionally, tolerance limits are recommended by the UG as an acceptable approach to establish background-based groundwater protection standards for assessment monitoring under the CCR rule. Upper tolerance limits (UTLs) were calculated for each of the CCR Appendix IV parameters. The following narrative describes the methods employed and the results obtained and the Sanitas™ output files are included as an attachment.

The set of background wells utilized for the DEK BAP, JCW BAP, and JCW LF sites includes MW-15002, MW-15008, MW-15016, and MW-15019. The background evaluation included the following steps:

- Review of data quality reports for the baseline/background data sets for CCR Appendix IV constituents;
- Graphical representation of the baseline data as time versus concentration (T v. C) by well/constituent pair;
- Graphical representation of cumulative baseline background data sorted from lowest to highest concentration for each constituent;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of percentage of nondetects for each background well-constituent (w/c) pair;
- Distribution of the data;

- Calculation of the UTL for each cumulative background data set; and
- Establishment of GWPS as the higher of the MCL, RSL or the UTL for each Appendix IV constituent.

The results of these evaluations are presented and discussed below.

Data Quality

Data from each sampling round were evaluated for completeness, overall quality and usability, method-specified sample holding times, precision and accuracy, and potential sample contamination. The review was completed using the following quality control (QC) information which at a minimum included chain-of-custody forms, investigative sample results including blind field duplicates, and matrix spike and matrix spike duplicates (MS/MSDs) recoveries, and, as provided by the laboratory, method blanks, laboratory control spikes, laboratory duplicates. The data were found to be complete and usable for the purposes of the CCR monitoring program.

Time versus Concentration Graphs

The T v. C graphs show a potential outlier for lithium (high value for MW-15016 in February 2017) (Figure 1). This data set will be tested by the Sanitas™ software to assess whether the potential outliers are statistically significant.

While variations in results are present, the graphs do not suggest that data sets, as a whole, likely have overall trending or seasonality. The data sets are of relatively short duration for making such observations.

Cumulative Baseline Data Sets

Ideally, the background data sets provide a continuous concentration distribution. The ideal is rarely achieved by multiple background wells representing a relatively large geographic area such as is the case at the Karn and Weadock complex. When sorted by concentration, the data generally group by well (Figure 2). Most of the parameters have a relatively consistent distribution. These results need to be taken into consideration as they represent potential non-CCR upgradient contributions to downgradient wells.

Outlier Testing

The Dixon's Outlier Test in Sanitas™ was used to test the potential outlier in the lithium data set for MW-15016 that was identified in the T v. C graphs (Figure 1) and in the cumulative concentration distribution (Figure 2). The suspect data point was found to not be an outlier at the 0.01 significance level (see attached Sanitas™ output file). The potential outlier was not confirmed and not removed from the data set. The data point will be retained for the Groundwater Protection Standards UTL calculations.

Percentage of Nondetects

Table 1 summarizes the percentage of results below the reporting limit for each w/c pair.

Table 1
Summary of Percentage of Appendix IV Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
MW-15002	Antimony	100
	Arsenic	25
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	13
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	38
	Mercury	100
	Molybdenum	100
	Selenium	88
	Thallium	100
	Radium 226 and 228 combined	38
MW-15008	Antimony	100
	Arsenic	50
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	0
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	0
	Mercury	100
	Molybdenum	100
	Selenium	100
	Thallium	100
	Radium 226 and 228 combined	13
MW-15016	Antimony	100
	Arsenic	0
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	50

Table 1
Summary of Percentage of Appendix IV Baseline Results Below Reporting Limit

WELL	CONSTITUENT	PERCENT NON-DETECT
MW-15016 *(cont'd)*	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	0
	Mercury	100
	Molybdenum	75
	Selenium	75
	Thallium	100
	Radium 226 and 228 combined	25
MW-15019	Antimony	100
	Arsenic	88
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	50
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	0
	Mercury	100
	Molybdenum	100
	Selenium	100
	Thallium	100
	Radium 226 and 228 combined	13
COMBINED	Antimony	100
	Arsenic	41
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	28
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	9
	Mercury	100
	Molybdenum	94
	Selenium	91
	Thallium	100
	Radium 226 and 228 combined	22

Distribution of the Data Sets

The distribution of the data sets is determined by the Sanitas™ software during calculation of the upper tolerance limit. The Shapiro-Wilk normality test is used for samples sizes less than 50. Non-detect/censored data were handled in accordance with the Stats Plan. If the data appear to be non-normal, mathematical transformations of the data may be utilized such that the transformed data follow a normal distribution (e.g., lognormal distributions). Alternatively, non-parametric tests may be utilized when data cannot be normalized. Table 2 summarizes the distributions determined by the Sanitas™ software. The distribution is based on the combined baseline results for all four background monitoring wells.

Table 2
Summary of Background/Baseline Data Distributions

CONSTITUENT	DISTRIBUTION
Antimony	All ND – use highest RL
Arsenic	Nonnormal
Barium	Normalized by natural log transformation
Beryllium	All ND – use highest RL
Cadmium	All ND – use highest RL
Chromium	Nonnormal
Cobalt	All ND – use highest RL
Fluoride	All ND – use highest RL
Lead	All ND – use highest RL
Lithium	Nonnormal
Mercury	All ND – use highest RL
Molybdenum	Nonnormal (>75% censored data)
Selenium	Nonnormal (>75% censored data)
Thallium	All ND – use highest RL
Radium 226 and 228 combined	Normalized by square root transformation

ND = Non-detect
RL = Reporting Limit

Upper Tolerance Limits

Table 3 presents the calculated upper tolerance limits for the background/baseline data sets. For data sets with normal distributions or distributions normalized by transformation, UTLs are calculated for 95 percent coverage and 95 percent confidence using parametric tolerance limits. For nonnormal background datasets, a nonparametric tolerance limit is utilized, resulting in the highest value from the background dataset as the UTL. The achieved confidence and/or coverage rates depend entirely on the number of background data points, and coverage rates for various confidence levels are shown in the Sanitas™ outputs for nonparametric tolerance limits. Verification resampling (1 of 2) is recommended per the Stats Plan and UG to achieve a site-wide false positive rate within the range specified in the CCR rules.

Table 3
Summary of Initial Groundwater Protection Standards

CONSTITUENT	UNITS	UPPER TOLERANCE LIMIT – FROM SANITAS™	MAXIMUM CONTAMINANT LEVEL	REGIONAL SCREENING LEVEL	GROUNDWATER PROTECTION STANDARD
Antimony	ug/L	RL (1)	6	NA	6
Arsenic	ug/L	21	10	NA	21
Barium	ug/L	1,300	2,000	NA	2,000
Beryllium	ug/L	RL (1)	4	NA	4
Cadmium	ug/L	RL (0.2)	5	NA	5
Chromium	ug/L	3	100	NA	100
Cobalt	ug/L	RL (15)	NC	6	15
Fluoride	ug/L	RL (1,000)	4,000	NA	4,000
Lead	ug/L	RL (1)	NC	15	15
Lithium	ug/L	180	NC	40	180
Mercury	ug/L	RL (0.2)	2	NA	2
Molybdenum	ug/L	6	NC	100	100
Selenium	ug/L	2	50	NA	50
Thallium	ug/L	RL (2)	2	NA	2
Radium 226 and 228 combined	pCi/L	3.32	5	NA	5

RL = Reporting Limit
NC = No Criteria
NA = Not Applicable

Revised 12/7/18

Attachments

Table A1 – Summary of Groundwater Sampling Results (Analytical)

Figure 1 – Background Concentration Time-Series Charts
Figure 2 – Combined Background Distribution

Sanitas™ Output Files

Table A1
Summary of Groundwater Sampling Results
(Analytical)

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
Essexville, Michigan

Sample Location:		MW-15002										
Sample Date:		12/8/2015	3/28/2016	5/23/2016	8/22/2016	11/30/2016	2/22/2017	5/17/2017	8/1/2017	9/19/2017	4/9/2018	5/22/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	275	22	163	79	48	133	138	205	313	--	69.2
Calcium	mg/L	198	174	288	114	84.7	260	267	255	249	--	221
Chloride	mg/L	1,130	773	2,140	420	260	1,470	1,970	2,290	2,270	--	2,020
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	7.0	7.0	6.6	6.9	7.2	7.0	6.8	6.9	6.9	6.7	7.0
Sulfate	mg/L	9.63	40.3	5.25	39.8	23.4	13.1	11.5	< 2.0	< 2.0	--	37.8
Total Dissolved Solids	mg/L	2,400	1,700	4,500	1,300	980	3,100	4,300	4,600	4,280	--	3,810
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	4	< 1	7	< 1	2	2	3	4.8	--	< 1.0	< 1.0
Barium	ug/L	1,010	216	796	167	212	851	580	912	--	547	364
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	1	1	2	< 1	1	1	2	1.3	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	37.7	< 10	21	< 10	< 10	24	22	31	--	24	14
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	0.637	0.33	0.893	< 0.264	< 0.402	0.556	0.879	1.72	--	0.866	0.751
Radium-226/228	pCi/L	2.047	< 0.644	2.523	< 1.05	< 0.433	2.036	2.98	4.65	--	2.45	2.47
Radium-228	pCi/L	1.41	< 0.644	1.63	< 1.05	< 0.433	1.48	2.1	2.93	--	1.58	1.72
Selenium	ug/L	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
-- - not analyzed.
All metals were analyzed as total
unless otherwise specified.

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
Essexville, Michigan

Sample Location:		MW-15008											
Sample Date:		12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/17/2017	8/2/2017	9/19/2017	4/10/2018	4/10/2018	5/22/2018
Constituent	Unit	Background											
Appendix III												Field Dup	
Boron	ug/L	236	169	176	202	204	174	187	164	183	--	--	153
Calcium	mg/L	114	126	113	114	113	107	114	108	109	--	--	111
Chloride	mg/L	292	231	246	214	192	200	149	300	329	--	--	255
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.8	6.7	6.5	6.7	6.8	6.8	6.7	6.9	6.8	6.6	--	6.8
Sulfate	mg/L	5.15	26.7	8.6	17.9	25.6	27.7	10.1	13.4	3.9	--	--	4.3
Total Dissolved Solids	mg/L	860	720	880	730	790	760	840	866	848	--	--	744
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	< 1	1	1	1	1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	69	64	63	58	69	57	60	58.2	--	57.1	56.7	54.7
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	3	2	3	2	2	1	2	1.1	--	< 1.0	1.1	2.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	22.3	19.7	17	20	22	20	19	22	--	26	25	19
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	0.481	0.546	0.411	0.32	0.444	< 0.419	0.228	< 0.937	--	< 0.621	< 0.420	< 0.929
Radium-226/228	pCi/L	1.531	1.42	1.611	1.96	1.454	0.826	1.45	< 1.79	--	< 1.26	< 1.15	2.00
Radium-228	pCi/L	1.05	0.874	1.2	1.64	1.01	0.717	1.22	< 0.848	--	0.795	< 0.727	1.94
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed.

All metals were analyzed as total unless otherwise specified.

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
Essexville, Michigan

Sample Location:		MW-15016										
Sample Date:		12/8/2015	3/29/2016	5/24/2016	8/22/2016	11/30/2016	2/22/2017	5/17/2017	8/1/2017	9/19/2017	4/10/2018	5/22/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	490	56	472	660	435	463	491	590	602	--	409
Calcium	mg/L	178	204	188	216	192	295	221	208	160	--	212
Chloride	mg/L	89.7	264	91.1	93.6	83	160	110	113	99.5	--	82.4
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	7.1	7.1	6.8	6.8	7.0	7.2	7.0	7.0	7.1	7.3	7.3
Sulfate	mg/L	35.1	151	75	70.6	18.1	817	243	294	13.3	--	539
Total Dissolved Solids	mg/L	670	1,000	900	920	840	1,700	1,100	1,090	756	--	1,230
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	11	2	16	18	16	2	12	20.5	--	< 1.0	< 1.0
Barium	ug/L	237	114	233	299	241	109	151	197	--	41.8	47.4
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Chromium	ug/L	1	1	1	< 1	< 1	2	< 1	< 1.0	--	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Lithium	ug/L	31.2	16.9	33	48	28	181	88	83	--	120	100
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20
Molybdenum	ug/L	6	< 5	< 5	< 5	< 5	6	< 5	< 5.0	--	5.4	6.5
Radium-226	pCi/L	0.311	0.303	0.292	< 0.199	< 0.304	< 0.312	0.479	< 1.01	--	< 0.658	< 0.711
Radium-226/228	pCi/L	1.581	0.75	1.402	< 1.41	1.079	0.736	0.958	< 2.34	--	< 1.36	< 1.48
Radium-228	pCi/L	1.27	< 0.673	1.11	< 1.41	0.871	0.573	< 0.619	< 1.33	--	< 0.697	< 0.765
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	2	1	< 1.0	--	1.7	1.2
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
-- - not analyzed.
All metals were analyzed as total
unless otherwise specified.

