2018 Annual Groundwater Monitoring Report

Former BC Cobb Power Plant
Bottom Ash Pond & Ponds 0-8
Muskegon, 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), as amended July 30, 2018. The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the Consumers Energy Company (CEC) Bottom Ash Pond and Ponds 0-8 (BCC Ponds) at the former BC Cobb Power Plant Site (the Site) located in Muskegon, Michigan. 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). On behalf of CEC, TRC Environmental Corporation (TRC) has prepared this Annual Groundwater Monitoring Report for calendar year 2018 activities at the BCC Ponds CCR units.

In the January 31, 2018 *Annual Groundwater Monitoring Report for the Former BC Cobb Power Plant Bottom Ash Pond & Ponds 0-8 CCR Unit*, covering calendar year 2017 activities, CEC reported that boron, fluoride, and pH 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 units. Therefore, CEC initiated an Assessment Monitoring Program for the BCC Ponds 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 system was subsequently sampled for the Appendix III and Appendix IV constituents in June 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 June 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 USEPA 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 ASD 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) (USEPA, April 2015), as amended (USEPA, July 2018). The CCR Rule, which became effective on October 19, 2015 (amendment effective August 29, 2018), applies to the Consumers Energy Company (CEC) Bottom Ash Pond and Ponds 0-8 (BCC Ponds) at the former BC Cobb Power Plant Site (the Site) located in Muskegon, Michigan. 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). On behalf of CEC, TRC Environmental Corporation (TRC) has prepared this Annual Groundwater Monitoring Report for calendar year 2018 activities at the BCC Ponds CCR unit.

In the January 31, 2018 *Annual Groundwater Monitoring Report for the Former BC Cobb Power Plant Bottom Ash Pond & Ponds 0-8 CCR Unit* (2017 Annual Report), covering calendar year 2017 activities, CEC reported that boron, fluoride, and pH 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 BCC Ponds 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 preliminary 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 C) (TRC, October 2018). The 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 former BC Cobb coal-fired power generation facility is located east of Muskegon Lake, south of Cedar Creek, northwest of the CSX rail line, and west of the Muskegon River marsh in Muskegon, Michigan (Figure 1). The plant began generating electricity in 1948, and plant operations ceased in April 2016. There are two RCRA CCR units associated with the plant—the Bottom Ash Pond and Ponds 0-8, both of which were wet ash dewatering areas. From 1984 through plant closure in 2016, CCR were deposited in the ash ponds by utilizing sluicing methods. Some of the CCR was periodically removed from the ponds and transported by truck to the JH Campbell Type III landfill (West Olive, Michigan) for disposal or were commercially marketed for beneficial reuse to the extent possible. Site features are shown on Figure 2.

1.3 Geology/Hydrogeology

The majority of the BCC Ponds are comprised of surficial CCR and sand fill. USGS topographic maps and aerial photographs dating back to 1929, in addition to field descriptions of subsurface soil at the site, indicate that the area currently occupied by the ash ponds was originally marsh land. The subsurface materials encountered in the pond area generally consist of CCR ranging from 3 to 28 feet below ground surface (ft bgs) overlying 10 to 20 feet of poorly graded, fine-grained sand. Discontinuous layers of organic materials (i.e., humus) and peat (on the order of 0.5 to 1.0 feet thick), and organic-rich zones or sand and silt are present within the fine-grained sand. Organic-rich silt was also encountered at 20 to 30 ft bgs, beneath the fine-grained sand, ranging in thickness from approximately 1 to 13 feet. Silty clay and/or poorly graded, fine- to medium-grained sand is generally observed within 30 to 40 ft bgs, beneath the organic-rich silt. An underlying gray clay was encountered throughout the pond area at approximately 40 ft bgs, beneath the fine to medium-grained sand.

Bedrock and quaternary geologic maps of Michigan and local water well records indicate that 120 to 190 feet of glacio-lacustrine sand, gravel, moraine and lacustrine clay deposits are present throughout Muskegon County. These lacustrine deposits are situated on top of the sandstone bedrock that is part of the Marshall Formation, typically encountered at approximately 200 to 250 ft bgs throughout Muskegon County. Glacial moraine deposits are more prevalent in the northern and eastern portions of the County, while glacio-lacustrine sands dominate in the western and southern areas surrounding Muskegon Lake, and the area approaching Lake Michigan. The site is located in the central area of the County.

The BCC Ponds are bound by several surface water features (Figure 2): The North Channel Muskegon River and former plant-associated discharge channel adjoin the northwestern and southernmost boundaries of the pond area, and Veterans Memorial Pond is located northeast of the pond area, approximately 100 feet northeast of Michigan Highway 120. Prior to 2018,

Veterans Memorial Pond was separated from the River by a weir. In 2017 it was drained, underwent maintenance and construction modifications, and the weir was removed.

Significant changes occurred in the ash management area during the CCR Rule baseline period that caused variations in groundwater flow at the Site. The monitoring well system was installed in October 2015 while the plant and the pond system were in operation. The plant shut down in April 2016 and ceased sluicing ash to the BCC Ponds and the ponds began dewatering. Veterans Memorial Pond to the north of the BCC Ponds was dewatered for maintenance activities sometime during the period between August and December 2017. These changes have had a profound effect on groundwater flow rates and directions at both the upgradient and downgradient monitoring wells.

While the ponds were in operation, groundwater mounded within the pond area and flowed radially toward the surrounding water bodies. Starting with the July 2016 groundwater sampling round, groundwater continued to flow radially to the surrounding water bodies, but with a much lower gradient. When Veterans Memorial Pond was drained, a stronger gradient was established along the eastern side of the peninsula toward the Veterans Memorial Pond area. Veterans Memorial Pond is no longer drained and hydraulic loading of the BCC Ponds was discontinued back in 2016, therefore currently groundwater flow gradients in the BCC Ponds are essentially flat.

Section 2
Groundwater Monitoring

2.1 Monitoring Well Network

In accordance with 40 CFR 257.91, CEC established a groundwater monitoring system for the BCC Ponds, which had initially consisted of 22 monitoring wells (seven background monitoring wells and 15 downgradient monitoring wells) that are screened in the uppermost aquifer. Six additional downgradient monitoring wells were installed in late 2017 and incorporated into the groundwater monitoring system in 2018. Seven monitoring wells located southwest of the BCC Ponds provide data on background groundwater quality that has not been affected by the CCR unit (BCC-MW-15002 through BCC-MW-15008). The monitoring well locations are shown on Figure 2.

Prior to the initiation of the assessment monitoring program, it was determined that additional wells were needed along the North Channel Muskegon River (adjacent to deeper screened monitoring wells BCC-MW-15016 through BCC-MW-15020, in addition to BCC-MW-15021 along the northeast edge of the pond area) to further characterize shallow groundwater quality. Thus, CEC retained TRC to install six shallow monitoring wells paired with the six existing deeper wells and characterize groundwater quality and flow directions. Monitoring wells BCC-MW-17001 through BCC-MW-17006 (shallow 2017 wells) were installed in December 2017 and were sampled quarterly in accordance with the SAP for Appendix III and IV constituents in December 2017, February 2018, June 2018, and August 2018 to accumulate a background data set for the new wells. The locations of the monitoring wells are depicted on Figure 2. The soil boring logs and well construction diagrams for the 2017 shallow wells are included in Appendix A.

Monitoring wells BCC-MW-15009 through BCC-MW-15014 encircle the BAP, while BCC-MW-15015 through BCC-MW-15023 and BCC-MW-17001 through BCC-MW-17006 are located at the outer edge of the peninsula formed by the bottom ash pond system. Because the perimeter and interior berms within the ash management area were constructed in part with ash and bodies of water surround the ash management area, wells could not be installed entirely beyond the CCR material boundary.

2.2 Shallow Well Background Sampling

Background groundwater monitoring was conducted at the 2017 shallow wells quarterly from December 2017 through August 2018 in accordance with the SAP. Data collection included four rounds of static water elevation measurements, analysis for constituents required in the CCR

Rule's Appendix III and Appendix IV to Part 257, and field parameters (dissolved oxygen, oxidation reduction potential, pH, specific conductivity, temperature, and turbidity) from the six shallow monitoring wells. The sampling was conducted by TRC and the collected groundwater samples were analyzed by Pace Analytical Services, LLC (Pace) in accordance with the SAP. Background data are included in Tables 1 through 3, where: Table 1 is a summary of static water elevation data; Table 2 is a summary of field data; and Table 3 is a summary of groundwater analytical data compared to potentially relevant criteria. The shallow monitoring wells were incorporated into the assessment monitoring program in April 2018.

2.3 Preliminary Assessment Monitoring

CEC reported in the 2017 Annual Report that Appendix III constituents boron, fluoride, and pH were observed within groundwater at one or more downgradient monitoring well(s) with potential SSIs above background concentration levels. TRC performed an alternative source demonstration (ASD) evaluation 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 BCC Ponds. Therefore, CEC initiated an Assessment Monitoring Program for the BCC Ponds 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 BC Cobb Monitoring Program Sample and Analysis Plan (SAP) (ARCADIS, 2016).

2.3.1 Data Summary

The preliminary Appendix IV only assessment monitoring event (per §257.95(b)) was performed on April 16 through April 19, 2018 in accordance with the SAP and §257.95. Downgradient monitoring wells BCC-MW-15009 through BCC-MW-15023, BCC-MW-17001 through BCC-MW-17006, and background monitoring wells BCC-MW-15002 through BCC-MW-15008 were sampled during this 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 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 for Appendix IV constituents during the preliminary assessment monitoring event in accordance with the SAP. The analytical results from each event are summarized in Table 3.

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 B.

2.3.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the April preliminary assessment monitoring event are provided in Table 1. The April 2018 groundwater elevation data were used to construct a groundwater contour map (Figure 3).

Groundwater elevation data collected during the April 2018 assessment monitoring sampling event showed that the hydraulic gradient for groundwater within the uppermost aquifer is so low that groundwater flow across the Ponds 0-8 CCR unit is essentially nonexistent. The average gradient observed on April 16, 2018, using well pairs BCC-MW-15007/BCC-MW-15001, BCC-MW-17006/BCC-MW-15015, BCC-MW-15023/BCC-MW-17002, and BCC-MW-15023/BCC-MW-17005, showed a horizontal gradient of approximately 0.00011 ft/ft with a minimal discernible overall flow direction across the BCC Ponds. Using the average hydraulic conductivity measured at the Ponds 0-8 monitoring wells of 58 feet/day (ARCADIS, 2016), and an assumed effective porosity of 0.3, this results in groundwater flow rate of approximately 0.02 feet/day (approximately 8 feet/year).

2.4 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 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.

2.4.1 Data Summary

The first semiannual groundwater assessment monitoring event for 2018 was performed on June 11 through June 15, 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 7 background monitoring wells and 21 downgradient monitoring wells for the Appendix III and Appendix IV constituents and field parameters. A summary of the groundwater data collected

during the June 2018 event is provided on Table 1 (static groundwater elevation data), Table 2 (field data), and Table 3 (analytical results).

The second semiannual groundwater assessment monitoring event for 2018 was performed on November 26 through November 30, 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 7 background monitoring wells and 21 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 forthcoming 2019 Annual Groundwater Monitoring and Corrective Action Report.

2.4.2 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 B.

2.4.3 Groundwater Flow Rate and Direction

Groundwater elevation data collected during the June 2018 assessment monitoring event are provided in Table 1. The June 2018 groundwater elevation data were used to construct groundwater contour map (Figure 4).

The groundwater elevation data collected during the June 2018 event were similar to the April 2018 event, with no discernable flow direction across the area of the BCC Ponds. The average hydraulic gradient throughout the Site during the June 2018 event is estimated at 0.00017 ft/ft. The gradient was calculated using the same well pairs, hydraulic conductivity and effective porosity as the aforementioned April 2018 event, and resulted in an estimated average seepage velocity of approximately 0.03 ft/day or 12 ft/year for the June 2018 event.

The low hydraulic gradient and lack of general flow direction is similar to that identified in recent sampling events; however, in the past, groundwater was typically encountered at a similar or slightly higher elevation relative to the surrounding surface water features, flowing outward toward the bounding surface water features and has undergone several changes over time due to permanent discontinuation of hydraulic loading in the BCC

Ponds CCR unit area and the dewatering of Veteran's Memorial Pond in 2017 (as discussed in the 2017 Annual Report). Although the overall gradient has diminished, general groundwater flow is still expected to be slightly outward toward the river, or equal to the river, with groundwater flowing toward the BCC Ponds from the area of the background wells (Figures 3 and 4) and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix III/IV constituents that could potentially migrate from the BCC Ponds.

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), 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 BCC-MW-15002 through BCC-MW-15008 (December 2015 through April 2018). The calculation of the GWPSs is documented in the *Groundwater Protection Standards* technical memorandum included in Appendix C of this annual report (TRC, October 2018). The GWPS is established as the higher of the USEPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the USEPA 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 BCC Ponds 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 forthcoming 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 forthcoming 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 USEPA in April 2018, the first round of semiannual assessment monitoring data were statistically evaluated against the GWPSs 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 the completion of the statistical analysis. This evaluation will be included in the forthcoming 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 ASD 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 include it 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

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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
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)	December 7, 2017		February 22, 2018	
												Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background															
BCC-MW-15001	583.6	586.52	Sand with organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	20.0	563.6	7.92	578.60	5.05	581.47
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	20.0	563.8	7.75	579.12	5.00	581.87
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	20.0	564.1	7.38	579.74	5.15	581.97
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	20.0	567.7	10.45	580.12	8.59	581.98
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	20.0	564.8	7.32	580.45	6.21	581.56
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	20.0	564.9	7.29	580.52	5.20	582.61
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	20.0	564.5	7.35	580.08	5.09	582.34
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	20.0	564.8	7.21	580.55	6.02	581.74
Downgradient															
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	24.0	562.3	9.25	580.02	7.79	581.48
BCC-MW-15010	585.2	588.11	Sand with little silt and organic material	12.0	to	22.0	573.2	to	563.2	24.0	561.2	8.88	579.23	6.33	581.78
BCC-MW-15011	592.3	595.22	Sand with some silt	21.0	to	31.0	571.3	to	561.3	32.0	560.3	15.81	579.41	13.61	581.61
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	35.0	559.5	17.86	579.53	16.00	581.39
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	40.0	555.9	18.37	580.13	17.53	580.97
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	40.0	556.2	19.10	579.94	18.01	581.03
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	30.0	563.9	16.45	580.30	16.10	580.65
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	45.0	541.2	8.99	580.06	8.60	580.45
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	40.0	545.7	8.43	580.18	8.19	580.42
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	45.0	544.4	12.22	580.21	11.94	580.49
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	45.0	544.4	12.42	580.00	11.88	580.54
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	45.0	544.5	12.65	579.58	11.58	580.65
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	50.0	540.7	14.50	579.23	13.20	580.53
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	45.0	547.6	18.00	577.82	14.55	581.27
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	20.0	565.4	11.94	576.14	6.40	581.68
Shallow 2017 Wells															
BCC-MW-17001	586.1	589.29	Sand with some organic material	15.0	to	20.0	571.1	to	566.1	20.0	566.1	8.91	580.38	8.84	580.45
BCC-MW-17002	585.8	588.79	Sand	13.5	to	18.5	572.3	to	567.3	19.0	566.8	8.43	580.36	8.69	580.1
BCC-MW-17003	589.3	592.37	Sand	17.0	to	22.0	572.3	to	567.3	22.0	567.3	11.97	580.40	11.90	580.47
BCC-MW-17004	589.1	591.84	Sand	17.5	to	22.5	571.6	to	566.6	22.5	566.6	11.63	580.21	11.18	580.66
BCC-MW-17005	589.3	592.42	Sand	20.0	to	25.0	569.3	to	564.3	30.0	559.3	13.06	579.36	11.45	580.97
BCC-MW-17006	590.5	593.78	Sand	24.5	to	29.5	566.0	to	561.0	30.0	560.5	16.80	576.98	12.30	581.48

Notes:
Survey conducted by Williams & Works, November 2015, and Consumers Energy Company in January 2018.
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.
ft BGS: Feet below ground surface.

Table 1
Summary of Groundwater Elevation Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			April 16, 2018		June 11, 2018		August 7, 2018	
										Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background															
BCC-MW-15001	583.6	586.52	Sand with organic seam at 18.8 ft bgs	10.0	to	20.0	573.6	to	563.6	4.95	581.57	5.11	581.41	5.35	581.17
BCC-MW-15002	583.8	586.87	Sand	15.0	to	20.0	568.8	to	563.8	5.32	581.55	5.42	581.45	5.72	581.15
BCC-MW-15003	584.1	587.12	Sand	13.0	to	18.0	571.1	to	566.1	5.67	581.45	5.65	581.47	5.98	581.14
BCC-MW-15004	587.7	590.57	Sand	5.0	to	15.0	582.7	to	572.7	9.21	581.36	9.10	581.47	9.43	581.14
BCC-MW-15005	584.8	587.77	Sand	5.0	to	15.0	579.8	to	569.8	6.37	581.40	6.33	581.44	6.55	581.22
BCC-MW-15006	584.9	587.81	Sand	5.0	to	15.0	579.9	to	569.9	6.25	581.56	6.23	581.58	6.64	581.17
BCC-MW-15007	584.5	587.43	Sand	4.0	to	10.0	580.5	to	574.5	5.88	581.55	5.84	581.59	6.30	581.13
BCC-MW-15008	584.8	587.76	Sand	4.0	to	9.0	580.8	to	575.8	6.23	581.53	6.32	581.44	6.64	581.12
Downgradient															
BCC-MW-15009	586.3	589.27	Sand (14 - 17.2 ft bgs) and Clay/silt (17.2 - 24 ft bgs)	14.0	to	24.0	572.3	to	562.3	7.79	581.48	7.75	581.52	8.09	581.18
BCC-MW-15010	585.2	588.11	Sand with little silt and organic material	12.0	to	22.0	573.2	to	563.2	6.56	581.55	6.60	581.51	6.99	581.12
BCC-MW-15011	592.3	595.22	Sand with some silt	21.0	to	31.0	571.3	to	561.3	13.75	581.47	13.71	581.51	14.09	581.13
BCC-MW-15012	594.5	597.39	Sand	21.0	to	31.0	573.5	to	563.5	15.95	581.44	15.92	581.47	16.29	581.10
BCC-MW-15013	595.9	598.50	Sand with clay/silt and organic material from 36.5 - 37.5 ft bgs	30.0	to	40.0	565.9	to	555.9	17.09	581.41	17.12	581.38	17.41	581.09
BCC-MW-15014	596.2	599.04	Sand/silty sand	23.0	to	31.0	573.2	to	565.2	17.66	581.38	17.69	581.35	17.99	581.05
BCC-MW-15015	593.9	596.75	Sand with clay/silt and organic material from 29 - 29.5 ft bgs	20.0	to	30.0	573.9	to	563.9	15.44	581.31	15.53	581.22	15.82	580.93
BCC-MW-15016	586.2	589.05	Sand	35.0	to	40.0	551.2	to	546.2	7.71	581.34	7.74	581.31	7.93	581.12
BCC-MW-15017	585.7	588.61	Sand	35.0	to	40.0	550.7	to	545.7	7.27	581.34	7.33	581.28	7.52	581.09
BCC-MW-15018	589.4	592.43	Sand	37.5	to	42.5	551.9	to	546.9	11.02	581.41	11.18	581.25	11.40	581.03
BCC-MW-15019	589.4	592.42	Sand	37.0	to	42.0	552.4	to	547.4	10.99	581.43	11.15	581.27	11.35	581.07
BCC-MW-15020	589.5	592.23	Sand	35.0	to	40.0	554.5	to	549.5	10.77	581.46	10.91	581.32	11.13	581.10
BCC-MW-15021	590.7	593.73	Sand	39.5	to	42.5	551.2	to	548.2	12.42	581.31	12.40	581.33	12.60	581.13
BCC-MW-15022	592.6	595.82	Sand	24.0	to	30.0	568.6	to	562.6	14.40	581.42	14.45	581.37	14.78	581.04
BCC-MW-15023	585.4	588.08	Sand/silty sand	12.0	to	19.5	573.4	to	565.9	6.60	581.48	6.81	581.27	6.95	581.13
Shallow 2017 Wells															
BCC-MW-17001	586.1	589.29	Sand with some organic material	15.0	to	20.0	571.1	to	566.1	7.87	581.42	8.07	581.22	8.32	580.97
BCC-MW-17002	585.8	588.79	Sand	13.5	to	18.5	572.3	to	567.3	7.35	581.44	7.53	581.26	7.78	581.01
BCC-MW-17003	589.3	592.37	Sand	17.0	to	22.0	572.3	to	567.3	10.97	581.40	11.15	581.22	11.44	580.93
BCC-MW-17004	589.1	591.84	Sand	17.5	to	22.5	571.6	to	566.6	10.43	581.41	10.60	581.24	10.91	580.93
BCC-MW-17005	589.3	592.42	Sand	20.0	to	25.0	569.3	to	564.3	11.05	581.37	11.20	581.22	11.52	580.90
BCC-MW-17006	590.5	593.78	Sand	24.5	to	29.5	566.0	to	561.0	12.40	581.38	12.52	581.26	12.98	580.80

Notes:
Survey conducted by Williams & Works, November 2015, and Consumers Energy Company in January 2018.
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.
ft BGS: Feet below ground surface.

