July 30, 2020

Ms. Lori Babcock
Michigan Department of Environment, Great Lakes, and Energy
Materials Management Division
Saginaw Bay District Office
401 Ketchum St, Suite B
Bay City, Michigan 48708

SUBJECT: **Semiannual Progress Report – Selection of Final Remedy pursuant to §257.97(a)**
DE Karn Bottom Ash Pond Coal Combustion Residuals (CCR) Unit

Dear Ms. Babcock,

Consumers Energy prepared and submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) a closure work plan for the Karn Bottom Ash Pond (Karn Bottom Ash Pond Work Plan) and a Response Action Plan developed in accordance with Part 115 dated November 30, 2018 and March 15, 2019, respectively. These plans were developed in anticipation of supporting the Assessment of Corrective Measures that would be necessary for evaluating and selecting a remedy for the Karn Bottom Ash Pond. Consumers Energy provided notification of exceeding a Groundwater Protection Standard (GWPS), per §257.95(g) on January 14, 2019, that indicated arsenic was present at statistically significant levels above the GWPS in five of six downgradient wells at the Karn Bottom Ash Pond.

EGLE approved the Karn Bottom Ash Pond Work Plan on December 20, 2018 based on expectation that a report documenting the removal activities and certifying solid waste has been removed in accordance with the work plan would be submitted at the completion of activities. Subsequently, EGLEEGLE approved the Response Action Plan on May 14, 2019 based on the anticipated submittal of the Assessment of Corrective Measures. Consumers Energy submitted for review and approval, *D.E. Karn Generating Facility Bottom Ash Pond CCR Removal Documentation Report* (Karn Bottom Ash Pond Closure Report) on October 30, 2019 to satisfy requirements for completing the removal of solid waste which rendered the need for a solid waste operating license was unnecessary.

This Semiannual Progress Report, prepared as a requirement of §257.97(a) of the Federal Coal Combustion Residual (CCR) Rule, describes progress towards selecting and implementing any additional remedy for the Karn Bottom Ash Pond after the completion of the *Assessment of Corrective Measures, DE Karn Bottom Ash Pond Coal Combustion Residual Unit*, dated September 11, 2019 (Karn Bottom Ash Pond ACM) (TRC, 2019). Groundwater management alternatives considered to be technically feasible following source removal activities that could potentially address the residual arsenic under *known* groundwater conditions were identified in the report as: 1) Post-remedy monitoring, 2) Groundwater capture/control, 3) Impermeable barrier, 4) Active geochemical sequestration, and 5) Passive geochemical sequestration.

Results of May 2020 Sampling Event

Statistical analysis from the May 2020 assessment groundwater monitoring event verified that the only constituent of concern that is present at statistically significant levels above the established Groundwater Protection Standard (GWPS) is arsenic. Results are presented in the enclosed *May 2020 Assessment Monitoring Data Summary and Statistical Evaluation Consumers Energy, DE Karn Site, Bottom Ash Pond CCR Unit* (May 2020 Event Summary) (TRC, 2020). Additionally, monitoring performed under the Karn Groundwater Surface-Water Interface (GSI) Compliance Plan demonstrates protection of human health and the environment with criteria determined to be protective at the point of exposure. These results are depicted in Figure 4 of the May 2020 Event Summary.

Significant observations from the event summary are as follows:

- No additional Appendix IV constituents have been observed at statistically significant levels above GWPS for the Karn Bottom Ash Pond groundwater monitoring system;
- Groundwater potentiometric surface continues to exhibit radial flow but the "high" point has shifted from the former Karn Bottom Ash Pond pool area to an area delineated by Monitoring Wells OW-11 and DEK-MW-15003;
- Arsenic concentrations are generally declining at DEK-MW-15002, DEK-MW-15003, and DEK-MW-18001; and
- Arsenic concentrations at DEK-MW-15002 have been below the GWPS for three consecutive sampling events.

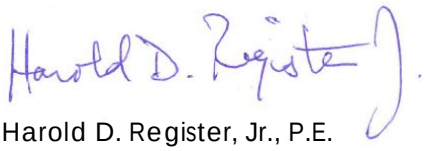
Conclusions

Source removal activities for the Karn Bottom Ash Pond have been completed and documented in the Karn Bottom Ash Pond Closure Report submitted to EGLE on October 30, 2019. Improvements in groundwater quality have been observed in the groundwater monitoring system, but observations of ongoing changes in groundwater potentiometric surface that may influence groundwater flow characteristics and/or alter groundwater redox conditions at monitoring locations that could influence constituent concentrations, still require further evaluation before a final remedy can be selected. Subsequent sampling events will inform the on-going improvements and retention of monitoring-only, passive, or active remedial options following the source removal. As conditions continue to be evaluated post-source removal, the drinking water and groundwater-surface water interface (GSI) pathway are protected by quarterly monitoring performed under the Michigan-approved hydrogeological monitoring plan that includes a GSI Compliance Monitoring Program.

The final remedy for the Karn Bottom Ash Pond will be formally selected per §257.97 and Michigan Solid Waste requirements once the selected option is reviewed and commented on by EGLE and a public meeting is conducted at least 30-days prior to the final selection as required under §257.96(e).

The next semiannual progress report will be submitted in six months by January 31, 2020. Please feel free to contact me with any questions or clarifications.

Sincerely,



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Ms. Darby Litz, TRC
Mr. Jacob Krenz, TRC

Enclosure: *May 2020 Assessment Monitoring Data Summary and Statistical Evaluation Consumers Energy, DE Karn Site, Bottom Ash Pond CCR Unit*. (TRC, July 30, 2020).

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July 30, 2020

Harold Register
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1945 W. Parnall Road
Jackson, MI 49201

Subject: May 2020 Assessment Monitoring Data Summary and Statistical Evaluation Consumers Energy, DE Karn Site, Bottom Ash Pond CCR Unit

Dear Mr. Register:

Consumers Energy Company (CEC) is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule[1] for the for the DE Karn Power Plant (DEK) Bottom Ash Pond (Karn Bottom Ash Pond) located in Essexville, Michigan. During the statistical evaluation of the initial assessment monitoring event (May 2018), arsenic was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standard (GWPS). Therefore, CEC initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. This letter report has been prepared to provide the summary of the May 2020 assessment groundwater monitoring results, data quality review, and statistical data evaluation.

Assessment Monitoring Sampling Summary

TRC conducted the first semiannual assessment monitoring event of 2020 for Appendix III and IV constituents at the Karn Bottom Ash Pond CCR Unit in accordance with the DE Karn Monitoring Program Sample Analysis Plan (ARCADIS, 2016) (SAP). The semiannual assessment monitoring event was performed on May 13 through May 15, 2020. Downgradient monitoring wells DEK-MW-18001, DEK-MW-15002 through DEK-MW-15006 and background monitoring wells MW-15002, MW-15008, MW-15016, and MW-15019 were sampled during this monitoring event.

TRC personnel collected static water level measurements from the Karn Bottom Ash Pond well network during the May 2020 sampling event. Static water elevation data are summarized in Table 1 and groundwater elevation data are shown on Figure 3. 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.

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

The groundwater samples were analyzed by the Consumers Energy Trail Street Laboratory for Appendix III and IV constituents in accordance with the SAP. Radium analyses were completed by Eurofins TestAmerica Inc. (TestAmerica). The analytical results for the background wells are summarized in Table 3, and the analytical results for the downgradient monitoring wells are summarized in Table 4.

Groundwater Flow Rate and Direction

Groundwater elevation data collected during the May 2020 assessment monitoring event are provided in Table 1. The May 2020 groundwater elevation data was used to construct the groundwater contour map (Figure 3).

Groundwater elevations measured at the site in May 2020 are generally within the range of 581 to 587 feet above mean sea level (ft NAVD88) and groundwater is typically encountered at equal elevation relative to the surrounding surface water features or within approximately 6 feet higher, flowing toward the bounding surface water features.

Although historically the point source discharge of sluiced bottom ash into the bottom ash pond created localized mounding of the potentiometric surface, the new Karn Lined Impoundment went into service on June 7, 2018 and has been continuously collecting the process water and bottom ash that went into the former bottom ash pond. Since the pond is no longer being hydraulically loaded with sluiced ash, there is no longer standing water in the bottom ash pond. The groundwater elevation data collected near the former bottom ash pond in May 2020 demonstrate a reduction in groundwater elevation measurements by several feet when compared to groundwater elevations measured prior to June 2018. Groundwater at the facility is locally influenced by incidental infiltration from precipitation over the uncovered acreage. OW-11and DEK-MW-15003 represent a groundwater elevation high point with porewater flow generally flowing radially towards the adjacent surface water features, as illustrated in Figure 3.

The average hydraulic gradient observed on May 11, 2020 in the Karn Bottom Ash Pond area during these events is estimated at 0.0022 ft/ft. The gradient was calculated using the well pair DEK-MW-15004/DEK-MW-15005, as well as the well water elevation difference and distance between DEK-MW-15003 and the discharge channel. The discharge channel elevation was taken from the May 11, 2020 NOAA gauging station data. Using the mean hydraulic conductivity of 15 ft/day (ARCADIS, 2016) and an assumed effective porosity of 0.3, the estimated average seepage velocity was 0.11 ft/day or 40 ft/year which is slightly lower than previous estimates. Due to the operational changes of the bottom ash pond and the progress of the landfill capping activities, the gradient between the bottom ash pond area and the surrounding surface water bodies is flattening out as compared to previous quarters, as expected. The general flow direction is similar to that identified in previous monitoring rounds and continues to demonstrate that the downgradient wells are appropriately positioned to detect the presence of Appendix III/IV constituents that could potentially migrate from the Karn Bottom Ash Pond CCR unit.

Data Quality

Analytical data were found to be usable for assessment monitoring and were generally consistent with previous sampling events. The Data Quality Reviews are included as Attachment A.

Assessment Monitoring Statistical Evaluation

Assessment monitoring is continuing at the Karn Bottom Ash Pond while Consumers Energy further evaluates corrective measures in accordance with §257.96 and §257.97 as outlined in the ACM. The following section summarizes the statistical approach applied to assess the May 2020 groundwater data in accordance with the assessment monitoring program.

Establishing Groundwater Protection Standards

The GWPSs are used to assess whether Appendix IV constituent concentrations are present in groundwater at unacceptable levels as a result of CCR Unit operations by statistically comparing concentrations in the downgradient wells to the GWPSs for each Appendix IV constituent. In accordance with §257.95(h) and the Stats Plan, GWPSs were established for the Appendix IV constituents following the preliminary assessment monitoring event using nine rounds of data collected from the background monitoring wells MW-15002, MW-15008, MW-15016, and MW-15019 (December 2015 through April 2018). The calculation of the GWPSs is documented in the Groundwater Protection Standards technical memorandum included as Appendix C of the 2018 Annual Report. The GWPS is established as the higher of the EPA Maximum Contaminant Level (MCL) or statistically derived background level for constituents with MCLs and the higher of the EPA Regional Screening Levels (RSLs) or background level for constituents with RSLs.

Data Comparison to Groundwater Protection Standards

The compliance well groundwater concentrations for Appendix IV constituents were compared to the GWPSs to determine if a statistically significant exceedance had occurred in accordance with §257.95. Consistent with the *Unified Guidance*[2] , 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 GWPSs. As documented in the January 14, 2019 Notification of Appendix IV Constituent Exceeding Groundwater Protection Standard per §257.95(g), arsenic was present at statistically significant levels above the federal GWPS in five of the six downgradient wells at the Karn Bottom Ash Pond.

Confidence intervals were established per the statistical methods detailed in the *Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event* technical memorandum provided in Attachment B. For each Appendix IV constituent, the concentrations were first compared directly to the GWPSs. Constituent-well combinations that included a direct exceedance of the GWPSs were retained for further statistical analysis using confidence limits.

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

The statistical evaluation of the third semiannual assessment monitoring event data indicate the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the DEK BAP:

Constituent	GWPS	#Downgradient Wells Observed
Arsenic	21 ug/L	4 of 6

Previously, arsenic was present in downgradient well DEK-MW-15002 at a statistically significant level; however, the statistical evaluation of the October 2019 and May 2020 data shows that the lower confidence limit for arsenic is currently below the GWPS. A summary of the confidence intervals for May 2020 is provided in Table 5.

Nature and Extent of Affected Groundwater

Since one or more Appendix IV constituents have been detected at the Karn Bottom Ash Pond at statistically significant levels above the GWPSs (i.e., arsenic), the nature and extent of the release was characterized in accordance with the requirements of §257.95(g)(1). The initial nature and extent characterization is included in the ACM. Installation of additional monitoring wells at locations downgradient of the CCR units was not necessary or feasible due to the presence of existing HMP monitoring wells, and the proximity of the surface water bodies. Although arsenic concentrations exceed the GWPS in on-site groundwater monitoring locations, arsenic is delineated within the limits of the property owned by Consumers Energy and there are currently no adverse effects on human health or the environment from either surface water or groundwater due to CCR management at the Karn Bottom Ash Pond. The property is owned and operated by Consumers Energy and groundwater is not used for drinking water. There are no on-site drinking water wells, so the drinking water pathway is not complete.