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
Essexville, Michigan

Sample Location:		MW-15019											
Sample Date:		12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/16/2017	8/2/2017	9/19/2017	4/9/2018	5/22/2018	5/22/2018
Constituent	Unit	Background											
Appendix III													Field Dup
Boron	ug/L	304	244	279	343	300	317	299	293	324	--	225	247
Calcium	mg/L	171	150	179	227	154	149	146	165	155	--	128	137
Chloride	mg/L	437	387	408	358	359	379	357	380	438	--	382	379
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	6.8	6.8	6.7	6.7	6.8	6.8	6.8	6.9	6.9	6.8	6.9	--
Sulfate	mg/L	99.7	51.2	116	195	67.3	54.2	49.5	120	99.7	--	51.6	66.4
Total Dissolved Solids	mg/L	1,400	1,100	1,300	1,300	1,100	1,200	1,100	1,250	1,200	--	1,080	1,120
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Barium	ug/L	293	263	269	319	275	289	283	265	--	246	258	255
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Chromium	ug/L	2	2	2	< 1	< 1	1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Lithium	ug/L	15.8	11	14	21	13	13	14	16	--	17	11	12
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	1.02	0.477	0.515	0.759	0.524	< 0.3	0.36	< 0.844	--	0.444	< 0.690	< 0.799
Radium-226/228	pCi/L	1.835	1.243	1.502	1.677	1.006	1.045	1.74	< 1.57	--	1.03	< 1.56	< 1.59
Radium-228	pCi/L	0.815	0.766	0.987	0.918	< 0.666	0.814	1.38	< 0.722	--	< 0.589	< 0.874	0.964
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

-- - not analyzed.

All metals were analyzed as total unless otherwise specified.

Table A1
Summary of Groundwater Sampling Results (Analytical) – December 2015 to May 2018
DE Karn & JC Weadock Background – RCRA CCR Monitoring Program
Essexville, Michigan

Sample Location:		MW-15027								
Sample Date:		12/9/2015	3/29/2016	5/24/2016	8/23/2016	11/30/2016	2/22/2017	5/17/2017	8/2/2017	9/19/2017
Constituent	Unit	Background								
Appendix III										
Boron	ug/L	208	144	181	253	169	135	178	199	223
Calcium	mg/L	103	109	108	111	95.8	93.6	120	113	103
Chloride	mg/L	348	285	348	293	223	225	275	386	379
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
pH, Field	SU	7.0	6.9	6.8	6.8	7.0	7.0	6.9	7.0	7.0
Sulfate	mg/L	16	30.7	12.9	20.8	25.4	19.5	22.9	10.8	15.0
Total Dissolved Solids	mg/L	800	890	980	850	790	750	910	982	968
Appendix IV										
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--
Arsenic	ug/L	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1.0	--
Barium	ug/L	95	89	95	94	78	79	103	107	--
Beryllium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--
Cadmium	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--
Chromium	ug/L	2	1	2	1	1	1	2	< 1.0	--
Cobalt	ug/L	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--
Fluoride	ug/L	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--
Lithium	ug/L	27.2	21.3	21	23	20	19	23	26	--
Mercury	ug/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--
Molybdenum	ug/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--
Radium-226	pCi/L	0.386	0.461	0.485	0.359	< 0.305	0.396	0.431	< 0.878	--
Radium-226/228	pCi/L	1.356	1.395	1.308	1.277	0.962	1.606	1.27	2.15	--
Radium-228	pCi/L	0.97	0.934	0.823	0.918	0.706	1.21	0.836	1.56	--
Selenium	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--
Thallium	ug/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

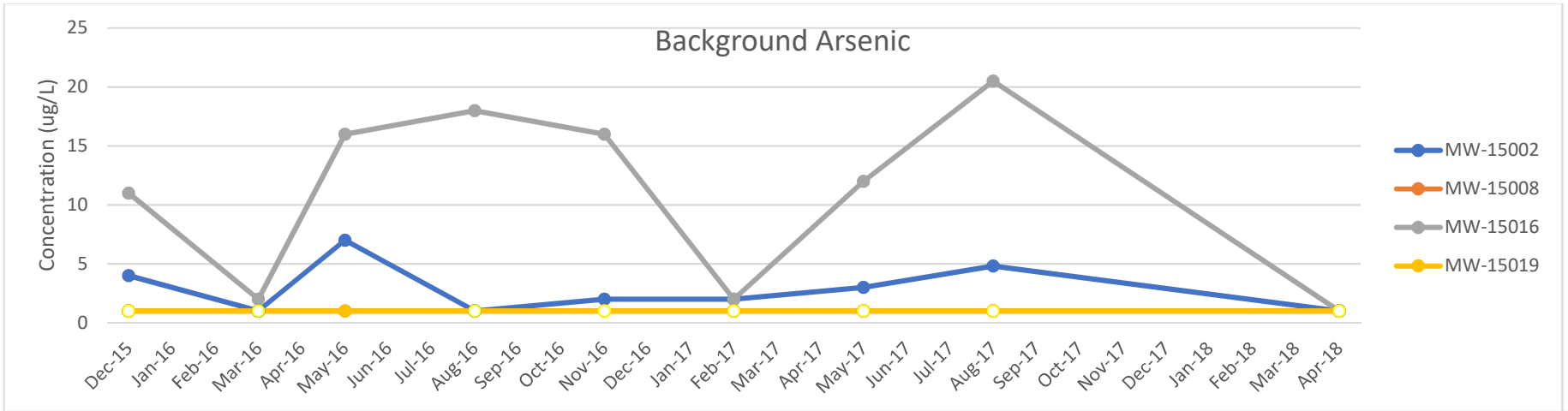
pCi/L - picocuries per liter.

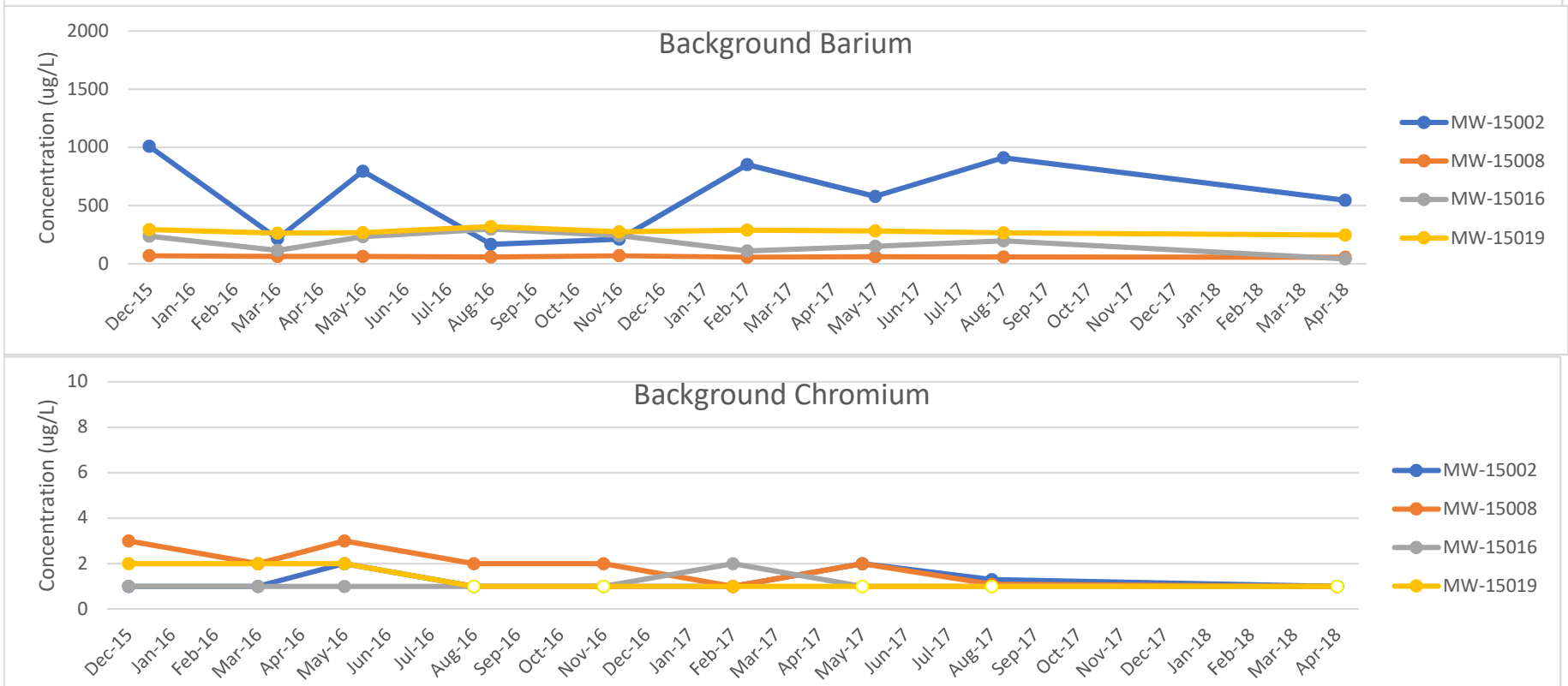
-- - not analyzed.

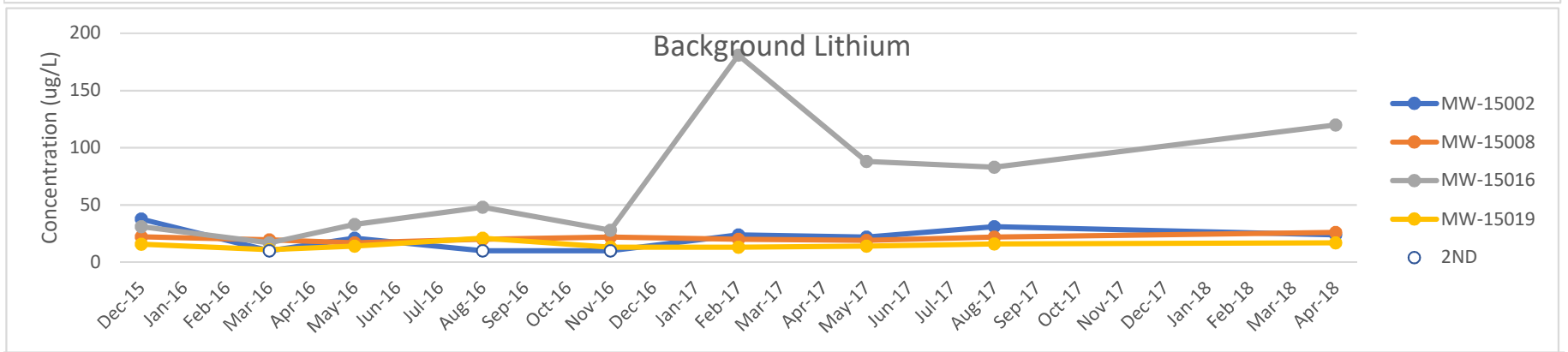
All metals were analyzed as total unless otherwise specified.