Table 2
Summary of Field Parameter Results – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
BCC-MW-15002	4/19/2018	0.25	-7.1	7.5	1,318	10.8	0.8
	6/14/2018	0.30	18.4	7.4	1,014	16.2	1.6
BCC-MW-15003	4/19/2018	0.23	-28.9	7.5	3,911	8.9	2.5
	6/14/2018	0.28	14.5	7.3	3,522	14.2	2.3
BCC-MW-15004	4/19/2018	0.37	-29.7	7.3	957	8.8	2.5
	6/12/2018	0.35	-23.6	7.0	909	17.0	3.6
BCC-MW-15005	4/19/2018	4.22	-62.5	7.7	513	6.3	2.9
	6/14/2018	0.31	-14.7	7.4	451	17.2	4.4
BCC-MW-15006	4/19/2018	4.34	-6.0	7.5	642	5.1	2.8
	6/14/2018	1.16	-15.3	7.3	420	18.8	8.1
BCC-MW-15007	4/19/2018	0.44	-3.0	7.0	2,993	5.9	2.5
	6/14/2018	0.39	-22.2	6.9	2,626	17.4	3.7
BCC-MW-15008	4/18/2018	0.23	-1.0	7.8	896	6.7	0.9
	6/14/2018	0.30	-23.4	7.5	786	17.5	6.8
BCC-MW-15009	4/16/2018	0.30	-381.1	9.8	482	10.9	2.4
	6/13/2018	0.31	-107.9	9.8	477	18.1	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 2
Summary of Field Parameter Results – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Downgradient							
BCC-MW-15010	4/16/2018	0.26	-146.3	7.8	941	10.6	0.7
	6/14/2018	0.34	5.30	7.4	991	13.3	5.1
BCC-MW-15011	4/16/2018	0.25	-215.1	9.1	272	12.5	3.5
	6/13/2018	0.34	-25.9	8.5	251	18.3	1.2
BCC-MW-15012	4/17/2018	0.24	-345.6	9.7	774	12.3	0.5
	6/13/2018	0.34	-98.6	10.2	884	18.3	0.8
BCC-MW-15013	4/17/2018	0.28	-91.5	7.6	423	12.4	1.6
	6/13/2018	0.41	-17.8	7.7	400	18.3	1.2
BCC-MW-15014	4/17/2018	0.21	-155.1	11.6	554	11.6	2.9
	6/13/2018	0.27	-71.2	11.4	474	17.9	2.2
BCC-MW-15015	4/17/2018	0.24	-125.4	8.3	407	11.2	1.2
	6/13/2018	0.33	11.3	7.9	408	16.4	1.5
BCC-MW-15016	4/17/2018	0.20	-71.6	6.8	2,121	9.9	2.2
	6/12/2018	0.27	-88.4	6.5	2,038	17.8	3.2
BCC-MW-15017	4/17/2018	0.21	-85.4	6.8	2,334	9.6	2.8
	6/12/2018	0.24	-96.8	6.5	2,225	17.4	1.3

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

Table 2
Summary of Field Parameter Results – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Downgradient							
BCC-MW-15018	4/18/2018	0.27	-45.0	6.9	817	10.0	4.6
	6/12/2018	0.32	-68.7	6.8	771	17.8	2.9
BCC-MW-15019	4/18/2018	0.25	-89.9	7.0	944	11.1	2.6
	6/12/2018	0.31	-102.6	6.7	980	18.4	3.4
BCC-MW-15020	4/18/2018	0.24	-89.9	7.0	853	11.2	4.2
	6/12/2018	0.30	-102.4	6.7	968	18.0	2.0
BCC-MW-15021	4/18/2018	0.21	-97.3	7.1	1,131	12.2	8.3
	6/12/2018	0.37	-107.8	6.8	1,035	17.0	0.7
BCC-MW-15022	4/18/2018	0.21	-82.1	7.8	388	14.0	1.9
	6/11/2018	0.35	-190.5	8.3	377	18.8	1.1
BCC-MW-15023	4/18/2018	0.29	-15.5	7.6	981	11.3	1.1
	6/11/2018	0.35	-68.7	7.4	702	17.8	0.4

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

Table 2
Summary of Field Parameter Results – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Shallow 2017 Wells (Downgradient)							
BCC-MW-17001	12/7/2017	0.10	-253.7	7.1	920	11.9	3.4
	2/20/2018	0.20	-206.4	7.0	943	11.6	3.1
	6/15/2018	0.22	-328.2	7.2	903	15.0	3.6
	8/6/2018	0.35	69.7	6.9	894	17.6	3.7
BCC-MW-17002	12/7/2017	0.10	-283.4	7.0	1,069	11.3	4.3
	2/20/2018	0.21	-262.1	7.1	1,252	11.1	2.9
	6/15/2018	0.26	-365.0	7.2	1,227	14.6	2.0
	8/6/2018	0.35	-294.3	7.1	1,090	17.4	2.8
BCC-MW-17003	12/7/2017	0.19	81.3	7.0	580	11.7	4.1
	2/20/2018	0.28	-115.5	7.2	510	11.2	1.9
	6/15/2018	0.38	5.10	7.4	517	14.9	1.2
	8/7/2018	0.33	-84.3	7.3	553	16.8	1.8
BCC-MW-17004	12/6/2017	0.25	28.7	7.2	452	14.0	3.4
	2/20/2018	0.26	-72.0	7.3	450	13.6	<1.0
	6/15/2018	0.36	7.90	7.4	569	15.4	<1.0
	8/7/2018	0.37	-51.2	7.3	550	18.5	1.4
BCC-MW-17005	12/6/2017	0.22	28.9	7.3	426	14.9	3.8
	2/20/2018	0.23	-80.8	7.3	483	13.9	2.5
	6/15/2018	0.38	9.20	7.4	568	16.7	3.6
	8/7/2018	0.35	-104.3	7.3	512	20.8	<1.0
BCC-MW-17006	12/6/2017	0.22	60.7	7.7	794	11.1	3.0
	2/20/2018	2.09	10.8	7.3	11	13.5	1.3
	6/15/2018	0.42	16.4	7.5	717	15.8	1.3
	8/7/2018	0.37	-60.7	7.5	693	19.6	<1.0

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) – December 2017 to August 2018

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

					Sample Location:	BCC-MW-15009		BCC-MW-15010		BCC-MW-15011		BCC-MW-15012		BCC-MW-15013		BCC-MW-15014	
					Sample Date:	4/16/2018	6/13/2018	4/16/2018	6/14/2018	4/16/2018	6/13/2018	4/17/2018	6/13/2018	4/17/2018	6/13/2018	4/17/2018	6/13/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient											
Appendix III																	
Boron	ug/L	NC	**500**	**500**	7,200	--	**1,670**	--	**2,100**	--	**1,630**	--	**1,450**	--	**1,130**	--	**1,370**
Calcium	mg/L	NC	NC	NC	500	--	42.4	--	133	--	22.6	--	95.1	--	47.3	--	50.8
Chloride	mg/L	250**	250	250	500	--	95.7	--	29.3	--	23.2	--	22.7	--	21.5	--	21.3
Fluoride	ug/L	4,000	NC	NC	NC	< 1000	<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	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	**9.8**	**9.8**	7.8	7.4	**9.1**	**8.5**	**9.7**	**10.2**	7.6	7.7	**11.6**	**11.4**
Sulfate	mg/L	**250****	**250**	**250**	**500**	--	< 2.0	--	73.7	--	12.3	--	**355**	--	8.7	--	2.4
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	--	456	--	**636**	--	244	--	**902**	--	324	--	338
Appendix IV																	
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	9.4	8.5	< 1.0	< 1.0	6.4	1.5	1.8	3.4	< 1.0	< 1.0	6.2	5.5
Barium	ug/L	2,000	2,000	2,000	**690**	16.5	13.8	63.4	64.8	15.2	16.6	109	105	43.3	43.9	**779**	607
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 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	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 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	< 15.0	< 15.0	< 15.0	< 15.0
Fluoride	ug/L	4,000	NC	NC	NC	< 1000	<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	NC	4	4	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	24	21	46	54	21	11	13	11	27	24	27	16
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3200	16.0	11.6	< 5.0	< 5.0	8.9	5.8	50.8	71.3	< 5.0	< 5.0	**94.7**	**100**
Radium-226	pCi/L	NC	NC	NC	NC	< 0.934	< 0.580	< 0.869	0.661	< 0.742	0.350	< 0.693	< 0.526	< 0.505	< 0.546	< 1.11	< 1.17
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.89	< 3.85	< 1.75	< 1.45	< 1.61	< 1.25	< 1.43	< 1.32	< 1.14	< 1.30	< 2.08	< 3.02
Radium-228	pCi/L	NC	NC	NC	NC	< 0.957	< 3.27	< 0.877	< 0.978	< 0.872	< 0.923	< 0.733	< 0.789	< 0.633	< 0.754	< 0.972	< 1.85
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	3.3	< 1.0	< 1.0	1.2	1.2
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 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 site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 2018 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- 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.

Table 3

Summary of Groundwater Sampling Results (Analytical) – December 2017 to August 2018

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

					Sample Location:	BCC-MW-15015		BCC-MW-15016		BCC-MW-15017		BCC-MW-15018		BCC-MW-15019		BCC-MW-15020	
					Sample Date:	4/17/2018	6/13/2018	4/17/2018	6/12/2018	4/17/2018	6/12/2018	4/18/2018	6/12/2018	4/18/2018	6/12/2018	4/18/2018	6/12/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient											
Appendix III																	
Boron	ug/L	NC	**500**	**500**	7,200	--	398	--	76.6	--	83.8	--	**559**	--	**1,170**	--	**708**
Calcium	mg/L	NC	NC	NC	500	--	45.0	--	168	--	243	--	87.6	--	97.7	--	96.3
Chloride	mg/L	250**	250	250	500	--	19.5	--	197	--	224	--	48.9	--	67.7	--	92.1
Fluoride	ug/L	4,000	NC	NC	NC	<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	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	8.3	7.9	6.8	**6.5**	6.8	**6.5**	6.9	6.8	7.0	6.7	7.0	6.7
Sulfate	mg/L	**250****	**250**	**250**	**500**	--	12.6	--	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0	--	< 2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	--	316	--	**986**	--	**1,120**	--	**598**	--	**524**	--	**622**
Appendix IV																	
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	4.7	5.5	1.5	1.3	2.3	2.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	39.9	37.9	649	652	**955**	**936**	139	156	161	187	148	197
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 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	2.1	2.0	3.4	3.4	< 1.0	< 1.0	< 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	< 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	<1,000	<1,000	<1,000	<1,000
Lead	ug/L	NC	4	4	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	16	13	< 10	< 10	< 10	< 10	29	26	25	23	16	16
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3200	9.4	7.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.467	< 0.475	1.56	< 0.810	2.23	2.13	< 0.843	< 0.756	< 0.717	< 0.594	0.744	< 0.899
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.20	< 1.24	3.64	2.50	**5.16**	**5.43**	1.59	1.77	< 1.46	1.75	1.56	2.64
Radium-228	pCi/L	NC	NC	NC	NC	< 0.730	< 0.763	2.08	1.81	2.93	3.30	0.869	1.39	< 0.742	1.36	0.813	1.75
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	1.5	1.4	1.7	2.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 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 site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 201 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- 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.

Table 3
Summary of Groundwater Sampling Results (Analytical) – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-15021		BCC-MW-15022		BCC-MW-15023		BCC-MW-17001			
					Sample Date:	4/18/2018	6/12/2018	4/18/2018	6/11/2018	4/18/2018	6/11/2018	12/7/2017	2/20/2018	6/15/2018	8/6/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient						Shallow 2017 Wells (downgradient)			
Appendix III															
Boron	ug/L	NC	**500**	**500**	7,200	--	**809**	--	**1,170**	--	**1,650**	**991**	**827**	**1,100**	**1,220**
Calcium	mg/L	NC	NC	NC	500	--	89.4	--	38.2	--	98.9	118	118	124	117
Chloride	mg/L	250**	250	250	500	--	112	--	21.5	--	19.4	27.3	28.5	29.1	29.1
Fluoride	ug/L	4,000	NC	NC	NC	<1,000	<1,000	<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	6.8	7.8	8.3	7.6	7.4	7.1	7.0	7.2	6.9
Sulfate	mg/L	**250****	**250**	**250**	**500**	--	< 2.0	--	24.1	--	139	156	135	90.8	18.7
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	--	**576**	--	210	--	474	**558**	**552**	**566**	476
Appendix IV															
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	5.2	< 1.0	< 1.0	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	236	238	102	104	97.1	87.8	85.6	71.3	65.8	73.8
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 0.20	< 0.20	< 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	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 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	< 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	< 1,000	< 1,000
Lead	ug/L	NC	4	4	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	< 10	< 10	13	11	19	18	55	73	65	62
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	7.1	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.461	< 0.689	0.666	< 0.708	< 0.572	< 0.958	< 0.509	< 0.890	< 0.766	< 0.616
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.96	1.97	1.13	< 1.45	< 1.32	< 1.85	< 1.34	< 1.79	< 1.71	< 1.44
Radium-228	pCi/L	NC	NC	NC	NC	< 1.50	1.60	< 0.644	< 0.742	< 0.749	< 0.891	< 0.830	< 0.901	< 0.947	< 0.822
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0
Thallium	ug/L	2	2	2	3.7	< 2.0	< 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 site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 201 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- 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.

Table 3

Summary of Groundwater Sampling Results (Analytical) – December 2017 to August 2018

BC Cobb – RCRA CCR Monitoring Program

Muskegon, Michigan

					Sample Location:	BCC-MW-17002				BCC-MW-17003				BCC-MW-17004			
					Sample Date:	12/7/2017	2/20/2018	6/15/2018	8/6/2018	12/7/2017	2/20/2018	6/15/2018	8/7/2018	12/6/2017	2/20/2018	6/15/2018	8/7/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Shallow 2017 Wells (downgradient)											
Appendix III																	
Boron	ug/L	NC	**500**	**500**	7,200	**8,280**	**12,800**	**13,300**	**9,440**	413	394	369	383	367	429	**525**	425
Calcium	mg/L	NC	NC	NC	500	178	201	224	194	74.3	55.7	63.2	74.6	53.7	48.1	73.1	68.9
Chloride	mg/L	250**	250	250	500	15.3	14.2	13.2	15.4	18.3	21.5	22.7	21.9	21.3	21.3	21.4	21.2
Fluoride	ug/L	4,000	NC	NC	NC	< 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	**6.5 - 8.5****	**6.5 - 8.5**	**6.5 - 8.5**	**6.5 - 9.0**	7.0	7.1	7.2	7.1	7.0	7.2	7.4	7.3	7.2	7.3	7.4	7.3
Sulfate	mg/L	**250****	**250**	**250**	**500**	**330**	**325**	**332**	226	48.4	< 2.0	< 2.0	17.7	< 2.0	< 2.0	8.3	< 2.0
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**726**	**892**	**936**	**740**	324	330	412	326	228	238	410	320
Appendix IV																	
Antimony	ug/L	6	6	6	130	1.5	< 1.0	< 1.0	< 2.0	1.1	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	**45.5**	2.0	2.6	3.8	**26.0**	< 1.0	< 1.0	1.0	2.5	1.8	1.1	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	148	76.7	62.8	57.6	128	78.1	66.5	77.9	145	116	175	148
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 0.20	< 0.20	< 0.20	< 0.20	< 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	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 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	< 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	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4	4	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	75	160	150	130	19	17	13	18	< 10	< 10	< 10	< 10
Mercury	ug/L	2	2	2	0.20#	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Molybdenum	ug/L	NC	**73**	210	3200	30.1	< 5.0	< 5.0	< 5.0	48.8	6.3	< 5.0	< 5.0	9.9	5.9	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 1.03	< 1.07	< 0.757	0.306	< 0.889	< 0.755	< 0.594	< 0.687	< 0.945	< 0.723	< 0.441	< 0.519
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 2.03	< 4.84	< 3.11	1.56	< 1.55	< 1.46	< 1.42	< 1.49	< 1.75	< 1.44	< 1.25	< 1.46
Radium-228	pCi/L	NC	NC	NC	NC	< 0.996	< 3.77	< 2.35	1.25	< 0.663	< 0.707	< 0.828	0.932	< 0.804	< 0.719	< 0.810	1.03
Selenium	ug/L	50	50	50	5	1.1	< 1.0	< 1.0	< 2.0	< 1.0	2.2	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 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 site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 201 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- 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.

Table 3
Summary of Groundwater Sampling Results (Analytical) – December 2017 to August 2018
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

					Sample Location:	BCC-MW-17005				BCC-MW-17006			
					Sample Date:	12/6/2017	2/20/2018	6/15/2018	8/7/2018	12/6/2017	2/20/2018	6/15/2018	8/7/2018
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Shallow 2017 Wells (downgradient)							
Appendix III													
Boron	ug/L	NC	**500**	**500**	7,200	191	238	377	342	**669**	**594**	**653**	**765**
Calcium	mg/L	NC	NC	NC	500	51.9	54.2	71.2	68.1	106	95.0	97.5	90.4
Chloride	mg/L	250**	250	250	500	19.4	21.6	20.5	19.6	19.0	20.3	20.9	21.5
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**	7.3	7.3	7.4	7.3	7.7	7.3	7.5	7.5
Sulfate	mg/L	**250****	**250**	**250**	**500**	11.5	< 2.0	9.6	4.3	129	93.1	69.8	46.2
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	262	310	358	318	474	472	478	438
Appendix IV													
Antimony	ug/L	6	6	6	130	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Arsenic	ug/L	**10**	**10**	**10**	**10**	2.9	< 1.0	< 1.0	< 1.0	4.9	2.4	4.6	< 1.0
Barium	ug/L	2,000	2,000	2,000	**690**	168	123	161	179	83.3	79.0	70.3	73.0
Beryllium	ug/L	4	4	4	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	ug/L	5	5	5	3.1	< 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	< 1.0	< 1.0	< 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	29	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Lithium	ug/L	NC	170	350	440	10	11	< 10	13	38	37	31	36
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	3200	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Radium-226	pCi/L	NC	NC	NC	NC	< 0.863	< 0.804	< 0.692	0.440	< 0.930	< 0.766	< 0.862	< 0.582
Radium-226/228	pCi/L	**5**	NC	NC	NC	< 1.59	< 1.71	< 1.49	< 1.15	< 1.76	< 1.48	< 1.75	< 1.34
Radium-228	pCi/L	NC	NC	NC	NC	< 0.722	< 0.904	< 0.796	< 0.741	< 0.833	< 0.716	< 0.888	< 0.757
Selenium	ug/L	50	50	50	5	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 1.0	< 1.0	< 2.0
Thallium	ug/L	2	2	2	3.7	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Notes:

ug/L - micrograms per liter.

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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.

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^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using site-specific hardness of 154 mg CaCO3/L as measured at surface water sample SW-01 collected on February 22, 201 from the North Channel Muskegon River. Chromium GSI criterion based on hexavalent chromium per footnote {H}.

- 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.

N

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

0 3,000 6,000
FEET

TRC

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

TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB BOTTOM ASH POND AND PONDS 0-8 AREA
MUSKEGON, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	S. HOLMSTROM
APPROVED BY:	G. CROCKFORD
DATE:	NOVEMBER 2018
PROJ. NO.:	269767-001
FILE:	269767-001-020slm.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\269767-001-020slm.mxd -- Saved By: SMAJOR on 11/30/2018, 12:01:46 PM

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- APPROXIMATE POND BOUNDARY

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL.