Overall, the assessment monitoring statistical evaluations have confirmed that arsenic is the only Appendix IV constituent present at statistically significant levels above the GWPS. The distribution of arsenic in the shallow water-nearing unit as compared to the GWPS is presented in Figure 4. Two categories were assigned, as follows:

- White – No Exceedances: all concentrations were below the GWPS
- Orange – Two or More Exceedances above the GWPS[3]

The groundwater impacts related to arsenic appear to be concentrically located around the Karn Bottom Ash Pond. The highest concentrations of arsenic have been observed at DEK MW-15003, a well located to the north of the bottom ash pond and associated with the “highest” elevation of mounded groundwater relative to the Bottom Ash Pond. The other groundwater monitoring wells are relatively consistent in the same concentration limit but also located in “lesser” mounded areas. Recent data

[3] Although an exceedance is defined as a single detection above the GWPS, confidence intervals will be used to determine compliance per the CCR Rule. Once corrective action is triggered (i.e., the lower confidence limit is above the GWPS), the upper confidence limit must be below the GWPS to demonstrate achievement of the GWPS for units that were not closed by removal. For units that are closed by removal, two consecutive rounds of data below the GWPS are needed to demonstrate closure.

shows that groundwater quality is improving for select constituents (e.g., downward trends in arsenic concentrations) since sluicing to the Karn Bottom Ash Pond ceased in June 2018 when the bottom ash and transport water was diverted to the Karn Lined Impoundment. Arsenic concentrations at DEK-MW-15002, DEK-MW-15003, and DEK-MW-18001 appear to exhibit a downward trend on the time-series chart (Attachment B). These data sets were tested further in Sanitas™ utilizing Sen's Slope to estimate the average rate of change in concentration over time and utilizing the Mann-Kendall trend test to test for significance of the trend at the 98% confidence level. The trend tests showed that arsenic concentrations are generally decreasing with time, as evidenced by the negative Sen's Slope, and that the downward trend of arsenic at DEK-MW-15002 is statistically significant. Groundwater chemistry already appears to be improving as a result of discontinuing the hydraulic loading to the Karn Bottom Ash Pond and is expected to further improve following the completed source removal of CCR. The influence of the bottom ash sluice water loading or changes in redox geochemistry impacted by the sluice water loading is still being evaluated as additional data collection events are completed.

Arsenic in the nature and extent wells located along the landfill perimeter bordering Saginaw Bay also exhibit concentrations above the GWPS. Although arsenic is present above the GWPS, the drinking water pathway is not complete as there are no drinking water wells on-site.

Due to the presence of the surrounding surface water bodies, another relevant pathway is the GSI pathway. Transect/porewater GSI compliance sampling data collected quarterly under the Part 115 HMP shows that biogeochemical conditions are contributing to the reduction of arsenic in groundwater as arsenic concentrations in transect push-point samples located along the water's edge of Saginaw Bay are much lower than the arsenic concentrations observed in the perimeter dike wells. Compliance has been demonstrated by evaluating the total chronic loading based upon the authorization for the mixing zone.

Next Steps

Consumers Energy will continue to evaluate corrective measures in accordance with §257.96 and §257.97 as outlined in the ACM. The groundwater management remedy for the Karn Bottom Ash Pond will be selected as soon as feasible to meet the federal standards of §257.96(b) of the CCR Rule and state standards in R299.4444(2) of PA 640. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with§257.90 - §257.98. The next semiannual monitoring event is tentatively scheduled for the fourth calendar quarter of 2020.

Sincerely,

TRC

Darby Litz
Hydrogeologist/Project Manager

Jacob Krenz
Staff Geologist

Attachments:

Table 1	Summary of Groundwater Elevation Data
Table 2	Summary of Field Parameter Results
Table 3	Summary of Background Wells Groundwater Sampling Results (Analytical)
Table 4	Summary of Groundwater Sampling Results (Analytical)
Table 5	Summary of Groundwater Protection Standard Exceedances – May 2020
Figure 1	Site Location Map
Figure 2	Karn and Weadock Complex Map
Figure 3	Shallow Groundwater Contour Map – May 2020
Figure 4	Nature and Extent Summary GWPS Exceedances.
Attachment A	Data Quality Reviews
Attachment B	Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event

Tables

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

Well Location	TOC Elevation (ft)	Geologic Unit of Screen Interval	Screen Interval Elevation (ft)			March 9, 2020		May 11, 2020	
						Depth to Water (ft BTOC)	Groundwater Elevation (ft)	Depth to Water (ft BTOC)	Groundwater Elevation (ft)
Background									
MW-15002	587.71	Sand	580.9	to	570.9	6.11	581.60	5.53	582.18
MW-15008	585.36	Sand with clay	578.7	to	568.7	3.66	581.70	3.01	582.35
MW-15016	586.49	Sand	581.2	to	578.2	4.26	582.23	4.73	581.76
MW-15019	586.17	Sand and Sand/Clay	579.5	to	569.5	4.60	581.57	3.95	582.22
DEK Bottom Ash Pond									
DEK-MW-15002	590.87	Sand	578.3	to	575.3	6.08	584.79	6.15	584.72
DEK-MW-15004	611.04	Sand	576.6	to	571.6	27.71	583.33	27.48	583.56
DEK-MW-15005	589.72	Sand	572.3	to	567.3	8.32	581.40	7.24	582.48
DEK-MW-15006	589.24	Sand	573.0	to	568.0	7.83	581.41	6.72	582.52
DEK Bottom Ash Pond & Karn Lined Impoundment									
DEK-MW-15003	602.74	Sand	578.8	to	574.8	16.36	586.38	16.19	586.55
DEK-MW-18001	593.47	Sand	579.2	to	574.2	8.32	585.15	8.27	585.20
OW-10	591.58	Silty Sand and Silty Clay	576.0	to	571.0	6.38	585.20	6.36	585.22
OW-11	607.90	Silt/Fly Ash	587.5	to	582.5	21.38	586.52	21.20	586.70
OW-12	603.07	Silty Sand	584.2	to	579.2	17.16	585.91	17.03	586.04
DEK Nature and Extent									
MW-01	597.02	Sand	573.0	to	570.0	15.45	581.57	14.60	582.42
MW-03	597.30	Sand	569.8	to	566.8	15.81	581.49	14.85	582.45
MW-06	589.43	Sand and Silty Sand	578.5	to	563.5	7.70	581.74	6.90	582.53
MW-08	598.78	Sand and Silty Clay	580.9	to	570.9	16.76	582.02	16.18	582.60
MW-10	596.97	Sand	582.5	to	572.5	14.84	582.13	14.20	582.77
MW-12	598.60	Sand	583.9	to	573.9	16.83	581.77	16.20	582.40
MW-14	594.36	Sand and Silty Clay	584.7	to	574.7	12.60	581.77	11.87	582.49
MW-16	595.80	Sand and Sand/Bottom Ash	584.1	to	574.1	14.29	581.51	13.48	582.32
MW-22	598.99	Ash/Sand	571.4	to	568.4	15.92	583.07	15.60	583.39
MW-23	595.57	Ash/Sand	576.9	to	571.9	12.13	583.44	12.05	583.52
DEK Bottom Ash Pond and Lined Impoundment (water level only)									
MW-02	597.34	Sand and Silty Clay	572.5	to	567.5	15.78	581.56	14.95	582.39
MW-04	598.01	NR	569.5	to	564.5	16.52	581.49	15.60	582.41
MW-17	597.91	Sand	577.0	to	574.0	12.60	585.31	12.51	585.40
MW-18	609.22	Silty Sand and Silty Clay	575.8	to	573.8	25.47	583.75	25.20	584.02
MW-19	597.28	NR	572.1	to	567.1	15.59	581.69	14.70	582.58
MW-20	631.44	Sand	582.3	to	579.3	51.11	580.33	50.35	581.09
MW-21	632.91	Sand	587.1	to	584.1	50.18	582.73	50.00	582.91
OW-01	630.17	NR	572.5	to	567.5	49.61	580.56	48.95	581.22
OW-02	598.01	Fly Ash	579.4	to	576.4	14.08	583.93	14.55	583.46
OW-03	597.94	Fly Ash and Sand	573.6	to	568.6	15.46	582.48	15.02	582.92
OW-04	590.21	Sand and Bottom/Fly Ash	579.1	to	574.1	8.40	581.81	7.77	582.44
OW-05	593.53	Sand	576.9	to	571.9	11.50	582.03	11.10	582.43
OW-06	603.76	NR	580.9	to	575.9	20.20	583.80	20.45	583.31
OW-07	596.41	Ash	583.3	to	580.3	13.00	583.41	13.12	583.29
OW-08	593.93	NR	581.0	to	576.0	10.49	583.44	10.40	583.53
OW-09	593.45	NR	585.5	to	580.5	10.80	582.65	10.00	583.45
OW-13	588.52	NR	579.5	to	574.5	3.65	584.87	4.08	584.44
OW-15	587.75	NR	572.8	to	567.8	4.18	583.57	4.30	583.45

Notes:
Survey data from: Rowe Professional Services Company (Nov. 2015) and Consumers Energy Company drawings: SG-21733, Sheet 1, Rev. G (Karn, 11/27/18); and SG-21733, Sheet 2, Rev. C (Weadock, 11/27/18).
Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).
TOC: Top of well casing.
ft BTOC: Feet below top of well casing.
NR: Not Recorded

Table 2
Summary of Field Parameters: May 2020
DE Karn Bottom Ash Pond - Essexville - RCRA CCR Monitoring Program
Essexville, Michigan

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (SU)	Specific Conductivity (umhos/cm)	Temperature (°C)	Turbidity (NTU)
Background							
MW-15002	5/15/2020	1.55	-59.3	7.8	1,110	10.8	6.6
MW-15008	5/14/2020	0.16	-50.7	6.7	1,809	9.3	4.2
MW-15016	5/15/2020	1.36	9.9	7.5	1,344	9.9	1.3
MW-15019	5/15/2020	0.59	19.6	6.6	1,310	8.2	1.3
Karn Bottom Ash Pond							
DEK-MW-15002	5/13/2020	0.63	91.2	7.1	1,522	9.8	3.8
DEK-MW-15003	5/14/2020	1.98	9.9	8.5	446	12.2	2.0
DEK-MW-15004	5/14/2020	1.60	-79.5	7.8	852	13.5	3.8
DEK-MW-15005	5/13/2020	1.49	-88.9	8.1	727	11.2	5.0
DEK-MW-15005(1)	5/14/2020	1.44	-69.1	7.8	748	10.5	5.0
DEK-MW-15006	5/13/2020	1.69	-88.3	8.1	1,304	10.4	3.0
DEK-MW-18001	5/14/2020	1.55	-71.0	7.7	840	9.3	3.8

Notes:
mg/L - Milligrams per Liter.
mV - Millivolts.
SU - Standard Units.
umhos/cm - Micromhos per centimeter.
°C - Degrees Celcius.
NTU - Nephelmetric Turbidity Unit.
(1) Field parameter results for radium sample collected on 5/14/2020 at DEK-MW-15004.

Table 3
Summary of Groundwater Sampling Results (Analytical): May 2020
DE Karn JC Weadock Background – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	**MW-15002**	**MW-15008**	**MW-15016**	**MW-15019**
					Sample Date:	5/15/2020	5/14/2020	5/15/2020	5/15/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	Background			
Appendix III									
Boron	ug/L	NC	500	500	4,000	< 20	129	278	221
Calcium	mg/L	NC	NC	NC	500	35.2	124	182	163
Chloride	mg/L	**250****	**250**	**250**	**50**	**160**	**305**	**69.1**	**287**
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	**250****	**250**	**250**	500	5.87	5.68	**300**	103
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**577**	**1,110**	**922**	**1,190**
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.8	6.7	7.5	6.6
Appendix IV									
Antimony	ug/L	6	6.0	6.0	2.0	< 1	< 1	< 1	< 1
Arsenic	ug/L	10	10	10	10	1	< 1	1	< 1
Barium	ug/L	2,000	2,000	2,000	1,200	43	79	48	287
Beryllium	ug/L	4	4.0	4.0	33	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	2.5	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	< 1	< 1	< 1	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	< 1,000	< 1,000
Lead	ug/L	NC	4.0	4.0	14	3	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	< 10	19	70	14
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	120	< 5	< 5	< 5	< 5
Radium-226	pCi/L	NC	NC	NC	NC	< 0.132	0.403	0.167	0.282
Radium-228	pCi/L	NC	NC	NC	NC	< 0.568	0.976	< 0.546	< 0.649
Radium-226/228	pCi/L	5	NC	NC	NC	< 0.568	1.38	< 0.546	0.911
Selenium	ug/L	50	50	50	5.0	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	2.0	< 2	< 2	< 2	< 2
MI Part 115 Parameters									
Iron	ug/L	**300****	**300**(1)	**300**(1)	500,000	**1,080**	**13,700**	**988**	**14,300**
Copper	ug/L	1,000**	1,000(1)	1,000(1)	20	2	< 1	2	< 1
Nickel	ug/L	NC	100	100	120	< 2	< 2	2	< 2
Silver	ug/L	100**	34	98	0.2	< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	**4.5**	62	27	3	**6**	< 2	2
Zinc	ug/L	5,000**	2,400	5,000(1)	260	< 10	< 10	< 10	< 10

Notes:

ug/L - micrograms per liter.

mg/L - milligrams per liter.

SU - standard units; pH is a field parameter.

pCi/L - picocuries per liter.

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

NC - no criteria.

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

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

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

- If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE 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.

(1) - Criterion is the aesthetic drinking water value per footnote {E}.

