

Valmont Station CCR Landfill and Surface Impoundments

Notification of Statistically Significant Levels over Groundwater Protections Standards

Public Service Company of Colorado (PSCo), an Xcel Energy Company, is the owner of Valmont Station which historically was a coal-fired, steam turbine electric generating station and is subject to requirements of the Disposal of Coal Combustion Residuals from Electrical Utilities Rule (Federal CCR Rule), finalized on April 17, 2015. The station was retired from operations on September 30, 2017. During the active coal operations, two incised CCR impoundments (3A and 3B) were used for temporary storage of bottom ash prior to disposal at the onsite CCR landfill. Both CCR impoundments ceased receiving CCR in 2017, and were closed in 2018 by removal of all CCR pursuant to 40 CFR Part 257.102(c) of the CCR Rule. The CCR landfill will continue to be used for disposal of non-CCR waste, and is scheduled to be closed in 2021. A Written Closure Plan has been prepared for the CCR landfill which includes installation of a CCR compliant final cover (HDR, 2017).

Protecting the environment is a core value for Xcel Energy

PSCo conducts all of its business in an environmentally responsible manner which includes regularly monitoring operations and taking steps to protect air, water and other natural resources. Pursuant to 257.95(g), PSCo has made a determination that one or more constituents listed in Appendix IV have been detected at Statistically Significant Levels (SSLs) above the Groundwater Protection Standards (GPS) established for the site pursuant to 257.95(h). The attached memo, Valmont Station Groundwater Protection Standards and Determination of SSLs, establishes the GPS for each Appendix IV constituent that was detected in groundwater at the site and identifies those constituents for which SSLs above the GPS have been determined. These results do not indicate there is any impact on local drinking water. The monitoring wells evaluate groundwater immediately adjacent to the CCR units, and measure groundwater conditions within the Valmont Station property boundary. PSCo will continue to monitor groundwater at the site in accordance with the assessment monitoring program as specified in 257.95.

Memo

Date October 10, 2018

To: Jennifer McCarter, Public Service Company of Colorado

From: Matt Rohr, HDR, Inc.

Valmont Station CCR Units
Subject: Groundwater Protection Standards and Determination of SSLs per 257.95(g)

1.0 Introduction

The U.S. Environmental Protection Agency's (EPA's) final Coal Combustion Residuals (CCR) Rule establishes a comprehensive set of requirements for the management and disposal of CCR (or coal ash) in landfills and surface impoundments by electric utilities. Valmont Station, located in Boulder County, Colorado, has three existing CCR units subject to the CCR Rule: the ash landfill and two incised bottom ash impoundments. The two CCR impoundments have undergone closure by removal of CCR. All CCR and all areas affected by releases of CCR have been removed from the impoundments.

The objective of this memorandum is to document the groundwater protection standard (GPS) concentrations for each constituent of interest (COI) for the CCR facilities and evaluate if the concentration of detected Appendix IV constituents in groundwater from assessment monitoring were present at statistically significant levels (SSLs) over the GPS. At Valmont, groundwater monitoring has been conducted to collect eight rounds of background sampling plus the initial detection monitoring (completed before October 17, 2017) as specified under CCR Rule Part 257.94. The water quality data collected from monitoring wells located upgradient of the CCR facilities has been compiled and statistically analyzed to develop background values for each COI at each CCR facility. In addition, assessment monitoring has been initiated at the landfill and the impoundments.

CCR Rule 257.95(d)(2) requires that after results have been obtained from the initial and subsequent assessment monitoring sampling events, the owner must establish groundwater protection standards for all constituents detected during those events and that the groundwater protection standards must be established in accordance with paragraph (h) of the CCR Rule 257.95.

CCR Rule 257.95(h) describes that a groundwater protection standard must be established for each constituent in appendix IV detected in the groundwater. The groundwater protection standard shall be:

- (1) the maximum contaminant level (MCL) for that constituent;
- (2) for constituents for which an MCL has not been established, the background concentration for the constituent established from background wells; or,
- (3) For constituents for which the background level is higher than the MCL, the background concentration.

2.0 GPS for the Landfill

As stipulated in CCR Rule 257.95(b), an initial assessment monitoring event was completed in February 2018 to sample all of the monitoring wells around the landfill CCR facility for Appendix IV constituents. **Table 1** lists the constituents in Appendices III and IV of CCR Rule Part 257.