N

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

SITE PLAN WITH CCR MONITORING WELL LOCATIONS

DRAWN BY:	S. MAJOR	PROJ NO.:	284111-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		**FIGURE 2**
DATE:	OCTOBER 2018		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 284111-001-011.mxd

TRC - GIS
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
Plot Date: 10/16/2018, 11:13:29 AM by SMAJOR – LAYOUT: ANSI B(11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\284111-001-011.mxd

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHARACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL, AND WERE NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1 " = 300 '

1:3,600

PROJECT:

CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:

SHALLOW GROUNDWATER CONTOUR MAP APRIL 16, 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	284111-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		
DATE:	OCTOBER 2018		

FIGURE 3

TRC

1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 284111-001-010.mxd

Plot Date: 10/16/2018, 11:28:50 AM by SMAJOR
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\284111-001-010.mxd
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
TRC - GIS
– LAYOUT: ANSI B(11"x17")

LEGEND

- BACKGROUND MONITORING WELL
- DOWNGRADIENT MONITORING WELL
- MONITORING WELL (STATIC WATER LEVEL ONLY)
- APPROXIMATE POND BOUNDARY
- (580.85) GROUNDWATER ELEVATION (FEET, MSL)
- GROUNDWATER ELEVATION CONTOUR (0.5' INTERVAL, DASHED WHERE INFERRED)

NOTES

1. BASE MAP IMAGERY FROM NEARMAP, 3/29/2017.
2. WELL LOCATIONS SURVEYED BY WILLIAMS & WORKS ON 11/23/2015.
3. MONITORING WELLS BCC-MW-17001 THROUGH BCC-MW-17006 SURVEYED BY CONSUMERS ENERGY CO. ON 1/16/2018.
4. DEEP SCREENED WELLS (DEEP) ARE CHRACTERIZED BY WELL SCREENS SET BELOW 555 FEET MSL, AND WERE NOT USED TO CONSTRUCT CONTOUR MAP.

N

0 300 600 Feet

1 " = 300 '
1:3,600

PROJECT:
CONSUMERS ENERGY COMPANY
BC COBB POWER PLANT
MUSKEGON, MICHIGAN

TITLE:
SHALLOW GROUNDWATER CONTOUR MAP JUNE 11, 2018

DRAWN BY:	S. MAJOR	PROJ NO.:	284111-001
CHECKED BY:	C. SCIESZKA		
APPROVED BY:	S. HOLMSTROM		**FIGURE 4**
DATE:	OCTOBER 2018		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 284111-001-009.mxd

TRC - GIS
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
Plot Date: 10/16/2018, 11:24:41 AM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: E:\ConsumersEnergy\CCR_GW\2017_269767\284111-001-009.mxd

Appendix A
Monitoring Well Installation Logs

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17001

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/6/17	12/6/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	586.1	589.29	20.0	6

Boring Location: 7 feet west of BCC-MW-15016. N: 646228.0 E: 12622452.1	Personnel: Logged By - T. Hess; Driller - B. Marshal	Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Muskegon	Muskegon	MI	While Drilling: Date/Time 12/6/17 00:00 ▽ Depth (ft bgs) 10.0 After Drilling: Date/Time 12/7/17 11:35 ▼ Depth (ft bgs) 5.81

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, dark gray (10YR 4/1), loose, dry.				
			2					
			4					
			5	Change to some woody material at 5.0 feet. ▼				
2 CS	100		6					
			8	**SILTY SAND WITH ASH** mostly fine to medium sand, some silt and ash, few to little woody material, light brownish gray (10YR 6/2), loose, moist.	SM			
			10	Change to saturated at 10.0 feet. ▽				
			12	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, moist.	SP			
3 CS	100		14					
			15	**PEAT** dark organic woody material (10YR 2/1), brittle, saturated.				
			16	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			17	**PEAT** dark organic woody material (10YR 2/1), brittle, saturated.				
			18	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			20	End of boring at 20.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC_CORP_INCHES.GDT 2/7/18

Signature: For Tanner Hess

Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	**BCC-MW-17001**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/6/2017 INSTALLED BY: Tanner Hess	CHECKED BY:	CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
589.29	3.1	TOP OF CASING
586.1	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
18.1		RISER PIPE LENGTH
	11.0	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	13.0	BENTONITE SEAL
571.1	15.0	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
566.1	20.0	BOTTOM OF SCREEN
	20.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
566.1	20.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 20 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	23.36	T/PVC	12/6/2017	1653
DTB AFTER DEVELOPING:	23.36	T/PVC	12/6/2017	1727
SWL BEFORE DEVELOPING:	8.99	T/PVC	12/6/2017	1653
SWL AFTER DEVELOPING:	9.59	T/PVC	12/6/2017	1727
OTHER SWL:	8.91	T/PVC	12/7/2017	1135
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17002

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/6/17	12/6/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	585.8	588.79	19.0	6

Boring Location: 6 feet southeast of BCC-MW-15017.

N: 646348.8 E: 12622087.2

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/6/17 00:00 ▽ Depth (ft bgs) 10.0
After Drilling: Date/Time 12/7/17 11:28 ▼ Depth (ft bgs) 5.43

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, dark gray (10YR 4/1), loose, dry.				
			2					
			4					
			6					
2 CS	100		8	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, dry.				
			10	**SAND WITH COAL ASH** mostly fine to medium sand, little coal ash, dark gray (10YR 4/1), loose, dry. ▽	SP			
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.				
			12					
3 CS	100		14		SP			
			16					
			18	**PEAT** mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
				End of boring at 19.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC_CORP_INCHES.GDT 2/7/18

Signature: Sarah E. Holmstrom
For Tanner Hess

Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb			WELL ID: **BCC-MW-17002**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/6/2017	INSTALLED BY: Tanner Hess	CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
588.79	3.0	TOP OF CASING
585.8	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
16.5		RISER PIPE LENGTH
	9.0	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	11.0	BENTONITE SEAL
572.3	13.5	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
567.3	18.5	BOTTOM OF SCREEN
	18.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
566.8	19.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 18 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: LIGHT BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): SLIGHT SULFUR

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	21.49	T/PVC	12/6/2017	1533
DTB AFTER DEVELOPING:	21.49	T/PVC	12/6/2017	1615
SWL BEFORE DEVELOPING:	8.49	T/PVC	12/6/2017	1533
SWL AFTER DEVELOPING:	8.58	T/PVC	12/6/2017	1615
OTHER SWL:	8.43	T/PVC	12/7/2017	1128
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17003

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/5/17	12/5/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	589.3	592.37	22.0	6

Boring Location: 7.5 feet northeast of BCC-MW-15018.

N: 646794.9 E: 12622184.8

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/5/17 00:00 ▽ Depth (ft bgs) 11.0
After Drilling: Date/Time 12/7/17 11:24 ▼ Depth (ft bgs) 9.07

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0–2	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.				
2 CS	100		2–8					
			8	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose, dry. ▼				
			10	▽ Change to saturated at 11.0 feet.				
3 CS	100		12–14					
			14	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			16–18					
4 CS	100		20					
			22	End of boring at 22.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC_CORP_INCHES.GDT 2/7/18

Signature: Sarah E Johnston
For Tanner Hess

Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	**BCC-MW-17003**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/6/2017 INSTALLED BY: Tanner Hess	CHECKED BY:	CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
592.37	2.9	TOP OF CASING
589.3	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
19.9		RISER PIPE LENGTH
	13.0	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	15.0	BENTONITE SEAL
572.3	17.0	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
567.3	22.0	BOTTOM OF SCREEN
	22.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
567.3	22.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 22 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	25.25	T/PVC	12/6/2017	1258
DTB AFTER DEVELOPING:	25.25	T/PVC	12/6/2017	1337
SWL BEFORE DEVELOPING:	12.05	T/PVC	12/6/2017	1258
SWL AFTER DEVELOPING:	12.10	T/PVC	12/6/2017	1337
OTHER SWL:	11.97	T/PVC	12/7/2017	1124
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17004

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/5/17	12/5/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	589.1	591.84	22.5	6

Boring Location: 8 feet northeast of BCC-MW-15019.

N: 647110.1 E: 12622373.4

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/5/17 00:00 ▽ Depth (ft bgs) 10.0
After Drilling: Date/Time 12/7/17 11:20 ▼ Depth (ft bgs) 9.03

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.				
			2					
			4					
2 CS	0		6					No recovery from 5.0 to 10.0 feet.
			8	**COAL ASH** mostly coal ash, dark gray (10YR 4/1), loose.				
			10	Change to saturated at 10.0 feet.				
			12					
3 CS	100		14	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			16					
			18					
4 CS	80		20					
			22	End of boring at 22.5 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC_CORP_INCHES.GDT 2/7/18

Signature: For Tanner Hess

Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb			WELL ID: **BCC-MW-17004**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/5/2017	INSTALLED BY: Tanner Hess	CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
591.84	2.6	TOP OF CASING
589.1	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
20.1		RISER PIPE LENGTH
	13.0	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	15.0	BENTONITE SEAL
571.6	17.5	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
566.6	22.5	BOTTOM OF SCREEN
	22.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
566.6	22.5	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 22 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	25.27	T/PVC	12/5/2017	1544
DTB AFTER DEVELOPING:	25.27	T/PVC	12/5/2017	1625
SWL BEFORE DEVELOPING:	11.20	T/PVC	12/5/2017	1544
SWL AFTER DEVELOPING:	11.30	T/PVC	12/5/2017	1625
OTHER SWL:	11.63	T/PVC	12/7/2017	1120
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17005

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/4/17	12/5/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	589.3	592.42	30.0	6

Boring Location: 8 feet southwest of BCC-MW-15020.
N: 647433.9 E: 12622619.7

Personnel
Logged By - T. Hess
Driller - B. Marshal

Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:
Muskegon	Muskegon	MI

Water Level Observations:
While Drilling: Date/Time 12/4/17 00:00 ▽ Depth (ft bgs) 11.5
After Drilling: Date/Time 12/7/17 11:17 ▼ Depth (ft bgs) 9.96

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
			0	**GRAVEL** mostly gravel, white (10YR 8/1), road base.	GP			
1 HA	100			**SANDY COAL ASH** mostly coal ash, some fine to medium sand, trace gravel, brown (10YR 4/3), loose, dry.				
			5					
2 CS	50			Change to very dark gray (10YR 3/1) at 8.0 feet.				
			10	▼ ▽				
				COAL ASH mostly coal ash, dark gray (10YR 4/1), loose, saturated.				
3 CS	100		15					
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.				
			20		SP			
4 CS	100		25	**PEAT** mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			30	End of boring at 30.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC_CORP_INCHES.GDT 2/7/18

Signature: Sarah B Hobston
For Tanner Hess

Firm: TRC Environmental Corporation (734) 971-7080
1540 Eisenhower Place Ann Arbor, MI 48108 Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb			WELL ID: **BCC-MW-17005**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/5/2017	INSTALLED BY: Tanner Hess	CHECKED BY: CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
592.42	3.1	TOP OF CASING
589.3	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
23.1		RISER PIPE LENGTH
	15.0	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	17.0	BENTONITE SEAL
569.3	20.0	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
564.3	25.0	BOTTOM OF SCREEN
	25.0	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
559.3	30.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 24 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 9.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	27.89	T/PVC	12/5/2017	1400
DTB AFTER DEVELOPING:	27.89	T/PVC	12/5/2017	1445
SWL BEFORE DEVELOPING:	12.73	T/PVC	12/5/2017	1400
SWL AFTER DEVELOPING:	12.80	T/PVC	12/5/2017	1445
OTHER SWL:	13.06	T/PVC	12/7/2017	1117
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

WELL CONSTRUCTION LOG

WELL NO. BCC-MW-17006

Facility/Project Name:	Date Drilling Started:	Date Drilling Completed:	Project Number:
CEC: BC Cobb	12/4/17	12/4/17	269767.0000.0000

Drilling Firm:	Drilling Method:	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns	Sonic	590.5	593.78	30.0	6

Boring Location: 9 feet west of BCC-MW-15021. N: 646657.7 E: 12623301.3	Personnel: Logged By - T. Hess; Driller - B. Marshal	Drilling Equipment: Geoprobe 8140 LS

Civil Town/City/or Village:	County:	State:	Water Level Observations:
Muskegon	Muskegon	MI	While Drilling: Date/Time 12/4/17 00:00 ▽ Depth (ft bgs) 11.5 After Drilling: Date/Time 12/7/17 11:11 ▼ Depth (ft bgs) 13.5

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100		0	**TOPSOIL** black (10YR 2/1).				
				COAL ASH mostly coal ash, dark gray (10YR 4/1), fine, soft, loose.				
2 CS	100		5					
				Change to moist at 9.0 feet.				
			10	Change to dry at 10.0 feet.				
				▽ Change to saturated at 11.5 feet.				
3 CS	100		15					
			20					
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
				PEAT mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
4 CS	100		25	**SAND** mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
				PEAT mostly organic material, some silt and woody material, black (10YR 2/1), saturated.				
				SAND mostly fine to medium sand, light brownish gray (10YR 6/2), loose, saturated.	SP			
			30	End of boring at 30.0 feet below ground surface.				

SOIL BORING WELL CONSTRUCTION LOG BCC GSI WELLS.GPJ TRC_CORP_INCHES.GDT 2/7/18

Signature: For Tanner Hess

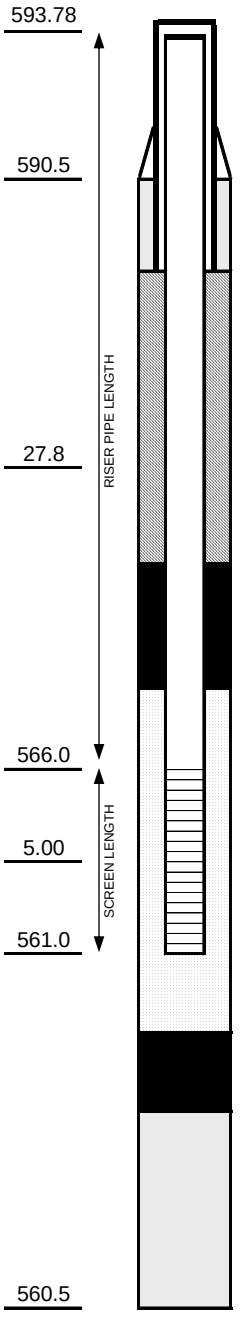
Firm: TRC Environmental Corporation, 1540 Eisenhower Place Ann Arbor, MI 48108, (734) 971-7080, Fax (734) 971-9022

Checked By: C. Scieszka

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: CEC: BC Cobb		WELL ID:	**BCC-MW-17006**
PROJ. NO: 269767.0000	DATE INSTALLED: 12/4/2017 INSTALLED BY: Tanner Hess	CHECKED BY:	CS

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
593.78	3.3	TOP OF CASING
590.5	0.0	GROUND SURFACE
	1.0	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: BENTONITE SLURRY
		GROUT/BACKFILL METHOD: TREMIE
27.8		RISER PIPE LENGTH
	20.5	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	22.5	BENTONITE SEAL
566.0	24.5	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
561.0	29.5	BOTTOM OF SCREEN
	29.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
560.5	30.0	HOLE BOTTOM



NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 6 IN. FROM 0 TO 30 FT.
____ IN. FROM ____ TO ____ FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.75 HOURS

WATER REMOVED: 14.25 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: CLOUDY

COLOR BEFORE: BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: CLEAR

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	32.69	T/PVC	12/5/2017	1153
DTB AFTER DEVELOPING:	32.69	T/PVC	12/5/2017	1315
SWL BEFORE DEVELOPING:	16.60	T/PVC	12/5/2017	1153
SWL AFTER DEVELOPING:	16.90	T/PVC	12/5/2017	1315
OTHER SWL:	16.80	T/PVC	12/7/2017	1111
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: Consumers

Appendix B
Data Quality Review

Laboratory Data Quality Review
Groundwater Monitoring Event April 2018
CEC BC Cobb

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 4610965, 4610966, and 4611064.

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

- BCC-MW-15002
- BCC-MW-15003
- BCC-MW-15004
- BCC-MW-15005
- BCC-MW-15006
- BCC-MW-15007
- BCC-MW-15008
- BCC-MW-15009
- BCC-MW-15010
- BCC-MW-15011
- BCC-MW-15012
- BCC-MW-15013
- BCC-MW-15014
- BCC-MW-15015
- BCC-MW-15016
- BCC-MW-15017
- BCC-MW-15018
- BCC-MW-15019
- BCC-MW-15020
- BCC-MW-15021
- BCC-MW-15022
- BCC-MW-15023

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.

- Three equipment blanks (EB-01, EB-02, and EB-03) and two field blanks (FB-01 and FB-02) were collected.
  - Antimony was detected in FB-01 at a concentration of 1.4 µg/L. The concentration of antimony in sample BCC-MW-15014 was <10x the blank concentration and therefore may be a false positive (see attached table); however, the antimony concentration detected at BCC-MW-15014 was within the range of historical concentrations observed at that well.
  - Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result, as summarized in the attached table.
    - Radium-226 was detected in the equipment blank EB-02 at 0.491 ± 0.369 pCi/L and in the field blank FB-01 at 0.273 ± 0.313 pCi/L. Radium-226 sample results are potentially impacted (see attached table); however, the radium-226 concentrations were consistent with the range of historical results.
- LCS recoveries were within laboratory control limits for all analytes.
- MS/MSDs were performed on samples BCC-MW-15003, BCC-MW-15009, and BCC-MW-15022.
  - MS/MSDs were performed on BCC-MW-15009 for batch 21132 for metals. The MS/MSD recoveries for selenium were below the lower laboratory control limit. The selenium results for samples analyzed in the same batch may be biased low (see attached table); however, the selenium concentrations for batch 21132 samples were consistent with the range of historical results.
  - MS/MSDs were performed on BCC-MW-15022 for batch 21833 for mercury. The MS had a recovery that was below the lower laboratory control limit. Mercury results for samples analyzed in the same batch may be biased low (see attached table); however, the mercury concentrations for batch 21833 samples were consistent with the range of historical results.
  - MS/MSD was performed on BCC-MW-15009 for batch 21061 for fluoride. The MSD had a recovery that was below the lower laboratory control limit. Fluoride results for samples analyzed in the same batch may be biased low (see attached table); however, the fluoride concentrations for batch 21061 samples were consistent with the range of historical results.
- Laboratory duplicates were performed on BCC-MW-15003, BCC-MW-15009, and BCC-MW-15022 for fluoride. Relative percent differences (RPDs) were within laboratory control limits.
- Dup-01 corresponds to sample MW-15013, Dup-02 corresponds to sample BCC-MW-15018, and Dup-03 corresponds to sample BCC-MW-15008. RPDs were within QC limits.

Attachment B
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15014_20180417	4/17/2018	Antimony	Detection in field blank (FB-01). Sample result ≤10X the blank concentration. Results may be false positives.
BCC-MW-15002_20180419	4/19/2018	Radium-226	Detection in equipment blank EB-02 and field blank FB-01. Normalized absolute difference between blank and sample result <1.96. Results may be false positives.
BCC-MW-15003_20180419	4/19/2018		
BCC-MW-15004_20180419	4/19/2018		
BCC-MW-15008_20180418	4/18/2018		
BCC-MW-15016_20180417	4/17/2018		
BCC-MW-15017_20180417	4/17/2018		
BCC-MW-15020_20180418	4/18/2018		
BCC-MW-15022_20180418	4/18/2018		
Dup-02_20180418	4/18/2018		
BCC-MW-15009_20180416	4/16/2018	Fluoride	Recovery in the MSD was below acceptance criteria. Results may be biased low.
BCC-MW-15010_20180416	4/16/2018		
BCC-MW-15011_20180416	4/16/2018		
BCC-MW-15012_20180417	4/17/2018		
BCC-MW-15013_20180417	4/17/2018		
BCC-MW-15014_20180417	4/17/2018		
BCC-MW-15015_20180417	4/17/2018		
BCC-MW-15016_20180417	4/17/2018		
BCC-MW-15017_20180417	4/17/2018		
Dup-01_20180417	4/17/2018		
EB-01_20180417	4/17/2018		
FB-01_20180417	4/17/2018		

Attachment B
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15009_20180416	4/16/2018	Selenium	Recovery in the MS/MSD was below acceptance criteria. Results may be biased low.
BCC-MW-15010_20180416	4/16/2018		
BCC-MW-15011_20180416	4/16/2018		
BCC-MW-15012_20180417	4/17/2018		
BCC-MW-15013_20180417	4/17/2018		
BCC-MW-15014_20180417	4/17/2018		
BCC-MW-15015_20180417	4/17/2018		
BCC-MW-15016_20180417	4/17/2018		
BCC-MW-15017_20180417	4/17/2018		
Dup-01_20180417	4/17/2018		
BCC-MW-15005_20180419	4/19/2018	Mercury	Recovery in the MS was below acceptance criteria. Results may be biased low.
BCC-MW-15006_20180419	4/19/2018		
BCC-MW-15007_20180419	4/19/2018		
BCC-MW-15008_20180418	4/18/2018		
BCC-MW-15018_20180418	4/18/2018		
BCC-MW-15019_20180418	4/18/2018		
BCC-MW-15020_20180418	4/18/2018		
BCC-MW-15021_20180418	4/18/2018		
BCC-MW-15022_20180418	4/18/2018		
BCC-MW-15023_20180418	4/18/2018		
Dup-02_20180418	4/18/2018		
Dup-03_20180418	4/18/2018		
EB-02_20180418	4/18/2018		
FB-02_20180418	4/18/2018		

Laboratory Data Quality Review
Groundwater Monitoring Event June 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the June 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 4613592, 4613593, 4613433, and 4613432.