Table 4
Summary of Groundwater Sampling Results (Analytical): May 2020
Karn Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

					Sample Location:	DEK-MW-15002	DEK-MW-15003	DEK-MW-15004	DEK-MW-15005	DEK-MW-15006	DEK-MW-18001
					Sample Date:	5/13/2020	5/14/2020	5/14/2020	5/13/2020	5/13/2020	5/14/2020
Constituent	Unit	EPA MCL	MI Residential*	MI Non-Residential*	MI GSI^	downgradient					
Appendix III											
Boron	ug/L	NC	**500**	**500**	4,000	**1,390**	**739**	**795**	**863**	**1,090**	**1,670**
Calcium	mg/L	NC	NC	NC	500	170	26.9	52.7	71	70.4	72.1
Chloride	mg/L	250**	250	250	**50**	**130**	47.9	**66.6**	48	**71.5**	**64.7**
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	1,140	< 1,000	< 1,000	1,090
Sulfate	mg/L	**250****	**250**	**250**	500	**367**	55.6	125	18.9	**316**	51.1
Total Dissolved Solids	mg/L	**500****	**500**	**500**	**500**	**1,100**	271	**509**	419	**833**	484
pH, Field	SU	6.5 - 8.5**	6.5 - 8.5	6.5 - 8.5	6.5 - 9.0	7.1	8.5	7.8	8.1	8.1	7.7
Appendix IV											
Antimony	ug/L	6	6.0	6.0	**2.0**	< 1	1	< 1	< 1	**3**	< 1
Arsenic	ug/L	**10**	**10**	**10**	**10**	3	**365**	**157**	**34**	**21**	**79**
Barium	ug/L	2,000	2,000	2,000	1,200	196	40	96	127	86	130
Beryllium	ug/L	4	4.0	4.0	33	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium	ug/L	5	5.0	5.0	2.5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium	ug/L	100	100	100	11	< 1	< 1	< 1	< 1	2	< 1
Cobalt	ug/L	NC	40	100	100	< 6	< 6	< 6	< 6	< 6	< 6
Fluoride	ug/L	4,000	NC	NC	NC	< 1,000	< 1,000	1,140	< 1,000	< 1,000	1,090
Lead	ug/L	NC	4.0	4.0	14	< 1	< 1	< 1	< 1	< 1	< 1
Lithium	ug/L	NC	170	350	440	48	18	36	20	15	27
Mercury	ug/L	2	2.0	2.0	0.20#	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Molybdenum	ug/L	NC	73	210	120	< 5	52	11	< 5	18	< 5
Radium-226	pCi/L	NC	NC	NC	NC	0.673	< 0.271	< 0.494	< 0.469[(2)]	< 0.370	< 0.608
Radium-228	pCi/L	NC	NC	NC	NC	< 0.763	< 0.468	< 0.700	1.14[(2)]	0.780	< 0.676
Radium-226/228	pCi/L	5	NC	NC	NC	0.899	0.565	< 0.700	1.34[(2)]	1.01	< 0.676
Selenium	ug/L	50	50	50	5.0	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	ug/L	2	2.0	2.0	2.0	< 2	< 2	< 2	< 2	< 2	< 2
MI Part 115 Parameters											
Iron	ug/L	**300****	**300[(1)]**	**300[(1)]**	500,000	**3,800**	98	**1,690**	**973**	**1,000**	**962**
Copper	ug/L	1,000**	1,000[(1)]	1,000[(1)]	20	1	< 1	< 1	< 1	1	2
Nickel	ug/L	NC	100	100	120	3	< 2	2	< 2	23	< 2
Silver	ug/L	100**	34	98	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Vanadium	ug/L	NC	4.5	62	27	< 2	< 2	< 2	< 2	< 2	< 2
Zinc	ug/L	5,000**	2,400	5,000[(1)]	260	< 10	< 10	< 10	< 10	< 10	< 10

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April, 2012.
NC - no criteria.
* - Michigan Part 201 Generic Drinking Water Cleanup Criteria, December 30, 2013.
** - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April, 2012.
^ - Michigan Part 201 Groundwater Surface Water Interface (GSI) Criteria. Hardness-dependent criteria calculated using hardness of 258 mg CaCO3/L (average of SW-01 [Lake Huron] and SW-02 [Saginaw River] collected in April 2018) per footnote {G} of Michigan Part 201 criteria tables. Chromium GSI criterion based on hexavalent chromium per footnote {H}. GSI criterion is protective for surface water used as a drinking water source as described in footnote {X}. GSI criterion for chloride is 50 mg/L when the discharge is to the Great Lakes or connecting waters per footnote {FF}
# - If detected above 0.20 ug/L, further evaluation of low-level mercury may be necessary to evaluate the GSI pathway per Michigan Part 201 and EGLE 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.
(1) - Criterion is the aesthetic drinking water value per footnote {E}.
(2) - Radium data was collected on May 14, 2020.

Table 5

Summary of Groundwater Protection Standard Exceedances – May 2020

DE Karn Bottom Ash Pond – RCRA CCR Monitoring Program

Essexville, Michigan

Constituent	Units	GWPS	DEW-MW-15002		DEK-MW-15003		DEK-MW-15004		DEK-MW-15005		DEK-MW-15006		DEK-MW-18001	
			LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL	LCL	UCL
Arsenic	ug/L	21	6.7	68	390	460	110	160	24	120	17	25	28	230

Notes:

ug/L - micrograms per Liter.

GWPS - Groundwater Protection Standard as established in TRC's Technical Memorandum dated October 15, 2018.

UCL - Upper Confidence Limit (α = 0.01) of the downgradient data set.

LCL - Lower Confidence Limit (α = 0.01) of the downgradient data set.

Indicates a statistically significant exceedance of the GWPS. An exceedance occurs when the LCL is greater than the GWPS.

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
www.trccompanies.com
TRC - GIS

PROJECT:

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

TITLE:

SITE LOCATION MAP

DRAWN BY:	S. MAJOR
CHECKED BY:	J. KRENZ
APPROVED BY:	D. LITZ
DATE:	JULY 2020
PROJ. NO.:	367388.0001
FILE:	367388-001-004.mxd

FIGURE 1

S:\1-PROJECTS\Consumers_Energy_Company\Michigan\CCR_GW\2017_269767\367388-001-004.mxd -- Saved By: SMAJOR on 7/15/2020, 14:00:57 PM

LEGEND

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

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).
4. A SINGLE WELL SYMBOL IS SHOWN FOR WELL PAIRS MW-01/MW-02, MW-03/MW-04, OW-02/MW-22, AND OW-07/MW-23 AS THE WELLS ARE LOCATED WITHIN 15-FT OF EACH OTHER.

0 1,000 2,000 Feet

1 " = 1,000 '

1:12,000

PROJECT:

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

TITLE:

KARN AND WEADOCK COMPLEX AREA

DRAWN BY:	S. MAJOR	PROJ NO.:	367388-001
CHECKED BY:	J. KRENZ		
APPROVED BY:	D. LITZ		**FIGURE 2**
DATE:	JULY 2020		

TRC
1540 Eisenhower Place
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FILE NO.: 367388-001-005.mxd

TRC - GIS
Plot Date: 7/17/2020, 09:19:50 AM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: S:\1-PROJECTS\Consumers Energy Company\Michigan\CCR_GW\2017 269767\367388-Map\Site
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0

LEGEND

- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- DEK LINED IMPOUNDMENT MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- MONITORING WELL (STATIC ONLY)
- SURFACE WATER GAUGING STATION
- NATURE AND EXTENT WELL
- SLURRY WALL (APPROXIMATE)
- EXTENT OF GEOSYNTHETICS (KARN LINED IMPOUNDMENT)
- GROUNDWATER ELEVATION CONTOUR (1' INTERVAL, DASHED WHERE INFERRED)
- *(580.50)* GROUNDWATER ELEVATION (FEET)
- *(NM)* NOT MEASURED

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).
4. GROUNDWATER ELEVATIONS DISPLAYED IN FEET RELATIVE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.

N

0 600 1,200 Feet

1 " = 600 '
1:7,200

PROJECT:
CONSUMERS ENERGY COMPANY
DE KARN POWER PLANT
ESSEXVILLE, MICHIGAN

TITLE:
SHALLOW GROUNDWATER CONTOUR MAP MAY 11, 2020

DRAWN BY:	S. MAJOR	PROJ NO.:	367388.0001
CHECKED BY:	J. KRENZ		
APPROVED BY:	D. LITZ		**FIGURE 3**
DATE:	JULY 2020		

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FILE NO.: 367388-001-006.mxd

Plot Date: 7/23/2020, 14:28:11 PM by SMAJOR -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\Consumers Energy Company\Michigan\CCR GW\2017 269767\367388-Map Rotation: 0
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
TRC - GIS

Constituent	GWPS
Antimony	6 ug/L
Arsenic	21 ug/L
Barium	2,000 ug/L
Beryllium	4 ug/L
Cadmium	5 ug/L
Chromium	100 ug/L
Cobalt	15 ug/L
Fluoride	4,000 ug/L
Lead	15 ug/L
Lithium	180 ug/L
Mercury	2 ug/L
Molybdenum	100 ug/L
Radium-226/228	5 pCi/L
Selenium	50 ug/L
Thallium	2 ug/L

MW-03
MW-06
MW-01
MW-06
Arsenic
POREWATER SAMPLES COLLECTED UNDER MICHIGAN P115 PROGRAM TO DEMONSTRATE COMPLIANCE WITH THE GSI PATHWAY IN THIS AREA
Lake Huron
INTAKE CHANNEL
DEK-MW-15004
Arsenic *
DEK-MW-15004
MW-22
Arsenic
MW-08
MW-08
Arsenic
MW-22
BOTTOM ASH POND
DEK-MW-15003
Arsenic*
OW-11
OW-11
Arsenic
DEK-MW-15003
KARN LINED IMPOUNDMENT
MW-10
MW-10
Arsenic
DEK-MW-15005
Arsenic *
DEK-MW-15005
OW-12
DEK-MW-15001
MW-12
MW-12
Arsenic
OW-12
Arsenic
DEK-MW-15006
Arsenic
DEK-MW-15006
DEK-MW-18001
OW-10
MW-23
MW-23
Arsenic
DEK-MW-18001
Arsenic *
MW-14
MW-14
Arsenic
DEK-MW-15002
Arsenic*
DEK-MW-15002
MW-16
DE KARN GENERATING FACILITY
Saginaw River
BOTTOM ASH POND
JC WEADOCK GENERATING FACILITY
DISCHARGE CHANNEL
SLURRY WALL

LEGEND

- DEK BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK BOTTOM ASH POND MONITORING WELL
- DEK LINED IMPOUNDMENT MONITORING WELL
- DECOMMISSIONED MONITORING WELL
- NATURE AND EXTENT WELL
- NO EXCEEDANCES
- TWO OR MORE EXCEEDANCES (NOTES 4 + 5)
- STATISTICALLY SIGNIFICANT GWPS EXCEEDANCE (NOTE 6)
- SLURRY WALL (APPROXIMATE)
- EXTENT OF GEOSYNTHETICS (KARN LINED IMPOUNDMENT)
- POREWATER SAMPLING AREA
- * EXCEEDANCE TRIGGERED ASSESSMENT OF CORRECTIVE MEASURES PURSUANT TO §257.96

WELL ID
CONSTITUENT(S) EXCEEDING GWPS

NOTES

1. BASE MAP IMAGERY FROM GOOGLE EARTH PRO, 2018.
2. MONITORING WELL AND SLURRY WALL LOCATIONS PROVIDED BY CEC; SG21733SHT2 REVB.DWG DATED 11/21/2018.
3. GWPS (GROUNDWATER PROTECTION STANDARD) IS THE HIGHER OF THE MAXIMUM CONTAMINANT LEVEL (MCL)/REGIONAL SCREENING LEVEL FROM 83 FR 36435 (RSL) AND UPPER TOLERANCE LIMIT (UTL) AS ESTABLISHED IN TRC'S TECHNICAL MEMORANDUM DATED OCTOBER 15, 2018.
4. GROUNDWATER DATA FROM MARCH 2016 TO MAY 2020 ARE SCREENED AGAINST THE GWPS FOR EVALUATION PURPOSES ONLY. AN EXCEEDANCE IS DEFINED AS A SINGLE DETECTION ABOVE THE GWPS, HOWEVER, CONFIDENCE INTERVALS WILL BE USED TO DETERMINE COMPLIANCE PER THE CCR RULES.
5. AN EXCEEDANCE OF THE GWPS DOES NOT INDICATE UNACCEPTABLE RISK FROM GROUNDWATER EXPOSURE; THE DRINKING WATER PATHWAY IS NOT COMPLETE ON THE PROPERTY. GROUNDWATER CONDITIONS CONTINUE TO BE MONITORED TO INFORM THE DEK BOTTOM ASH POND REMEDY SELECTION.
6. LOWER CONFIDENCE LIMIT IS ABOVE GWPS.