Table 1. Groundwater quality constituents	
Appendix III Constituents for Detection Monitoring	Appendix IV Constituents for Assessment Monitoring
Boron	Antimony
Calcium	Arsenic
Chloride	Barium
Fluoride	Beryllium
pH	Cadmium
Sulfate	Chromium
Total Dissolved Solids (TDS)	Cobalt
Additional Constituents	Fluoride
Total Suspended Solids (TSS)	Lead
	Lithium
	Mercury
	Molybdenum
	Selenium
	Thallium
	Radium-226 and -228 combined

EPA's Unified Guidance has recommended that the UTL be used as a fixed value similar to a groundwater protection standard where an MCL does not exist for the constituent at the location (USEPA, 2009). The upper tolerance limits (UTLs) for Appendix IV constituents are displayed in **Table 2**. The UTL was established based on the eight background sample events at the upgradient monitoring well (MW-7). The UTLs serve as the background values for assessment monitoring.

Table 2. Upper Tolerance Limits (UTL) with 95% coverage and 95% confidence for Appendix IV constituent for Valmont Landfill (Assessment Monitoring Background Value)

Constituent	Unit	N	No BDL	% BDL	Statistical Method ¹	UTL	Notes
Appendix IV Constituents							
Antimony	mg/l	8	0	0	Parametric	0.0230	
Arsenic	mg/l	8	0	0	Nonparametric	0.00700	****
Barium	mg/l	8	0	0	Nonparametric	0.110	****
Beryllium	mg/l	8	5	62.5	Parametric	0.00100	**
Cadmium	mg/l	8	3	37.5	Parametric	0.0310	
Chromium, Total	mg/l	8	0	0	Parametric	0.0880	
Cobalt	mg/l	8	0	0	Parametric	0.00800	
Lead	mg/l	8	0	0	Parametric	0.0230	
Lithium	mg/l	8	0	0	Nonparametric	0.0830	****
Mercury	mg/l	8	7	87.5	Maximum	0	**
Molybdenum	mg/l	8	0	0	Nonparametric	0.0280	****
Selenium	mg/l	8	0	0	Parametric	0.0200	
Thallium	mg/l	8	6	75	Nonparametric	0	**
Radium-226/228	pci/l	8	1	12.5	Parametric	4.55	

DQR - Double Quantification Rule: for the 100 percent ND groups, the Unified Guidance (pages 6-11) recommends a confirmed exceedance is registered if any well-constituent pair in the '100% non-detect' group exhibits quantified measurements in two consecutive sample and resample events'. For the application of this rule, observations detected above the MDL are deemed to be quantified measurements.

¹Best fit is based on detected data.

Notes: **Data set is too small to compute reliable and meaningful statistics and estimates. Recommend maximum detected value as the upper tolerance limit until more samples can be calculated. ***All observations are NDs. Recommend the double quantification rule (**DQR**). ****Upper Tolerance Limits with 85% Coverage and 95% Confidence due to nonparametric data with sample size < 59.

Results from the initial assessment monitoring sample event identified the detected Appendix IV constituents. All Appendix IV constituents were detected in at least one well with the exception of antimony, mercury, and thallium. Therefore GPS are established for all Appendix IV COIs except for antimony, mercury, and thallium.

In accordance with CCR Rule 257.95(h), GPS were established for each detected Appendix IV COI. For each detected COI, Table 3 lists the EPA established MCL from 40 CFR 141.62 and 141.66, the assessment monitoring background values for the Valmont landfill, and the GPS. The GPS for each COI is the higher of the two: MCL or background value. There are four COIs that do not have established MCLs (cobalt, lead, lithium, and molybdenum); however in the July 17, 2018 CCR Rule Amendment EPA adopted health-based concentrations as the GPS for the four Appendix IV constituents without a designated MCL. These concentrations are listed in the MCL column of Table 3.

Table 3. Groundwater Protection Standards for Detected Appendix IV constituents for Valmont Landfill				
Constituent	Unit	MCL	Background Value (UTL)	GPS
Fluoride	mg/l	4.00	0.787	4.00
Arsenic	mg/l	0.0100	0.00700	0.0100
Barium	mg/l	2.00	0.110	2.00
Beryllium	mg/l	0.00400	0.000720	0.00400
Cadmium	mg/l	0.00500	0.0310	0.0310
Chromium, Total	mg/l	0.100	0.0876	0.100
Cobalt	mg/l	0.00600*	0.00795	0.00795
Lead	mg/l	0.0150*	0.0228	0.0228
Lithium	mg/l	0.0400*	0.0830	0.0830
Molybdenum	mg/l	0.100*	0.0280	0.100
Radium-226-228	pci/l	5.0^	4.55	5.0
Selenium	mg/l	0.0500	0.0203	0.0500

*EPA adopted health-based value for constituents with no MCL.