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

- BCC-MW-15002
- BCC-MW-15003
- BCC-MW-15004
- BCC-MW-15005
- BCC-MW-15006
- BCC-MW-15007
- BCC-MW-15008
- BCC-MW-15009
- BCC-MW-15010
- BCC-MW-15011
- BCC-MW-15012
- BCC-MW-15013
- BCC-MW-15014
- BCC-MW-15015
- BCC-MW-15016
- BCC-MW-15017
- BCC-MW-15018
- BCC-MW-15019
- BCC-MW-15020
- BCC-MW-15021
- BCC-MW-15022
- BCC-MW-15023

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 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
  - Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result, as summarized in the attached table.
    - Radium-228 was detected in the method blank in batch 302940 at a concentration 2.86 ± 1.71 pCi/L. Radium-228 sample results are potentially impacted (see attached table); however, radium-228 concentrations from batch 302940 samples were within the range of historical radium-228 concentrations, with the exception of BCC-MW-15018 and BCC-MW-15020. Radium at BCC-MW-15018 and BCC-MW-15020 were above the range of historical results.
- Three equipment blanks (EB-01, EB-02, and EB-03) and two field blanks (FB-01 and FB-02) were collected.
  - Barium was detected in FB-02 at a concentration of 1.1 µg/L. The concentrations of barium in samples associated with the field blank were >10x the blank concentration. Therefore, there is no impact to data usability.
  - Normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result, as summarized in the attached table.
    - Radium-226 was detected in the equipment blank EB-02 at 0.211 ± 0.242 pCi/L. Radium-226 sample results are potentially impacted (see attached table); however, the concentrations of radium-226 were within range of historical radium-226 concentrations. Data are deemed usable for the intended purpose.
- LCS recoveries were within laboratory control limits for all analytes.
- MS/MSDs were performed on samples BCC-MW-15008, BCC-MW-15009, and BCC-MW-15022.
  - The boron recovery in the MS performed on BCC-MW-15009 for batch 26308 was below the lower laboratory control limit. However, the boron concentration in the parent sample was >4x the spike concentration; therefore, the laboratory control limit is not applicable. The selenium recoveries in the MS/MSD in this batch were below the lower laboratory control limit. The selenium results for samples analyzed in the same batch may be biased low (see attached table); however, the selenium concentrations observed in batch 26308 samples were within the range of historical selenium concentrations, with the exception of BCC-MW-15012. The BCC-MW-15012 selenium concentration was slightly above the historical range.

- The barium recovery in the MSD was below the lower laboratory control limit for batch 26122; however, the barium concentration in the parent sample was >4x the spike concentration; therefore, the laboratory control limits are not applicable.
- The sulfate recoveries in the MS/MSD were above the upper laboratory control limit in batch 25977. The positive sulfate results for samples analyzed in the same batch may be biased high (see attached table); however, the concentrations of sulfate observed in batch 25977 samples were within the range of historical sulfate concentrations with the exception of BCC-MW-15012. Sulfate is suspect and potentially an outlier, it was detected at BCC-MW-15012 at 355 mg/L, an order of magnitude higher than the historical range of sulfate concentrations at that well.
- The radium-228 recoveries in the MS/MSD performed on BCC-MW-15009 for batch 302943 were low and outside of the default acceptance criteria for MS/MSD recovery. The low MS/MSD recovery is due to sample matrix interference as indicated by a low Ba-133 tracer yield on the MS, MSD, and parent sample. The radium-228 results for this sample may be biased low (see attached table); however, the radium-228 concentration detected in BCC-MW-15019 was measured at its highest concentration to date.

- Laboratory duplicates were performed on BCC-MW-15009 for anions and total dissolved solids, BCC-MW-15015 for total dissolved solids, BCC-MW-22 for anions and total dissolved solids (TDS), and Dup-02 for anions. Relative percent differences (RPDs) were within laboratory control limits.
- Field duplicate sample Dup-01 corresponds to sample BCC-MW-15020, Dup-02 corresponds to sample BCC-MW-15017, and Dup-03 corresponds to sample BCC-MW-15013. RPDs were within QC limits.

Attachment B
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15019_20180612	6/12/2018	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample result <1.96. Results may be false positives.
BCC-MW-15018_20180612	6/12/2018		
Dup-01_20180612	6/12/2018		
BCC-MW-15021_20180612	6/12/2018		
BCC-MW-15020_20180612	6/12/2018		
BCC-MW-15016_20180612	6/12/2018		
Dup-02_20180612	6/12/2018		
BCC-MW-15017_20180612	6/12/2018		
EB-02_20180613	6/13/2018	Radium-226	Detection in equipment blank EB-02. Normalized absolute difference between blank and sample result <1.96. Results may be false positives.
BCC-MW-15003_20180614	6/14/2018		
BCC-MW-15010_20180614	6/14/2018		
BCC-MW-15011_20180613	6/13/2018		
BCC-MW-15002_20180614	6/14/2018	Selenium	Recoveries in the MS/MSD were below acceptance criteria. Results may be biased low.
BCC-MW-15003_20180614	6/14/2018		
BCC-MW-15005_20180614	6/14/2018		
BCC-MW-15006_20180614	6/14/2018		
BCC-MW-15007_20180614	6/14/2018		
BCC-MW-15008_20180614	6/14/2018		
BCC-MW-15009_20180613	6/13/2018		
BCC-MW-15010_20180614	6/14/2018		
BCC-MW-15011_20180613	6/13/2018		
BCC-MW-15012_20180613	6/13/2018		
BCC-MW-15013_20180613	6/13/2018		
BCC-MW-15014_20180613	6/13/2018		
BCC-MW-15015_20180613	6/13/2018		
Dup-03_20180613	6/13/2018		
EB-02_20180613	6/13/2018		
EB-03_20180613	6/13/2018		
FB-02_20180613	6/13/2018		

Attachment B
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-15002_20180614	6/14/2018	Sulfate	Recoveries in the MS/MSD were above acceptance criteria. Results may be biased high.
BCC-MW-15005_20180614	6/14/2018		
BCC-MW-15006_20180614	6/14/2018		
BCC-MW-15007_20180614	6/14/2018		
BCC-MW-15010_20180614	6/14/2018		
BCC-MW-15011_20180613	6/13/2018		
BCC-MW-15012_20180613	6/13/2018		
Dup-03_20180613	6/13/2018		
BCC-MW-15009_20180613	6/13/2018	Radium-228	Recoveries in the MS/MSD were below acceptance criteria. Results may be biased low.

Laboratory Data Quality Review
Groundwater Monitoring Event December 2017
CEC BC Cobb

Groundwater samples were collected by TRC for the December 2017 sampling event. Samples were analyzed for anions, total metals, total dissolved solids, and alkalinity by Pace Analytical Services, LLC (Pace), located in Grand Rapids, Michigan, and radium-226, radium-228, and total radium by Pace, located in Greensburg, Pennsylvania. The laboratory analytical results are reported in laboratory report 465626.

During the December 2017 sampling event, a groundwater sample was collected from each of the following wells:

- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Metals	EPA 6020A, EPA 6010C, EPA 7470A
Total Dissolved Solids	SM 2540C
Radium-226, Radium-228, and 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, as noted in the cover page or case narrative;
- Technical holding times for analyses;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;

- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD). Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Reporting limits (RLs) compared to project-required RLs;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes;
- Data for laboratory control samples (LCSs). The LCSs are used to assess the accuracy of the analytical method using a clean matrix;
- 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; 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.

QA/QC Sample Summary:

- One equipment blank (EB-01) and one field blank (FB-01) were collected; no analytes were detected in the blank samples. Sample FB-01 was not preserved properly based on laboratory pH readings.
- Dup-01 corresponds to BCC-MW-17005; relative percent differences (RPDs) between the parent and duplicate sample were within the QC limits with the following exception:
  - The RPD for radium-226 for the sample duplicate pair (BCC-MW-17005/Dup-01) exceeded the 20% acceptance limit. In addition, the duplicate error ratio (DER) was calculated to further evaluate precision. The DER was within acceptance limits. Sample precision for radium-226 for the field duplicate pair is acceptable. Data usability is not affected.
- No target analytes were detected in the method blanks.
- LCS recoveries were within laboratory control limits.

- MS/MSD analyses were performed on samples BCC-MW-17006 and BCC-MW-17002.
  - MS/MSD analyses were performed on BCC-MW-17006 for batch 11511. The recoveries for sulfate in the MS/MSD performed on BCC-MW-17006 were below the lower laboratory control limit. The sulfate results for samples analyzed in the same batch may be biased low (see attached table).
  - MS/MSD analyses were performed on BCC-MW-17006 for batch 11544. The boron recoveries in the MS/MSD were above the upper laboratory control limit; however, the boron concentration in the parent sample was >4x the spike concentration, therefore, the laboratory control limits are not applicable.
- Laboratory duplicates were performed on samples BCC-MW-17002 and BCC-MW-17006 for anions, total dissolved solids, and alkalinity. The RPDs for the laboratory duplicates were within the QC limits.

Attachment B
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-17001	12/7/2017	Sulfate	Recovery in the MS/MSD was below acceptance criteria. Results may be biased low.
BCC-MW-17002	12/7/2017		
BCC-MW-17003	12/7/2017		
BCC-MW-17004	12/6/2017		
BCC-MW-17005	12/6/2017		
BCC-MW-17006	12/6/2017		
FB-01	12/6/2017		
Dup-01	12/6/2017		
EB-01	12/6/2017		

Laboratory Data Quality Review
Groundwater Monitoring Event February 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the February 2018 sampling event. Samples were analyzed for anions, total dissolved solids, alkalinity, 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 468629 and 468630.

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

- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Alkalinity	SM 2320B-11
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 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:

- Sample receipt: Although the temperature was recorded as <6°C for the temperature blanks in laboratory reports 468629, some samples had measured temperatures >6°C. Not all samples were collected on the day of laboratory receipt but were kept on ice until delivery to the laboratory. The coolers were hand delivered to the courier and received by the laboratory on the day sampling concluded and contained ice upon receipt; thus, there was no impact to data usability
- Potassium was detected in the method blank associated with batch 16334 at a concentration of 1 mg/L. Potassium results for samples analyzed in the same batch with concentrations ≤10x the method blank concentration may be false positives (see attached table). The potassium concentration detected in sample BCC-MW-17001 was ≤10x the method blank concentration, the potassium result may be a false positive.

- An equipment blank (EB-01) and a field blank (FB-01) were collected; no analytes were detected in the blank samples.
- LCS recoveries were within laboratory control limits for all analytes.
- MS/MSDs were performed on samples BCC-MW-17001 and BCC-MW-17004.
  - MS/MSDs were performed on BCC-MW-17004 for batch 16473 for 6020A metals. The MS recovery for boron was below the lower laboratory control limit. The boron concentration in the parent sample was >4x the spike concentrations; therefore, the laboratory control limits are not applicable. Data usability was not affected.
- Laboratory duplicates were performed on BCC-MW-17004 for anions, alkalinity, and total dissolved solids. Relative percent differences (RPDs) were within laboratory control limits.
- The field duplicate pair samples were Dup-01 and BCC-MW-17005. RPDs were within QC limits.

Attachment B
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-17001_20180220	2/20/2018	Potassium	Detection in method blank. Results with concentrations ≤10x the method blank concentration may be false positives.

Laboratory Data Quality Review
Groundwater Monitoring Event June 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the June 2018 sampling event. Samples were analyzed for anions, total dissolved solids, alkalinity, 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 4613648 and 4613649.

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

- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Alkalinity	SM 2320B-11
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 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.
- An equipment blank (EB-04) and a field blank (FB-04) were collected.
- LCS recoveries were within laboratory control limits for all analytes.
- MS/MSDs were performed on samples BCC-MW-17004 and BCC-MW-17006.
  - MS/MSDs were performed on BCC-MW-17006 for batch 26414 for 6010C metals. The MS recovery for calcium was above the upper laboratory control limits. 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.

  - MS/MSDs were performed on BCC-MW-17006 for batch 26416 for 6020A metals. The MSD recovery for boron below the lower laboratory control limit. The boron concentration in the parent sample was >4x the spike concentrations; therefore, the laboratory control limits are not applicable. Data usability was not affected.

- Laboratory duplicates were performed on BCC-MW-17004, BCC-MW-17005, and BCC-MW-17006 for anions, alkalinity, and total dissolved solids. Relative percent differences (RPDs) were within laboratory control limits.

- The field duplicate pair samples were Dup-04 and BCC-MW-17005. RPDs were within QC limits.

Laboratory Data Quality Review
Groundwater Monitoring Event August 2018
CEC BC Cobb

Groundwater samples were collected by TRC for the August 2018 sampling event. Samples were analyzed for anions, total dissolved solids, alkalinity, 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 4615955 and 4615957.

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

- BCC-MW-17001
- BCC-MW-17002
- BCC-MW-17003
- BCC-MW-17004
- BCC-MW-17005
- BCC-MW-17006

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Alkalinity	SM 2320B-11
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:

- Sample receipt: Although the temperature was recorded as <6°C for the temperature blanks in laboratory reports 4615595 and 4615597, two samples had measured temperatures >6°C (11.1 and 13.2°C). Not all samples were collected on the day of laboratory receipt, but were kept on ice until delivery to the laboratory. The coolers were hand delivered to the courier and received by the laboratory on the day sampling concluded and contained ice upon receipt; thus, there was no impact to data usability.
- A method blank was analyzed with each analytical batch. For radium, normalized absolute difference comparisons between blank and sample that are between 1.96 and 2.58 may indicate biased high results and normalized absolute differences <1.96 may indicate a false positive sample result.

- Radium-228 was detected in the method blank in batch 309143 at 0.708 ± 0.374 pCi/L. The positive results for radium-228 in samples associated with this method blank were potentially impacted, as summarized in the attached table; however, radium-228 concentrations in batch 309143 samples were within the range of historical radium-228 concentrations, or consistent with apparent trends. The data are deemed usable for their intended purpose.

- An equipment blank (EB-04) and a field blank (FB-04) were collected. No analytes were detected in FB-04.
  - Radium-228 was detected in EB-04 at 0.918 ± 0.433 pCi/L. However, the positive result for radium-228 in this sample was potentially due to method blank contamination, as summarized in the attached table. Therefore, data usability was not further affected.
- LCS recoveries were within laboratory control limits for all analytes except for mercury.
  - The LCS recovery for mercury in batch 30104 was above the upper laboratory control limit. However, mercury was not detected in any samples in this data set. Therefore, data usability was not affected.
- MS and/or MSDs were performed on sample BCC-MW-17005 for radium-226, radium-228, anions, metals, and alkalinity.
  - The MS/MSD recoveries for mercury in batch 30104 were above the upper laboratory control limit. However, mercury was not detected in any samples in this data set. Therefore, data usability was not affected.
- Laboratory duplicates were performed on BCC-MW-17005 for anions, alkalinity, and total dissolved solids. Relative percent differences (RPDs) were within laboratory control limits.
- The field duplicate pair samples were Dup-04 and BCC-MW-17003. RPDs between the parent and duplicate sample were within the QC limits (20%), with the exception of sulfate (38%). Potential variability exists for sulfate results for samples Dup-04 and BCC-MW-17003 due to field duplicate variability, as summarized in the attached table; however, the sulfate concentrations for both the primary and duplicate samples were within the range of historical sulfate concentrations observed at that well. The data are deemed usable for their intended purpose.

Attachment B
Summary of Data Non-Conformances for Groundwater Analytical Data
BC Cobb – RCRA CCR Monitoring Program
Muskegon, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
BCC-MW-17002_20180806	8/6/2018	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample result <1.96. Results may be false positives.
BCC-MW-17003_20180807	8/7/2018		
BCC-MW-17004_20180807	8/7/2018		
EB-04_20180807	8/7/2018		
Dup-04_20180807	8/7/2018	Sulfate	RPD for the field duplicate pair exceeded 30%. Potential uncertainty exists for sulfate results due to the field duplicate variability.
BCC-MW-17003_20180807	8/7/2018		

Appendix C
Groundwater Protection Standards

Technical Memorandum

Date: October 15, 2018; Revised December 7, 2018

To: Michelle Marion, CEC

From: Darby Litz, TRC
Sarah Holmstrom, TRC
Joyce Peterson, TRC

Project No.: 284111.0000 Phase 001, Task 002

Subject: Groundwater Protection Standards – Consumers Energy, Former BC Cobb Power Plant Site, Bottom Ash Ponds & Ponds 0-8 CCR Unit

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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) BC Cobb Power Plant (BC Cobb site) in Muskegon, Michigan, was conducted on September 13 and 14, 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 17 through 20, 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 June 11 through 14, 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 that do not have established MCLs, the GWPS are based upon the EPA Regional Screening Levels

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

(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 BC Cobb 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 background data for the BC Cobb site 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 BC Cobb site 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 BCC Ponds CCR unit at the BC Cobb site includes BCC-MW-15002, BCC-MW-15003, BCC-MW-15004, BCC-MW-15005, BCC-MW-15006, BCC-MW-15007, and MW-15008. 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, and 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 no potential outlier for Appendix IV constituents in the background well sets (Figure 1).

The T v. C graphs showed potential trending for some Appendix IV well/constituent pairs. These were tested by the Sanitas™ software to assess whether the potential outliers are statistically significant. The Sens Slope test results provided the following conclusions. The Sanitas™ trend test outputs are attached. Despite the trending concentrations, these data sets will be included in the establishment of background/baseline concentrations and groundwater protection standards.

Sens Slope Test Results for Potential Trends in Background Data Sets

WELL	CONSTITUENT	DIRECTION	RESULT
BCC-MW-15002	Arsenic	Down	Confirmed
BCC-MW-15002	Barium	Down	Confirmed
BCC-MW-15003	Barium	Down	Confirmed
BCC-MW-15006	Molybdenum	Up	Not Statistically Significant at 95% Confidence
BCC-MW-15008	Lithium	Up	Confirmed

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 BC Cobb site. 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

No suspect data points were identified in the T v. C graphs (Figure 1) or in the cumulative concentration distribution (Figure 2). The Dixon's Outlier Test in Sanitas™ was therefore not employed for outlier testing.

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
BCC-MW-15002	Antimony	100
	Arsenic	25
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	25
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	88
	Mercury	100
	Molybdenum	100
	Selenium	63
	Thallium	100
	Radium 226 and 228 combined	13
BCC-MW-15003	Antimony	100
	Arsenic	75
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	25

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

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15003 *(cont'd)*	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	88
	Mercury	100
	Molybdenum	100
	Selenium	63
	Thallium	100
	Radium 226 and 228 combined	13
BCC-MW-15004	Antimony	100
	Arsenic	0
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	25
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	88
	Selenium	63
	Thallium	100
	Radium 226 and 228 combined	25
BCC-MW-15005	Antimony	100
	Arsenic	38
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	75
	Cobalt	100
	Fluoride	100
	Lead	88
	Lithium	100
	Mercury	100
	Molybdenum	100
	Selenium	100
	Thallium	100
	Radium 226 and 228 combined	38

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

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15006	Antimony	75
	Arsenic	13
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	38
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	0
	Selenium	13
	Thallium	100
	Radium 226 and 228 combined	75
BCC-MW-15007	Antimony	88
	Arsenic	0
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	13
	Cobalt	100
	Fluoride	100
	Lead	100
	Lithium	100
	Mercury	100
	Molybdenum	88
	Selenium	75
	Thallium	100
	Radium 226 and 228 combined	13
BCC-MW-15008	Antimony	100
	Arsenic	63
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	63
	Cobalt	100
	Fluoride	100
	Lead	100

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

WELL	CONSTITUENT	PERCENT NON-DETECT
BCC-MW-15008 *(cont'd)*	Lithium	0
	Mercury	100
	Molybdenum	100
	Selenium	75
	Thallium	100
	Radium 226 and 228 combined	38
COMBINED	Antimony	95
	Arsenic	30
	Barium	0
	Beryllium	100
	Cadmium	100
	Chromium	38
	Cobalt	100
	Fluoride	100
	Lead	98
	Lithium	82
	Mercury	100
	Molybdenum	82
	Selenium	64
	Thallium	100
	Radium 226 and 228 combined	30

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 nonnormal, 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 seven background monitoring wells.