0 600 1,200 Feet
1 " = 600 '
1:7,200

PROJECT:
CONSUMERS ENERGY COMPANY
DE KARN POWER PLANT
ESSEXVILLE, MICHIGAN

TITLE:
NATURE AND EXTENT SUMMARY GWPS EXCEEDANCES

DRAWN BY:	S. MAJOR	PROJ NO.:	367388.0001
CHECKED BY:	K. AMONNETTE		
APPROVED BY:	D. LITZ		**FIGURE 4**
DATE:	JULY 2020		

TRC
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FILE NO.: 367388-ExceedancesNE_ACM.mxd

TRC - GIS
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
Plot Date: 7/23/2020, 12:49:02 PM by SMAJOR -- LAYOUT: ANSI B (11"x17")
Path: S:\1-PROJECTS\Consumers Energy Company\Michigan\CCR_GW\2017_269767\367388-ACM.mxd

Attachment A
Data Quality Reviews

Laboratory Data Quality Review
Groundwater Monitoring Event May 2020
JC Weadock/Karn DEK Background

Groundwater samples were collected by TRC for the May 2020 sampling event. Samples were analyzed for total metals, anions, and total dissolved solids by Consumers Energy (CE) Laboratory Services, located in Jackson, Michigan. The radium analyses were subcontracted to Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 20-0494 and 240-130407-1.

During the May 2020 sampling event, a groundwater sample was collected from each of the following wells:

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

Each sample was analyzed for the following constituents:

Analyte Group	Method
Anions (Chloride, Fluoride, Sulfate)	EPA 300.0
Total Dissolved Solids	SM 2540C
Total Metals	SW-846 6020/7470A
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, 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 Data Review (USEPA, 2017) and 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;
- 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 and equipment blanks are used to assess potential contamination arising from field procedures;

- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs 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 performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Percent recoveries for carriers. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- 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.

It should be noted that results for method blanks and laboratory control samples were not provided for review by CE Laboratory Services. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for the metals, anions, and TDS analyses.

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.

- The reviewed Appendix III and IV constituents as well as iron, copper, nickel, silver, vanadium, and zinc 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 for radium. Target analytes were not detected in the method blank samples with the following exception. 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 method blank 160-470963/20-A at 0.4163 +/- 0.243 pCi/L. The detected radium-228 result for sample MW-15008 associated with this method blank was potentially impacted, as summarized in the attached table, Attachment 1. However, results for radium-228 are consistent with historical results. Therefore, data usability is not affected.

- One field blank (FB-05) was collected. Target analytes were not detected in this blank sample.
- The LCS and LCSD recoveries and relative percent differences (RPDs) for radium were within QC limits.
- MS and MSD analyses were not performed on a sample from this data set.
- The field duplicate pair samples were DUP-05/ MW-15008. All criteria were met.
- Laboratory duplicate analyses were not performed on a sample from this data set.
- Carrier recoveries were within 40-110%.
- Samples did not undergo a 21-day wait period prior to radium-226 analysis; however, combined radium results were < 5 pCi/L so there is no impact on data usability.

Attachment 1

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

Samples	Collection Date	Analyte	Non-Conformance/Issue
MW-15008	5/14/2020	Radium-228	Detection in method blank. Normalized absolute difference between blank and sample <1.96; indicates possible false positive result. However, results were consistent with historical results; therefore, data usability is not affected.

Laboratory Data Quality Review
Groundwater Monitoring Event May 2020
DE Karn Bottom Ash Pond/ Lined Impoundment

Groundwater samples were collected by TRC for the May 2020 sampling event. Samples were analyzed for metals, anions, total dissolved solids, and alkalinity by Consumers Energy (CE) Laboratory Services in Jackson, Michigan. The laboratory analytical results were reported in laboratory sample delivery group (SDG) 20-0499. Samples were analyzed for radium 226, 228 and combined radium by Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in SDG 240-130413-1.

During the May 2020 sampling event, a groundwater sample was collected from each of the following wells:

- DEK-MW-15003
- DEK-MW-18001

Each sample was analyzed for one or more of the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate)	EPA 300.0
Total Dissolved Solids (TDS)	SM 2540C
Total Metals	SW-846 6020B/7470A
Alkalinity	SM 2320B
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, 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;
- Reporting limits (RLs) compared to project-required RLs;
- 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;
- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs 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 performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Percent recoveries for carriers for radiochemistry only. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- 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.

It should be noted that results for method blanks and laboratory control samples were not provided for review by CE Laboratory Services. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for the metals, anions, alkalinity, and TDS analyses.

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.

- The reviewed Appendix III and IV constituents as well as iron, copper, nickel, silver, vanadium, and zinc will be utilized for the purposes of a detection or assessment monitoring program.
- Data are usable for the purposes of the detection or assessment monitoring program.
- When the data are evaluated through a detection or 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 for radium; target analytes were not detected in the method blank samples.
- An equipment blank was not collected in this data set.
- A field blank was not collected in this data set.
- The LCS and LCSD recoveries and relative percent differences (RPDs) for radium-226 analysis were within QC limits. The RPDs for radium-228 were within QC limits. Radium-228 recovered above the upper acceptance limit in LCSD 160-470952/2-A; no data are affected as radium-228 was not detected in the samples.

- MS and MSD analyses were performed on sample DEK-MW-18001 for metals, anions, and alkalinity. The recoveries were within the acceptance limits. RPDs were not provided by the laboratory and therefore were not evaluated; further, MS/MSD concentrations were not provided by the laboratory. However, since all recoveries were within the acceptance limits, there is no impact on data usability due to this issue.
- A field duplicate pair was not collected in this data set.
- Laboratory duplicate analyses were not performed on a sample from this data set.
- Samples did not undergo a 21-day wait period prior to radium-226 analysis; however, combined radium results were < 5 pCi/L so there is no impact on data usability.
- Carrier recoveries, where applicable, were within 40-110%.

Laboratory Data Quality Review
Groundwater Monitoring Event May 2020
CEC DE Karn Bottom Ash Pond

Groundwater samples were collected by TRC for the May 2020 sampling event. Samples were analyzed for total and dissolved metals, anions, total dissolved solids, alkalinity, phosphorus, and ammonia by Consumers Energy (CE) Laboratory Services in Jackson, Michigan and subcontracted to Brighton Analytical (BA) for total and dissolved organic carbon. The laboratory analytical results were reported in laboratory sample delivery groups (SDGs) 20-0496 and 65105. Samples were analyzed for radium-226, 228 and combined radium by Eurofins TA in St. Louis, Missouri (Eurofins TA – St. Louis). The laboratory analytical results were reported in SDG 240-130413-1.

During the May 2020 sampling event, a groundwater sample was collected from each of the following wells:

- DEK-MW-15002
- DEK-MW-15004
- DEK-MW-15005
- DEK-MW-15006

Each sample was analyzed for one or more of the following constituents:

Analyte Group	Method
Anions (Fluoride, Chloride, Sulfate, Nitrate, Nitrite)	EPA 300.0
Total Dissolved Solids (TDS)	SM 2540C
Total Metals	SW-846 6020B/ 7470A
Dissolved Metals	SW-846 6020B
Alkalinity	SM 2320B
Total Phosphorus	SM 4500-P, B5-E
Ammonia	SM 4500 NH3
Total and Dissolved Organic Carbon (TOC/DOC)	SM 5310B
Radium (Radium-226, Radium-228, Combined Radium)	EPA 903.0, 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;
- Reporting limits (RLs) compared to project-required RLs;
- 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;
- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs 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 performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Percent recoveries for carriers for radiochemistry only. Carriers are used to assess the chemical yield for the preparation and/or instrument efficiency;
- 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.

It should be noted that results for method blanks and laboratory control samples were not provided for review by CE Laboratory Services. Therefore, potential contamination arising from laboratory sample preparation and/or analytical procedures and the accuracy of the analytical method using a clean matrix could not be evaluated for the metals, anions, TDS, alkalinity, ammonia, and phosphorus analyses.

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.

- The reviewed Appendix III and IV constituents as well as iron, copper, nickel, silver, vanadium, zinc and other additional geochemistry parameters 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 for radium and TOC/DOC; target analytes were not detected in the method blank samples.
- One field blank (FB-04) was collected. Target analytes were not detected in the field blank.
- An equipment blank was not collected in this data set.
- The LCS and LCSD recoveries and/or relative percent differences (RPDs) of the TOC/DOC and radium-226 analyses were within QC limits. The RPDs for radium-228 were within QC limits. Radium-228 recovered above the upper acceptance limit in LCSD 160-470952/2-A and a potential high bias exists for all positive results for radium-228, as summarized in the attached table, Attachment 1. However, results for radium-228 are consistent with historical results. Therefore, data usability is not affected.
- MS and MSD analyses were not performed on a sample from this data set.
- The field duplicate pair samples were DUP-04 and DEK-MW-15005; all criteria between the parent and duplicate sample were within the QC limits.
- Laboratory duplicate analyses were not performed on a sample from this data set.
- Samples did not undergo a 21-day wait period prior to radium-226 analysis; however, combined radium results were < 5 pCi/L so there is no impact on data usability.
- Carrier recoveries, where applicable, were within 40-110%.

Attachment 1

Summary of Data Non-Conformances for Groundwater Analytical Data
DE Karn Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
DEK-MW-15005	5/13/2020	Radium-228	Laboratory Control Sample Duplicate (LCSD) recovery excceds upper acceptance limit; indicates potential high bias in radium-228 results. However, results were consistent with historical results; therefore, data usability is not affected.
DEK-MW-15006	5/13/2020		

Attachment B
Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event

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Technical Memorandum

Date: July 15, 2020

To: J.R. Register, Consumers Energy

From: Darby Litz, TRC
Kristin Lowery, TRC

Project No.: 367388.0001 Phase 003, Task 002

Subject: Statistical Evaluation of May 2020 Assessment Monitoring Sampling Event
DE Karn Bottom Ash Pond, Consumers Energy Company, Essexville, Michigan

During the statistical evaluation of the initial assessment monitoring event (May 2018), arsenic was present in one or more downgradient monitoring wells at statistically significant levels exceeding the Groundwater Protection Standards (GWPSs). Therefore, Consumers Energy Company (Consumers Energy) initiated an Assessment of Corrective Measures (ACM) within 90 days from when the Appendix IV exceedance was determined. The ACM was completed on September 11, 2019. Currently, Consumers Energy is continuing semiannual assessment monitoring in accordance with §257.95 of the CCR Rule 1 at the DE Karn Power Plant Bottom Ash Pond (Karn Bottom Ash Pond).

The first semiannual assessment monitoring event for 2020 was conducted on May 13 through May 14, 2020. In accordance with §257.95, the assessment monitoring data must be compared to GWPSs to determine whether or not Appendix IV constituents are detected at statistically significant levels above the GWPSs. GWPSs were established in accordance with §257.95(h), as detailed in the October 15, 2018 Groundwater Protection Standards technical memorandum, which was also included in the 2018 Annual Groundwater Monitoring Report (TRC, January 2019). The following narrative describes the methods employed and the results obtained. The Sanitas™ output files are included as an attachment.

The statistical evaluation of the fifth semiannual assessment monitoring event data indicate the following constituent is present at statistically significant levels exceeding the GWPS in downgradient monitoring wells at the Karn Bottom Ash Pond:

Constituent	GWPS	#Downgradient Wells Observed
Arsenic	21 ug/L	4 of 6

Arsenic at DEK-MW-18001 was not present at statistically significant levels in previous evaluations due to a wider confidence interval as a result of a limited dataset. The results of the assessment monitoring

[1] USEPA final rule for the regulation and management of Coal Combustion Residuals (CCR) under the Resource Conservation and Recovery Act (RCRA) published April 17, 2015, as amended per Phase One, Part One of the CCR Rule (83 FR 36435).

statistical evaluation for the other downgradient wells are consistent with the results of the previous assessment monitoring data statistical evaluations, indicating that arsenic is the only constituent present at concentrations above the GWPS. Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Assessment Monitoring Statistical Evaluation

The compliance well network at the Karn Bottom Ash Pond includes six wells encircling the unit (DEK-MW-15002 through DEK-MW-15006 and DEK-MW-18001). Former downgradient monitoring well DEK-MW-15001 was decommissioned on April 18, 2018 to allow for construction of the new Karn Lined Impoundment. DEK-MW-18001 was installed approximately 80 feet southeast of the former DEK-MW-15001 location to maintain the perimeter downgradient monitoring well network. Although DEK-MW-18001 is considered to be a replacement well, the data from the two wells are not being combined in the statistical analyses at this time as groundwater chemistry data at DEK-MW-18001 is not comparable to DEK-MW-15001. Therefore, the statistical analysis for DEK-MW-15001 terminates at the April 2018 sampling event and statistical analysis for DEK-MW-18001 commenced with the first semiannual assessment monitoring event for 2019, following the collection of the minimum of four independent sampling events.

Following the first semiannual assessment monitoring sampling event for 2020, compliance well data for the DEK BAP were evaluated in accordance with the Groundwater Statistical Evaluation Plan (Stats Plan) (TRC, October 2017). An assessment monitoring program was developed to evaluate concentrations of CCR constituents present in the uppermost aquifer relative to acceptable levels (i.e., GWPSs). To evaluate whether or not a GWPS exceedance is statistically significant, the difference in concentration observed at the downgradient wells during a given assessment monitoring event compared to the GWPS must be large enough, after accounting for variability in the sample data, that the result is unlikely to have occurred merely by chance. Consistent with the Unified Guidance 2, the preferred method for comparisons to a fixed standard are confidence limits. Based on the number of historical observations in the representative sample population, the population mean, the population standard deviation, and a selected confidence level (i.e., 99 percent), an upper and lower confidence limit is calculated. The true concentration, with 99 percent confidence, will fall between the lower and upper confidence limits.