^Colorado Water Quality Regulation

On May 25, 2018, the second assessment monitoring samples were collected from all of the landfill wells. Samples were analyzed for Appendix III and detected Appendix IV COIs. In accordance with CCR Rule 257.95(e), downgradient well concentrations were compared against background values, and some concentrations were found to be above background values. In accordance with CCR Rule 257.95(f), detected Appendix IV COI concentrations in downgradient wells were compared against GPS and were found to exceed GPS. Therefore, following CCR Rule 257.95(g), downgradient well concentrations were statistically evaluated to determine “if one or more constituents in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard.”

To determine if an exceedance of a GPS was statistically significant, the 95% lower confidence limit (95LCL) was calculated for each of the downgradient wells at the landfill (MW-1, MW-3, MW-4, MW-6, and MW-8) for each of the detected Appendix IV COIs. The data set used to calculate the lower confidence limit (LCL) included all Appendix IV results from samples collected at these wells since the establishment of the groundwater monitoring system. Therefore, unless a well was dry during a sample event, most wells had 10 sample events that were used to calculate the LCL: eight background sample events from 2015-2017 and the two assessment monitoring events in February and May 2018. The LCL results that exceeded their respective GPS are provided in Table 4. Downgradient well MW-4 has 95LCLs for lithium and selenium that exceed the GPS; and downgradient well MW-8 has a 95LCL for lithium that exceeds the GPS.

Table 4. Lower Confidence Limits for Appendix IV Constituents for Valmont Landfill Wells Exceeding Groundwater Protection Standards			
	Appendix IV Constituent	Lithium	Selenium
	Units	mg/l	mg/l
	GPS	0.083	0.05
Monitoring Well	MW-4	0.199*	0.231*
	MW-8	0.102*	NA

*95% Adjusted Gamma LCL

3.0 GPS for the Impoundments

As stipulated in the CCR Rule 257.95(b) an initial assessment monitoring event was completed in February 2018 to sample all of the monitoring wells around the CCR bottom ash impoundments (Ponds 3A and 3B) for Appendix IV constituents. **Table 1** lists the Appendix III and IV constituents of CCR Rule Part 257.

EPA’s Unified Guidance has recommended that the UTL be used as a fixed value similar to a groundwater protection standard where an MCL does not exist for the constituent at the location (USEPA, 2009). The upper tolerance limits (UTLs) for Appendix IV constituents are displayed in **Table 5**. The UTL was established based on the eight background sample events at the upgradient monitoring well (MW-1P). The UTLs serve as the background values for assessment monitoring.

Table 5. Upper Tolerance Limits (UTL) with 95% Coverage and 95% Confidence for Appendix IV constituents for Valmont Impoundments (Assessment Monitoring Background Value)							
Constituent	Unit	N	No BDL	% BDL	Statistical Method ¹	UTL	Notes
Appendix IV Constituents							
Antimony	mg/l	8	2	25	Parametric	0.0170	
Arsenic	mg/l	8	0	0	Parametric	0.0110	
Barium	mg/l	8	0	0	Nonparametric	0.330	****
Beryllium	mg/l	8	6	75	Nonparametric	0.000400	**
Cadmium	mg/l	8	6	75	Nonparametric	0.000310	**
Chromium, Total	mg/l	8	3	37.5	Parametric	0.0240	
Cobalt	mg/l	8	0	0	Nonparametric	0.00500	****
Lead	mg/l	8	2	25	Parametric	0.00300	
Lithium	mg/l	8	0	0	Parametric	0.0180	
Mercury	mg/l	8	8	100	DQR	NA	***
Molybdenum	mg/l	8	0	0	Parametric	0.0270	
Selenium	mg/l	8	0	0	Parametric	0.00500	
Thallium	mg/l	8	6	75	Nonparametric	0.000280	**
Radium-226-228	pci/l	8	6	75	Nonparametric	1.07	**

4.0 DQR - Double Quantification Rule: for the 100 percent ND groups, the Unified Guidance (pages 6-11) recommends a confirmed exceedance is registered if any well-constituent pair in the '100% non-detect' group exhibits quantified measurements in two consecutive sample and resample events'. For the application of this rule, observations detected above the MDL are deemed to be quantified measurements.

5.0 ¹Best fit is based on detected data.

6.0 Notes: **Data set is too small to compute reliable and meaningful statistics and estimates. Recommend maximum detected value as the upper tolerance limit until more samples can be calculated. ***All observations are NDs. Recommend the double quantification rule (DQR). ****Upper Tolerance Limits with 85% Coverage and 95% Confidence due to nonparametric data with sample size < 59.