Table 2
Summary of Background/Baseline Data Distributions

CONSTITUENT	DISTRIBUTION
Antimony	Nonnormal (>50% censored data)
Arsenic	Nonnormal
Barium	Normalized by square root 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	Nonnormal (>50% censored data)
Lithium	Nonnormal (>50% censored data)
Mercury	All ND – use highest RL
Molybdenum	Nonnormal (>50% censored data)
Selenium	Nonnormal (>50% censored data)
Thallium	All ND – use highest RL
Radium 226 and 228 combined	Normal (NDs adjusted by Kaplan-Meier adjustment)

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 for nonparametric tests 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	10	10	NA	10
Barium	ug/L	340	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	2	NC	15	15
Lithium	ug/L	28	NC	40	40
Mercury	ug/L	RL (0.2)	2	NA	2
Molybdenum	ug/L	9	NC	100	100
Selenium	ug/L	3	50	NA	50
Thallium	ug/L	RL (2)	2	NA	2
Radium 226 and 228 combined	pCi/L	2.42	5	NA	5

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

Revised 12/7/2018

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) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15002										
Sample Date:		11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/11/2017	9/14/2017	4/19/2018	6/14/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	1,320	1,200	1,050	834	979	1,110	1,170	988	1,130	--	422
Calcium	mg/L	214	259	197	169	165	184	167	185	132	--	95.6
Chloride	mg/L	720	519	681	577	328	226	354	472	152	--	115
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	6.7	7.1	7.0	7.0	7.0	7.2	7.2	7.1	7.2	7.5	7.4
Sulfate	mg/L	250	327	300	202	127	116	85.6	113	13.8	--	3.0
Total Dissolved Solids	mg/L	1,900	1,900	1,900	1,800	1,100	1,100	1,200	1,500	772	--	738
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	10	4	2	2	1	1	< 1	< 1.0	--	< 1.0	< 1.0
Barium	ug/L	274	257	252	232	148	134	146	186	--	79.4	79.6
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	2	3	2	< 1	2	2	< 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	< 10	< 10	< 10	< 10	< 10	< 10	< 10	11	--	< 10	< 10
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	0.816	0.6	0.893	0.641	< 0.254	0.419	0.387	< 0.912	--	0.586	< 0.482
Radium-226/228	pCi/L	3.03	2.03	2.32	1.88	< 0.927	1.41	1.79	2.20	--	< 1.16	1.60
Radium-228	pCi/L	2.21	1.43	1.43	1.24	< 0.927	0.995	1.4	1.49	--	< 0.685	1.24
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) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15003											
Sample Date:		11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017	9/14/2017	2/21/2018	4/19/2018	6/14/2018
Constituent	Unit	Background											
Appendix III													
Boron	ug/L	542	574	2,370	528	494	608	679	695	361	--	--	290
Calcium	mg/L	216	233	180	177	179	163	167	154	145	--	--	148
Chloride	mg/L	700	682	640	581	512	456	363	293	493	--	--	917
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	7.2	7.1	7.2	7.1	7.1	7.4	7.3	7.1	7.1	7.3	7.5	7.3
Sulfate	mg/L	46	48.7	41.2	28.3	27.2	20.1	16.7	6.8	< 2.0	--	--	< 2.0
Total Dissolved Solids	mg/L	1,900	1,900	1,700	1,600	1,500	1,400	1,200	1,110	1,370	--	--	2,060
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Arsenic	ug/L	2	< 1	< 1	1	< 1	< 1	< 1	< 1.0	--	--	< 1.0	< 1.0
Barium	ug/L	236	219	189	170	159	137	138	112	--	--	151	139
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	2	2	2	1	1	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	< 10	< 10	< 10	< 10	< 10	< 10	< 10	11	--	--	12	12
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	0.667	0.633	0.522	0.387	0.284	0.35	0.442	0.442	--	--	0.707	0.573
Radium-226/228	pCi/L	2.4	1.3	1.39	1.66	1.53	1.58	1.25	< 1.03	--	--	1.81	1.86
Radium-228	pCi/L	1.73	0.664	0.87	1.27	1.25	1.23	0.807	< 0.858	--	--	1.10	1.29
Selenium	ug/L	2	< 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) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15004										
Sample Date:		11/30/2015	2/17/2016	4/12/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017	9/14/2017	4/19/2018	6/12/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	198	124	166	338	279	193	376	302	325	--	269
Calcium	mg/L	94.6	80.9	70.7	87	81.9	75.1	73.4	67.2	115	--	71.4
Chloride	mg/L	27	18.1	22	30.9	22.1	28.2	35.2	45.7	382	--	98.1
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	7.3	7.2	6.9	6.7	6.9	7.1	7.1	7.0	6.8	7.3	7.0
Sulfate	mg/L	33	17.8	13.6	< 2	8.06	7.2	< 2	2.9	5.8	--	< 2.0
Total Dissolved Solids	mg/L	440	340	350	420	380	340	380	450	934	--	506
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	2	1	1	2	7	2	2	3.2	--	1.5	1.1
Barium	ug/L	33	18	29	43	42	29	33	38.4	--	39.4	45.8
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	2	1	1	3	< 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	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
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	7	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0	< 5.0
Radium-226	pCi/L	< 0.203	< 0.216	< 0.37	< 0.157	< 0.292	< 0.181	< 0.308	< 0.654	--	0.602	< 0.728
Radium-226/228	pCi/L	1.02	< 0.565	0.518	0.808	1.08	1.18	1.02	< 1.45	--	1.34	< 1.43
Radium-228	pCi/L	0.879	< 0.565	0.518	0.768	0.986	1.1	1.02	< 0.796	--	< 0.821	< 0.701
Selenium	ug/L	< 1	2	2	< 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) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15005										
Sample Date:		12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/27/2016	2/13/2017	4/4/2017	7/12/2017	9/14/2017	4/19/2018	6/14/2018
Constituent	Unit	Background										
Appendix III												
Boron	ug/L	< 20	51	35	46	43	39	25	31.3	36.8	--	27.8
Calcium	mg/L	57.2	93.3	60.6	75.4	67.3	99.2	43.9	60.2	64.2	--	51.1
Chloride	mg/L	9.5	137	66.6	13.1	1.23	181	20.1	3.0	7.0	--	14.2
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	7.2	7.2	7.3	7.2	7.1	7.3	7.6	7.3	7.3	7.7	7.4
Sulfate	mg/L	10	5.27	4.69	5.39	< 2	5.57	7.88	4.4	2.9	--	4.9
Total Dissolved Solids	mg/L	230	480	340	590	230	570	200	204	240	--	322
Appendix IV												
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0
Arsenic	ug/L	1	1	< 1	2	2	< 1	< 1	1.1	--	1.3	< 1.0
Barium	ug/L	83	125	97	151	147	173	82	116	--	99.3	103
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	< 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	--	2.0	< 1.0
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	< 10	< 10
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	0.18	< 0.336	< 0.244	0.221	< 0.332	< 0.192	< 0.279	< 0.675	--	< 0.450	< 0.635
Radium-226/228	pCi/L	0.882	< 0.494	< 0.378	0.662	0.545	1.02	0.447	< 1.41	--	< 1.22	< 1.63
Radium-228	pCi/L	0.702	< 0.494	< 0.378	0.441	0.471	1.02	0.447	< 0.739	--	< 0.769	< 0.999
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) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15006											
Sample Date:		11/30/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/13/2017	4/4/2017	7/12/2017	9/14/2017	2/21/2018	4/19/2018	6/14/2018
Constituent	Unit	Background											
Appendix III													
Boron	ug/L	48	39	33	43	55	32	35	42.3	45.1	--	--	42.1
Calcium	mg/L	84.5	73.9	60	60.6	86.2	70.5	67.9	68.8	79.6	--	--	49.8
Chloride	mg/L	50	12.8	32.5	63.1	19.6	48	23.5	69.8	16.1	--	--	16.7
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	7.3	7.2	6.9	6.9	7.3	7.4	7.2	7.2	6.9	7.5	7.3
Sulfate	mg/L	17	17.1	12.7	8.54	12.2	7.34	6.88	9.4	11.6	--	--	6.8
Total Dissolved Solids	mg/L	380	290	300	380	320	330	260	346	322	--	--	340
Appendix IV													
Antimony	ug/L	< 1	1	< 1	< 1	1	< 1	< 1	< 1.0	--	--	< 1.0	1.4
Arsenic	ug/L	1	1	< 1	2	3	3	2	4.3	--	--	1.6	40.9
Barium	ug/L	26	16	17	20	26	17	17	27.8	--	--	20.5	52.1
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	0.22
Chromium	ug/L	< 1	1	2	1	< 1	1	1	< 1.0	--	--	< 1.0	3.7
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	1.1
Lithium	ug/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10
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	6	7	7	7	8	8	8.5	--	--	5.5	7.9
Radium-226	pCi/L	< 0.301	< 0.268	< 0.205	< 0.225	< 0.416	< 0.24	< 0.198	< 0.701	--	--	< 0.452	< 0.515
Radium-226/228	pCi/L	0.629	< 0.623	< 0.479	< 0.522	< 0.571	< 0.483	0.652	< 1.41	--	--	< 1.13	< 1.62
Radium-228	pCi/L	0.584	< 0.623	< 0.479	< 0.522	< 0.571	< 0.483	0.459	< 0.708	--	--	< 0.682	< 1.10
Selenium	ug/L	3	3	2	1	1	< 1	1	1.2	--	--	1.2	2.2
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) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15007											
Sample Date:		12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/4/2017	7/12/2017	9/14/2017	2/21/2018	4/19/2018	6/14/2018
Constituent	Unit	Background											
Appendix III													
Boron	ug/L	79	74	65	89	135	76	83	130	141	--	--	93.7
Calcium	mg/L	165	222	226	234	250	181	169	170	133	--	--	108
Chloride	mg/L	1,900	2,300	2,480	2,280	2,390	1,850	1,670	1,900	1,940	--	--	759
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	6.7	6.6	6.6	6.6	6.6	6.7	6.7	6.7	6.7	6.8	7.0	6.9
Sulfate	mg/L	21	15.7	11	9.87	9.38	3.19	4.25	9.1	8.3	--	--	17.9
Total Dissolved Solids	mg/L	3,700	2,000	3,900	4,500	4,800	3,700	3,100	3,700	2,690	--	--	1,510
Appendix IV													
Antimony	ug/L	< 1	< 1	< 1	< 1	< 1	< 1	1	< 1.0	--	--	< 1.0	< 1.0
Arsenic	ug/L	5	1	1	5	3	1	2	5.8	--	--	2.0	6.4
Barium	ug/L	285	267	236	294	377	227	167	229	--	--	61.0	66.5
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	2	2	2	1	2	2	1.1	--	--	< 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	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	--	--	< 10	< 10
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	8	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	--	< 5.0	< 5.0
Radium-226	pCi/L	0.686	0.659	0.289	0.554	1.15	0.629	0.492	< 0.711	--	--	< 0.445	< 0.408
Radium-226/228	pCi/L	2.19	1.69	1.56	1.65	2.75	2.02	1.29	< 1.45	--	--	< 1.21	< 1.38
Radium-228	pCi/L	1.5	1.03	1.27	1.1	1.6	1.39	0.796	0.850	--	--	< 0.760	< 0.972
Selenium	ug/L	1	< 1	< 1	< 1	< 1	< 1	2	< 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) – November 2015 to June 2018
BC Cobb Background – RCRA CCR Monitoring Program
Muskegon, Michigan

Sample Location:		BCC-MW-15008											
Sample Date:		12/1/2015	2/17/2016	4/13/2016	7/12/2016	9/28/2016	2/14/2017	4/4/2017	7/12/2017	9/14/2017	4/18/2018	4/18/2018	6/14/2018
Constituent	Unit	Background											
Appendix III												Field Dup	
Boron	ug/L	1,060	897	794	866	1,160	489	416	396	401	--	--	242
Calcium	mg/L	39.6	39.5	48.4	77.2	109	63.4	63	54.4	51.8	--	--	56.7
Chloride	mg/L	160	157	193	546	423	129	95.9	70.0	68.9	--	--	93.9
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	8.2	8.3	8.1	8.1	7.8	7.8	7.6	7.6	7.7	7.8	--	7.5
Sulfate	mg/L	45	3.05	5.13	22.3	12	8.7	4.6	3.9	3.0	--	--	< 2.0
Total Dissolved Solids	mg/L	540	530	590	1,300	1,100	650	510	414	448	--	--	534
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	4	< 1	< 1	< 1	2.3	--	< 1.0	< 1.0	2.1
Barium	ug/L	39	42	49	61	100	63	59	54.6	--	64.2	70.7	66.5
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	< 1	< 1	1	2	< 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	12.9	13.5	16	19	28	17	18	23	--	22	18	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	< 0.188	< 0.215	< 0.199	0.174	< 0.217	< 0.173	< 0.284	< 0.592	--	0.690	< 0.444	< 0.422
Radium-226/228	pCi/L	0.62	< 0.457	0.646	< 0.405	1.03	0.843	< 0.346	1.66	--	< 1.19	< 1.06	< 1.44
Radium-228	pCi/L	0.521	< 0.457	0.516	< 0.405	0.893	0.672	< 0.346	1.47	--	< 0.684	< 0.616	< 1.02
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.

Figures

Figure 1
Background Concentration Time-Series Charts
BC Cobb Site - Appendix IV Constituents