The concentrations observed in the downgradient wells are deemed to be a statistically significant exceedance when the 99 percent lower confidence limit of the downgradient data exceeds the GWPS. If the confidence interval straddles the GWPS (i.e., the lower confidence level is below the GWPS, but the upper confidence level is above), the statistical test result indicates that there is insufficient confidence that the measured concentrations are different from the GWPS and thus no compelling evidence that the measured concentration is a result of a release from the CCR unit versus the inherent variability of the sample data. This statistical approach is consistent with the statistical methods for

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

assessment monitoring presented in §257.93(f) and (g). Statistical evaluation methodologies built into the CCR Rule, and numerous other federal rules, are key in determining whether or not individually measured data points represent a concentration increase over the baseline or a fixed standard (such as a GWPS in an assessment monitoring program).

For each detected Appendix IV constituent, the concentrations from each well were first compared directly to the GWPS, as shown on Table 1. Parameter-well combinations that included a direct exceedance of the GWPS within the past eight sampling events (May 2017 through May 2020) were retained for further analysis. Arsenic in each of the downgradient monitoring wells at the Bottom Ash Pond had individual results exceeding the GWPS. Lead was detected in DEK-MW-15006 during May 2018 at a concentration of 320 ug/L, which exceeds its GWPS. However, this is the only detection of lead in the Bottom Ash Pond wells during either baseline sampling or assessment monitoring. Sampling conducted in November 2018 did not confirm the lead detection. Therefore, the single detection was classified as an outlier per the Double Quantification Rule as outlined in the Stats Plan and the Unified Guidance. As a result, only arsenic was retained for evaluation in all downgradient monitoring wells. In DEK-MW-15003, beryllium, cobalt, and thallium reporting limits exceeded the GWPSs in April 2019 due to sample dilutions performed due to the nature of the sample matrix. Beryllium, cobalt, and thallium have historically been non-detect at this location and results from October 2019 confirmed that these constituents are not detected above the GWPSs. Therefore, the elevated reporting limits are treated as outliers and no statistical evaluation will be completed for these parameter-well combinations.

Groundwater data were then evaluated utilizing Sanitas™ statistical software. Sanitas™ is a software tool that is commercially available for performing statistical evaluation consistent with procedures outlined in the Unified Guidance. Within the Sanitas™ statistical program, confidence limits were selected to perform the statistical comparison of compliance data to a fixed standard. Parametric and non-parametric confidence intervals were calculated for each of the CCR Appendix IV constituents using a using a per test[3] 99 percent confidence level, i.e., a significance level (α) of 0.01. The following narrative describes the methods employed, the results obtained and the Sanitas™ output files are included as an attachment.

The statistical data evaluation included the following steps:

- Review of data quality checklists for the data sets;
- Graphical representation of the monitoring data as time versus concentration by well/constituent pair;
- Outlier testing of individual data points that appear from the graphical representations as potential outliers;
- Evaluation of visual trends apparent in the graphical representations for statistical significance;
- Evaluation of percentage of non-detects for each well/constituent pair;
- Distribution of the data; and

[3] Confidence level is assessed for each individual comparison (i.e. per well and per constituent).

- Calculation of the confidence intervals for each cumulative dataset.

The results of these evaluations are presented and discussed below.

Data from each round were evaluated for completeness, overall quality, and usability and were deemed appropriate for the purposes of the CCR assessment monitoring program. Initially, the baseline (December 2015 through August 2017) results and the assessment monitoring results (April 2018 through May 2020) were observed visually for potential trends. No outliers were identified. Arsenic concentrations at DEK-MW-15002, DEK-MW-15003, and DEK-MW-18001 appear to exhibit a downward trend on the time-series chart (Attachment 1). These data sets were tested further in Sanitas™ utilizing Sen's Slope to estimate the average rate of change in concentration over time and utilizing the Mann-Kendall trend test to test for significance of the trend at the 98% confidence level. The trend tests showed that arsenic concentrations are generally decreasing with time, as evidenced by the negative Sen's Slope, and that the downward trend of arsenic at DEK-MW-18002 is statistically significant (Attachment 1). The decreases in arsenic concentrations at DEK-MW-15002, DEK-MW-15003, and DEK-MW-18001 are causing the confidence intervals to widen. Calculating a confidence interval around a trending data set incorporates not only variability present naturally in the underlying dataset, but also incorporates variability due to the trend itself. Arsenic concentrations have already triggered assessment monitoring (e.g., not a newly identified GWPS exceedance) and an interim measure has been initiated through the removal of CCR from the bottom ash pond in 2019; therefore, traditional confidence interval calculations are presented in this statistical evaluation until more post-CCR removal data are available. Once additional post-CCR removal data are collected, confidence bands may be a more appropriate assessment to determine compliance with the CCR Rule. Confidence bands are selected by the UG as the appropriate method for calculating confidence intervals on trending data. A confidence band calculates upper and lower confidence limits at each point along the trend to reduce variability and create a narrower confidence interval. At least 8 to 10 measurements should be available when computing a confidence band around a linear regression.

The Sanitas™ software was used to test compliance at the downgradient monitoring wells using the confidence interval method for the most recent 8 sampling events, with the exception of DEK-MW-18001, for which only five independent assessment monitoring sampling events have been completed. Eight independent sampling events provide the appropriate density of data as recommended per the UG yet are collected recently enough to provide an indication of current condition. The tests were run with a per-test significance of $\alpha = 0.01$. The software outputs are included in Attachment 1 along with data reports showing the values used for the evaluation. The percentage of non-detect observations for well/constituent pairs with a direct GWPS exceedance are also included in Attachment 1. Non-detect data was handled in accordance with the Stats Plan for the purposes of calculating the confidence intervals. Note that, as mentioned above, the statistical analysis for DEK-MW-15001 terminates at the April 2018 sampling event as it was decommissioned on April 18, 2018, and statistical analysis for DEK-MW-18001 commenced with the first semiannual sampling event for 2019.

The Sanitas™ software generates an output graph for the confidence intervals of each well. The data sets were found to be normally distributed with the exception of DEK-MW-15005, which used a non-parametric confidence interval due to non-normal data set, and DEK-MW-18001, which was normalized using a square root transformation. The confidence interval test compares the lower confidence limit to the GWPS. The statistical evaluation of the Appendix IV parameters shows exceedances for arsenic at

four of the six monitoring locations (DEK-MW-15003 through DEK-MW-15005 and DEK-MW-18001). Arsenic was not present at DEK-MW-18001 at a statistically significant level in the statistical evaluation of the October 2019 data. The limited dataset (4 events) used in the October 2019 statistical evaluation resulted in a wider confidence interval and as a result, the lower confidence limit was below the GWPS. As more data is collected, the confidence interval has narrowed, and the lower confidence limit is above the GWPS. The results of the assessment monitoring statistical evaluation for the other downgradient wells are consistent with the results of the previous assessment monitoring data statistical evaluations, indicating that arsenic is the only constituent present at concentrations above the GWPS. Consumers Energy will continue to evaluate corrective measures per §257.96 and §257.97. Consumers Energy will continue executing the self-implementing groundwater compliance schedule in conformance with §257.90 - §257.98.

Attachments:

Table 1 Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to May 2020

Attachment 1 Sanitas™ Output Files

Table

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2020
DE Karn Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	DEK-MW-15001[1]									
						Sample Date:	12/10/2015	3/30/2016	5/26/2016	8/24/2016	12/1/2016	2/23/2017	5/18/2017	8/3/2017	9/18/2017	4/10/2018
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient									
Appendix III																
Boron	ug/L	NC	NA	619	NA		3,630	2,420	3,110	2,810	2,740	2,520	3,270	2,690	2,700	--
Calcium	mg/L	NC	NA	302	NA		108	87.8	92.2	95	75.1	96.8	85.8	71.8	82.4	--
Chloride	mg/L	250*	NA	2,440	NA		75.7	79.0	75.7	72.5	71.0	76.5	75.0	81.9	82.2	--
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	1,530	1,440	1,160	1,500	1,650	1,330	1,700	2,100	1,600
Sulfate	mg/L	250*	NA	407	NA		72.4	53.3	64.9	37.4	52.7	53.4	59.9	66.3	36.2	--
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		600	470	510	480	470	450	510	516	594	--
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		7.6	7.5	7.5	7.4	7.4	7.4	7.4	7.6	7.5	7.3
Appendix IV																
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0
Arsenic	ug/L	10	NA	21	**21**		**118**	**159**	**138**	**108**	**144**	**133**	**145**	**158**	--	**103**
Barium	ug/L	2,000	NA	1,300	2,000		114	69	73	100	98	91	95	94.2	--	117
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20
Chromium	ug/L	100	NA	3	100		< 1	1	< 1	< 1	< 1	< 1	1	< 1.0	--	< 1.0
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	1,530	1,440	1,160	1,500	1,650	1,330	1,700	2,100	1,600
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0
Lithium	ug/L	NC	40	180	180		71.9	48.7	51	55	52	48	55	53	--	61
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20
Molybdenum	ug/L	NC	100	6	100		< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5.0	--	< 5.0
Radium-226	pCi/L	NC	NA	NA	NA		< 0.297	0.244	0.240	< 0.195	< 0.292	0.565	< 0.315	< 0.934	--	< 0.686
Radium-228	pCi/L	NC	NA	NA	NA		0.909	1.32	0.639	< 0.509	< 0.405	0.642	1.20	< 0.770	--	1.08
Radium-226/228	pCi/L	5	NA	3.32	5		1.181	1.564	0.879	< 0.509	< 0.405	1.207	1.29	< 1.70	--	< 1.42
Selenium	ug/L	50	NA	2	50		4	3	3	1	2	< 1	< 1	< 1.0	--	1.2
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 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.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) DEK-MW-15001 was decommissioned on April 18, 2018.
(2) Outlier; single detection above reporting limit.
(3) Laboratory reporting limits exceeds GWPS due to sample dilutions performed as a result of the sample matrix.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2020
DE Karn Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	DEK-MW-15002													
						Sample Date:	12/10/2015	3/30/2016	5/26/2016	8/24/2016	12/1/2016	2/23/2017	5/18/2017	8/3/2017	9/18/2017	4/12/2018	5/23/2018	11/5/2018	4/11/2019	10/15/2019	5/13/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient														
Appendix III																					
Boron	ug/L	NC	NA	619	NA		780	676	668	746	893	858	824	805	870	--	967	894	860	1,600	1,390
Calcium	mg/L	NC	NA	302	NA		102	119	99.6	105	94.8	149	80.1	71.1	66.9	--	53.7	67.8	72	130	170
Chloride	mg/L	250*	NA	2,440	NA		83.5	97.6	90.0	89.2	86.1	88.2	80.5	87.8	84.9	--	79.7	83.5	80	410	130
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	407	NA		275	418	291	384	326	289	299	256	290	--	263	77.2	45	150	367
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		790	890	800	1,700	810	810	1,500	696	722	--	660	536	560	1,300	1,100
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		7.8	7.5	7.6	7.5	7.6	7.5	7.5	7.8	7.9	7.5	8.0	7.3	7.5	7.3	7.1
Appendix IV																					
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**		**61**	**118**	**82**	**79**	**54**	**62**	**76**	**48.3**	--	**56.4**	**67.0**	**31.7**	9.0	6.5	3
Barium	ug/L	2,000	NA	1,300	2,000		140	148	136	131	121	120	107	96.1	--	82.7	84.5	71.6	71	140	196
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100		1	2	1	< 1	1	2	2	< 1.0	--	< 1.0	< 1.0	1.4	1.3	< 1.0	< 1
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 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	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	3	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180		50.7	53	43	44	40	41	42	36	--	43	35	32	26	35	48
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	100		19	30	29	41	26	27	38	27.7	--	30.8	35.4	< 5.0	< 5.0	< 5.0	< 5
Radium-226	pCi/L	NC	NA	NA	NA		< 0.301	0.301	0.314	0.513	0.255	0.68	0.321	< 0.854	--	< 0.478	< 0.698	< 0.850	< 0.376	0.334	0.673
Radium-228	pCi/L	NC	NA	NA	NA		0.809	0.645	1.26	0.908	0.547	0.844	0.929	1.17	--	1.16	< 0.744	0.730	0.684	0.654	< 0.763
Radium-226/228	pCi/L	5	NA	3.32	5		1.067	0.946	1.574	1.421	0.802	1.524	1.25	1.88	--	1.42	< 1.44	< 1.39	0.846	0.987	0.899
Selenium	ug/L	50	NA	2	50		< 1	< 1	2	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2