Results from the initial assessment monitoring sample event identified the detected Appendix IV constituents. All Appendix IV constituents were detected in at least one well with the exception of antimony, beryllium, cadmium, chromium, mercury, selenium, and thallium. Therefore GPS are established for all Appendix IV COIs except for antimony, beryllium, cadmium, chromium, mercury, selenium, and thallium.

In accordance with the CCR Rule 257.95(h), GPS were established for each detected Appendix IV COI. For each detected COI, Table 6 lists the EPA established MCL from 40 CFR 141.62 and 141.66, the assessment monitoring background value for the Valmont impoundments, and the GPS. The GPS for each COI is the higher of the two: MCL or impoundments assessment monitoring background value. There are four COIs that do not have established MCLs (cobalt, lead, lithium, and molybdenum); however in the July 17, 2018 CCR Rule Amendment EPA adopted health-based concentrations as the GPS for the four Appendix IV constituents without a designated MCL. These concentrations are listed in Table 6 in the MCL column.

Table 6. Groundwater Protection Standards for Detected Appendix IV constituents for Valmont Impoundments				
Constituent	Unit	MCL	Background Value (UTL)	GPS
Fluoride	mg/l	4.00	1.30	4.00
Arsenic	mg/l	0.0100	0.0107	0.0107
Barium	mg/l	2.00	0.330	2.00
Cobalt	mg/l	0.00600*	0.00530	0.00600
Lead	mg/l	0.0150*	0.00327	0.0150
Lithium	mg/l	0.0400*	0.0176	0.0400
Molybdenum	mg/l	0.100*	0.0267	0.100
Radium-226-228	pci/l	5.0^	1.07	5.0

*EPA adopted health-based value for constituents with no MCL.

^Colorado Water Quality Regulation.

On May 25, 2018, the second assessment monitoring samples were collected from all of the impoundment wells. Samples were analyzed for Appendix III and detected Appendix IV COIs. In accordance with CCR Rule 257.95(e), downgradient well concentrations were compared against background values and some concentrations were found to be above background values. In accordance with CCR Rule 257.95(f), detected Appendix IV COI concentrations in downgradient wells were compared against GPS and were found to exceed GPS. Therefore, following CCR Rule 257.95(g), downgradient well concentrations were statistically evaluated to determine “if one or more constituents in appendix IV to this part are detected at statistically significant levels above the groundwater protection standard.”

To determine if an exceedance of GPS was statistically significant, the 95% LCL was calculated for each of the downgradient wells at the impoundment (MW-9, MW-11, and MW-12) for each of the detected Appendix IV COIs. Monitoring well MW-10 had to be abandoned during CCR removal for impoundment closure and therefore no samples were collected. However, the remaining three wells are sufficient to characterize groundwater concentrations downgradient of the impoundments. The data set used to calculate the LCL included all Appendix IV results from samples collected at these wells since the establishment of the groundwater monitoring system. Therefore, unless a well was dry during a sample event, most wells had 10 sample events that were used to calculate the LCL: eight background sample events from 2015-2017 and the two assessment monitoring events in February and May 2018. The LCL results that exceeded their respective GPS are provided in Table 7. Downgradient wells MW-9, MW-11, and MW-12 have 95LCLs for cobalt that exceed the GPS; and downgradient well MW-9 has a 95LCL for molybdenum that exceeds the GPS. Closure of the two CCR impoundments was initiated prior to the second assessment monitoring event. Removal of CCR, and all areas affected by releases of CCR was completed in September 2018. Since the CCR material has been completely removed from the former impoundments, concentrations of CCR constituents are expected to decrease through natural attenuation.

Table 7. Lower Confidence Limits for Appendix IV Constituents for Valmont Impoundment Wells Exceeding Groundwater Protection Standards			
	Appendix IV Constituent	Cobalt	Molybdenum
	Units	mg/l	mg/l
	GPS	0.00600	0.100
Monitoring Well	MW-9	0.00890 [*]	0.147 [^]
	MW-11	0.0156 [^]	NA
	MW-12	0.00792 [#]	NA

*95% LCL around the Median (Non-Parametric)

[^]95% Adjusted Gamma LCL

[#]95% Lognormal LCL

4.0 References

U.S. Environmental Protection Agency (USEPA), 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance. Office of Resource Conservation and Recovery, Program Implementation and Information Division, USEPA, EPA 530/R-09-007, 2009