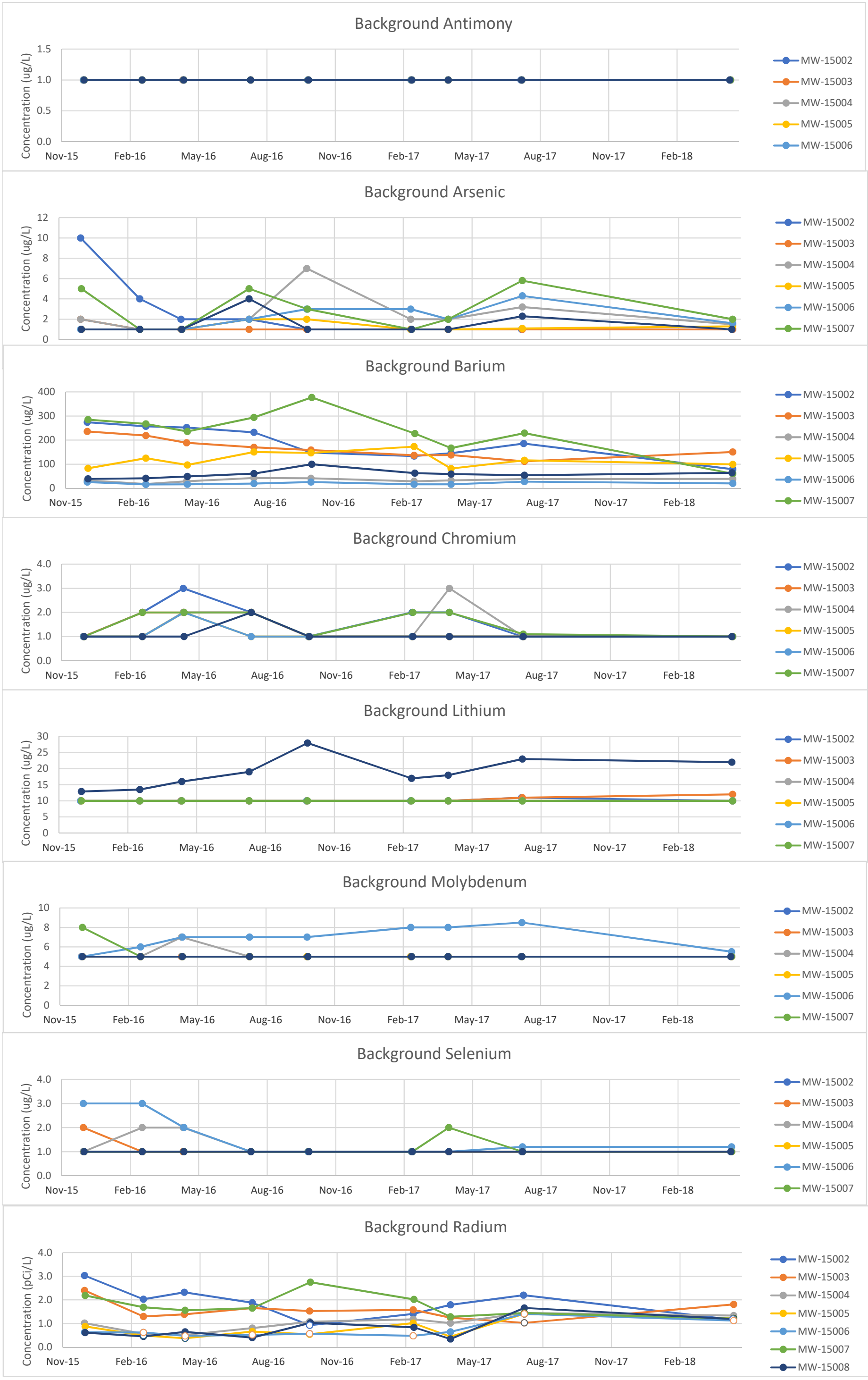

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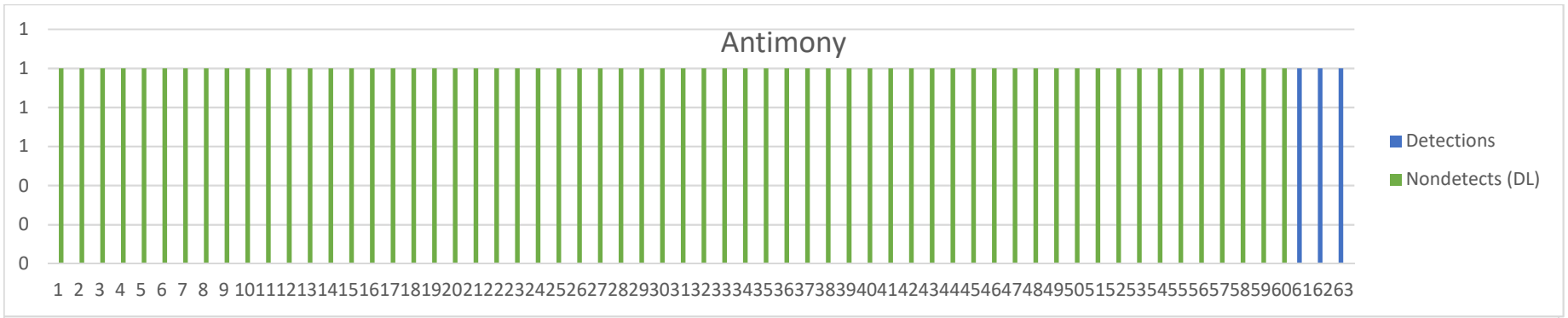
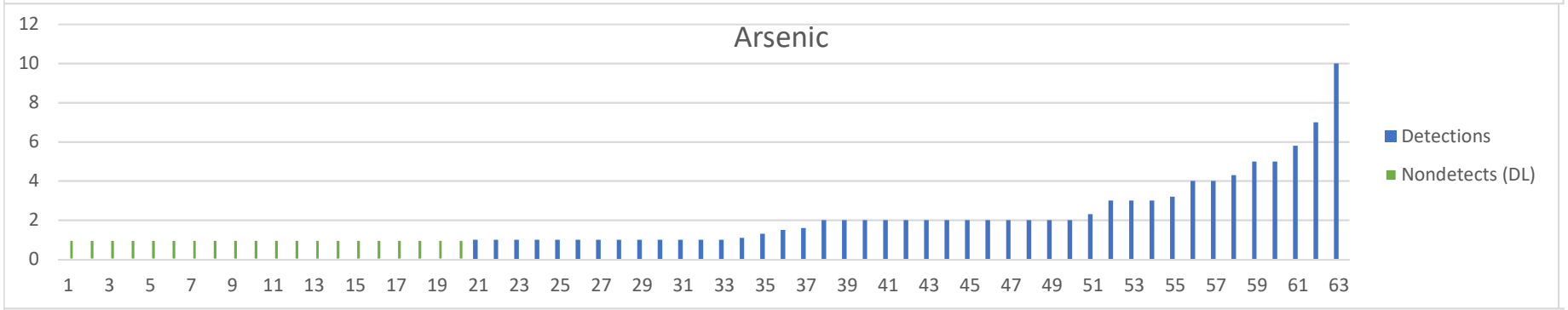
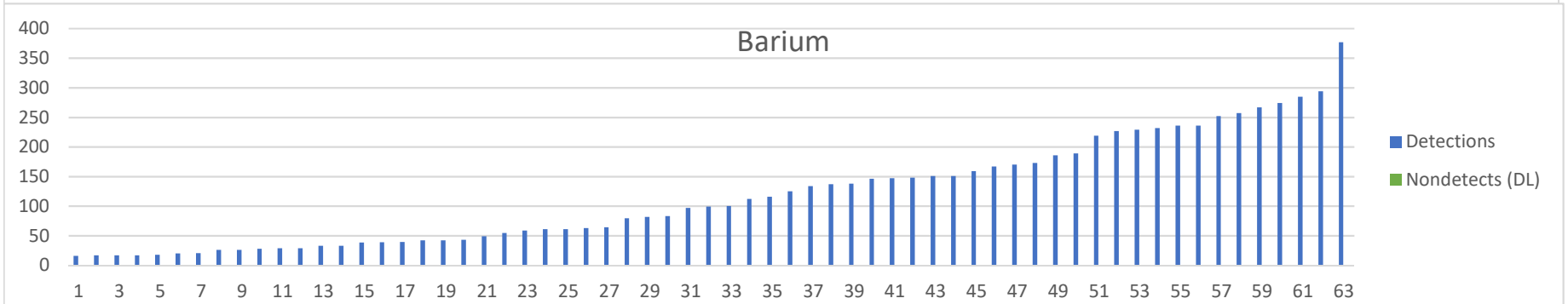
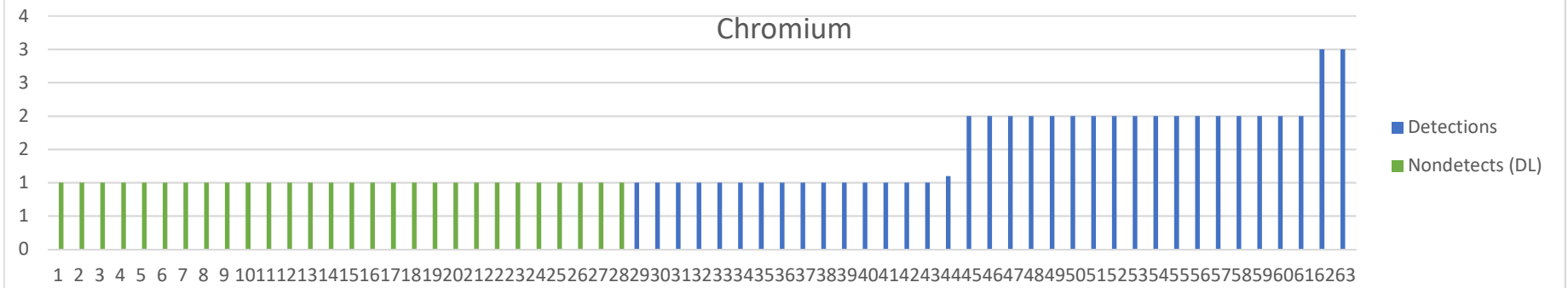
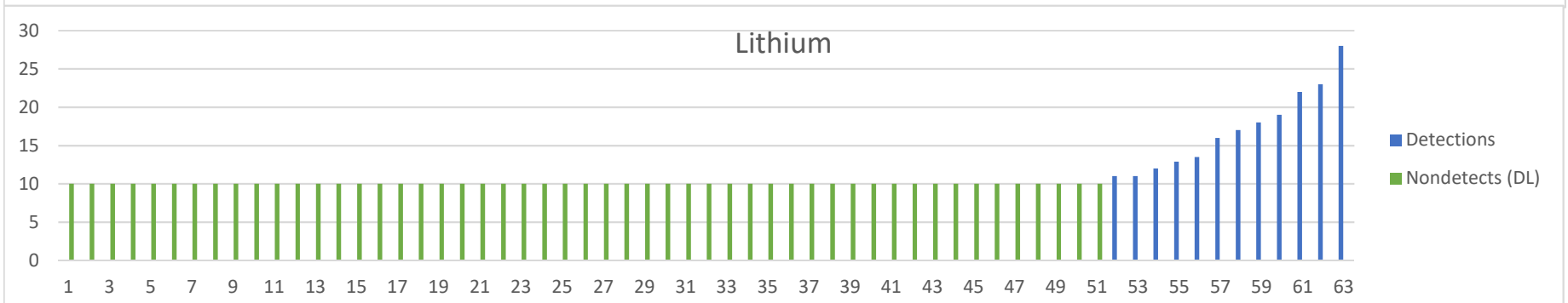
Figure 2
Cumulative Background Concentraitons - Appendix IV
BC Cobb Site

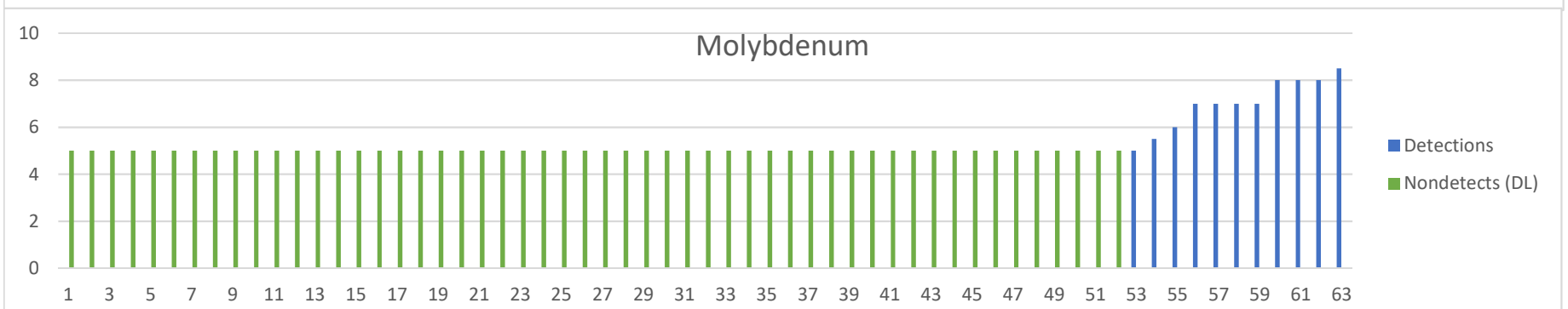


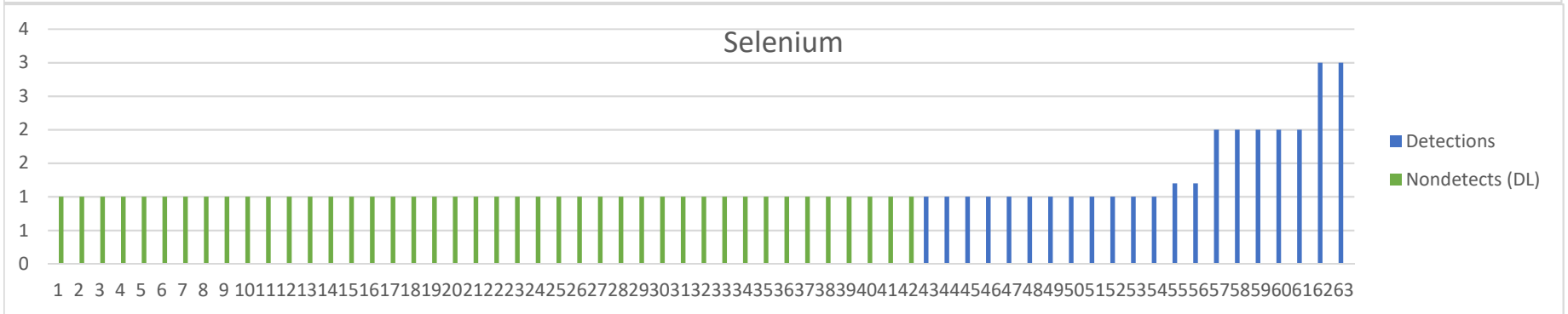


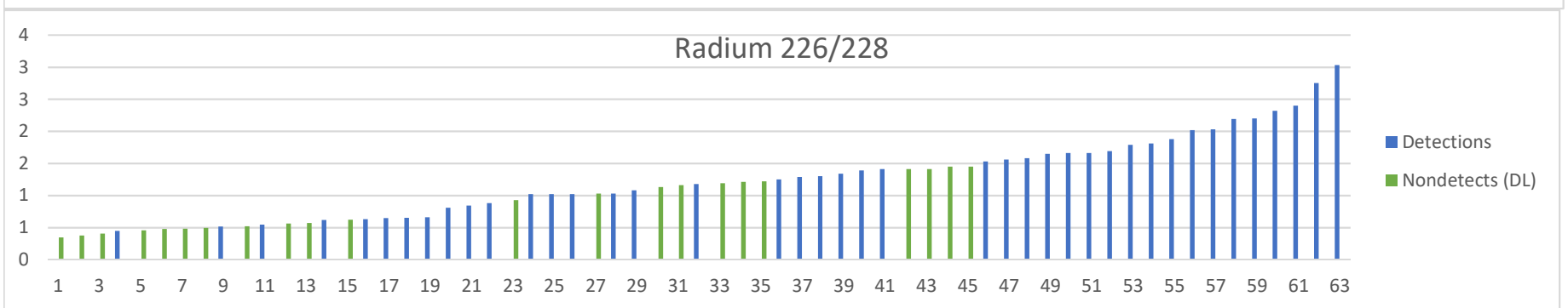












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Technical Memorandum

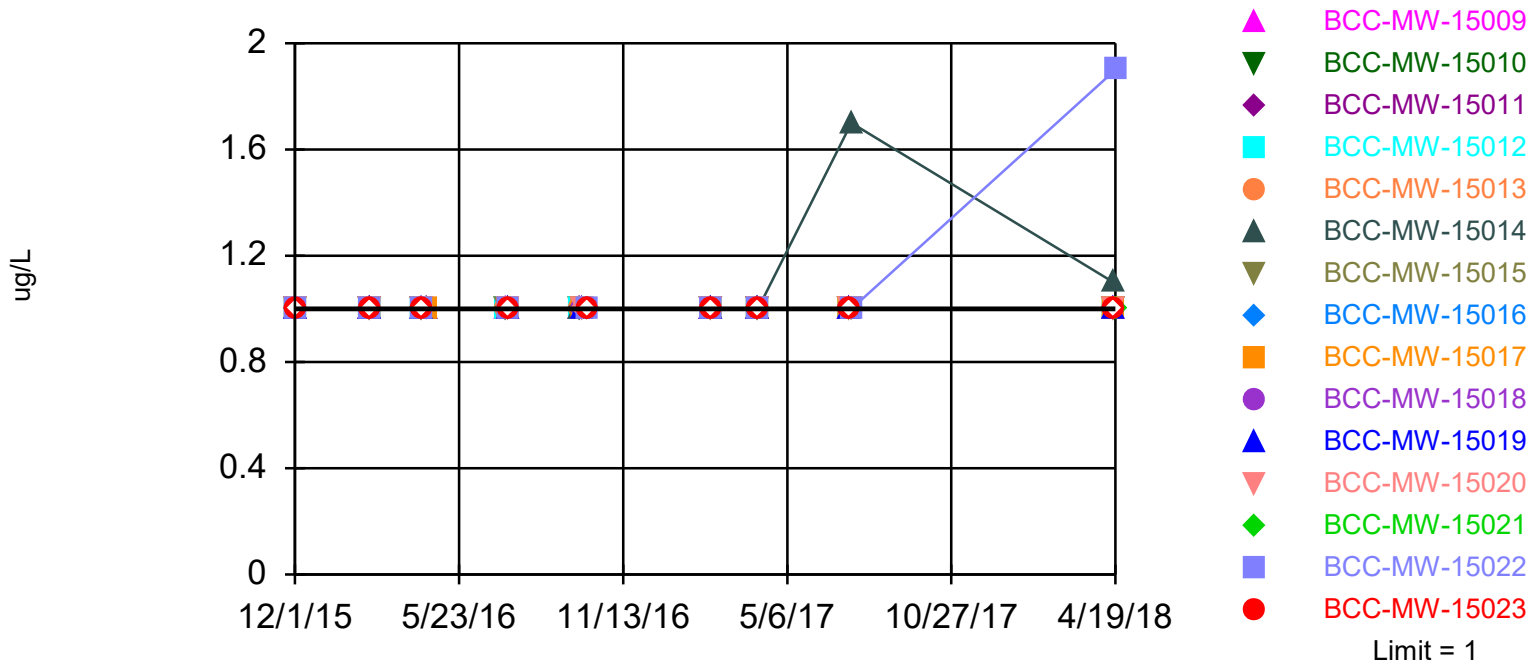
Sanitas™ Output Files

Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15014, BCC-MW-15022

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 95.31% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Antimony, Total Analysis Run 5/30/2018 11:20 AM

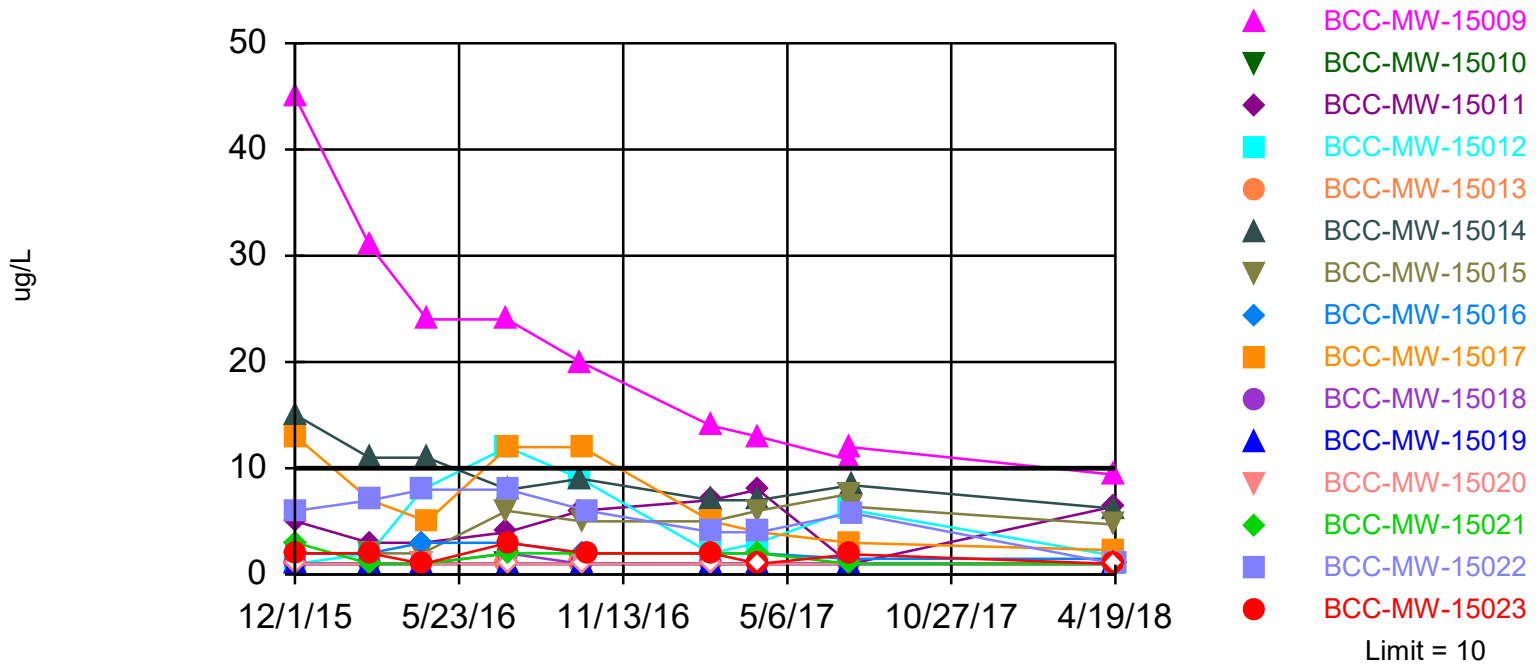
Client: Consumers Energy Data: BCC_Sanitas

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 Francia 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 64 background values. 32.81% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

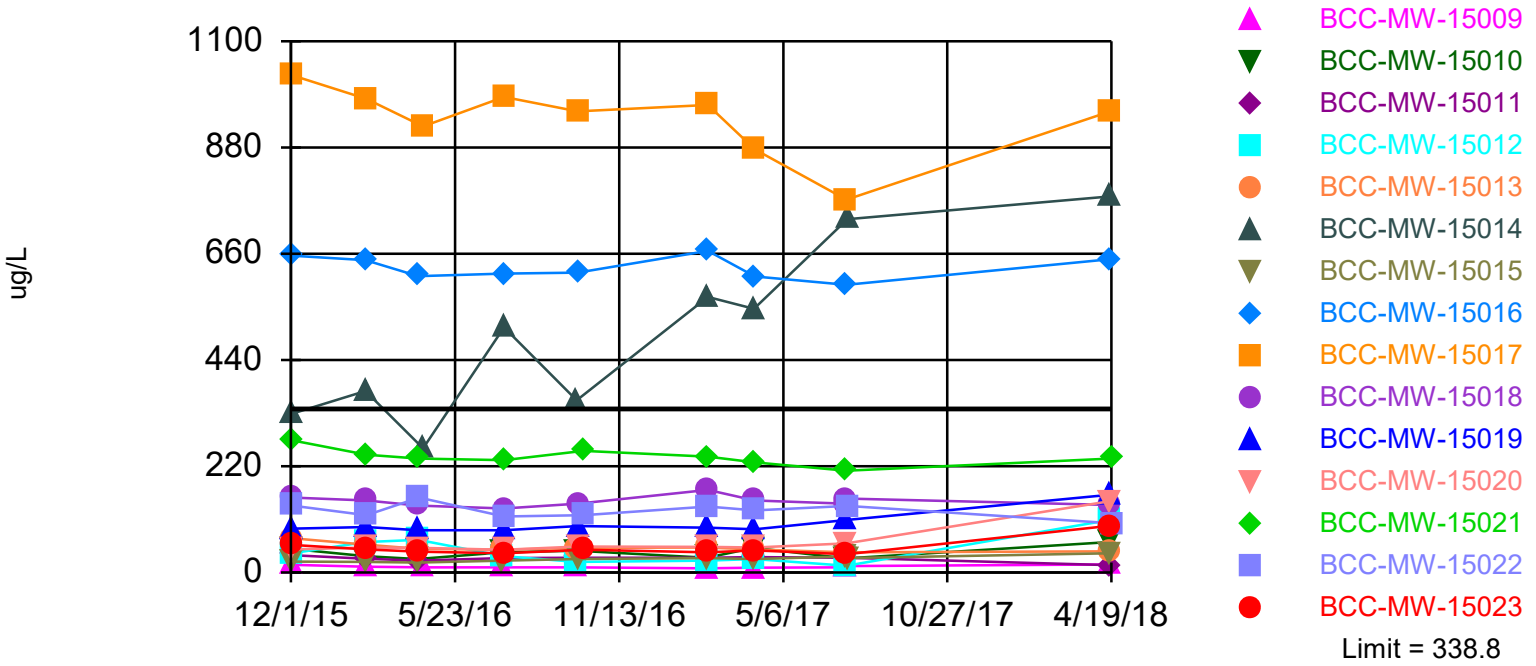
Constituent: Arsenic, Total Analysis Run 5/30/2018 8:55 AM

Client: Consumers Energy Data: BCC_Sanitas

Exceeds Limit: BCC-MW-15014, BCC-MW-15016, BCC-MW-15017

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (based on square root transformation): Mean=10.02, Std. Dev.=4.185, n=64. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9603, critical = 0.947. Report alpha = 0.05.