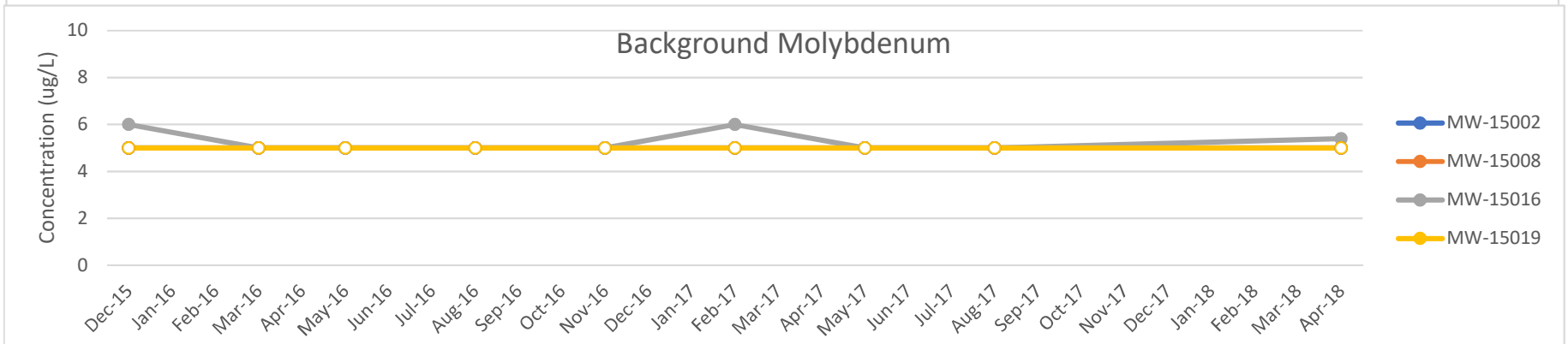
Figures

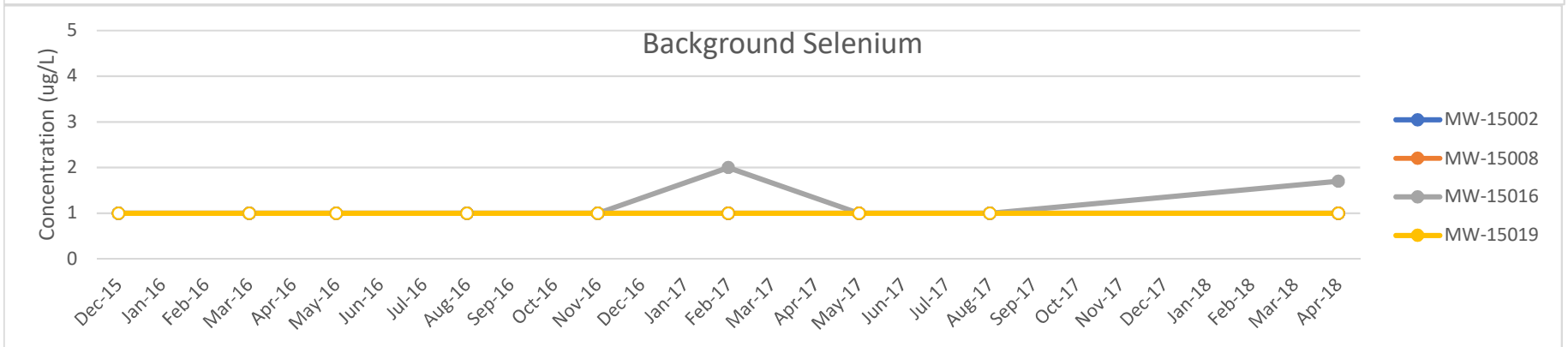
Figure 1
Background Concentration Time-Series Charts
Karn/Weadock Site - Appendix IV Constituents

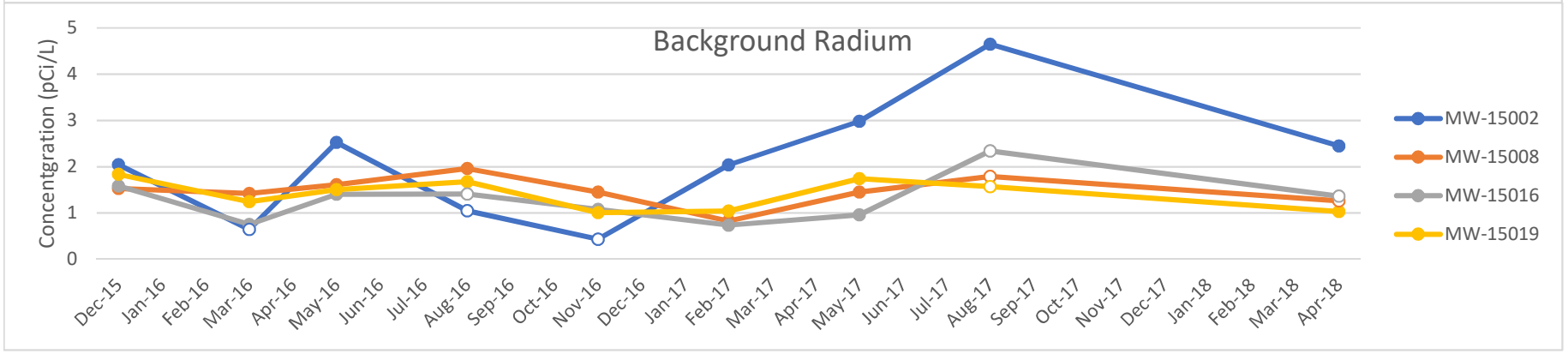






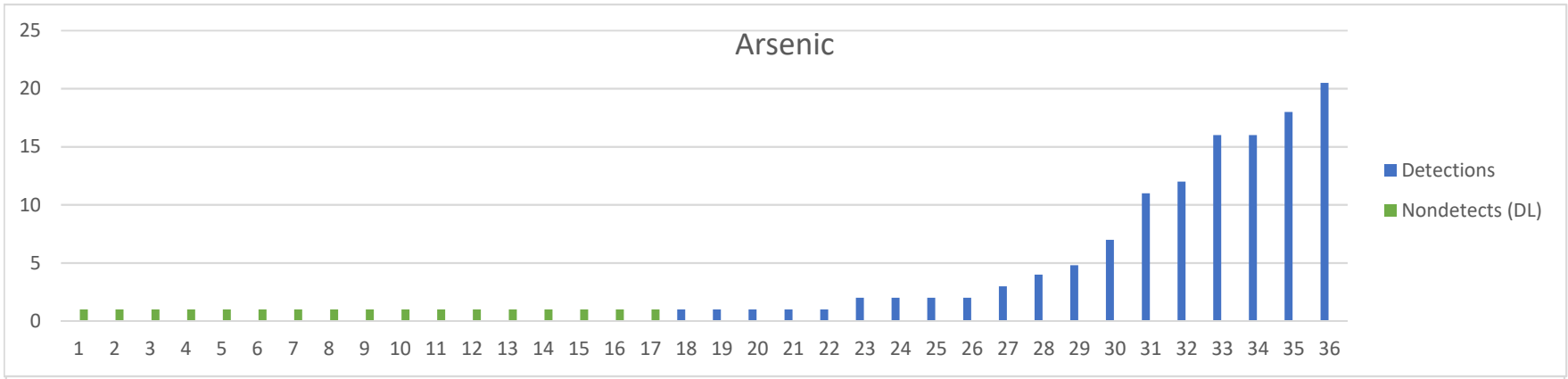


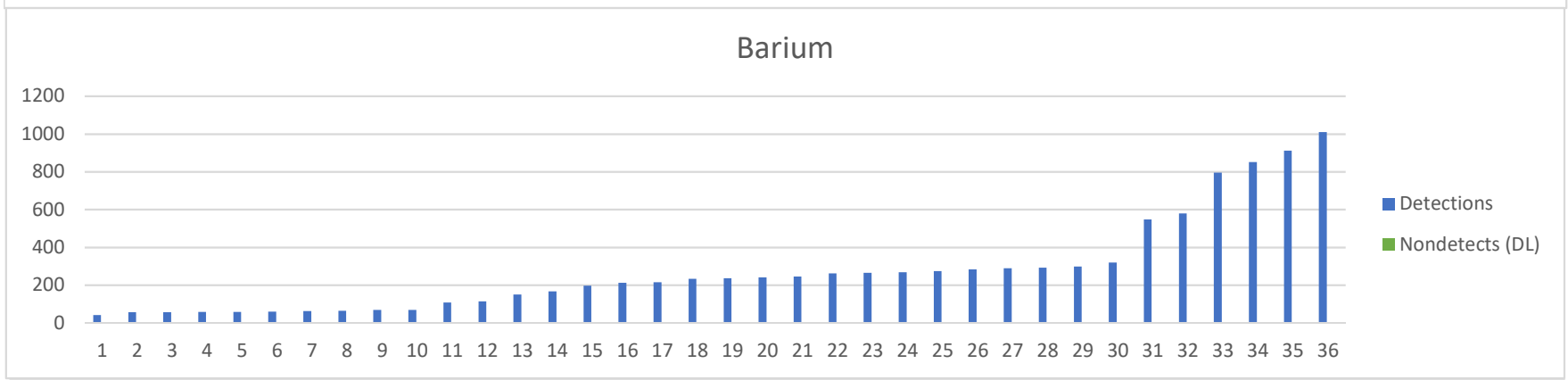


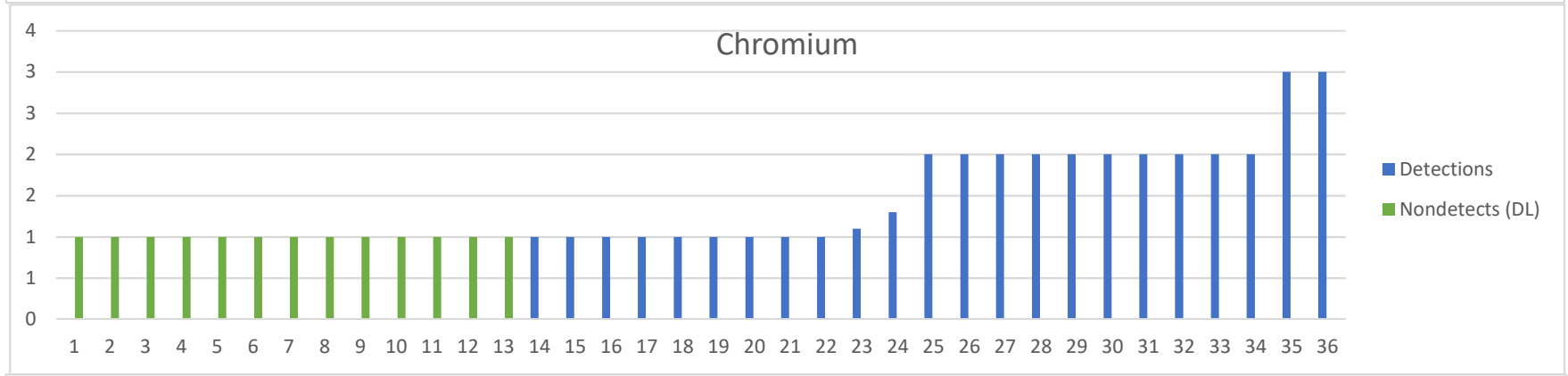


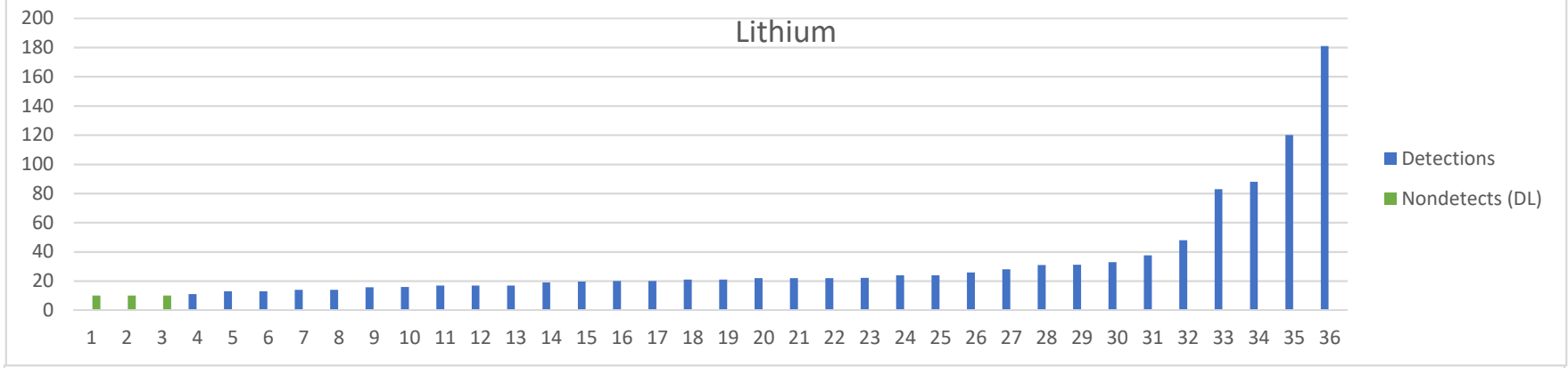
P:\Clients\Consumers Energy\Karn_Weadock\Assessment Monitoring\ProUCL_data_Karn-Weadock_20180516