Notes:
ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) DEK-MW-15001 was decommissioned on April 18, 2018.
(2) Outlier; single detection above reporting limit.
(3) Laboratory reporting limits exceeds GWPS due to sample dilutions performed as a result of the sample matrix.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2020
DE Karn Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Sample Location:	DEK-MW-15003													
						Sample Date:	12/10/2015	3/30/2016	5/26/2016	8/24/2016	12/1/2016	2/23/2017	5/18/2017	8/4/2017	9/18/2017	4/12/2018	5/23/2018	11/6/2018	4/11/2019	10/15/2019	5/14/2020
							downgradient														
Appendix III																				
Boron	ug/L	NC	NA	619	NA		1,020	920	982	1,010	1,140	1,090	1,270	1,160	1,030	--	1,010	944	960	1,100	739
Calcium	mg/L	NC	NA	302	NA		41.7	57.3	56.3	64.1	64.1	85.4	68.2	58.8	62.1	--	58.1	62.9	52	39	26.9
Chloride	mg/L	250*	NA	2,440	NA		63.8	62.0	61.2	59.8	54.8	56.3	54.9	61.7	60.2	--	57.2	61.7	58	58	47.9
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	407	NA		64.3	71.6	75.7	76.8	71.9	64.5	57.6	55.8	54.3	--	39.1	37.8	47	52	55.6
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		370	400	420	430	440	430	420	506	426	--	354	370	360	330	271
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		8.4	7.8	7.9	7.7	7.8	7.7	7.8	7.9	7.9	7.8	8.2	8.0	8.0	7.9	8.45
Appendix IV																				
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	1
Arsenic	ug/L	10	NA	21	**21**		**498**	**517**	**543**	**527**	**525**	**372**	**450**	**437**	--	**478**	**450**	**420**	**380**	**420**	**365**
Barium	ug/L	2,000	NA	1,300	2,000		96	69	68	73	71	71	66	68.5	--	61.2	73.3	70.9	62	58	40
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 5.0 (3)	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 1.0	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100		2	2	2	< 1	< 1	< 1	1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 30 (3)	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 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	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180		22.8	22.6	26	27	30	30	35	35	--	39	33	33	28	29	18
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	100		8	7	8	6	5	5	5	5.0	--	< 5.0	5.3	5.2	< 25	28	52
Radium-226	pCi/L	NC	NA	NA	NA		< 0.221	< 0.227	< 0.235	< 0.184	< 0.287	0.252	< 0.324	0.226	--	0.686	< 0.842	< 0.661	< 0.424	< 0.150	< 0.271
Radium-228	pCi/L	NC	NA	NA	NA		< 0.473	< 0.52	< 0.546	0.423	< 0.363	< 0.34	< 0.646	< 0.936	--	< 0.755	1.12	< 0.789	< 0.495	< 0.449	< 0.468
Radium-226/228	pCi/L	5	NA	3.32	5		< 0.473	< 0.52	< 0.546	0.469	< 0.363	< 0.34	< 0.646	< 1.14	--	< 1.33	1.63	< 1.45	< 0.495	< 0.449	0.565
Selenium	ug/L	50	NA	2	50		< 5	< 1	2	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 5.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 10 (3)	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) DEK-MW-15001 was decommissioned on April 18, 2018.
(2) Outlier; single detection above reporting limit.
(3) Laboratory reporting limits exceeds GWPS due to sample dilutions performed as a result of the sample matrix.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2020
DE Karn Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Sample Location:	DEK-MW-15004															
						Sample Date:	12/10/2015	3/30/2016	5/26/2016	8/24/2016	12/1/2016	2/23/2017	5/18/2017	8/3/2017	8/3/2017	9/19/2017	9/19/2017	4/12/2018	5/23/2018	5/23/2018	11/6/2018	4/11/2019	10/15/2019	5/14/2020
							downgradient																	
Appendix III															Field Dup		Field Dup			Field Dup				
Boron	ug/L	NC	NA	619	NA		478	435	514	472	535	637	839	785	768	730	750	--	800	842	910	840	540	795
Calcium	mg/L	NC	NA	302	NA		61.7	68.3	71.1	78.9	73	108	74.2	67.4	68.1	66.5	67.9	--	47.8	50.7	62.2	50	60	52.7
Chloride	mg/L	250*	NA	2,440	NA		71.5	72.7	72.3	77.4	73.3	75.3	70.3	81.4	81.5	79.8	79.9	--	72.5	72.6	70.6	63	77	66.6
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	1,550	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	1,100	1,100	1,100	1,100	1,140
Sulfate	mg/L	250*	NA	407	NA		213	188	184	198	215	211	220	258	261	283	281	--	176	178	168	150	160	125
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		680	560	560	580	590	580	590	642	582	596	564	--	494	504	482	490	530	509
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		8.0	7.7	7.4	7.4	7.5	7.5	7.5	7.6	--	7.3	--	7.3	7.7	--	7.4	7.1	7.4	7.8
Appendix IV																								
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**		**56**	**95**	**108**	**104**	**117**	**116**	**111**	**121**	**129**	--	--	**134**	**119**	**126**	**123**	**110**	**180**	**157**
Barium	ug/L	2,000	NA	1,300	2,000		107	94	102	110	115	110	103	111	115	--	--	86.9	79.6	82.6	95.1	77	99	96
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100		< 1	2	< 1	< 1	< 1	1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	< 15.0	--	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	1,550	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	1,200	1,100	1,100	1,100	1,100	1,100	1,140
Lead	ug/L	NC	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180		35.8	29.5	36	34	37	36	38	39	38	--	--	39	30	32	33	26	34	36
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	--	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	100		29	25	21	24	27	30	29	30.4	31.4	--	--	32.0	30.9	30.4	28.0	23	< 5.0	11
Radium-226	pCi/L	NC	NA	NA	NA		< 0.258	0.400	0.233	0.264	0.244	0.328	0.347	0.805	< 0.623	--	--	< 0.641	< 0.791	< 0.679	< 0.743	< 0.316	0.204	< 0.494
Radium-228	pCi/L	NC	NA	NA	NA		< 0.556	0.532	0.527	0.672	< 0.396	< 0.458	1.28	0.833	0.864	--	--	< 0.847	< 0.753	0.845	< 0.794	0.924	0.537	< 0.700
Radium-226/228	pCi/L	5	NA	3.32	5		< 0.556	0.932	0.76	0.936	0.588	0.665	1.63	1.64	< 1.46	--	--	< 1.49	< 1.54	1.29	< 1.54	1.07	0.741	< 0.700
Selenium	ug/L	50	NA	2	50		< 1	< 1	1	< 1	< 1	< 1	< 1	< 1.0	< 1.0	--	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	< 2.0	--	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
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Table 1
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DE Karn Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Sample Location:	DEK-MW-15005																	
						Sample Date:	12/10/2015	3/30/2016	5/26/2016	8/24/2016	12/1/2016	2/23/2017	5/18/2017	8/3/2017	9/18/2017	4/11/2018	4/11/2018	5/24/2018	11/6/2018	4/11/2019	4/11/2019	10/15/2019	10/15/2019	5/13/2020	5/13/2020
							downgradient										Field Dup				Field Dup		Field Dup		
Appendix III																								
Boron	ug/L	NC	NA	619	NA		410	396	465	589	687	712	788	792	714	--	--	806	947	910	910	700	650	863	858
Calcium	mg/L	NC	NA	302	NA		58.5	68.6	72.7	98.4	71.1	76.3	55	49.2	44.3	--	--	33.4	32.9	31	31	60	59	71.0	72.1
Chloride	mg/L	250*	NA	2,440	NA		77.9	82.6	82.3	93.9	80.1	77.5	73.3	81.4	79.3	--	--	72.6	69.1	60	60	64	64	48.0	47.5
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	407	NA		223	251	269	355	329	281	263	300	273	--	--	182	160	140	140	5.2	5.0	18.9	18.9
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		620	660	660	810	740	680	650	732	638	--	--	524	474	470	470	390	400	419	425
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		8.0	7.7	7.5	7.6	7.7	7.7	7.6	7.9	7.9	7.7	--	7.8	7.9	7.7	--	7.6	--	8.1	--
Appendix IV																								
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Arsenic	ug/L	10	NA	21	**21**		5	15	16	**23**	**29**	**29**	**28**	**31.9**	--	**28.3**	**29.1**	**31.7**	**35.0**	**24**	**24**	**120**	**120**	**34**	**34**
Barium	ug/L	2,000	NA	1,300	2,000		87	94	104	149	120	101	83	92.2	--	54.9	55.8	58.5	56.7	46	45	110	100	127	127
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Chromium	ug/L	100	NA	3	100		< 1	1	1	< 1	< 1	1	2	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 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	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Lithium	ug/L	NC	40	180	180		23.7	23	29	30	26	23	26	27	--	24	24	19	17	15	14	16	15	20	20
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2
Molybdenum	ug/L	NC	100	6	100		40	33	32	37	44	40	36	41.9	--	39.0	40.5	41.9	45.3	39	38	< 5.0	< 5.0	< 5	< 5
Radium-226	pCi/L	NC	NA	NA	NA		< 0.238	0.263	0.180	0.300	0.367	0.490	< 0.321	0.707	--	< 0.587	0.606	< 0.740	< 0.865	< 0.379	< 0.406	0.165	0.185	< 0.469	< 0.335
Radium-228	pCi/L	NC	NA	NA	NA		1.03	< 0.429	< 0.404	0.919	0.550	0.450	0.685	1.01	--	0.756	0.886	0.857	< 0.598	< 0.754	< 0.586	< 0.456	0.497	1.14	< 0.554
Radium-226/228	pCi/L	5	NA	3.32	5		1.197	0.686	0.458	1.219	0.917	0.940	0.875	1.72	--	< 1.34	1.49	< 1.53	< 1.46	< 0.754	< 0.586	0.524	0.682	1.34	0.662
Selenium	ug/L	50	NA	2	50		2	< 1	1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1	< 1
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) DEK-MW-15001 was decommissioned on April 18, 2018.
(2) Outlier; single detection above reporting limit.
(3) Laboratory reporting limits exceeds GWPS due to sample dilutions performed as a result of the sample matrix.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2020
DE Karn Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS	Sample Location:	DEK-MW-15006													
						Sample Date:	12/10/2015	3/30/2016	5/25/2016	8/24/2016	12/1/2016	2/23/2017	5/18/2017	8/3/2017	9/18/2017	4/11/2018	5/24/2018	11/5/2018	11/5/2018	4/11/2019	10/14/2019	5/13/2020
							downgradient												Field Dup			
Appendix III																						
Boron	ug/L	NC	NA	619	NA		1,070	706	942	979	1,230	1,120	1,420	1,240	1,070	--	1,200	1,340	1,270	1,700	1,200	1,090
Calcium	mg/L	NC	NA	302	NA		196	130	105	130	79.1	83.9	38.6	39.9	76.8	--	21.9	29.4	29.6	35	34	70.4
Chloride	mg/L	250*	NA	2,440	NA		153	152	135	188	128	102	97.1	104	133	--	85.8	87.9	88.3	75	45	71.5
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000	< 1,000
Sulfate	mg/L	250*	NA	407	NA		1,320	1,130	917	1,160	886	636	513	547	886	--	401	341	344	320	74	316
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		2,400	2,100	1,700	2,200	1,800	1,300	1,100	1,110	1,670	--	944	792	784	780	450	833
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		7.4	7.5	7.5	7.6	7.8	7.7	8.1	7.9	7.8	7.9	8.2	7.9	--	7.8	7.8	8.1
Appendix IV																						
Antimony	ug/L	6	NA	1	6		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3
Arsenic	ug/L	10	NA	21	**21**		13	19	18	20	20	20	20	14.6	--	18.3	**25.7**	20.9	19.6	21	**27**	21
Barium	ug/L	2,000	NA	1,300	2,000		97	55	44	58	41	30	27	31.0	--	39.6	22.8	38.5	38.3	43	51	86
Beryllium	ug/L	4	NA	1	4		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100		< 1	1	1	< 1	1	1	2	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	2
Cobalt	ug/L	NC	6	15	15		< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15.0	--	< 15.0	< 15.0	< 6.0	< 6.0	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	< 1,000	< 1,000	< 1,000	< 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	15	1	15		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1.0	--	< 1.0	320[(2)]	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180		36.1	20.7	22	22	19	16	16	17	--	18	< 10	< 10	10	< 10	11	15
Mercury	ug/L	2	NA	0.2	2		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.20	--	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	100		23	37	34	36	64	82	68	64.2	--	71.6	48.7	50.3	48.0	59	11	18
Radium-226	pCi/L	NC	NA	NA	NA		0.392	0.363	0.463	0.286	< 0.362	< 0.307	< 0.354	< 0.945	--	< 0.688	< 0.738	< 0.885	< 1.06	< 0.459	< 0.159	< 0.370
Radium-228	pCi/L	NC	NA	NA	NA		0.901	0.743	0.501	< 0.578	< 0.421	< 0.562	0.483	< 0.906	--	< 0.755	< 1.12	< 0.649	< 0.897	< 0.677	< 0.581	0.780
Radium-226/228	pCi/L	5	NA	3.32	5		1.293	1.106	0.964	0.748	< 0.421	< 0.562	0.585	< 1.85	--	< 1.44	< 1.86	< 1.53	< 1.96	< 0.677	< 0.581	1.01
Selenium	ug/L	50	NA	2	50		3	2	2	< 1	< 1	1	1	< 1.0	--	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2		< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2.0	--	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
* - Secondary Maximum Contaminant Level (SMCL), EPA Secondary Drinking Water Regulations (SDWR) April 2012.
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All metals were analyzed as total unless otherwise specified.
(1) DEK-MW-15001 was decommissioned on April 18, 2018.
(2) Outlier; single detection above reporting limit.
(3) Laboratory reporting limits exceeds GWPS due to sample dilutions performed as a result of the sample matrix.