Constituent: Barium, Total Analysis Run 5/30/2018 8:55 AM

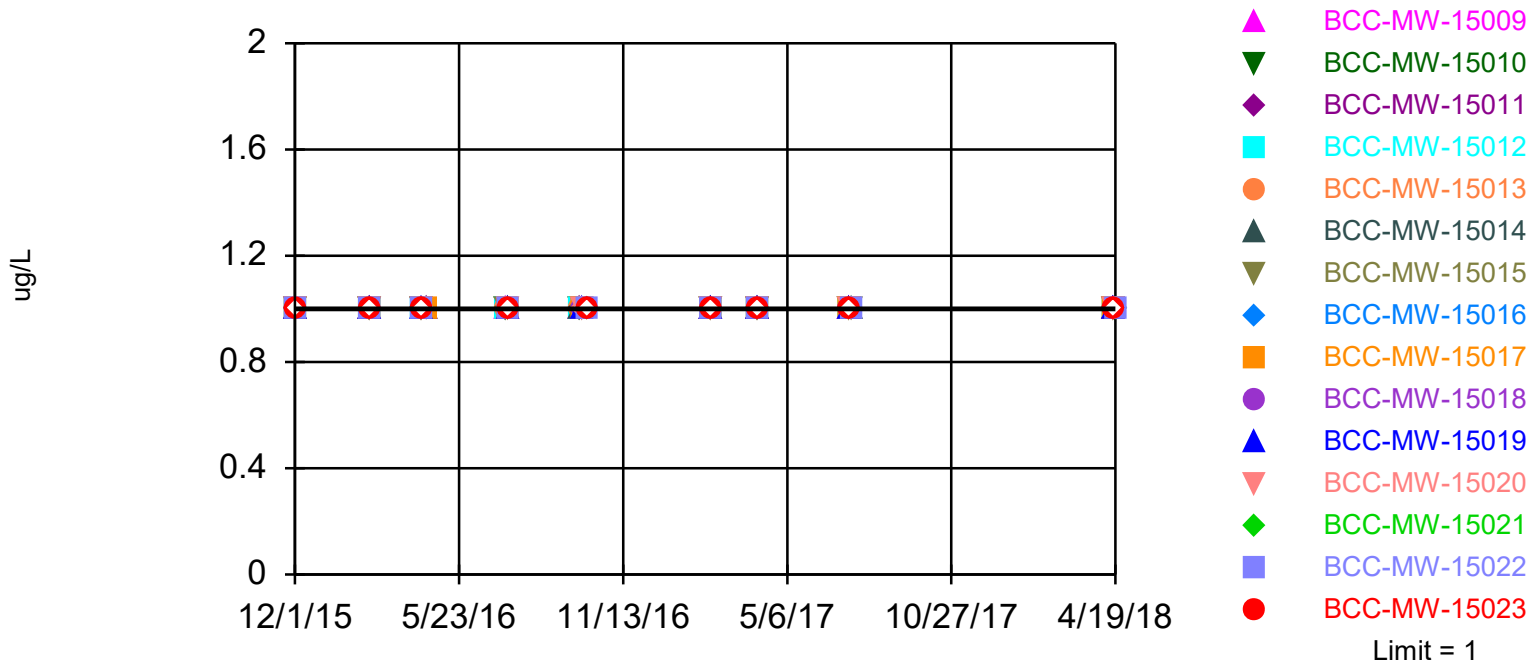
Client: Consumers Energy Data: BCC_Sanitas

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 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Beryllium, Total Analysis Run 6/12/2018 11:43 AM

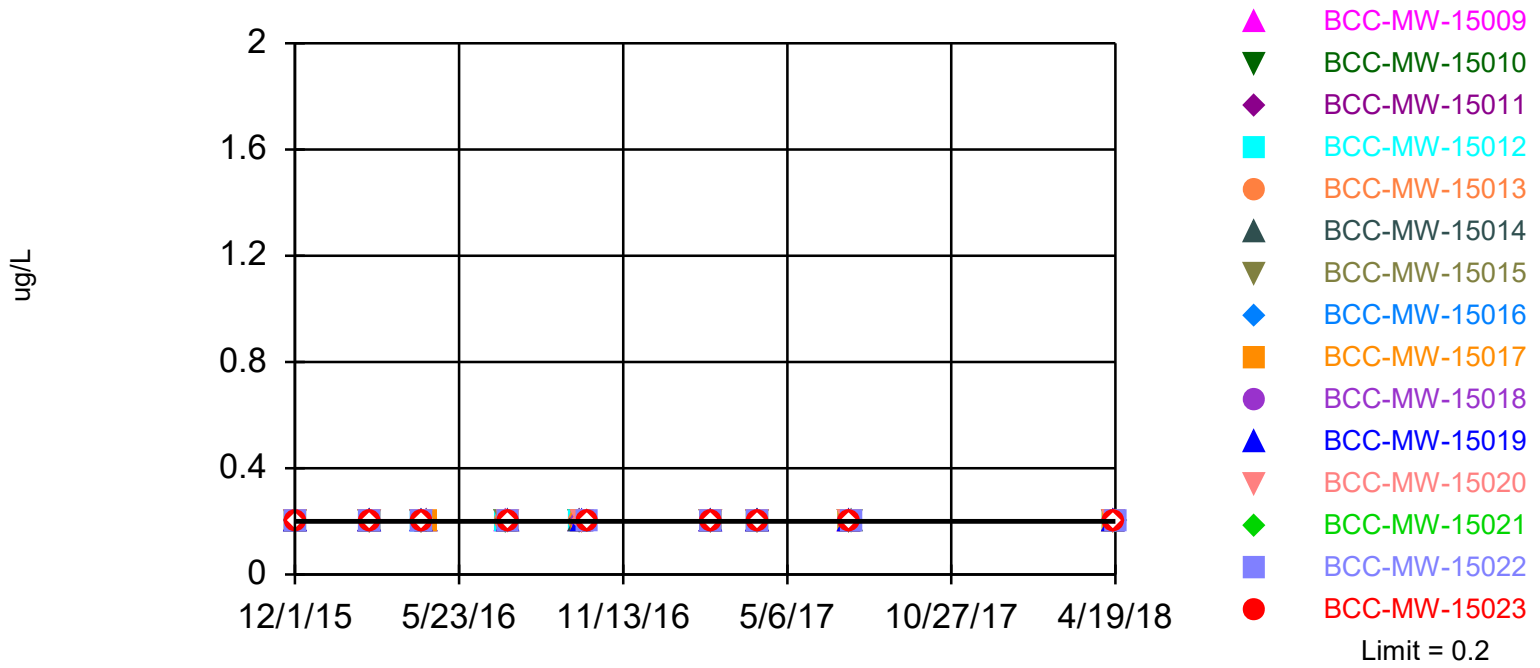
Client: Consumers Energy Data: BCC_Sanitas

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 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Cadmium, Total Analysis Run 6/12/2018 11:43 AM

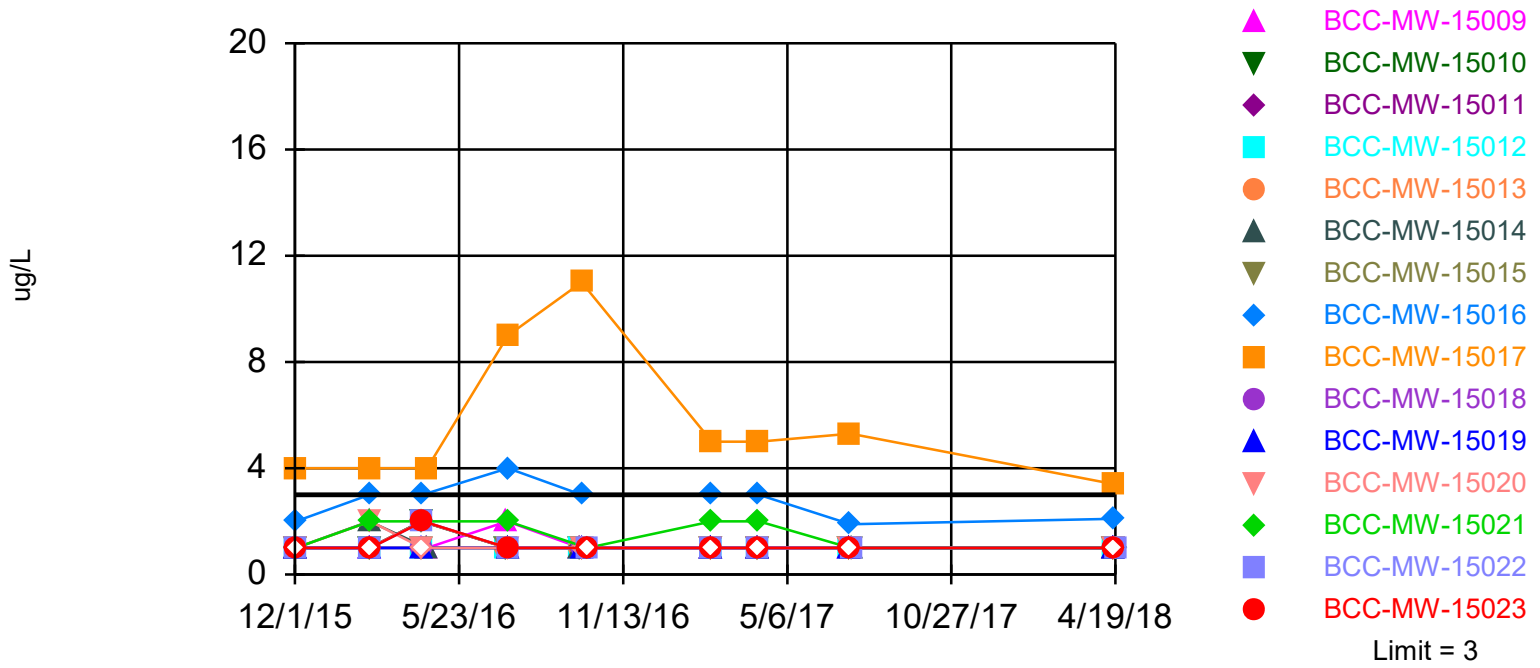
Client: Consumers Energy Data: BCC_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15017

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because the Shapiro Francia 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 64 background values. 45.31% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Chromium, Total Analysis Run 5/30/2018 8:56 AM

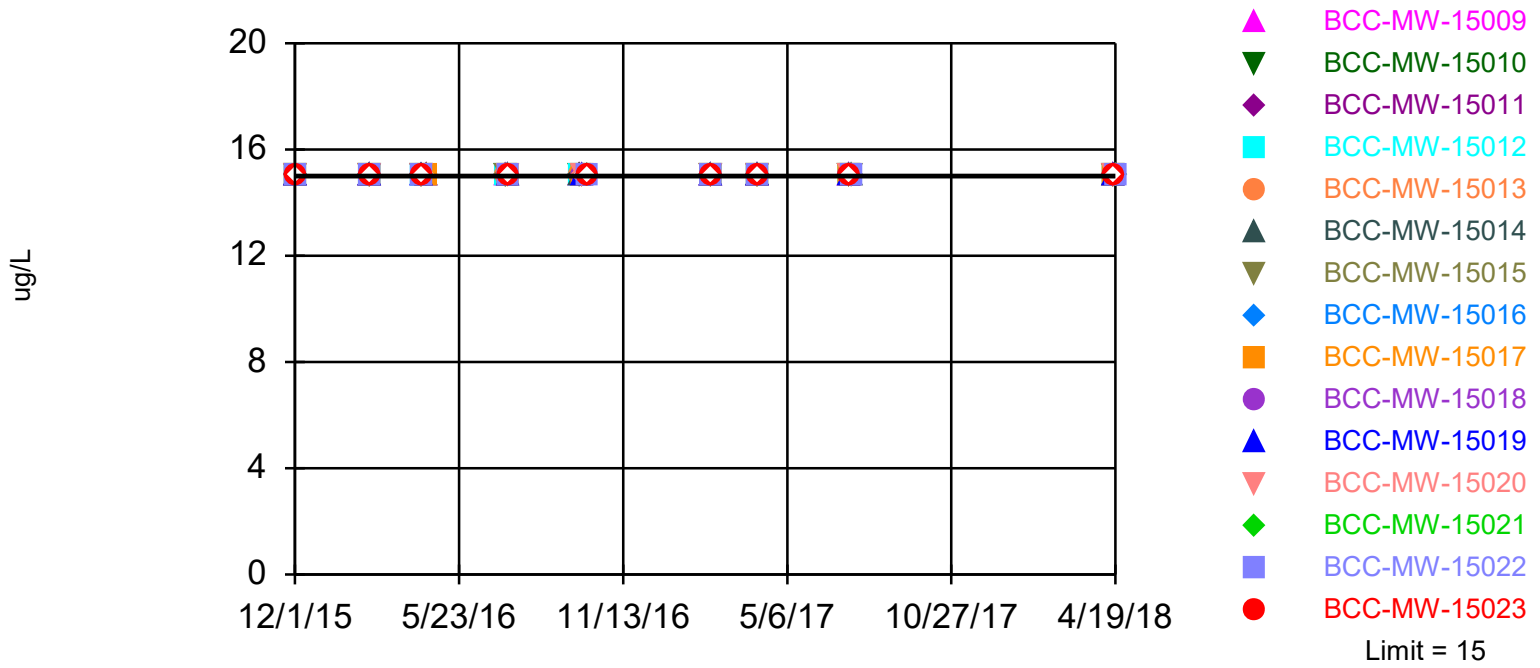
Client: Consumers Energy Data: BCC_Sanitas

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 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Cobalt, Total Analysis Run 6/12/2018 11:44 AM

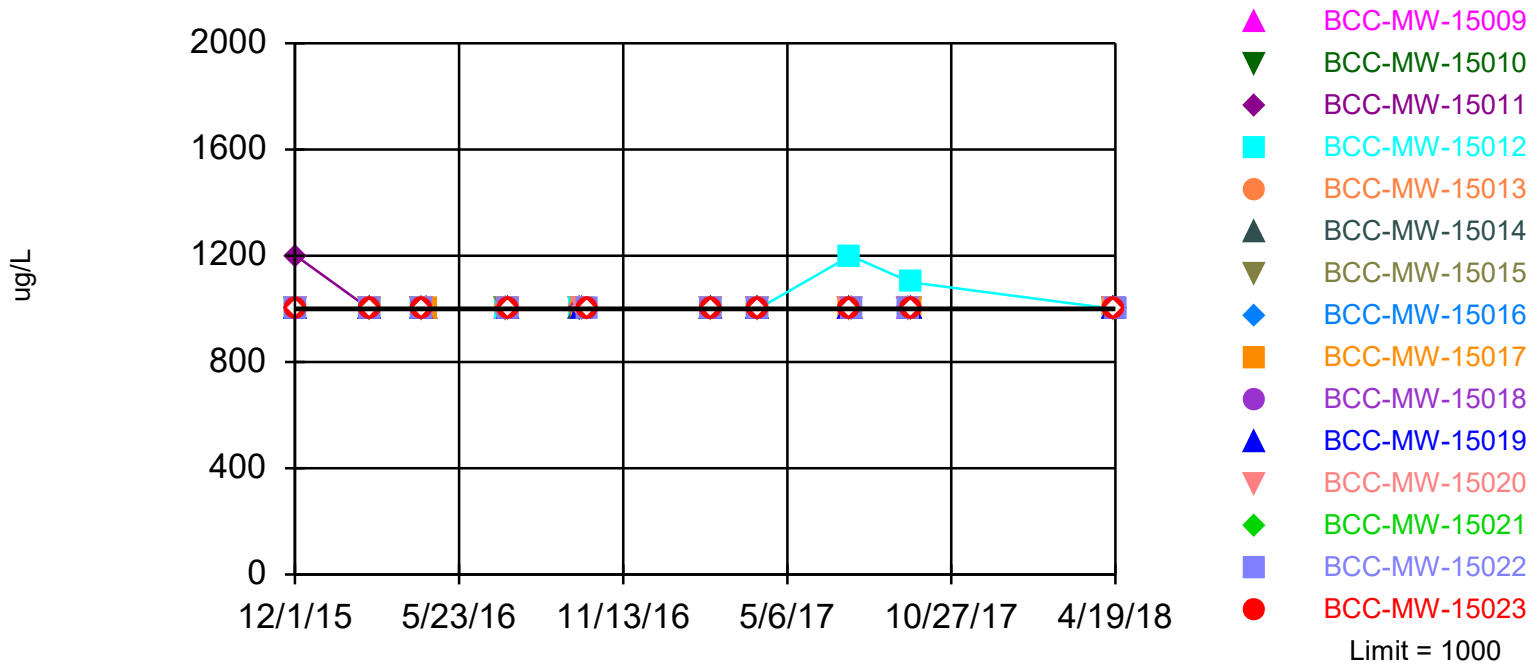
Client: Consumers Energy Data: BCC_Sanitas

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 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.55% coverage at alpha=0.01; 95.9% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.0262.

Constituent: Fluoride Analysis Run 6/12/2018 11:44 AM

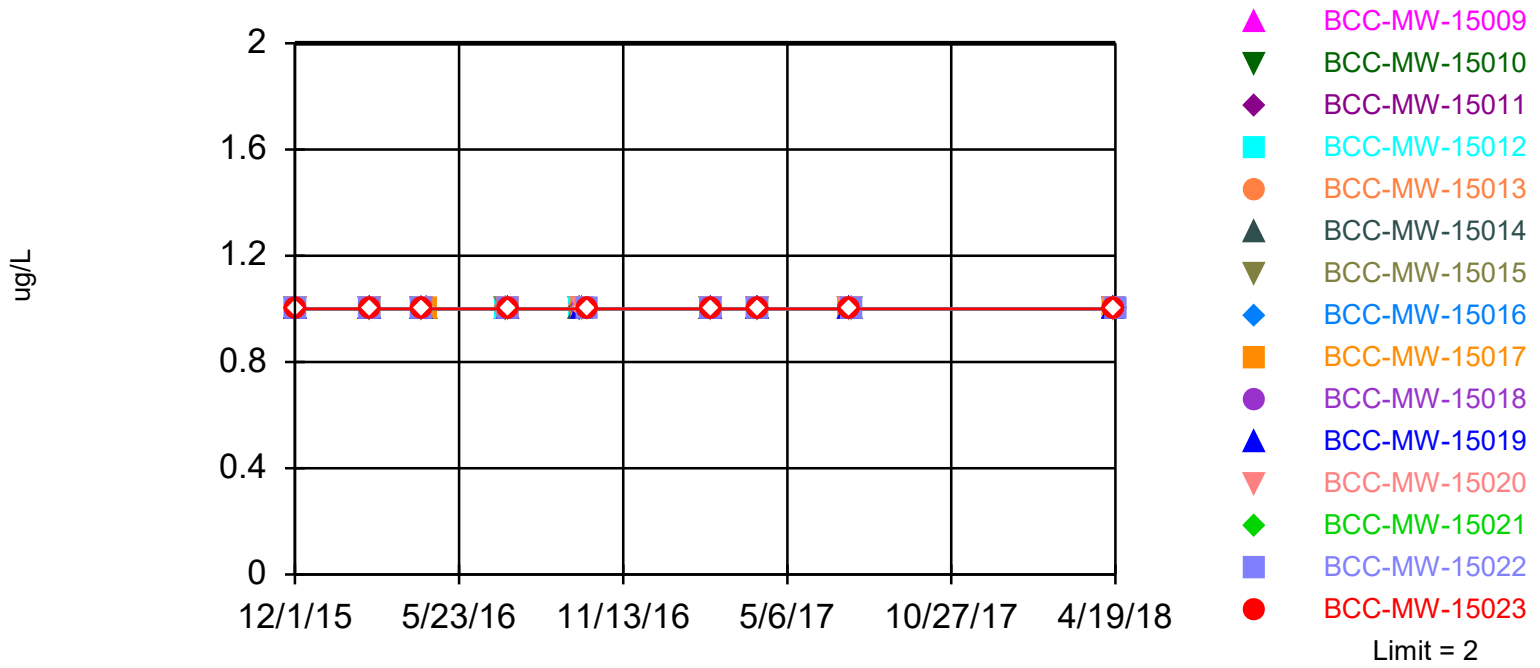
Client: Consumers Energy Data: BCC_Sanitas

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 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 96.88% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Lead, Total Analysis Run 5/30/2018 11:21 AM