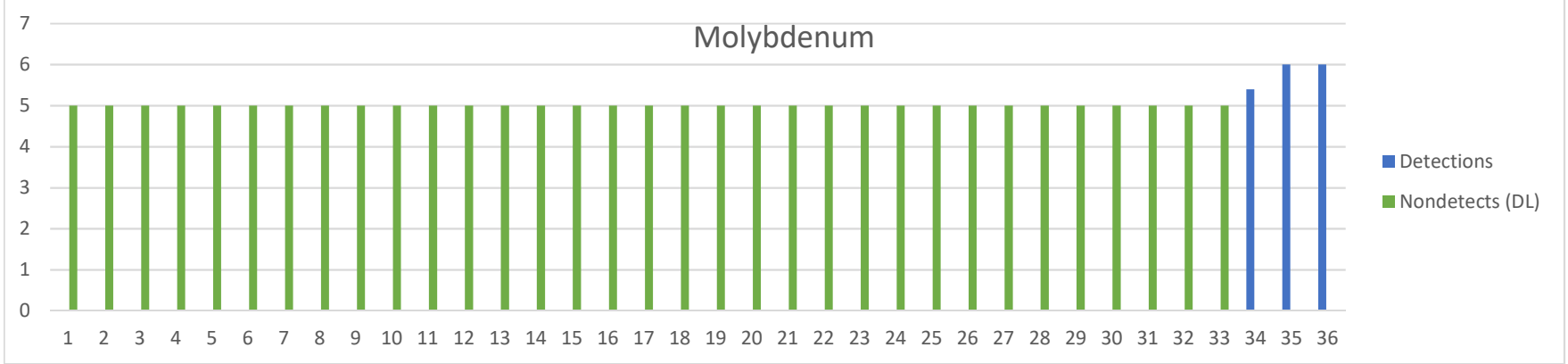
Figure 2
Cumulative Background Concentrations - Appendix IV
Karn/Weadock Complex

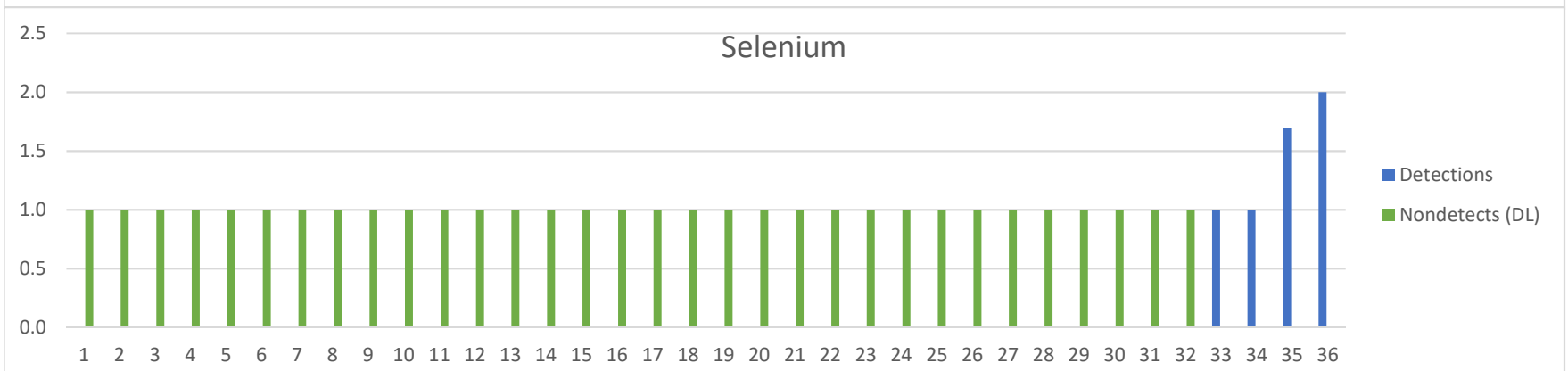


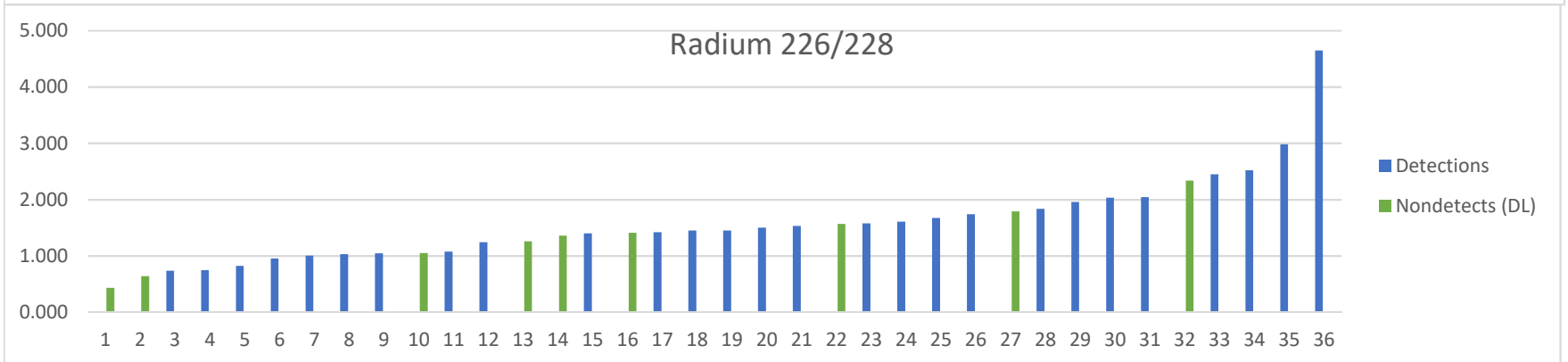










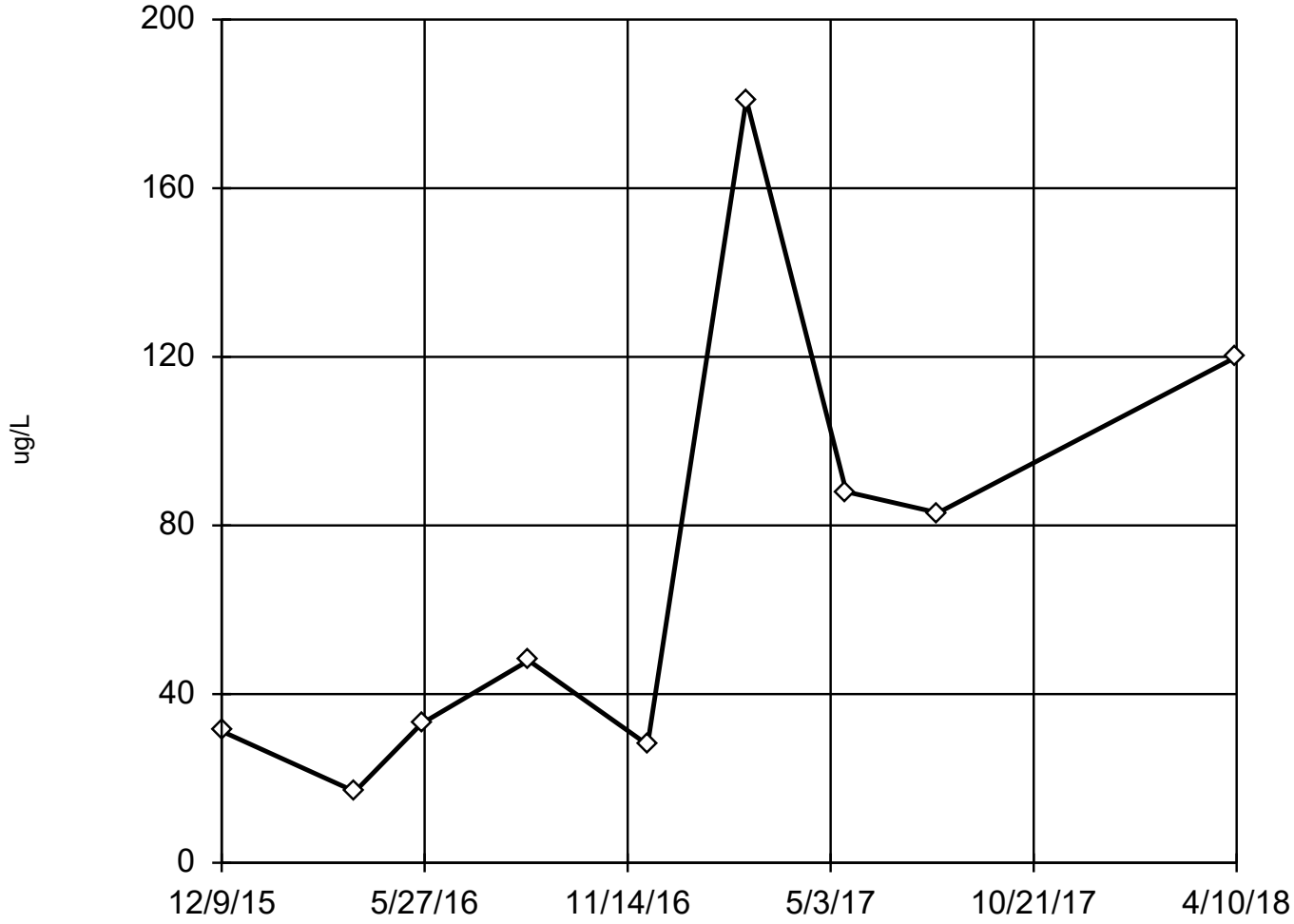


Technical Memorandum

Sanitas™ Output Files

EPA Screening (suspected outliers for Dixon's Test)

MW-15016 (bg)



n = 9

Dixon's will not be run.
Unable to establish suspect values.
Mean 69.9, std. dev. 53.92, critical Tn 2.11

Normality test used:
Shapiro Wilk@alpha = 0.1
Calculated = 0.8723
Critical = 0.859
The distribution was found to be normally distrib-uted.