Table 1
Comparison of Groundwater Sampling Results to Groundwater Protection Standards – December 2015 to April 2020
DE Karn Bottom Ash Pond – RCRA CCR Monitoring Program
Essexville, Michigan

						Sample Location:	DEK-MW-18001			
						Sample Date:	5/23/2018	11/6/2018	4/10/2019	10/15/2019	5/14/2020
Constituent	Unit	EPA MCL	EPA RSL	UTL	GWPS		downgradient				
Appendix III											
Boron	ug/L	NC	NA	619	NA		1,600	1,020	970	2,200	1,670
Calcium	mg/L	NC	NA	302	NA		64.9	51.1	48	84	72.1
Chloride	mg/L	250*	NA	2,440	NA		69.1	76.6	69	81	64.7
Fluoride	ug/L	4,000	NA	1,000	NA		< 1,000	1,300	1,200	1,000	1,090
Sulfate	mg/L	250*	NA	407	NA		30.6	< 2.0	< 2.0	31	51.1
Total Dissolved Solids	mg/L	500*	NA	4,600	NA		434	340	360	500	484
pH, Field	SU	6.5 - 8.5*	NA	6.5-7.3	NA		7.8	7.5	7.2	7.3	7.7
Appendix IV											
Antimony	ug/L	6	NA	1	6		< 1.0	< 1.0	< 1.0	< 1.0	< 1
Arsenic	ug/L	10	NA	21	**21**		**225**	**116**	**68**	**63**	**79**
Barium	ug/L	2,000	NA	1,300	2,000		101	79.5	75	160	130
Beryllium	ug/L	4	NA	1	4		< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cadmium	ug/L	5	NA	0.2	5		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Chromium	ug/L	100	NA	3	100		< 1.0	< 1.0	< 1.0	< 1.0	< 1
Cobalt	ug/L	NC	6	15	15		< 15.0	< 6.0	< 6.0	< 6.0	< 6
Fluoride	ug/L	4,000	NA	1,000	4,000		< 1,000	1,300	1,200	1,000	1,090
Lead	ug/L	NC	15	1	15		< 1.0	< 1.0	< 1.0	< 1.0	< 1
Lithium	ug/L	NC	40	180	180		23	24	24	36	27
Mercury	ug/L	2	NA	0.2	2		< 0.20	< 0.20	< 0.20	< 0.20	< 0.2
Molybdenum	ug/L	NC	100	6	100		< 5.0	< 5.0	< 5.0	< 5.0	< 5
Radium-226	pCi/L	NC	NA	NA	NA		0.906	< 0.813	0.173	0.206	< 0.608
Radium-228	pCi/L	NC	NA	NA	NA		< 0.733	0.811	0.694	0.746	< 0.676
Radium-226/228	pCi/L	5	NA	3.32	5		1.63	1.56	0.867	0.952	< 0.676
Selenium	ug/L	50	NA	2	50		< 1.0	< 1.0	< 1.0	< 1.0	< 1
Thallium	ug/L	2	NA	2	2		< 2.0	< 2.0	< 2.0	< 2.0	< 2

Notes:

ug/L - micrograms per liter.
mg/L - milligrams per liter.
SU - standard units; pH is a field parameter.
pCi/L - picocuries per liter.
NA - not applicable.
NC - no criteria.
-- - not analyzed.
MCL - Maximum Contaminant Level, EPA Drinking Water Standards and Health Advisories, April 2012.
RSL - Regional Screening Level from 83 FR 36435.
UTL - Upper Tolerance Limit (95%) of the background data set.
GWPS - Groundwater Protection Standard. GWPS is the higher of the MCL/RSL and UTL as established in TRC's Technical Memorandum dated October 15, 2018.
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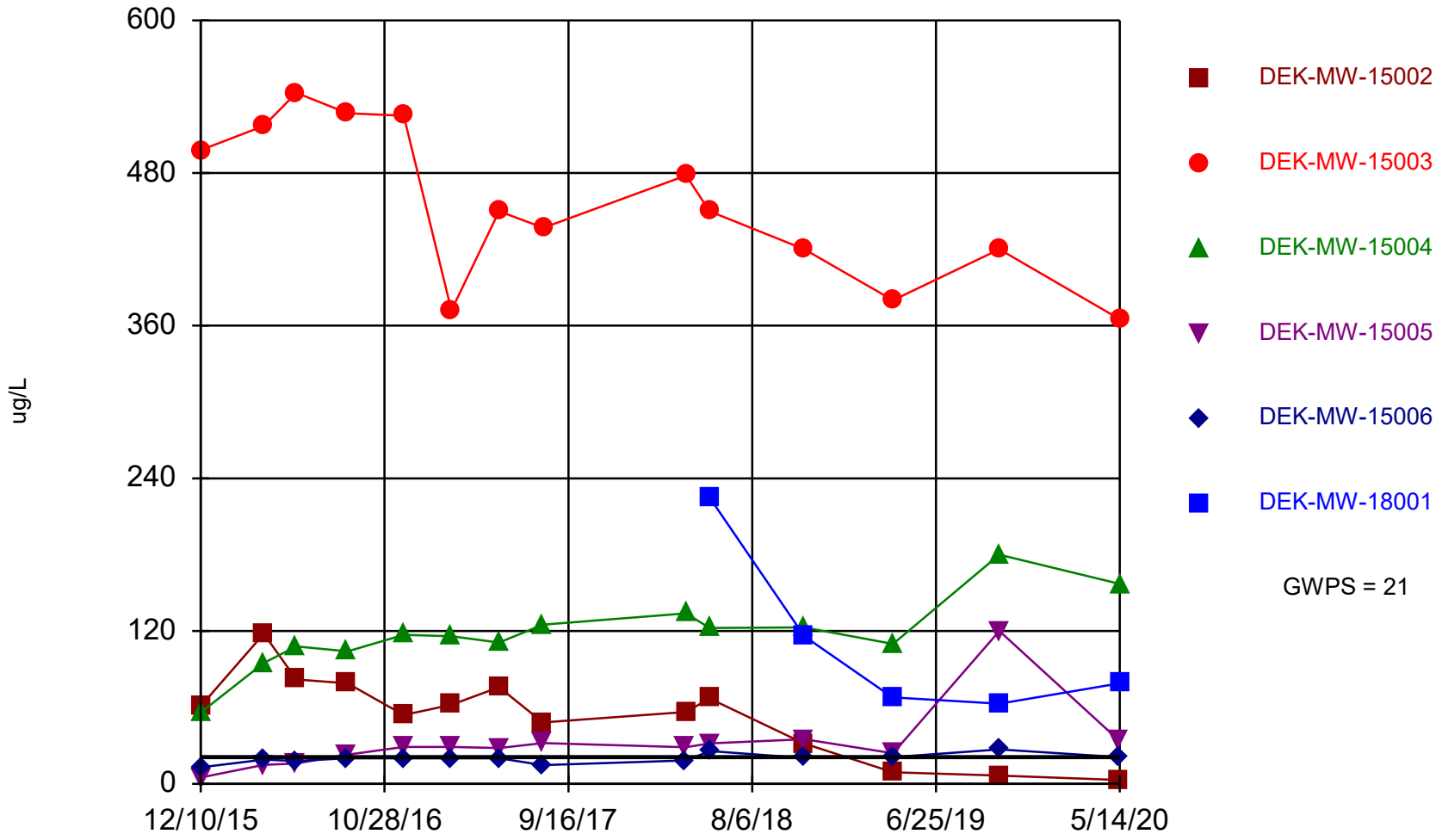
Bold value indicates an exceedance of the GWPS. Data from downgradient monitoring wells are screened against the GWPS for evaluation purposes only. Confidence intervals will be used to determine compliance per the CCR rules.
All metals were analyzed as total unless otherwise specified.
(1) DEK-MW-15001 was decommissioned on April 18, 2018.
(2) Outlier; single detection above reporting limit.
(3) Laboratory reporting limits exceeds GWPS due to sample dilutions performed as a result of the sample matrix.

Attachment 1
Sanitas™ Output Files

Arsenic, Total

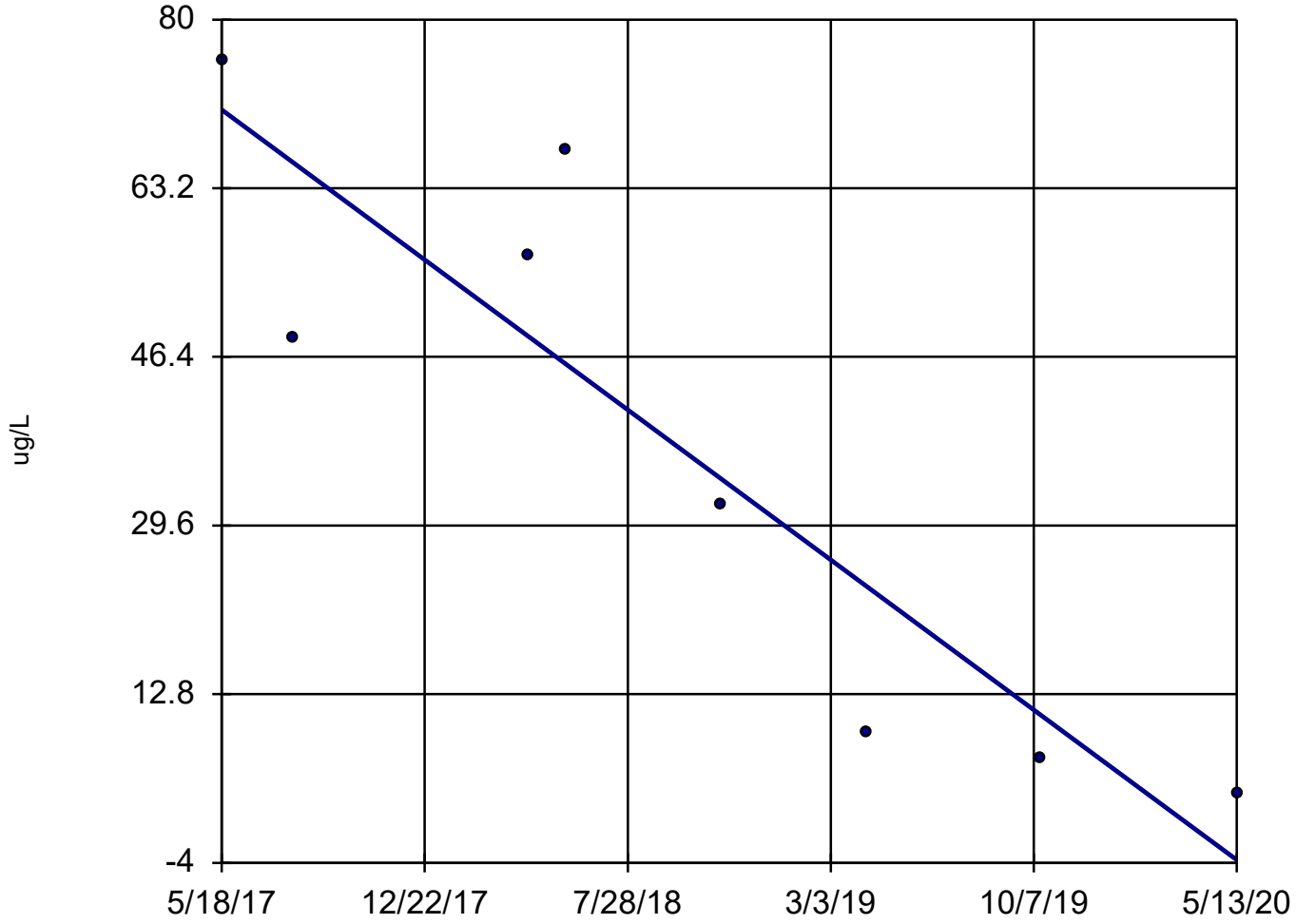


Time Series Analysis Run 6/24/2020 1:57 PM

Client: Consumers Energy Data: DEK_CCR_Sanitas_20.06.18

Arsenic, Total

DEK-MW-15002



n = 8

Slope = -25
units per year.