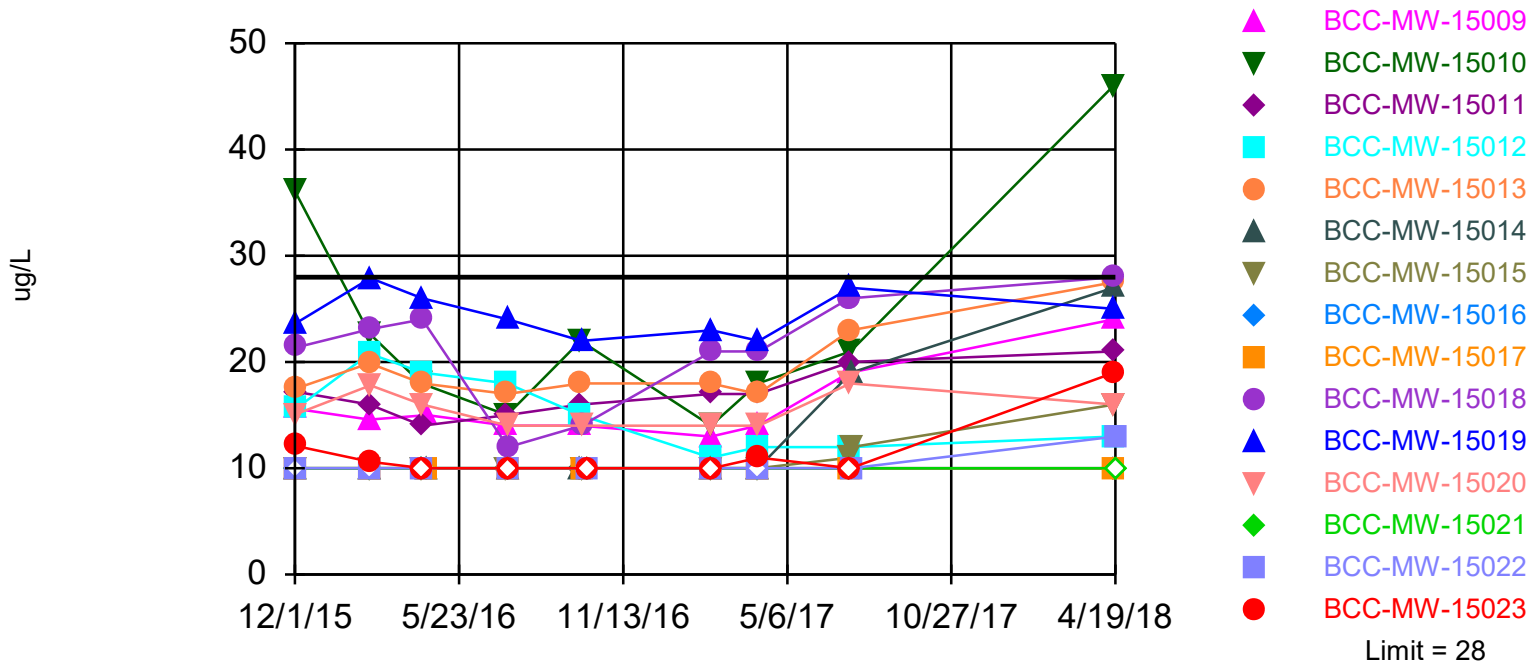
Client: Consumers Energy Data: BCC_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15010

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 79.69% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Lithium, Total Analysis Run 5/30/2018 8:57 AM

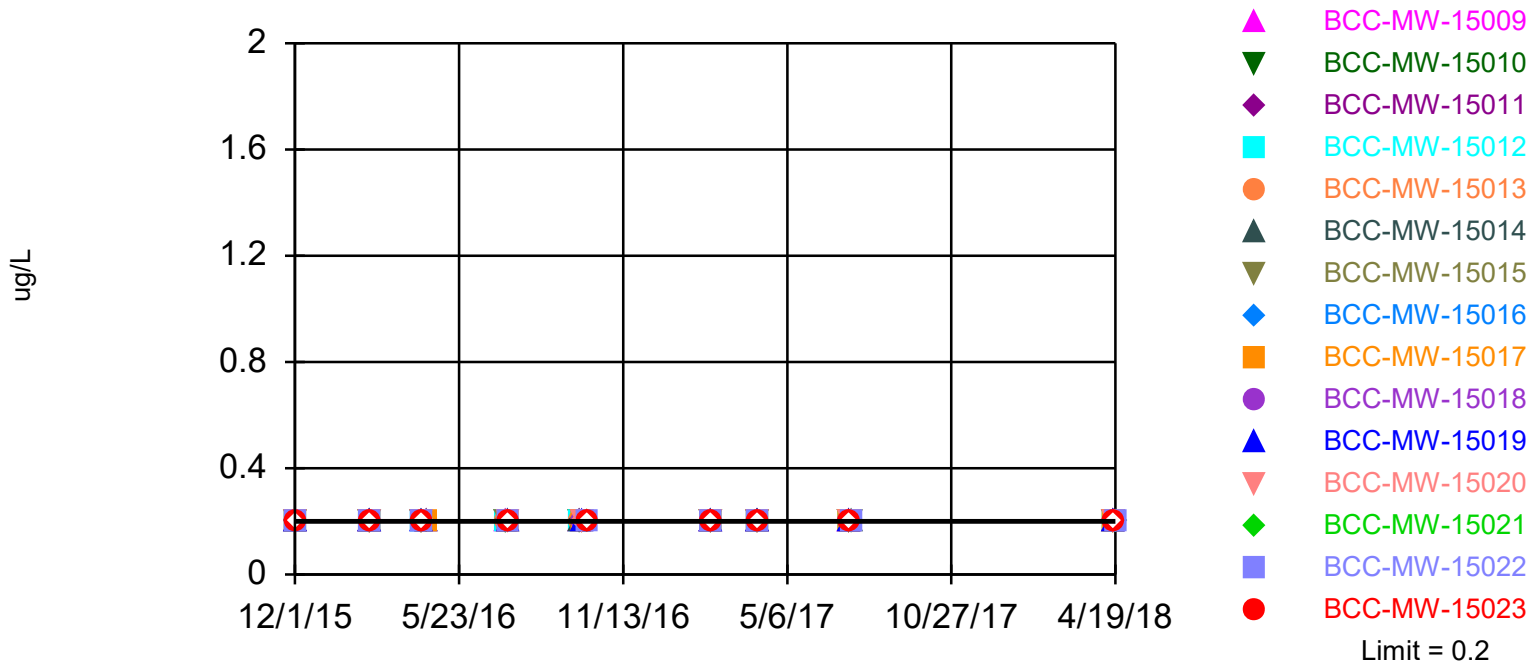
Client: Consumers Energy Data: BCC_Sanitas

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 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Mercury, Total Analysis Run 6/12/2018 11:45 AM

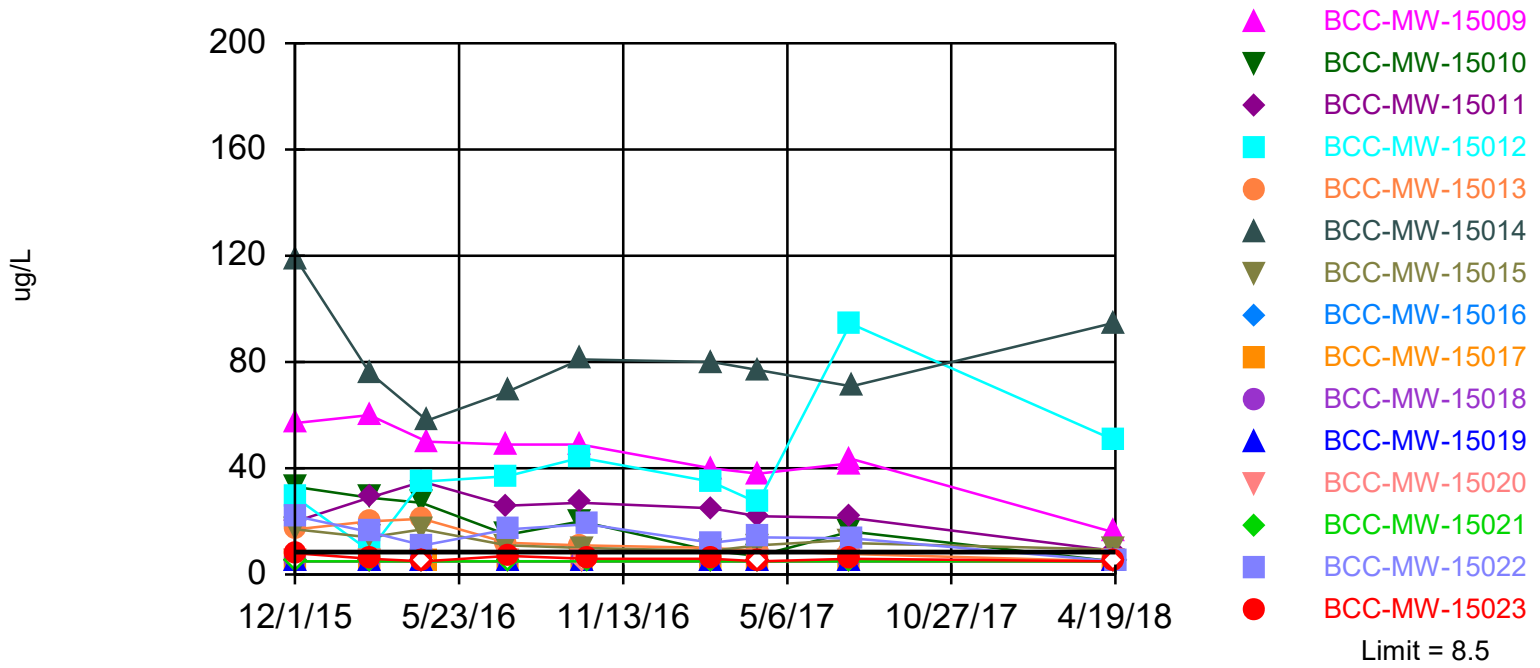
Client: Consumers Energy Data: BCC_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15009, BCC-MW-15011, BCC-MW-15012, BCC-MW-15014,..

Tolerance Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric tolerance limit because censored data exceeded 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 82.81% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Molybdenum, Total Analysis Run 5/30/2018 8:58 AM

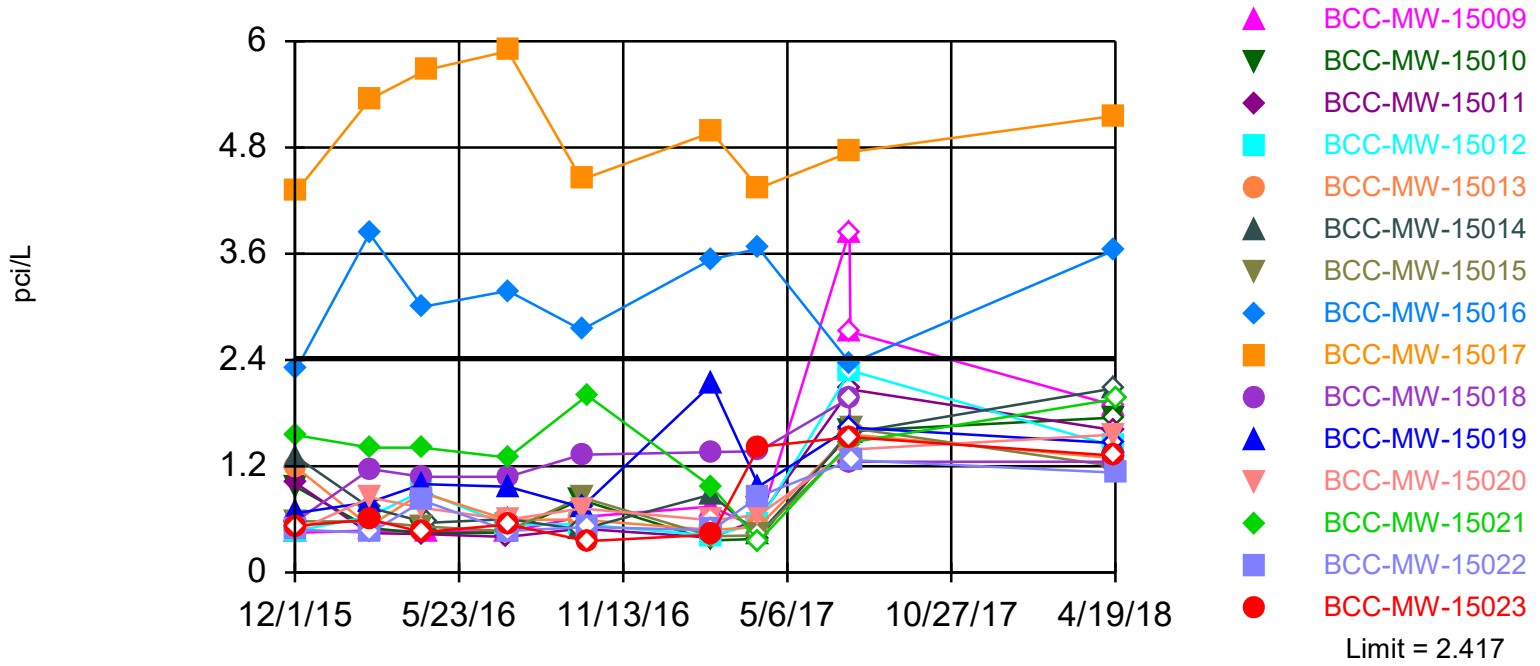
Client: Consumers Energy Data: BCC_Sanitas

Hollow symbols indicate censored values.

Exceeds Limit: BCC-MW-15016, BCC-MW-15017

Tolerance Limit

Interwell Parametric



95% coverage. Most recent observation is compared with limit. Background Data Summary (after Kaplan-Meier Adjustment): Mean=1.044, Std. Dev.=0.6854, n=64, 35.94% NDs. Normality test: Shapiro Francia @alpha = 0.01, calculated = 0.9487, critical = 0.947. Report alpha = 0.05.

Constituent: Radium-226/228 Analysis Run 5/30/2018 8:59 AM

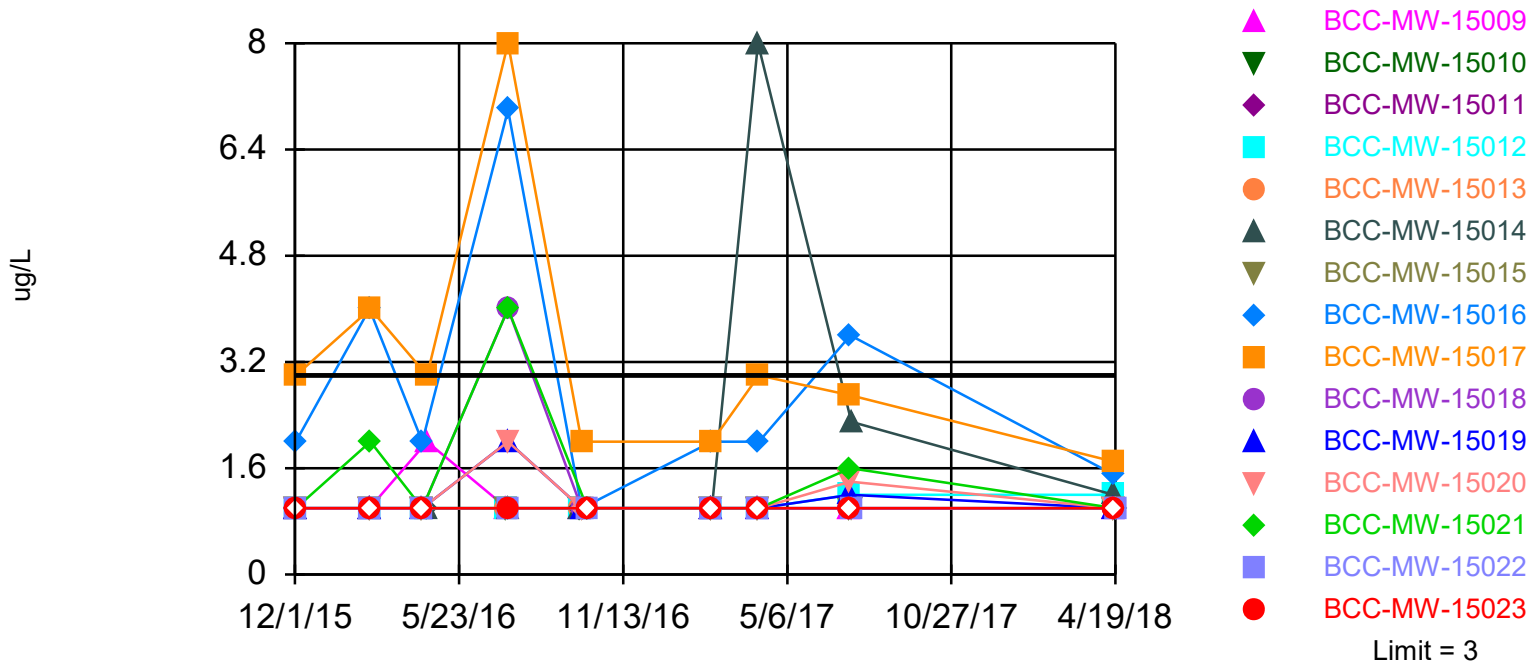
Client: Consumers Energy Data: BCC_Sanitas

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 50%. Most recent observation is compared with limit. Limit is highest of 64 background values. 67.19% NDs. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Selenium, Total Analysis Run 5/30/2018 9:00 AM

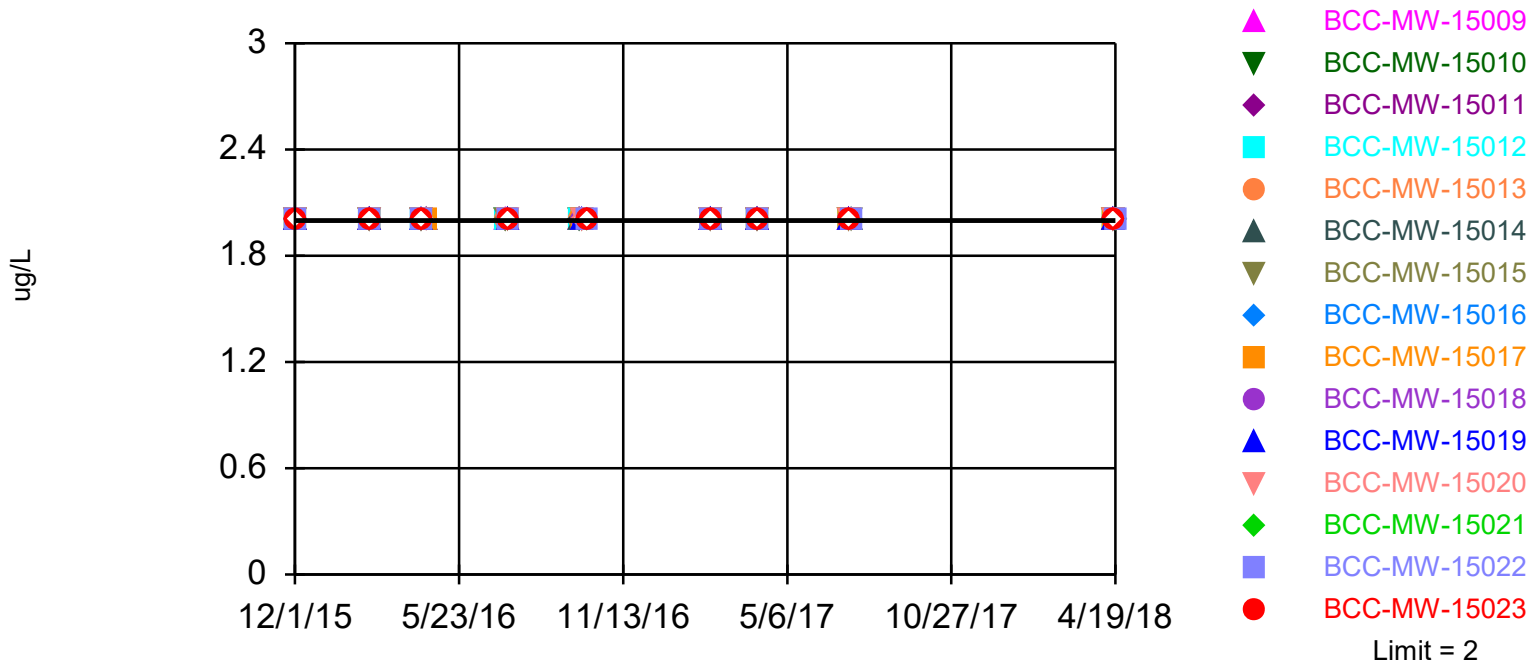
Client: Consumers Energy Data: BCC_Sanitas

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 50%. Most recent observation is compared with limit. All background values were censored; limit is most recent reporting limit. 93.16% coverage at alpha=0.01; 95.51% coverage at alpha=0.05; 99.02% coverage at alpha=0.5. Report alpha = 0.03752.

Constituent: Thallium, Total Analysis Run 6/12/2018 11:45 AM

Client: Consumers Energy Data: BCC_Sanitas