Constituent: Lithium, Total Analysis Run 8/28/2018 10:45 AM

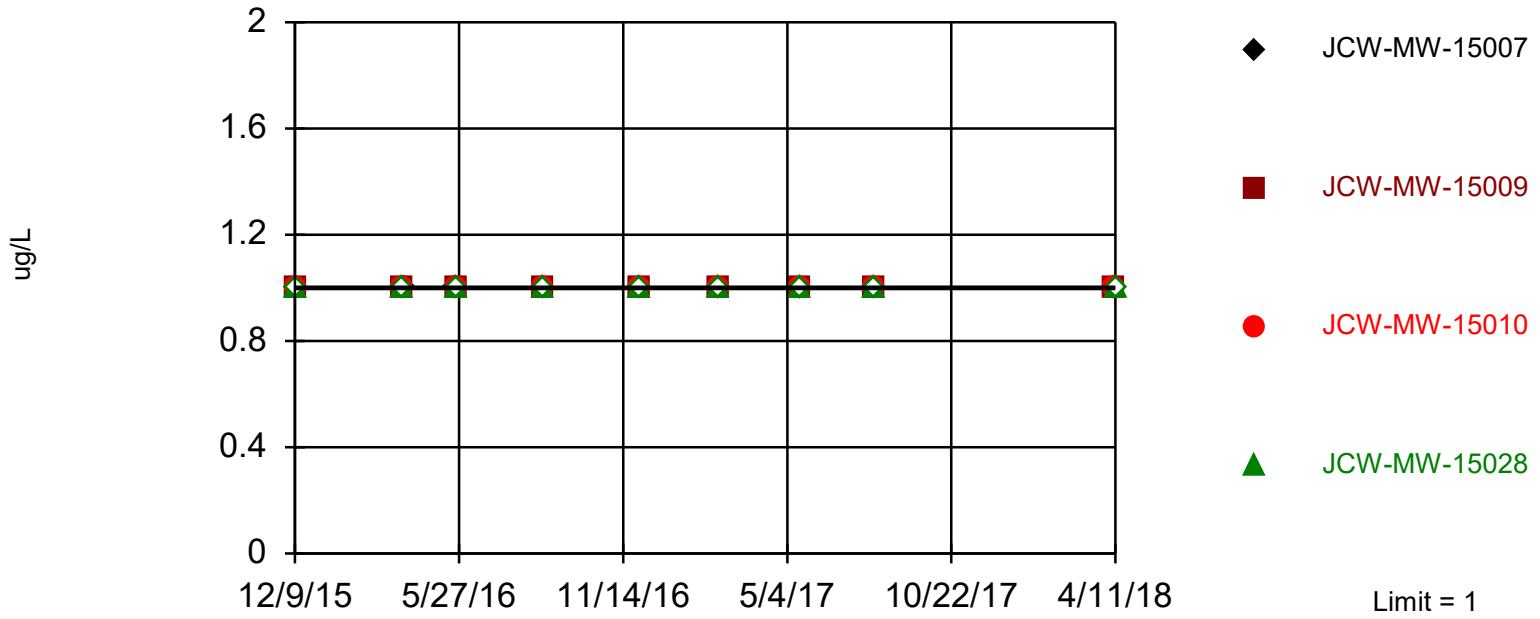
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.48% coverage at alpha=0.01; 92.38% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1499.

Constituent: Antimony, Total Analysis Run 8/20/2018 11:15 AM

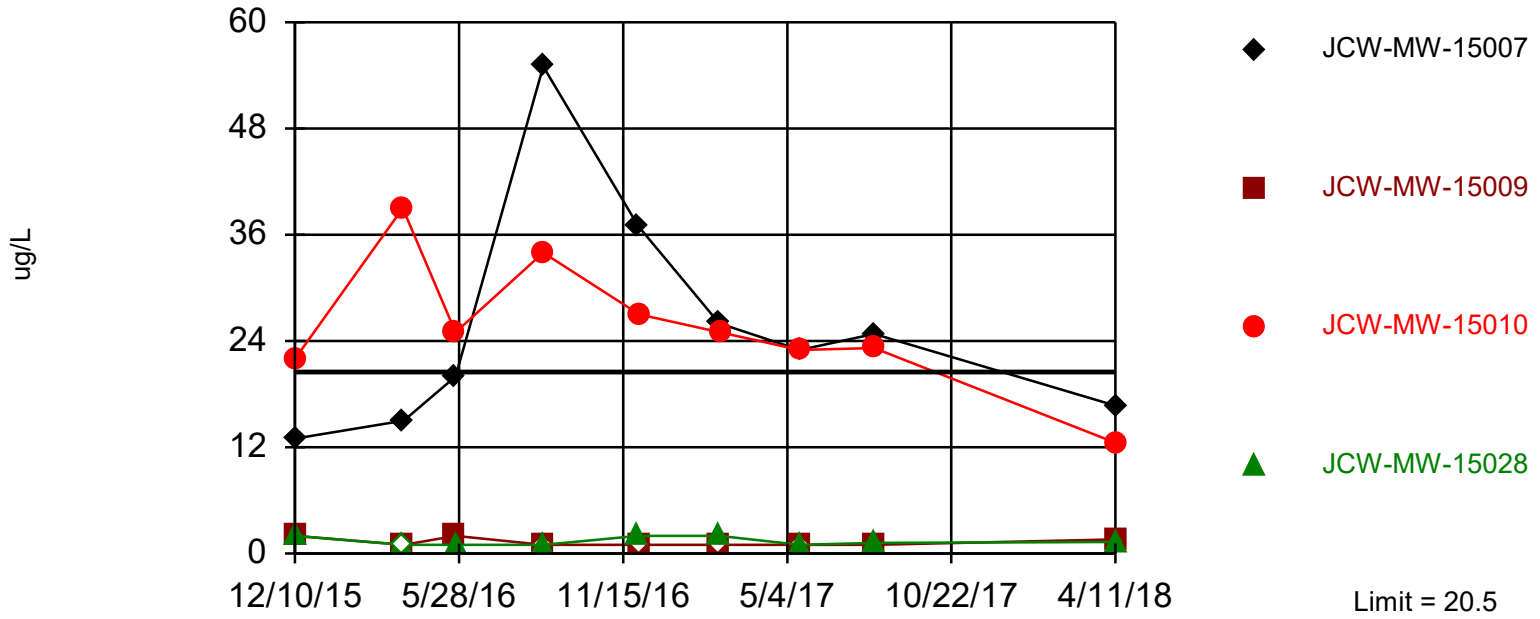
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 36 background values. 47.22% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

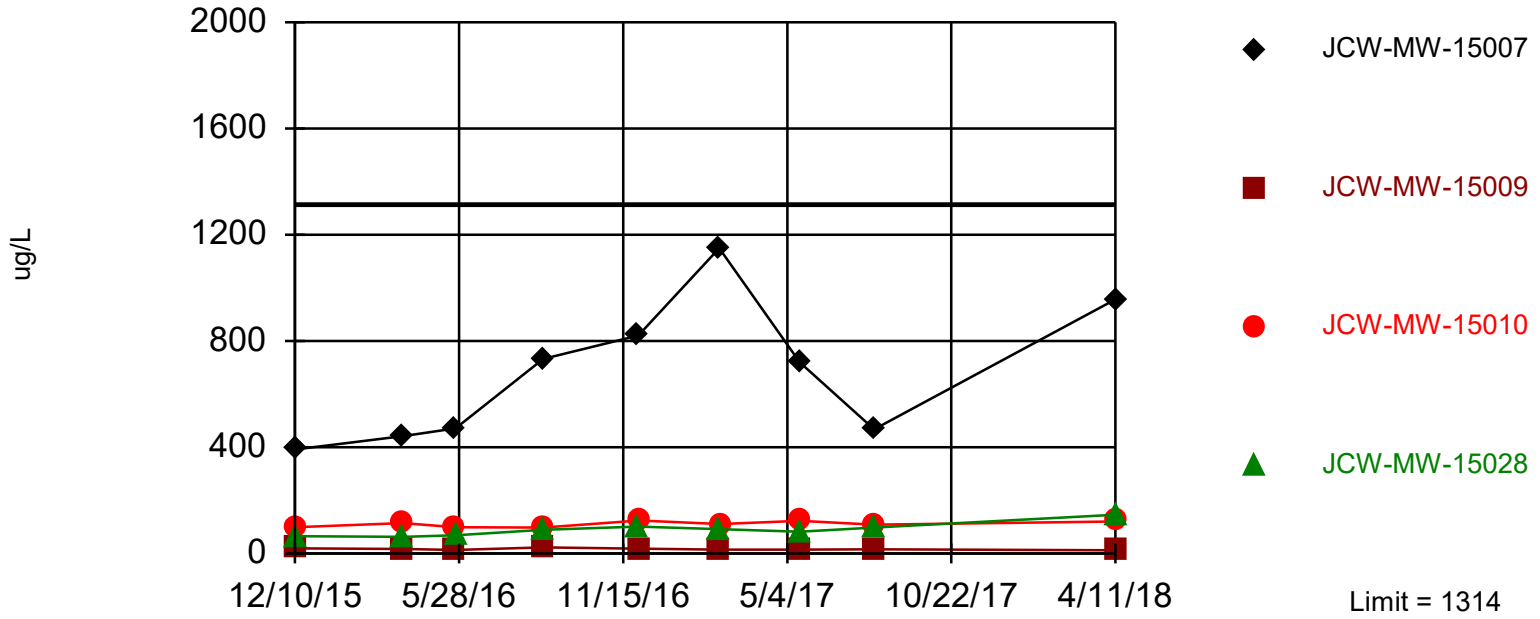
Constituent: Arsenic, Total Analysis Run 5/24/2018 2:35 PM

Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Within Limit

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on natural log transformation): Mean=5.248, Std. Dev.=0.8953, n=36. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9227, critical = 0.912. Report alpha = 0.05.

Constituent: Barium, Total Analysis Run 5/24/2018 2:36 PM

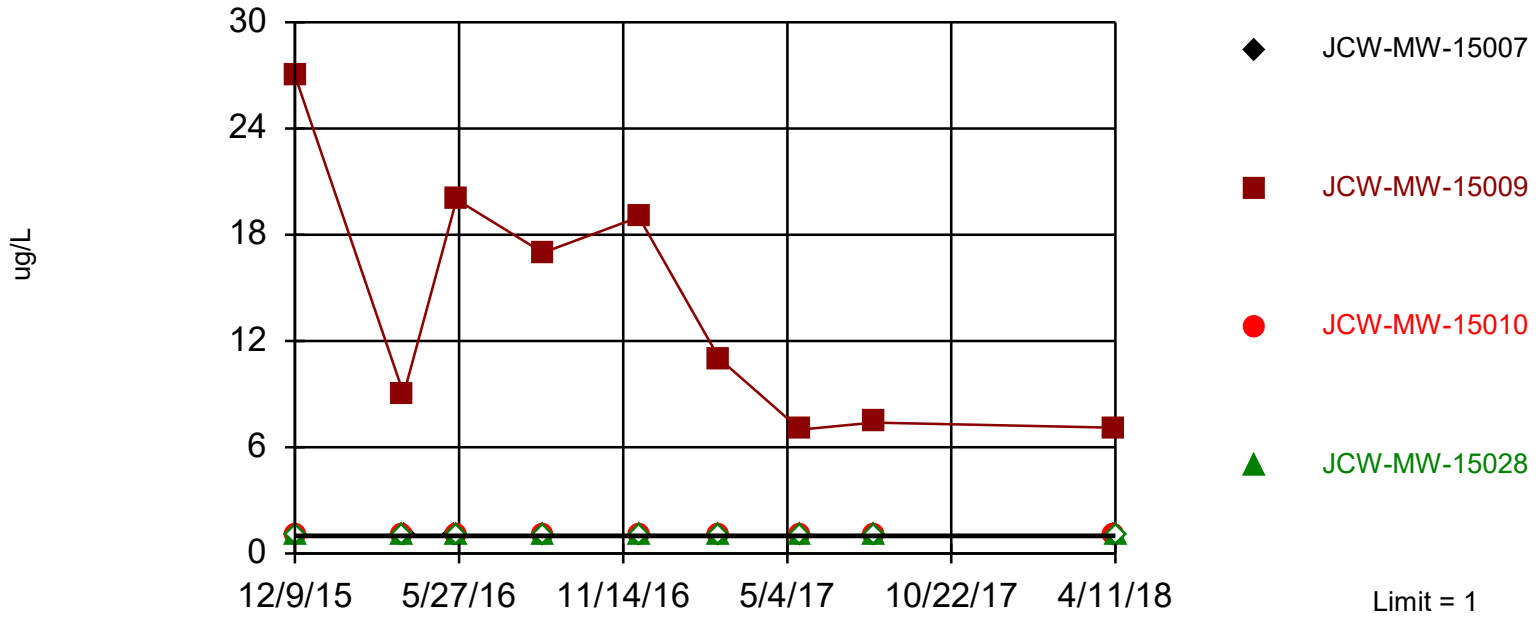
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: JCW-MW-15009