Mann-Kendall
statistic = -22
critical = -20

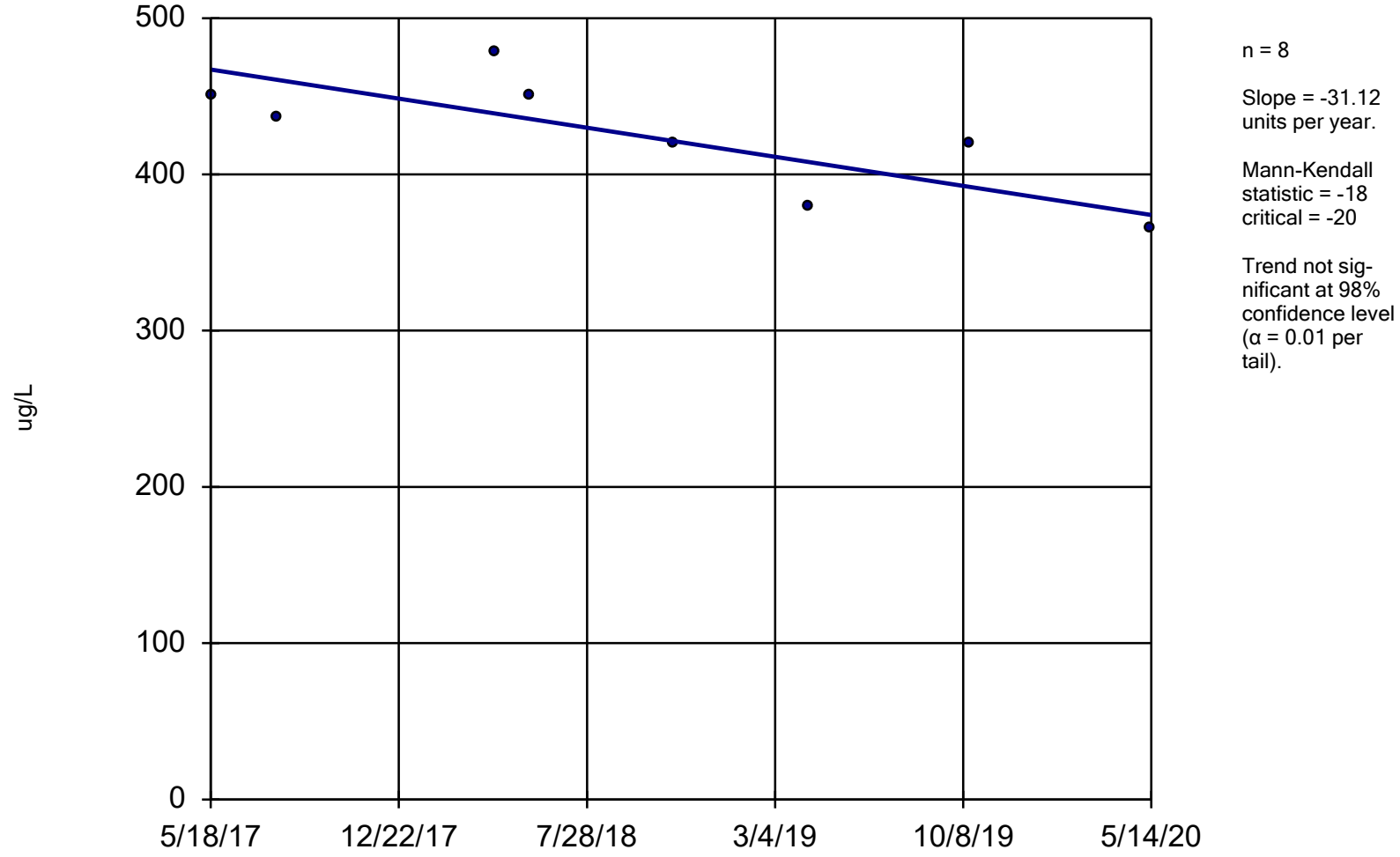
Decreasing trend
significant at 98%
confidence level
(α = 0.01 per
tail).

Sen's Slope Estimator Analysis Run 6/24/2020 2:00 PM

Client: Consumers Energy Data: DEK_CCR_Sanitas_20.06.18

Arsenic, Total

DEK-MW-15003



n = 8

Slope = -31.12 units per year.

Mann-Kendall statistic = -18
critical = -20

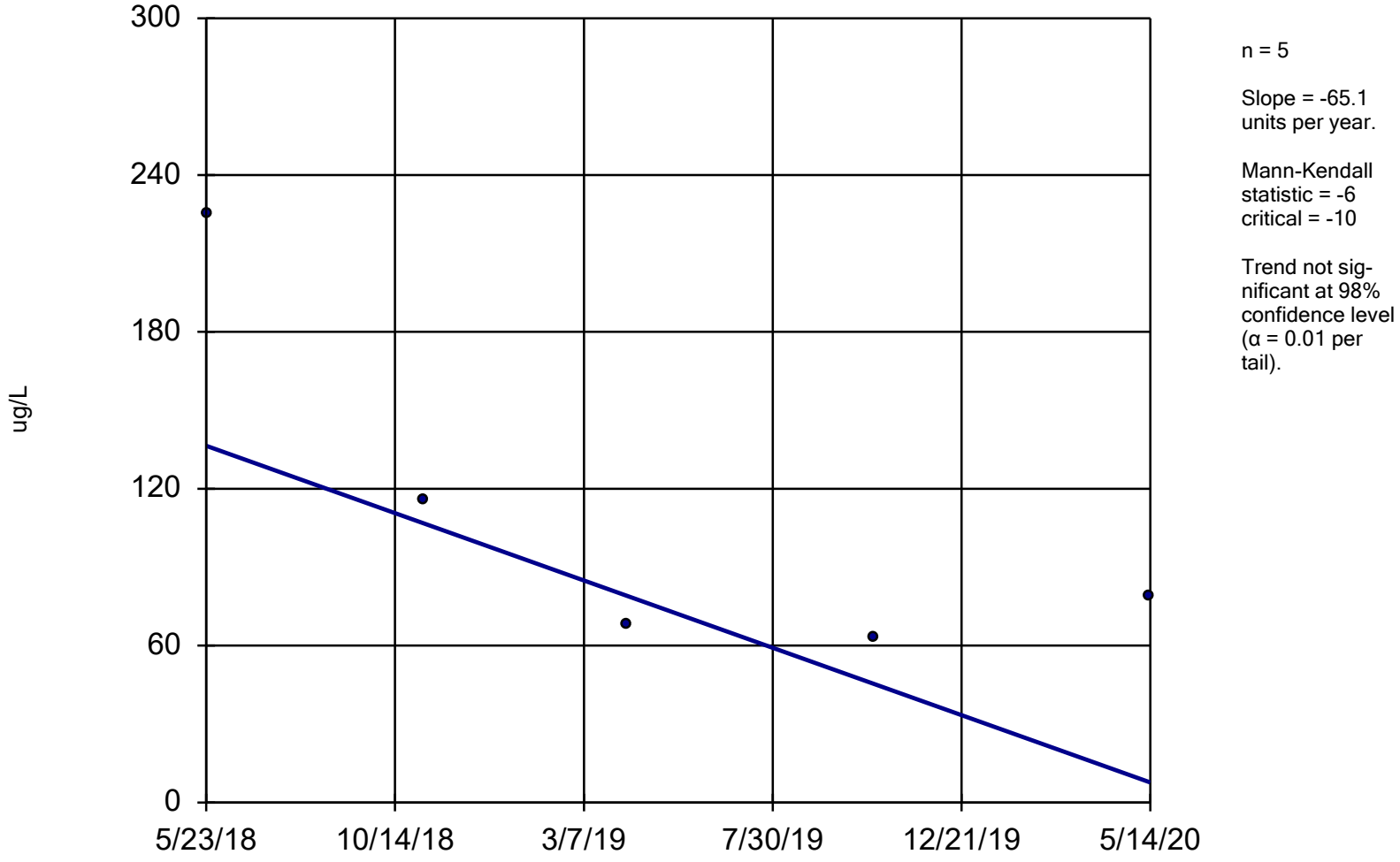
Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/24/2020 2:00 PM

Client: Consumers Energy Data: DEK_CCR_Sanitas_20.06.18

Arsenic, Total

DEK-MW-18001



n = 5

Slope = -65.1 units per year.

Mann-Kendall statistic = -6 critical = -10

Trend not significant at 98% confidence level (α = 0.01 per tail).

Sen's Slope Estimator Analysis Run 6/24/2020 2:00 PM

Client: Consumers Energy Data: DEK_CCR_Sanitas_20.06.18

Summary Report

Constituent: Arsenic, Total Analysis Run 6/24/2020 2:07 PM
Client: Consumers Energy Data: DEK_CCR_Sanitas_20.06.18

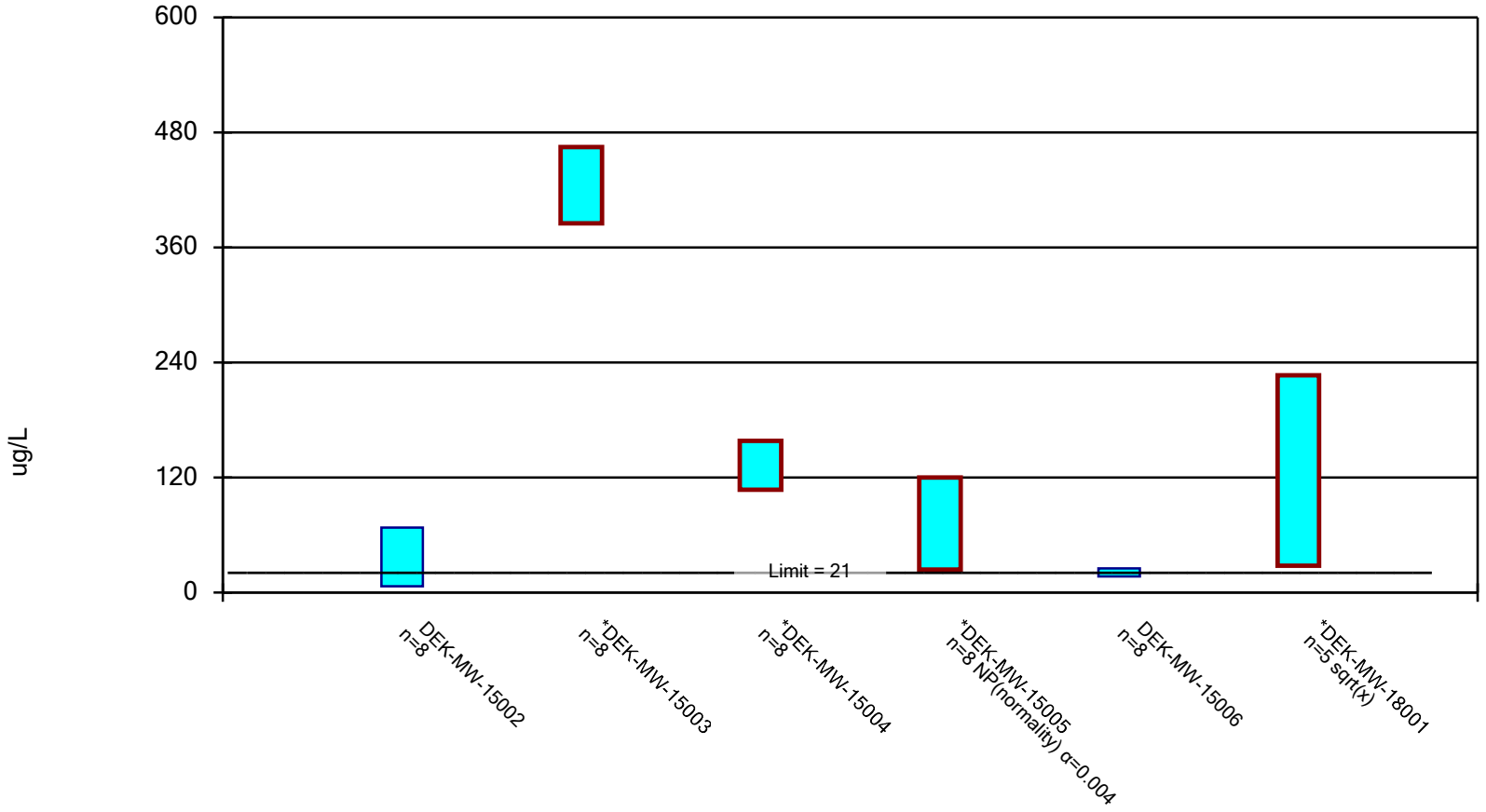
For observations made between 5/18/2017 and 5/14/2020, a summary of the selected data set:

Observations = 45
ND/Trace = 0
Wells = 6
Minimum Value = 3
Maximum Value = 478
Mean Value = 129.2
Median Value = 67
Standard Deviation = 148.5
Coefficient of Variation = 1.149
Skewness = 1.345

Well	#Obs.	ND/Trace	Min	Max	Mean	Median	Std.Dev.	CV	Skewness
DEK-MW-15002	8	0	3	76	37.24	40	28.84	0.7745	0.007236
DEK-MW-15003	8	0	365	478	425	428.5	37.57	0.08839	-0.3616
DEK-MW-15004	8	0	110	180	132.8	124	24.12	0.1816	1.028
DEK-MW-15005	8	0	24	120	41.66	31.8	31.85	0.7645	2.211
DEK-MW-15006	8	0	14.6	27	20.98	20.63	3.926	0.1871	0.1076
DEK-MW-18001	5	0	63	225	110.2	79	67.44	0.612	1.187

Parametric and Non-Parametric (NP) Confidence Interval

Compliance limit is exceeded.* Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Arsenic, Total Analysis Run 6/24/2020 2:04 PM

Client: Consumers Energy Data: DEK_CCR_Sanitas_20.06.18

Confidence Interval

Constituent: Arsenic, Total (ug/L) Analysis Run 6/24/2020 2:04 PM

Client: Consumers Energy Data: DEK_CCR_Sanitas_20.06.18

	DEK-MW-15002	DEK-MW-15003	DEK-MW-15004	DEK-MW-15005	DEK-MW-15006	DEK-MW-18001
5/18/2017	76	450	111	28	20	
8/3/2017	48.3		125 (D)	31.9	14.6	
8/4/2017		437				
4/11/2018				28.7 (D)	18.3	
4/12/2018	56.4	478	134			
5/23/2018	67	450	122.5 (D)			225
5/24/2018				31.7	25.7	
11/5/2018	31.7				20.25 (D)	
11/6/2018		420	123	35		116
4/10/2019						68
4/11/2019	9	380	110	24 (D)	21	
10/15/2019	6.5	420	180	120 (D)	27	63
5/13/2020	3			34 (D)	21	
5/14/2020		365	157			79
Mean	37.24	425	132.8	41.66	20.98	110.2
Std. Dev.	28.84	37.57	24.12	31.85	3.926	67.44
Upper Lim.	67.81	464.8	158.4	120	25.14	226.7
Lower Lim.	6.667	385.2	107.2	24	16.82	27.9