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Beryllium, Total Analysis Run 8/20/2018 11:16 AM

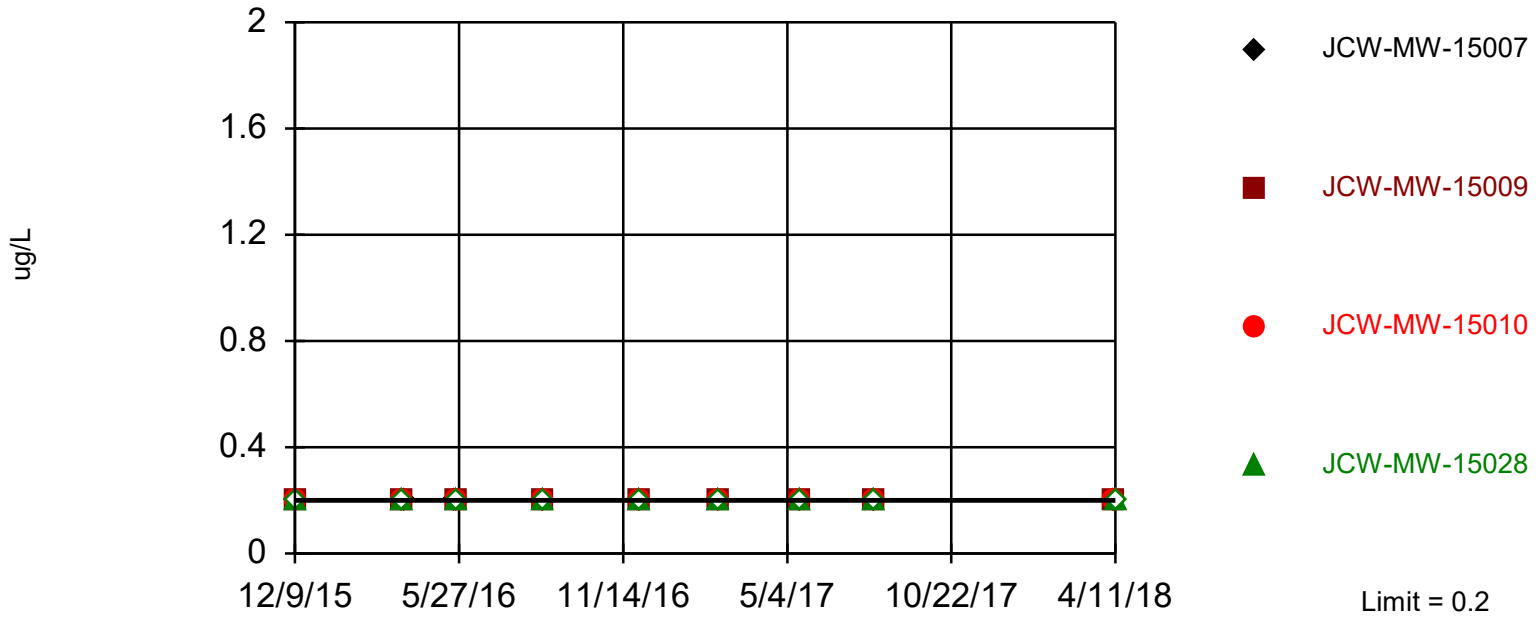
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Cadmium, Total Analysis Run 8/20/2018 11:17 AM

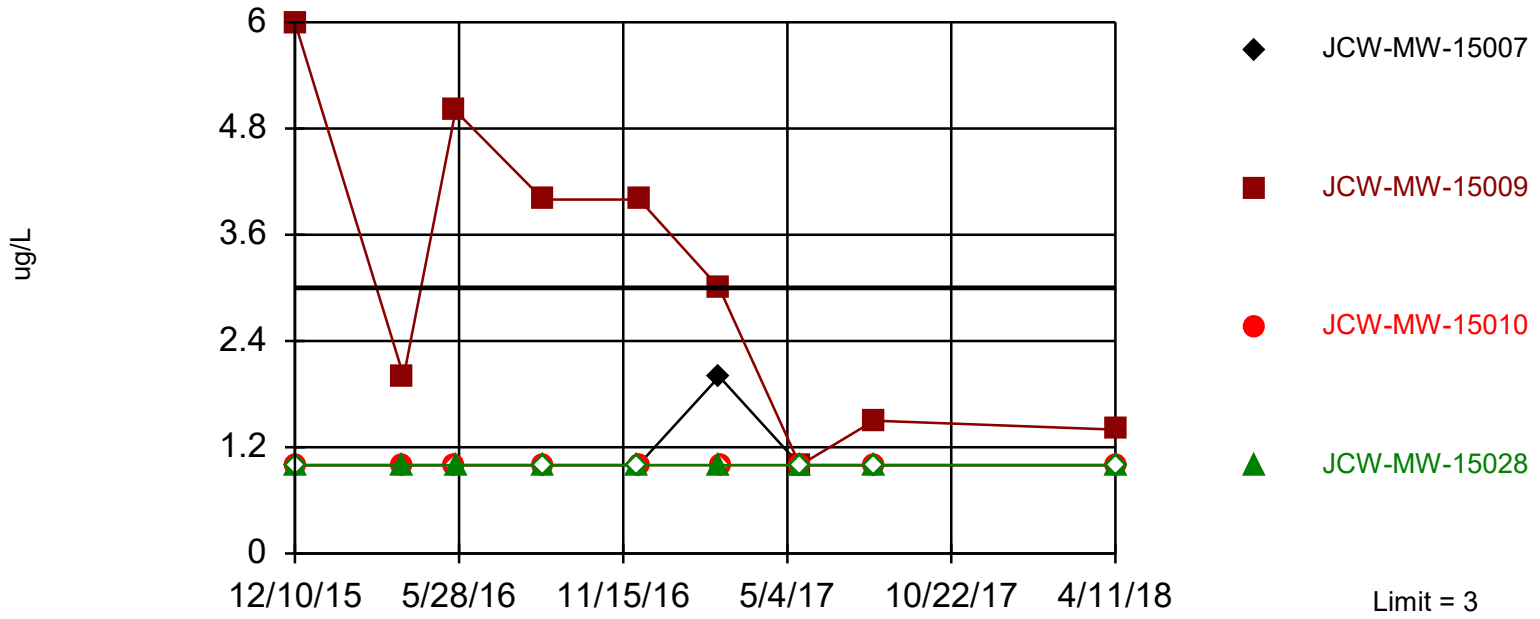
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 36 background values. 33.33% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Chromium, Total Analysis Run 5/24/2018 2:36 PM

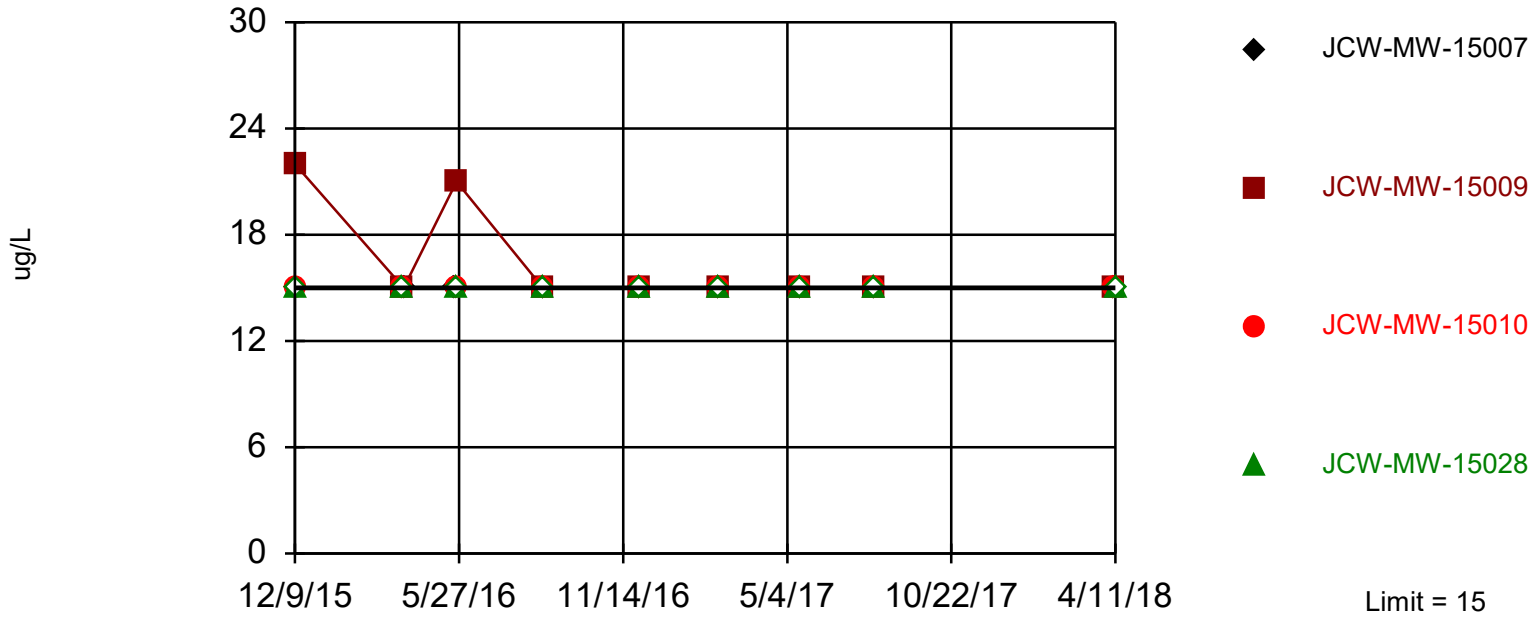
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Cobalt, Total Analysis Run 8/20/2018 11:18 AM

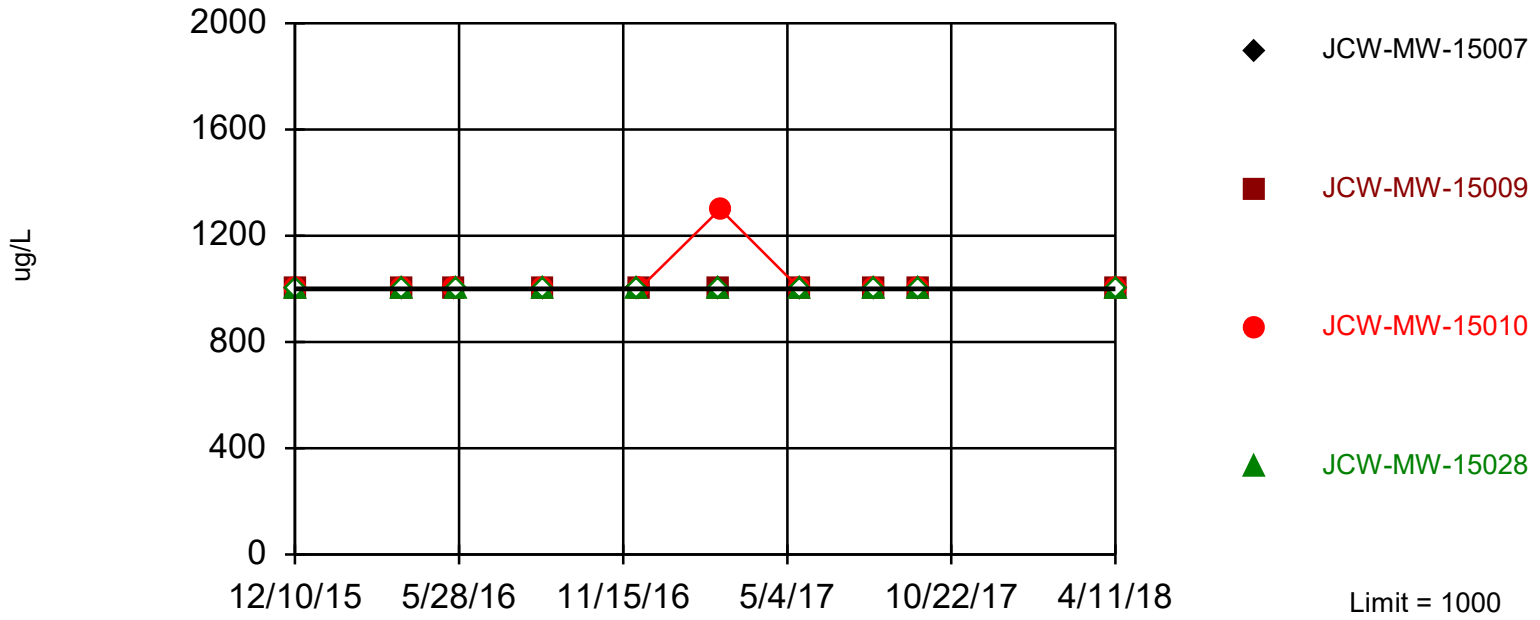
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 89.26% coverage at alpha=0.01; 92.77% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1285.

Constituent: Fluoride Analysis Run 5/24/2018 2:37 PM

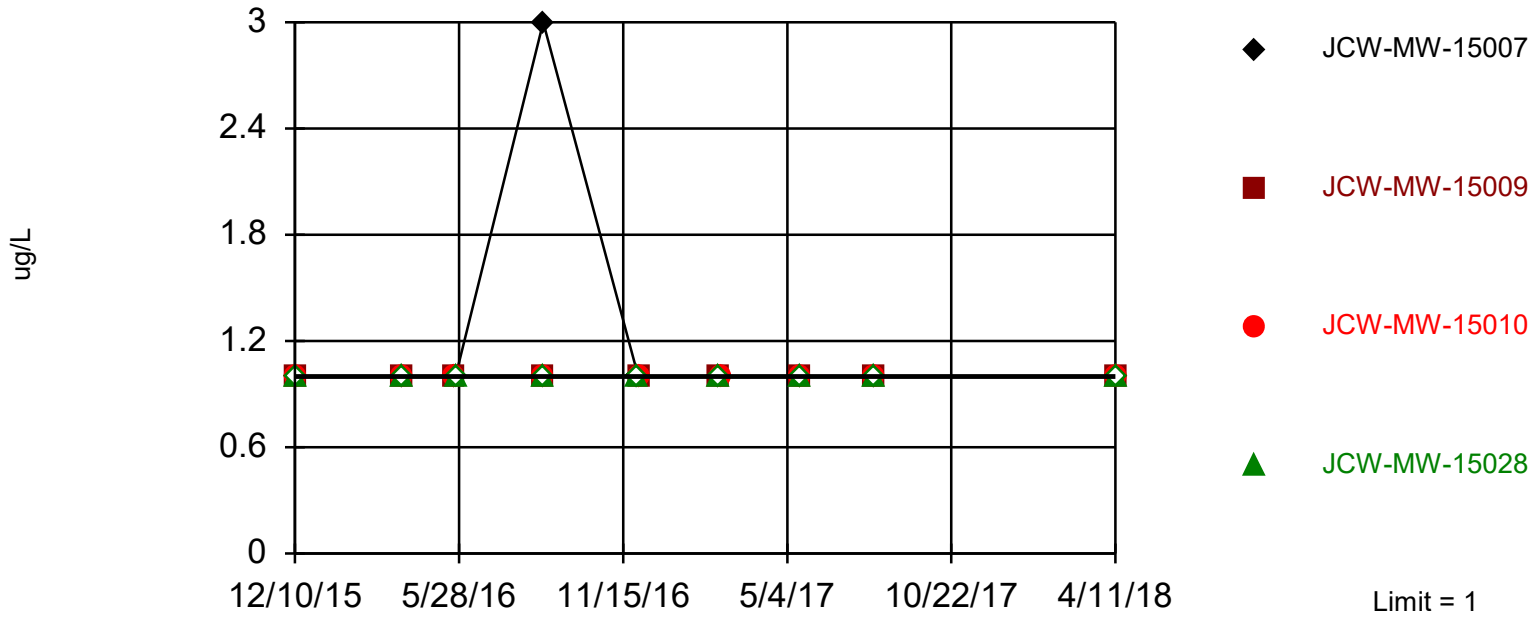
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

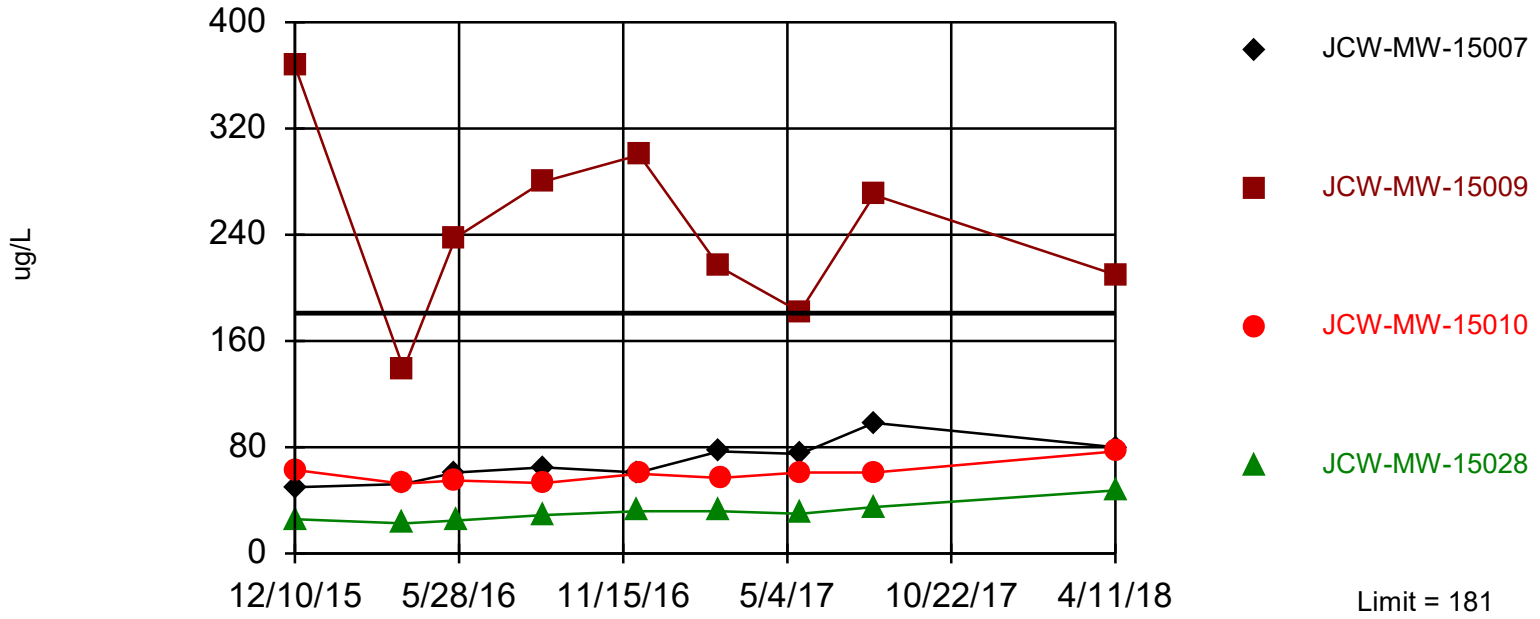
Constituent: Lead, Total Analysis Run 5/24/2018 2:38 PM

Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Exceeds Limit: JCW-MW-15009

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Most recent observation is compared with limit. Limit is highest of 36 background values. 8.333% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Lithium, Total Analysis Run 5/24/2018 2:37 PM

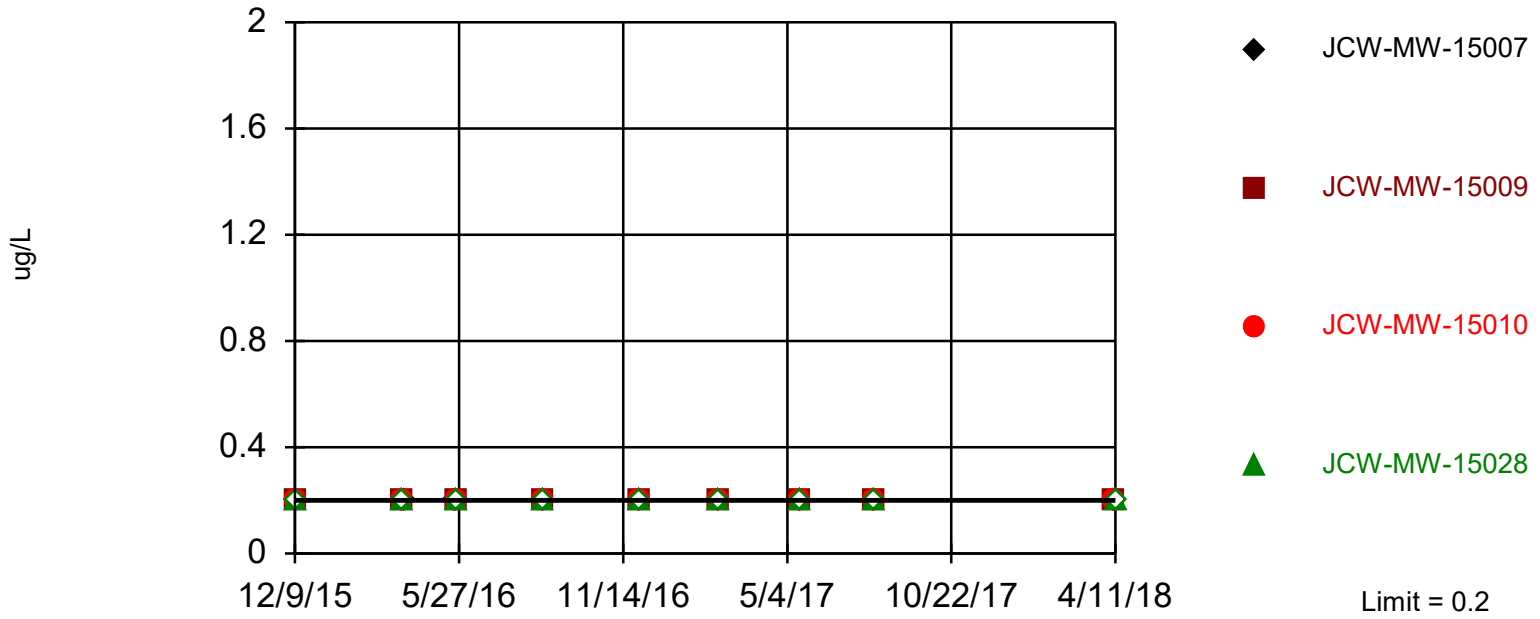
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Mercury, Total Analysis Run 8/20/2018 11:19 AM

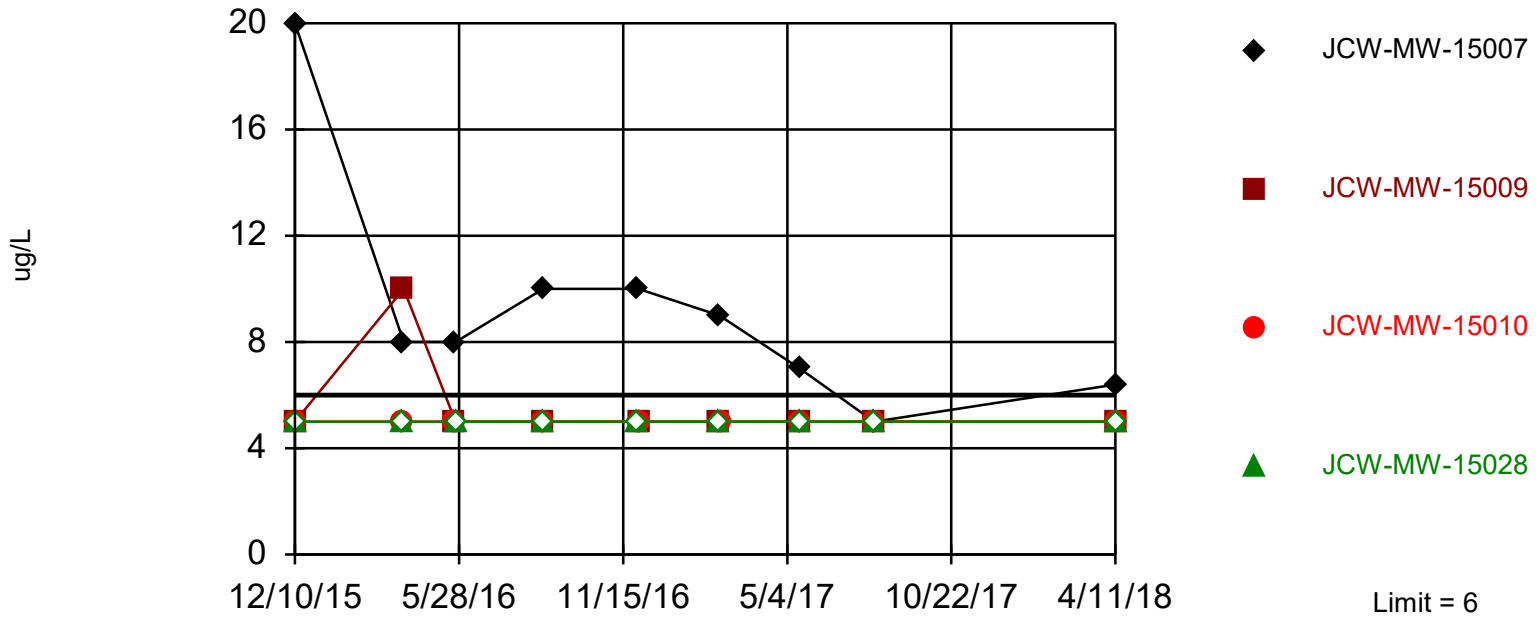
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: JCW-MW-15007

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. Limit is highest of 36 background values. 91.67% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Molybdenum, Total Analysis Run 5/24/2018 2:38 PM

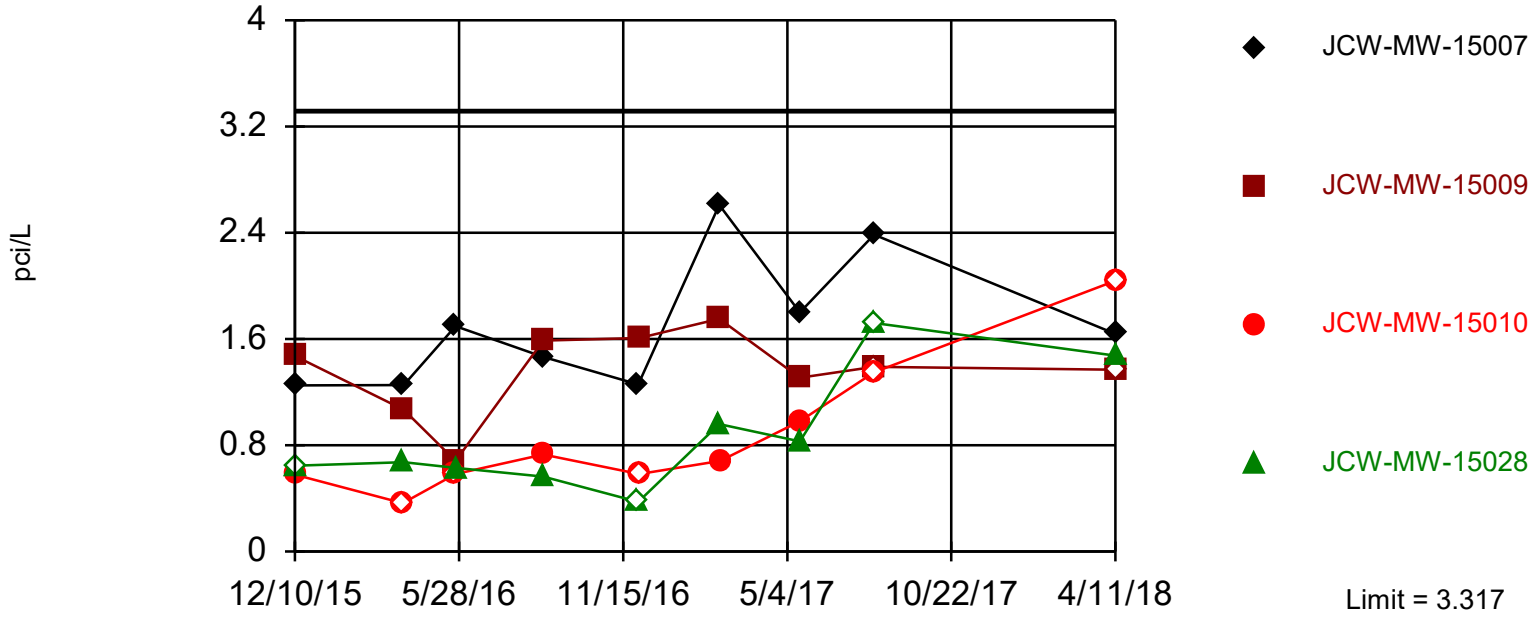
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Sanitas™ v.9.5.32 Sanitas software licensed to Consumers Energy. UG
Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on square root transformation) (after Kaplan-Meier Adjustment): Mean=1.165, Std. Dev.=0.304, n=36, 25% NDs. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9558, critical = 0.912. Report alpha = 0.05.

Constituent: Radium-226/228 Analysis Run 5/24/2018 2:39 PM

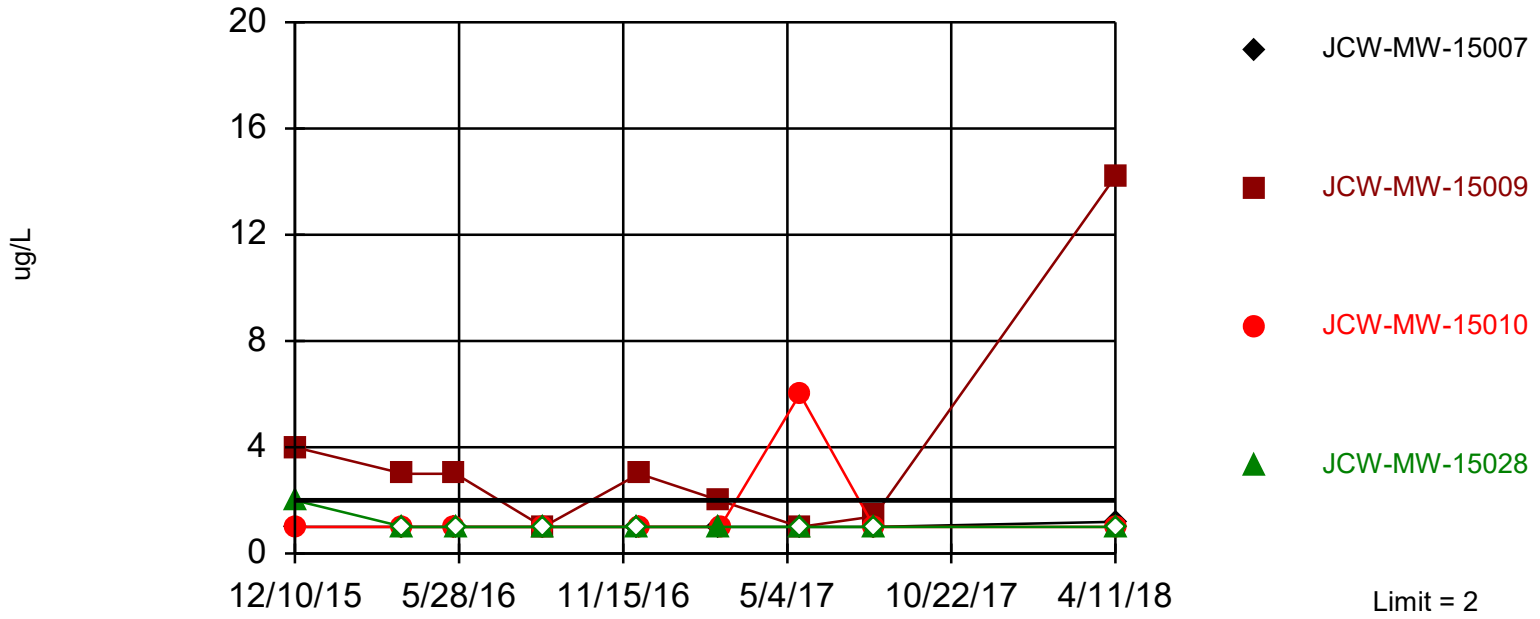
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: JCW-MW-15009

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. Limit is highest of 36 background values. 88.89% NDs. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Selenium, Total Analysis Run 5/24/2018 2:39 PM

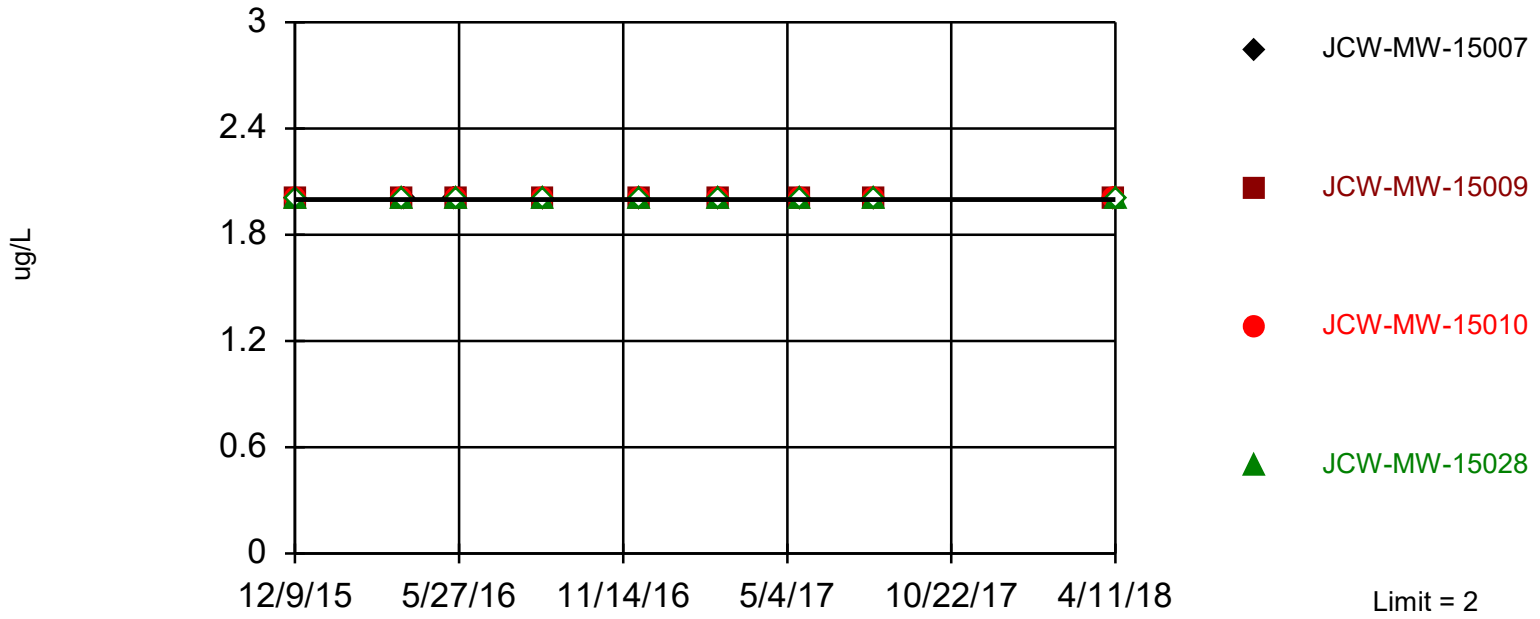
Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas

Hollow symbols indicate censored values.

Within Limit

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 75%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 88.09% coverage at alpha=0.01; 91.99% coverage at alpha=0.05; 98.24% coverage at alpha=0.5. Report alpha = 0.1578.

Constituent: Thallium, Total Analysis Run 8/20/2018 11:20 AM

Client: Consumers Energy Data: JCW_BAP_CCR_Sanitas